

Job No 2005/307

Friday, 17 June 2011

Anglican Retirement Villages
PO Box 284
Baulkham Hills NSW 1765

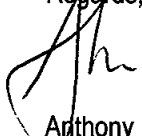
Attention James Chong

**RE Construction Certificate No 05/307/07
6 14 Macpherson Street, Warriewood**

Please find attached a copy of Construction Certificate 05/307/07 and required attachments issued by Steve Watson & Partners for the above mentioned development in accordance with Section 109C(1)(b) and 81A(2) of the Environmental Planning and Assessment Act 1979

If you have any queries please do not hesitate to contact me on (02) 9283 6555

Regards,



Anthony Marelic
Assistant Building Regulations Consultant
Steve Watson & Partners



**STEVE WATSON
& PARTNERS**

LEVEL 5 402 KENT STREET SYDNEY NSW 2000
 TEL: +61 2 9283 6055 | FAX: +61 2 9283 8500
 s.dney@swpartners.com.au
 www.swpartners.com.au
 ABN 48 132 366 576

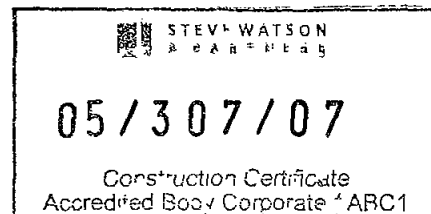
**CONSTRUCTION
CERTIFICATE**

Issued under the Environmental Planning and Assessment Act 1979 Section 109C(1)(b) and 109F

Construction Certificate No 05/307/07

Steve Watson and Partners certify that work completed in accordance with documentation accompanying the application for this certificate (with such modifications verified by me as may be shown on that documentation) will comply with the requirements of this Regulation as are referred to in section 81A (5) of the Environmental Planning and Assessment Act 1979

Applicant	Name Anglican Retirement Villages Address PO Box 284 Suburb Baulkham Hills State NSW Postcode 1765
Location of the Property	Address 6 14 Macpherson Street Suburb Warriewood State NSW Postcode 2102 Real Property Description Lot A & B DP 400488, Lot 22 DP 5464, Lot 5 8 DP 1115877 and Lot A & B DP 358765
Building description	Construction of seniors living independent living units development including 25 independent living units, ground level car parking, community centre with multipurpose space, cafe, gym, indoor swimming pool, medical consulting rooms External works including landscaping, driveway and car parking
Building Code of Australia Classification	Class 2, 5, 6, 7a and 9b
Date of Receipt	Date Received 29th April 2011
Determination	Approved Date of Determination 17th June 2011
Development Consent	Development Consent Number NO634/10 Council Pittwater Council Date of Determination 24th March 2011



Steve Watson (BPB0432) on behalf of

Steve Watson and Partners

Accreditation Body **BPB**

Accreditation no **ABC 1**

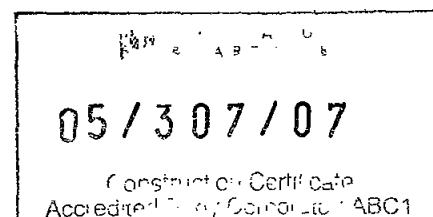
Date of Endorsement **Friday, 17 June 2011**

Design documentation approved for Construction Certificate 05/307/07 for 6 14 Macpherson Street, Warriewood

Drawing No	Drawing Title	Revision	Date	Drawn by
1200	Overall Ground Floor Plan	a09	17 06 11	NRP Architecture
1201	Overall First Floor Plan	a01	29 04 11	NRP Architecture
1400	Ground Floor Plan – Sheet 1	a07	17 06 11	NRP Architecture
1401	Ground Floor Plan – Sheet 2	a08	17 06 11	NRP Architecture
1402	Ground Floor Plan – Sheet 3	a05	02 06 11	NRP Architecture
1403	First Floor Plan – Sheet 1	a04	02 06 11	NRP Architecture
1404	First Floor Plan – Sheet 2	a05	02 06 11	NRP Architecture
2200	Sections	a01	26 04 11	NRP Architecture
2500	Elevations	a01	29 04 11	NRP Architecture
3201	Typical Wet Areas Details	a01	29 04 11	NRP Architecture
9001	Indicative Details (Used in Stage 1)	a01	29 04 11	NRP Architecture
9002	Indicative Details (Used in Stage 1)	a01	29 04 11	NRP Architecture
9003	Indicative Details (Used in Stage 1)	a01	29 04 11	NRP Architecture
10 136 M02	Mechanical Services – Single Line Layout 1 of 2	P1	06 10 10	Knox Advanced Engineering
10 136 M02	Mechanical Services – Single Line Layout 2 of 2	P1	06 10 10	Knox Advanced Engineering
10 136-M04	Mechanical Services – Air and water schematic	P1	06 10 10	Knox Advanced Engineering

Documentation relied upon to issue Construction Certificate 05/307/07 for 6 14 Macpherson Street, Warriewood

Item No	Description	Date
1	Application for Construction Certificate	29 04 11
2	Existing and proposed fire safety schedule	-
3	Evidence of Long Service Levy Payment	17 06 11
4	Email correspondence confirming exemption from Home Owners Warranty Insurance	15 04 11
5	Fire Safety Engineering Report 20011118MWR R002, Version A, prepared by Fire Engineering Design Pty Ltd	June 2011
6	Acoustic Specification Report prepared by Acoustic Logic Consultancy	15 10 10
7	BCA Section J1 & J2 Deemed to Satisfy Review – Fabric and Glazing Requirements	18 10 10
8	Documentation required to satisfy relevant DA conditions as per attached DA checklist	-





STEVE WATSON & PARTNERS

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 sydney@swpartners.com.au
 www.swpartners.com.au
 ABN 48 102 546 576

APPLICATION FOR CONSTRUCTION CERTIFICATE

PART 1 Application and Site Details

Applicant

It is important that we are able to contact you if we need more information

Please give us as much detail as possible

Note that a Building Contractor cannot be the applicant for a Construction Certificate or an Occupation Certificate

Mr Mrs Miss Ms Other

Surname (or Company) ANGELICAN RETIREMENT VILLAGES

Given names (or ABN) 39 922 848 563

Address PO BOX 284, BAULKHAM HILLS
 State NSW Post Code 1765

Phone (02) 9421 5318 Fax (02) 9421 2217

Mobile 0409 653 881 E-mail JAMES.CHONG@ARV.ORG.AU

Please ensure you sign the declaration in Part 3 of this application

Location of the Property

We need this to correctly identify the land

Owner of land / property ANGELICAN RETIREMENT VILLAGES

Address 6-14 MACPHERSON ST WARRIEWOOD
 Post Code 2102

Real Property Description LOTS A&B DP 400488, LOT 22 DP 5464,
 (eg Lot/DP/Section, etc) LOTS 5-8 DP 1115877 & LOTS A&B DP 358765

The real property description is mandatory these details are shown on your rate notices property deeds etc

PART 2 Work Description

Description of Work

Please describe briefly everything that you want approved

Building Work

CONSTRUCTION OF SENIORS LIVING ILU DEVELOPMENT
INCLUDING 25 INDEPENDENT LIVING UNITS, GROUND
LEVEL CARPARKING, COMMUNITY CENTRE WITH
MULTIPURPOSE SPACE, CAFE, GYM, INDOOR SWIMMING POOL,
MEDICAL CONSULTING ROOMS EXTERNAL WORKS INCLUDING
LANDSCAPING, DRIVEWAY & CAR PARKING

Estimated Cost of Work (inclusive of GST)

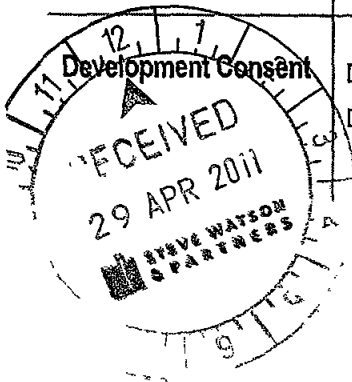
\$ 12.8 million

Development Consent

Development Consent No N0634/10

Date of Determination 24 / 3 / 2011

APPROVED	DATE
	28 APR 2011
PROJECT	ORDER
C/REF	
C/REF	



Building Code of Australia Classification	BCA Classification <u>CLASS 2 (ILU'S), 7a (CARPARK), 5 (ADMINISTRATION)</u> <u>CLASS 6 (CAFE), 9b (COMMUNITY CENTRE)</u>
Principal Contractor's Details <i>Required for all projects</i>	Name <u>HANSEN YUNCKEN PTY LTD</u> Address <u>15 BOURKE RD MASCOT NSW 2020</u> Contact Number <u>9770 7600</u>

PART 3 Declaration

ALL THE DETAILS SOUGHT IN THE CHECKLIST IN PART 5 MUST BE PROVIDED
 THE COMPLETED CHECKLIST MUST BE SUBMITTED WITH THIS APPLICATION FAILURE TO PROVIDE THE REQUIRED DOCUMENTATION OF AN ACCEPTABLE STANDARD WILL RESULT IN YOUR APPLICATION BEING RETURNED

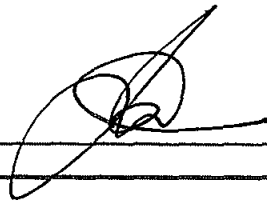
Declaration

If the applicant is a company or strata title body corporate a director or authorised delegate must sign this declaration

I apply for approval to carry out the development or works described in this application I declare that all the information in the application and checklist is, to the best of my knowledge, true and correct

I also understand that if the information is incomplete the application may be delayed or rejected or more information may be requested I acknowledge that if the information provided is misleading any approval granted may be void

Signature



Date

27 / 04 / 11.

PART 4 Schedule to Application for a Construction Certificate

Please complete this schedule. The information will be sent to the Australian Bureau of Statistics

All new buildings

Please complete the following

- Number of storeys (including underground floors)
- Gross floor area of new building (m²)
- Gross site area (m²)

2

4,965m² (EXCL CAR PARKING & BALCONIES)

12,950 m²

Residential buildings only

Please complete the following details on residential structures

- Number of dwellings to be constructed
- Number of pre existing dwellings on site
- Number of dwellings to be demolished
- Will the new dwelling(s) be attached to other new buildings?
- Will the new building(s) be attached to existing buildings?
- Does the site contain a dual occupancy?
(NB dual occupancy = two dwellings on the same site)

Nil

Nil

Nil

N/A Yes No

N/A Yes No

N/A Yes No

Materials – residential buildings

Please indicate the materials to be used in the construction of the new building(s)

Walls	Code	Roof	Code	Floor	Code	Frame	Code
Brick (double)	<input type="checkbox"/> 11	Tiles	<input type="checkbox"/> 10	Concrete or slate	<input checked="" type="checkbox"/> 20	Timber	<input type="checkbox"/> 40
Brick (veneer)	<input checked="" type="checkbox"/> 12	Concrete or slate	<input type="checkbox"/> 20	Timber	<input type="checkbox"/> 40	Steel	<input checked="" type="checkbox"/> 60
Concrete or stone	<input type="checkbox"/> 20	Fibre cement	<input type="checkbox"/> 30	Other	<input type="checkbox"/> 80	Aluminium	<input type="checkbox"/> 70
Fibre cement	<input type="checkbox"/> 30	Steel	<input checked="" type="checkbox"/> 60	Not specified	<input type="checkbox"/> 90	Other	<input type="checkbox"/> 80
Timber	<input type="checkbox"/> 40	Aluminium	<input type="checkbox"/> 70			Not specified	<input type="checkbox"/> 90
Curtain glass	<input type="checkbox"/> 50	Other	<input type="checkbox"/> 80				
Steel	<input type="checkbox"/> 60	Not specified	<input type="checkbox"/> 90				
Aluminium	<input type="checkbox"/> 70						
Other	<input type="checkbox"/> 80						
Not specified	<input type="checkbox"/> 90						

PART 5 Checklist

Where relevant, have you provided/completed the following	Yes	Not Relevant
• 4 copies of plans, elevations and sections	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• 4 copies of specifications	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• List of any existing and proposed fire safety measures (Refer to the Fire Safety Schedule)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
• Evidence of Home Building Act requirements satisfied	<input type="checkbox"/>	<input checked="" type="checkbox"/>
• Evidence that Long Service Levy has been paid	<input type="checkbox"/>	<input type="checkbox"/>
• Schedule to application for a construction certificate is completed	<input checked="" type="checkbox"/>	-
• Applicants signature	<input checked="" type="checkbox"/>	-

PART 6 Notes for Completing Application for a Construction Certificate

The following information must accompany applications for a Construction Certificate for Building Work

- 1 The ABS schedule is required to be completed for the purposes of providing information to the Australian Bureau of Statistics
- 2 Copies of compliance certificates relied upon
- 3 Four (4) copies of all plans and specifications must be submitted with your application. Plans for the building must be drawn to a suitable scale and consist of a general plan and a block plan. The general plan of the building is to
 - a) Show a plan of each floor section
 - b) Show a plan of each elevation
 - c) Show the levels of the lowest floor and of any yard or unbuilt on area belonging to that floor and the levels of the adjacent ground
 - d) Indicate the height design construction and provisions for fire safety and fire resistance
- 4 Where proposed building work involves any alteration or addition to, or rebuilding of an existing building the plan is to be coloured or otherwise marked to distinguish the proposed work to be approved
- 5 Where the proposed building work involves a modification to previously approved plans and specifications the general plans must be coloured or marked up to adequately distinguish the modifications
- 6 The specification is
 - a) To describe the construction and materials of which the building is to be built and the method of drainage sewerage and water supply
 - b) State whether the materials proposed to be used are new or second hand and give particulars of any second hand materials used
- 7 Where the application involves an alternative solution to meet the Performance Requirements of the BCA the application must also be accompanied by
 - a) Details of the Performance Requirements that the alternative solution is intended to meet, and
 Details of the assessment methods used to establish compliance with those Performance Requirements
- 8 Evidence of any accredited component process or design sought to be relied upon
- 9 Except in the case of any application for or in the respect of a class 1a or class 10 building
 - a) A list of any fire safety measures that are proposed to be implemented in the building or on the land on which the building is situated
 - b) If the application relates to a proposal to carry out any alteration or rebuilding of, or addition to an existing building a separate list of such of those measures as are currently implemented in the building or on the land on which the building is situated
 The list must describe the extent capability and basis of design of each of the measures concerned
- 10 The Development Consent conditions together with stamped approved DA drawings are to be provided for our assessment of the development and record purposes
- 11 Under section 109F(1)(b) of the *Environmental Planning and Assessment Act 1979* a Construction Certificate cannot be issued until any long service levy payable under section 34 of the *Building and Construction Industry Long Service Payments Act 1986* (or where such a levy is payable by instalments the first instalment of the levy) has been paid. The local council may be authorised to accept payment
- 12 In the case of an application for a Construction Certificate for residential building work (within the meaning of the Home Building Act 1989) attach the following
 - a) In the case of work performed by a licensee under that Act
 - i) A statement detailing the licensee's name and contract licence number and
 - ii) documentary evidence that the licensee has complied with the applicable requirements of that Act* or
 - b) in the case of work done by any other person
 - i) a statement detailing the persons name and owner builder permit number or
 - ii) a declaration signed by the owner of the land to the effect that the reasonable market cost of the labour and materials involved in the work is less than the amount prescribed for the purposes of the definition of owner-builder work in section 29 of that Act. (If the building work is less than \$12 000 provide a statement that states the proposed work is less than \$12 000)

* A certificate purporting to be issued by an approved insurer under Part 6 of the Home Building Act 1989 to the effect that a person is the holder of an insurance contract issued for the purposes of that Part is sufficient evidence that the person has complied with the requirements of that Part

FIRE SAFETY SCHEDULE



STEVE WATSON
& PARTNERS

6-14 Macpherson Street, Warriewood

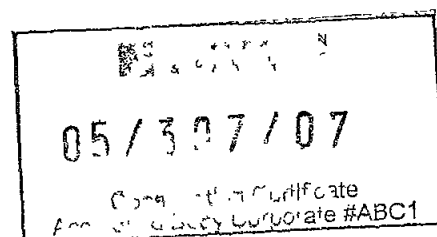
CC No 05/307/07

Existing Fire Safety Schedule

(NIL)

Proposed Fire Safety Schedule

Unit No.	Measure	Standard of Performance
1	Access panels, doors and hoppers to fire resisting shafts	BCA2010 Clause C3 13 and tested prototypes (AS 1530 4 – 2005)
2	Automatic fail safe devices	Scheduled devices release upon trip of smoke detection, fire detection or sprinkler activation in accordance with BCA2010 Clause D2 21
3	Automatic fire detection and alarm system (<i>smoke detection system</i>)	BCA2010 Specification E2 2a and AS 1670 1 – 2004
4	Automatic fire detection and alarm system (<i>smoke alarm system</i>)	BCA2010 Specification E2 2a and AS 3786 – 1993
5	Emergency lighting	BCA2010 Clause E4 2, E4 4 and AS 2293 1 – 2005
6	Exit signs	BCA2010 Clause E4 5, NSW E4 6, E4 7, E4 8 and AS 2293 1 – 2005
7	Fire dampers	BCA2010 Clause C3 15 and AS/NZS 1668 1 – 1998 (AS 1682 1-1990 and AS 1682 2-1990)
8	Fire doors	BCA2010 Specification C3 4 and AS 1905 1 – 2005
9	Fire hydrants systems	BCA2010 Clause E1 3 and AS 2419 1 – 2005
10	Fire seals protecting opening in fire resisting components of the building	BCA2010 Clause C3 15, Specification C3 15 and AS 1530 4 –2005 and AS 4072 1 – 2005 and installed in accordance with the tested prototype
11	Hose reel system	BCA2010 Clause E1 4 and AS 2441 – 2005
12	Lightweight construction	BCA2010 Specifications C1 8, Clause A2 3 and AS 1530 4-2005
13	Mechanical air handling system (<i>automatic shut down of air-handling system</i>)	BCA2010 Clause E2 2 and AS/NZ 1668 1-1998
14	Portable fire extinguishers	BCA2010 Clause E1 6 and AS 2444 – 2001
15	Safety curtains in proscenium openings	BCA2010 NSW H101 10
16	Warning and operational signs	BCA2010 Clauses D2 23, E1 4 & E3 3
17	Fire Safety Engineering Report 20011118MWR R002, Version A	Prepared by Fire Engineering Design Pty Ltd, dated June 2011



Pittwater Council

OFFICIAL RECEIPT

17/06/2011 Receipt No 303440

To ANGLICAN RETIREMENT VILLAGES

LEVEL 2, 62 NORWEST BLD
BAULHAM HILLS 2153

Applic Reference	Amount
SL Re OLSL-Buil	\$49,960 00
1 X N0634/10	

Total	\$49,960 00
Amounts Tended	
Cash	\$0 00
Cheque	\$49,960 00
Db/Cr Card	\$0 00
Money Order	\$0 00
Agency Rec	\$0 00
Total	\$49,960 00
Roundings	\$0 00
Cr Charge	\$0 00
Nett	\$49,960 00

Printed 17/06/2011 2:11:17
Cashier RLinds



STEVE WATSON
& PARTNERS

05/307/07

Construction Certificate
Accredited Body Corporate #ABC1

Andrew Rys

From Danny Kataieh [DKataieh@hansenyuncken.com.au]
Sent Friday, 15 April 2011 5:16 PM
To Andrew Rys
Subject RE: Warriewood stage 3

Andrew

Just confirming that Long Service Levy will be paid by ARV, Martin will provide a copy of the receipt of payment for the CC

Item 5 in your email below references a copy of the Annual Fire Safety Statement. I'm assuming this is not applicable to this project since it's a new building. Can you confirm?

Item 6 in your email below and DA Condition A5 both reference the Home Building Act 1989, Part 6 – Home Warranty Insurance. This act has been replaced by the Home Building Act and Regulation 2004. Reference to regulation 75 extract below indicates that this project is exempt from Home Owners Warranty Insurance requirements.

HOME BUILDING REGULATION 2004 - REG 75

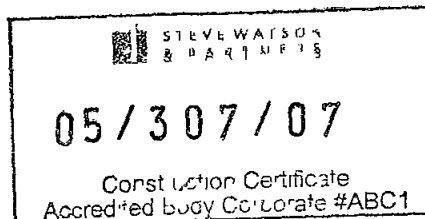
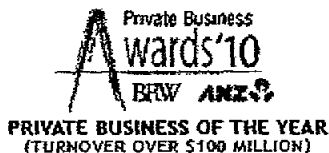
Exemption from insurance in relation to retirement villages

75 Exemption from insurance in relation to retirement villages

- (1) A holder of a contractor licence who does, or enters into a contract to do, residential building work on behalf of a developer, being residential building work relating to the construction of a self-contained dwelling in a retirement village, is exempt from the requirements of Part 6 of the Act in respect of that residential building work.
- (2) For the purposes of this clause, "retirement village" has the same meaning as in the Retirement Villages Act 1999, except that it does not include a retirement village that is subject to a community land scheme, company title scheme or strata scheme.
- (3) In this clause
"community land scheme" means a scheme (other than a strata scheme) within the meaning of the Community Land Management Act 1989
"company title scheme" has the same meaning as it has in the Retirement Villages Act 1999
"strata scheme" has the same meaning as it has in the Strata Schemes Management Act 1996

Regards

Danny Kataieh
Design Manager
Hansen Yuncken Pty Ltd
L6 15 Bourke Road Mascot NSW 2020
T 02 9770 7690 F 02 9770 7601 M 0434 367 611



www.hansenyuncken.com.au

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From Andrew Rys [mailto:arys@swpartners.com.au]
Sent Thursday, 14 April 2011 4:03 PM
To Danny Kataieh, Darren Skinner
Cc Martin Moore
Subject Warriewood stage 3

Gents

In reference to the requirements for the provision of a Construction Certificate for the proposed project, the following documentation will be required

- 1 One set of architectural drawings are to be provided to SWP for assessment against the BCA. Upon satisfactory assessment, four (3) sets of **architectural drawings** in A1 size or similar, and one (1) set in A3 size, are to be provided to SWP to form part of the approved construction certificate.
The plans and specifications accompanying the CC application are required to include detailed plans drawn to a suitable scale and consisting of a block plan and a general plan that show
 - i A plan of each floor section,
 - ii A plan of each elevation of the building
 - iii The levels of the lowest floor and of any yard or unbuilt on area belonging to that floor and the levels of the adjacent ground
 - iv The height, design, construction and provisions for fire safety and fire resistance,
 - v A description of the construction and material of which the building is to be built and the method of drainage, sewerage and water supply,
 - vi Details of whether the materials to be used are new or second hand and (in the case of second-hand materials) give particulars of the materials to be used
 - vii Where the development involves building work to alter, expand or rebuild an existing building a scaled plan of the existing building
- 2 Complete the **Application for Construction Certificate** attached. You must return the original form signed by the applicant and building owner. The owner may provide a separate letter of consent in lieu of completing our form.
- 3 Complete the **Notice of Commencement Form** attached. This form must be signed and returned to us in its original form.
- 4 Provide evidence of the payment of the long service levy. Payments are able to be processed online at www.lspc.nsw.gov.au. A copy of the receipt is to be sent to SWP. The levy payable is 0.35% of the total construction cost. The construction cost is based on the cost of building work inclusive of GST. Costs do not include loose furniture, consultant's fees and any other statutory charges. Long Service is only paid on jobs in excess of \$25,000.
- 5 Provide SWP with a copy of the buildings **Annual Fire Safety Statement** so that we are able to determine which services will be altered within your proposed fitout.
- 6 A copy of the builder's insurance details as required by the Home Building Act 1989.
- 7 The satisfaction of DA Conditions marked "*prior to the issue of a Construction Certificate*" or "*prior to the commencement of works*". A spreadsheet of DA conditions required to be satisfied at various stages of the project will be generated upon receipt of the Development Consent. Three (3) copies of all documentation required to satisfy the DA conditions is to be provided to SWP.
- 8 Three copies of any design documentation required "*prior to the issue of a Construction Certificate*" by the Development Consent.
- 9 A design verification certificate is to be provided, as required under Clause 143A of the EP&A Regulations, by a qualified designer for residential flat developments stating that the plans and specifications achieve or improve the design quality of the development having regard to the design quality principles set out in Part 2 of *State Environmental Planning Policy No 65 – Design Quality of Residential Flat Buildings*.

Further to our meeting this morning I confirm the following issues

- The lounge areas off the corridors must be separated from the corridors by construction having a FRL of at least 60/60/60 with opening protected by fire doors,

FIRE ENGINEERING DESIGN PTY LTD



Fire Safety Engineering Report

STAGE 3

WARRIEWOOD BROOK RETIREMENT VILLAGE

WARRIEWOOD

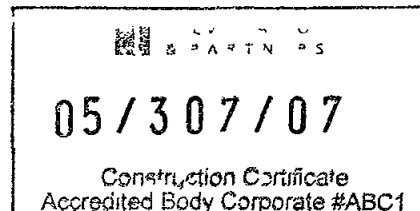
NSW

For

Anglican Retirement Villages

June 2011

Version A



PO Box 228
Balman
NSW 2041
Australia

ABN 13 097 166 010

Phone (02) 9810 2728
Fax (02) 9810 5051
MBL 0414 44 00 88
E mail fedesign@bigpond.com



REPORT ISSUE AUTHORISATION

Project Warriewood Brook Retirement Village - Warriewood

Project No 2011118

Version	Date	Status	Prepared
Draft	June	For review and comment	MWR
A	June	Final Issue	MWR

Version	Extent of revision
A	Grammatical Corrections

This report caters specifically for the requirements for this project, the client and associated regulatory /approval process. No warranty is intended or implied for use by any other third party and no responsibility is undertaken to any other third party for any material contained herein.

Fire safety solutions described in this report may be alternative solutions to those given by the BCA Deemed-to-Satisfy Provisions. Consideration of protection of the building owner's property may not be included unless this has been specifically requested – refer to Section 1.4 of this report.

Prepared by

Mike Radford

Accredited Fire Safety Engineer

BE, ME (Fire), CPEng (AUS/NZ), IntPE, NPER

C10 Accredited Certifier (Fire Safety Engineering Compliance, BPB0337)



EXECUTIVE SUMMARY

This report addresses the proposed new Warriewood Brook Retirement Village (Stage 3) in Warriewood NSW, for compliance with the relevant Performance Requirements of the Building Code of Australia (BCA) 2010

The areas of design requiring alternative solutions which have been addressed herein include the following

- Specification C1 1 Table 4 Some areas of the proposed building are located within 18m of an adjacent building
Performance Requirements CP1 & CP2 to be addressed
- Clause C3 3 Protection of openings in external walls The fire rating of external walls of the car park and Unit 69 will be rationalised to allow ventilation
Performance Requirements CP1 & CP2 to be addressed

A performance based assessment has been carried out on these aspects of the design, with the objective being satisfaction of the relevant Performance Requirements which of the BCA

It has been established that these objectives will be met by the proposed design of the building

Ongoing compliance of the building with this report can be achieved by compliance with the following conditions

- (i) The Scope of Works specified within Section 1 3 of this report is carried out, and
- (ii) The limitations specified within Section 1 4 of this report are considered

It is assumed that the scope of works, limitations and assumptions of this report are read and understood The author of this report should be contacted if there are any queries in regards to the content



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1 INTRODUCTION

1.1 Report Purpose

The purpose of this report is to present alternative fire safety solutions which deviate from the prescriptive requirements of the Building Code of Australia 2010

1.2 Relevant Stakeholders

The following groups are considered to be stakeholders in the development of the fire safety design process for the subject proposal

Name	Company	Role
	Anglican Retirement Villages	Client
Danny Kataieh	Hansen Yunken P/L	Clients Representative
Steve Watson Andrew Rys	SW&P	PCA
Mike Radford	Fire Engineering Design P/L	Fire Safety Engineer

1.3 Scope of Works

The primary assumption of this report is that with the exception of the specific non compliance issues addressed by this report for the new works, the balance of the fire safety design for the building complies with the Building Code of Australia 2010 (BCA) Deemed-to Satisfy provisions for fire safety

Under the stipulation that these provisions are provided, the implementation of the following scope of works will allow the proposed design to satisfy the performance requirements of the BCA for fire safety

- 1.3.1 Any areas of the external wall on the ground floor which are load bearing and are located within 18m of the adjoining building, are to achieve an FRL of not less than 120/30/-
- 1.3.2 Any areas of the external wall on the first floor level which are load bearing and are located within 18m of the adjoining building, are to achieve an FRL of not less than 60/-/-
- 1.3.3 Where any other areas of the external wall of the first floor provide structural support to the ceiling, irrespective of whether they are more than 18m of any other fire source feature, they must achieve an FRL of not less than 60/-/- from both sides



- 1 3 4 The internal and external walls of the SOU's on the ground floor, which are adjacent to the car park ventilation grilles are to have a "TWO WAY" FRL of not less than 120/120/120. In addition the external wall of the car park adjacent to Unit 69 is to achieve a "TWO WAY" FRL of not less than 120/120/120.
Refer Figure 5-7 on page 18 herein for the above requirements
- 1 3 5 All of the above fire ratings must be achieved with certified systems that have been tested and approved to AS1530 4 2005 by a Registered Testing Authority as specified in Clause A2 2 of the BCA.
- 1 3 6 Any and all penetrations through fire rated construction are to be fire stopped with products that have been tested and approved to AS1530 4 2005.
-
- 1 3 7 Test certificates of as installed fire rated walls and fire stopping products are to be provided to the Certifying Authority prior to issuance of the Occupation Certificate.

1 4 Assumptions & Limitations

(i) BCA Compliance

The primary assumption of this report, is that with the exception of the specific non-compliance issues addressed herein for the new works, all other fire safety requirements of the Building Code of Australia 2010 (BCA) Deemed-to Satisfy provisions for fire safety are implemented.

(ii) Property Protection

The design proposed herein complies with the Performance Requirements of the Building Code of Australia, 2010, which is primarily concerned with life safety, protection of neighbouring properties and fire brigade intervention.

Given the above, unless specifically requested by the client or stated in our report, issues above and beyond the BCA requirements, as described above, have not been considered. This may include, but not be limited to, considerations of business continuance, disabled egress and extent and availability of insurance. Similarly, multiple arson attack, malicious acts, acts of terrorism and the resulting impact of fires on the building performance has not been addressed within this report as they are not considered to be a reasonable scenario in this instance.

(iii) Generally

It is assumed that the scope of works, limitations and assumptions of this report are read and understood. The author of this report should be contacted if there are any queries in regards to the content.

2 BUILDING DETAILS

2.1 Description of Building

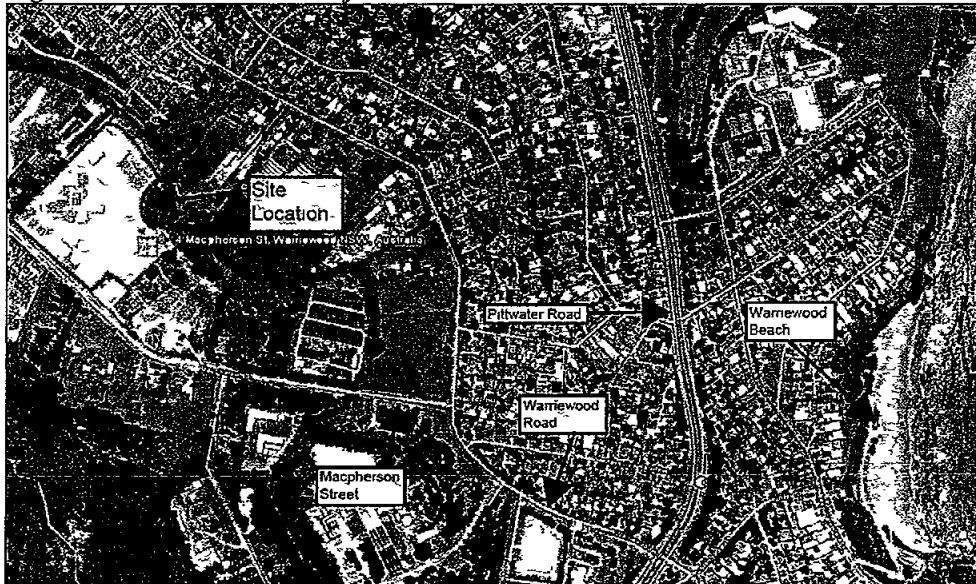
Warriewood Brook is a Warriewood retirement village located in the Warriewood Valley and bounded by Pittwater Road on the east as well as Mona Vale Road on the north

Stage 3, for which this report is specifically provided, will be a new two storey building located at 6 – 14 Macpherson Street in Warriewood NSW

The project scope consists of 25 independent living apartments over two floors, basement car parking on grade, large pool area, two internal lifts, cafe, gymnasium, multipurpose spaces, medical consulting rooms and administration areas

The location of the site is shown in the figure below

Figure 2-1 Aerial View of Subject Site

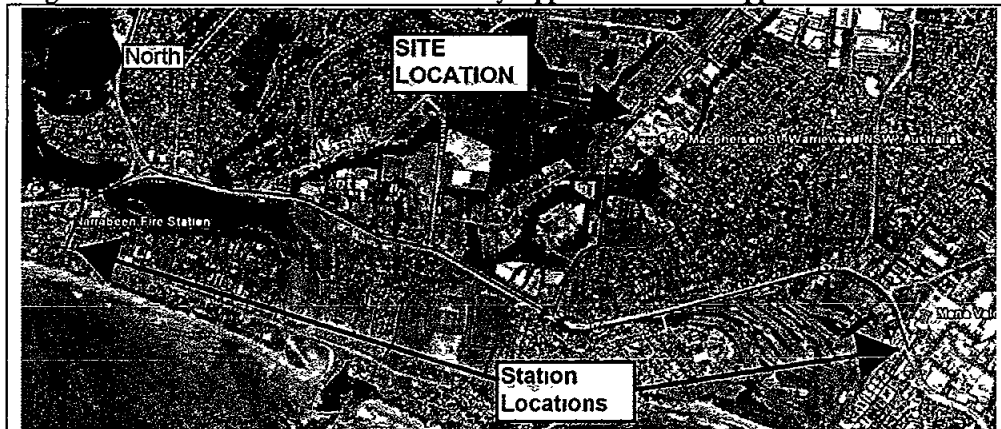


The two nearest permanently staffed fire stations are The Mona Vale Fire Station located at 6 Harkeith Street in Mona Vale NSW 2013 and the Narrabeen Fire Station located at 9 Ocean Street, Narrabeen NSW 2101

Each station is located 1.77km and 3.49km from the site respectively

The locations of the stations and the likely paths of travel for appliances from those stations to the site, are as indicated in the figure below

Figure 2-2 Fire Station Location and Likely Approach Path for Appliances



2.2 Building Code of Australia Description Summary

The general description of, and subsequent requirements for, the building under the current DTS provisions of the BCA are as indicated in the table hereunder

Table 2-1 BCA General Description & Requirements

BCA Clause	Description or Requirement
A1 1 Effective Height	Less than 12 metres
A3 2 Classification	Classes 2, 5 & 7a
C1 2 Rise in Storeys	2
C1 1 Type of Construction Required	Type B



3 BCA REQUIREMENTS

Table 3 1 outlines the issues of non-compliance with the BCA Deemed-to-Satisfy Provisions that are the subject of this report

Table 3-1 Non-compliance with Deemed-to-Satisfy provisions

Relevant BCA Clause	DTS non compliance	Alternative Solution	Relevant BCA Performance Requirement	Assessment Method
Spec C1 1 Table 4	In some instances the building is located within 18m of an adjacent building	The adjacent building is 14.85m away from the proposed building As this is greater than 6m, this complies with the DTS provisions of the BCA in regard to spread of fire It has been shown that even in the unlikely event that the external wall of the subject building failed as a single unit and fell outwards towards the adjacent building as if it was pivoted at the base it would land well short of the adjacent building. Therefore no physical damage to the adjacent building would likely occur	CP1 & CP2	Qualitative and Quantitative assessment in accordance with Clauses A0 5(b)(ii) and A0 9(c) of the BCA
C3 3	It is proposed to have louvers in the car park for ventilation adjacent to a number of SOU s It is not proposed to protect the louvers in accordance with Clause C3 4 of the BCA	The fire rating will be provided in full on either the SOU OR car park external wall where they are within 4m of one another, rather than half the fire rating on both the car park and the SOU external wall That is, under the DTS provisions of the BCA, the car park would require an FRL for 60/60/60 and the adjacent SOU would require an FRL of 60/60/60 such that no unprotected openings are within 4m of one another. In total fire spread would be expected to be mitigated between the car park and the affected SOU within 120 minutes It is proposed to provide a 120/120/120 FRL to the either the SOU OR the adjacent car park external wall such that no unprotected openings are located within 4m of each other between the compartments This is considered to be equivalent to the Performance and Objective of the DTS provisions in regard to mitigating fire spread between compartments Refer Figure 5 7 on page 18 herein	CP1 & CP2	Qualitative assessment in accordance with Clauses A0 5(b)(ii) and A0 9 (c) of the BCA



4 GENERIC DTS PROVISIONS OF THE BCA

The DTS provisions of the BCA prescribe a generic fire safety solution for each of the different building classifications that are defined. The intent of the DTS provisions is to provide users with a simple method of resolving fire safety requirements for buildings, and to provide society with a design method that achieves consistency between similar buildings. The prerequisite for simplicity requires the DTS provisions to be generic in nature.

The DTS provisions have been derived from the consideration of typical building and occupant characteristics in each different BCA classification which could reasonably be expected.

Compliance with the DTS provisions does not allow for any atypical or unique characteristics of the specific building being considered. As such, although various buildings of the same classification may achieve full compliance with the DTS provisions (in that they are consistent in the fire safety measures that are installed), the fire safety design does not provide the same level of fire safety throughout these buildings. This is the consequence of applying a generic fire safety design solution to buildings that vary.

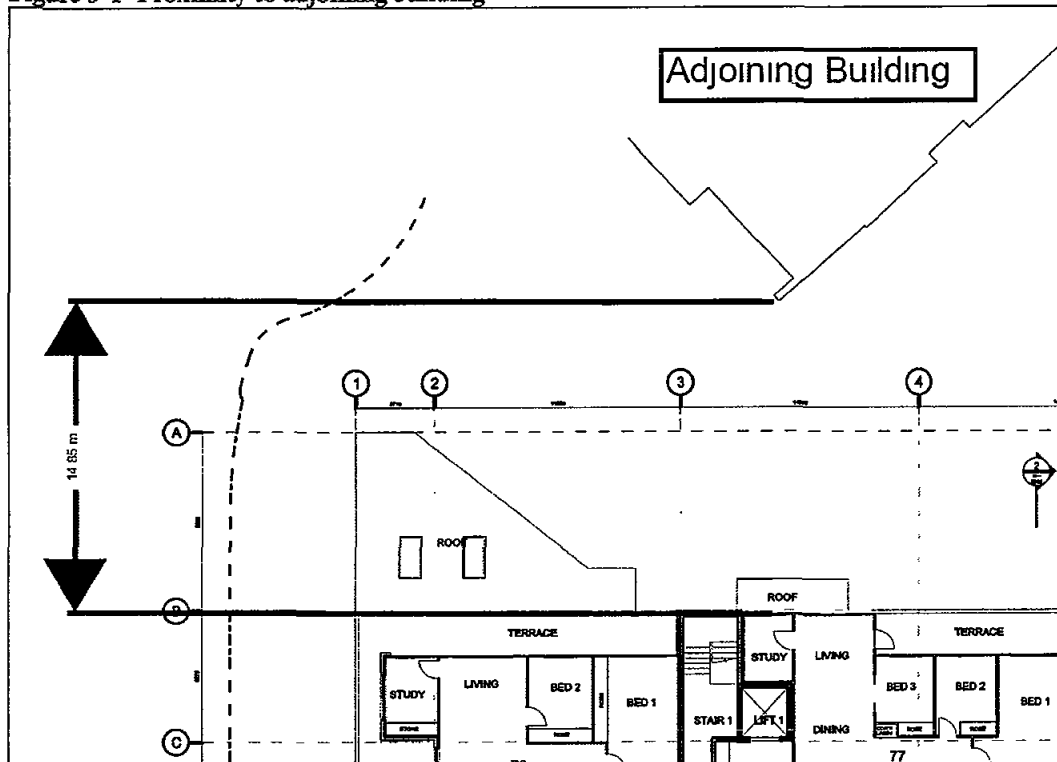
The following sections and alternative solutions, therefore assesses the building based on its specific characteristics and risks rather than adopting a generic approach.

5 ALTERNATIVE SOLUTIONS

5.1 Reduced FRL to Part of External Wall

There is a portion of the wall of the proposed new building which is located within 18m of the existing adjoining building. The nearest point is approximately 14.85m apart as shown in the figure below.

Figure 5-1 Proximity to adjoining building



It is proposed to reduce the FRL required for the external wall of the subject building where it is located within 18m of the adjoining building.

5.1.1 DTS PROVISIONS OF THE BCA

Under the DTS provisions of the BCA, where the external wall of a Type B building which contains Classes 2, 5 and 7a is load bearing, it is required to achieve an FRL of 120/30/ where it is located within 18m of any fire source feature.

5.1.2 ALTERNATIVE SOLUTION

5.1.2.1 SPREAD OF FIRE

In the affected areas which are located within 18m of the adjoining building, the actual use of the space is Class 2. As such the bounding construction between the SOU's must achieve an FRL of not less than 60 minutes.

For the top most level of the building, this may be achieved in two ways which are



- Scenario 1** Extend the internal fire rated walls between the SOU's to the underside of the roof or,
- Scenario 2** Extend the internal fire rated walls between the SOU's to the underside of a fire rated ceiling achieving an FRL of 60/60/60

Each of these scenarios is discussed further

Scenario 1 Discussion

With this scenario there are two solutions possible in regard to the requirements for the external wall which are

- Scenario 1A** If the roof is supported by the internal walls only, *which extend to the underside of the roof*, or structural members OTHER than the external wall, then the external wall need not be load bearing. Given this the external wall would only require a fire rating where it is located within 3m of a fire source feature

As the adjoining building is 14.85m away the external wall would therefore require an FRL of -/-/ and this would comply with the DTS provisions of the BCA

- Scenario 1B** With this scenario the roof is supported by the external walls and the fire separation between SOU's is provided by the internal fire walls extending to the underside of the roof

This is considered to be an anomaly with the DTS provisions of the BCA. Table 4 of specification C1.1 clearly states that a roof in a Type B building requires an FRL of -/-/.

As the external wall is however load bearing to the roof which requires NO FRL, technically, as it is load bearing, it requires an FRL of 120/30/-.

As the roof requires no FRL, the DTS provisions of the BCA would permit complete failure of the roof. Once this occurs, the external wall would technically no longer be required to be a load bearing element. As previously stated non load bearing external walls located >3m from a fire source feature for Type B construction require NO FRL.

It can therefore clearly be seen that to afford 120/30/- to the external wall, would provide no practical benefit whatsoever to the building structure and as such it is considered to be a nonsensical requirement to in this instance.



As the roof is not required to be fire rated and is permitted to fail, and as the external wall of the subject building is located greater than 3m from the nearest fire source feature, it is considered that an FRL of -/-/- may be applied to the external wall in this instance with this scenario and that the Objectives of the BCA in regard spread of fire and structural adequacy are satisfied and are at least equivalent to DTS permitted solutions

Scenario 2 Discussion

With this scenario there are two solutions possible in regard to the requirements for the external wall which are

Scenario 2A If the 60 minute fire rated ceiling is supported by the internal walls only, or structural members OTHER than the external wall, then the external wall need not be load bearing
Given this the external wall would only require a fire rating where it is located within 3m of a fire source feature

As the adjoining building is 14.85m away the external wall would therefore require an FRL of -/-/-, *on the provision that the failure of the external wall does not impair the structural adequacy and integrity of the fire rated ceiling*, then this would comply with the DTS provisions of the BCA

Scenario 2B With this scenario, if the 60 minute fire rated ceiling is supported by the external walls then, as the external walls are load bearing and as such are required to comply with Table 4 of specification C1.1 of the BCA. As such the external walls are “technically” required to achieve an FRL of 120/30/-

This is considered disproportionate to the risk, as the ceiling is only required an FRL of 60 minutes. After 60 minutes once the ceiling has failed, the external wall is not required to be load bearing.

Once the wall is non load bearing, as previously stated, non load bearing external walls located >3m from a fire source feature require NO FRL.

It can therefore clearly be seen that to afford 120/30/- is disproportionate to the risk.

With this scenario, it is considered that an FRL of 60/-/- may be applied to the external wall in this instance and that the Objectives of the BCA in regard spread of fire and structural adequacy are satisfied and are at least equivalent to DTS permitted solutions



We have been advised that the proposed method of compliance for the subject building is as discussed above for Scenario 2B

5.1.2.2 PROPERTY PROTECTION

In addition to spread of fire, it is considered that Type B construction also takes into consideration, the potential risk of physical damage to adjoining property as a result of structural failure

This is considered as, to comply with the DTS provision of the BCA for Type A and Type C construction, spread of fire is deemed to be mitigated to the degree necessary where external walls and unprotected openings are located

- a) 3m from a side or rear boundary of the allotment, or
- b) 6 m from the far boundary of a road, river, lake or the like adjoining the allotment, if not located in a storey at or near ground level, or
- c) 6 m from another building on the allotment that is not Class 10,

Type B construction however, is the only type of construction where an external wall needs consideration for distances to/from a fire source feature at

- Less than 1.5m and,
- Between 1.5m and 3m and,
- Between 3m and 9m and,
- Between 9m and 18m

Classes 5, 6, 7 and 8 are permitted to be Type B construction if they have a rise in storeys of 3

Typically with Classes 5 and 6, being commercial and retail respectively, one would likely expect an average floor to floor height of 3.2m or more. As such 3 storeys would equate to the external wall height of greater than 9m but not likely greater than 18m

Clause C1.2 of the BCA states

C1.2 Calculation of rise in Stories

- (c) In a Class 7 or 8 building, a storey that has an average internal height of more than 6 m is counted as—
 - (i) one storey if it is the only storey above the ground, or
 - (ii) 2 storeys in any other case
- (d) For the purposes of calculating the rise in storeys of a building—
 - (i) a mezzanine is regarded as a storey in that part of the building in which it is situated if its floor area is more than



- 200 m² or more than 1/3 of the floor area of the room, whichever is the lesser, and
- (ii) two or more mezzanines are regarded as a storey in that part of the building in which they are situated if they are at or near the same level and have an aggregate floor area more than 200 m² or more than 1/3 of the floor area of the room, Which ever is the lesser

External walls on buildings used for high piled rack storage, processing plants etc which may have minor mezzanines, typically have external walls which are greater than 9m in height

It is considered that this, coupled with 3 storey Class 5 & 6 occupancies which may have external walls which exceed 9m in height, is the principle reason that Type B construction is required to be provided with protection where they are located 18m of another fire source feature

In the event of a fire, the DTS provisions of the BCA are attempting to mitigate the likelihood that an external wall greater than 9m in height would fail, pivot at the base and fall onto an adjacent building

The height of the affected external wall from the ground to the ceiling of the first floor level is 6.75m. As such even in the unlikely event that the external wall collapsed as a single entity towards the adjoining building, it would not cause and physical damage as it would fall 8.1m short of the adjacent building

Given this, it is considered that the objective to mitigate physical damage to the adjoining building from the external wall of the subject building is inherently satisfied

5.1.3 SUMMARY

Based on all of the above, it is considered that the external wall of the subject building, here located within 18m of another fire source feature, need not achieve an FRL of 120/30/-

As the external wall provides structural stability to the fire rated ceiling it must achieve an FRL of not less than 60/-/- from BOTH sides

Given this, it is considered that Performance Requirements CP1 and CP2 are satisfied in accordance with Clauses A0.5(b)(i) and A0.9(c) of the BCA as summarised in the following tables



Table 5-1 Performance Requirement CPI

PERFORMANCE REQUIREMENT	ALTERNATIVE SOLUTION
A building must have elements which will to the degree necessary maintain structural stability during a fire appropriate to	
(a) The function or use of the building, and	Classes 2, 5 and 7a
(b) The fire load, and	Equivalent to DTS solution
(c) The potential fire intensity, and	Equivalent to DTS solution
(d) The fire hazard, and	Equivalent to DTS solution
(e) The height of the building and	Rise in Stories of 2
(f) Its proximity to other property, and	14 85m away
(g) Any active fire safety systems installed in the building, and	Equivalent to DTS
(h) The size of any fire compartment and	Equivalent to DTS
(i) Fire brigade intervention, and	Equivalent to DTS
(j) Other elements they support, and	The external wall on the first floor is only load bearing to the 60 minute fire rated ceiling After 60 minutes it is not required to be load bearing
(k) The evacuation time	Egress provisions comply with the DTS provisions of the BCA

Table 5-2 Performance Requirement CPI

PERFORMANCE REQUIREMENT	ALTERNATIVE SOLUTION
A building must have elements which will, to the degree necessary, avoid the spread of fire	
(a) To exits and	N/A
(b) To sole occupancy units and public corridors and	N/A
(c) Between buildings, and	N/A
(d) In a building appropriate to	

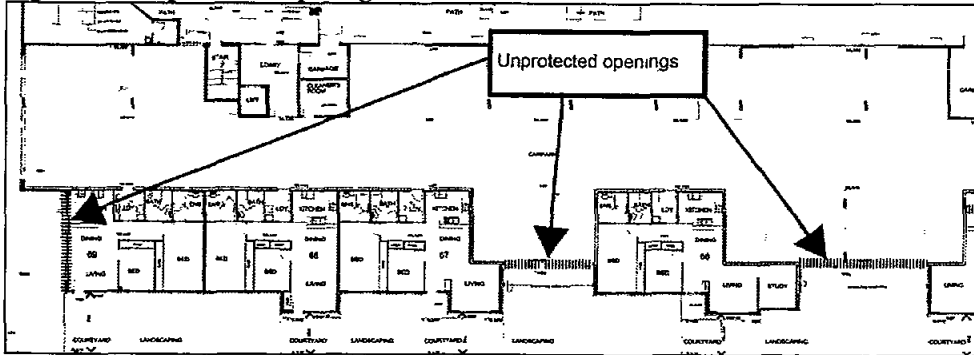


PERFORMANCE REQUIREMENT	ALTERNATIVE SOLUTION
(i) The function or use of the building and	Classes 2, 5 & 7a
(ii) The fire load and	Equivalent to DTS solution
(iii) The potential fire intensity and	Equivalent to DTS solution
(iv) The fire hazard and	Equivalent to DTS solution
(v) The number of storeys in the building, and	2
(vi) Its proximity to other property and	14 85m away
(vii) Any active fire safety systems installed in the building and	Equivalent to DTS
(viii) The size of any fire compartment and	Equivalent to DTS
(ix) Fire brigade intervention and	Equivalent to DTS
(x) Other elements they support, and	The external wall on the first floor is only load bearing to the 60 minute fire rated ceiling After 60 minutes it is not required to be load bearing
(xi) The evacuation time	Egress provisions comply with the DTS provisions of the BCA

5.2 Protection of Openings

On the ground floor, it is proposed to have grilles to the external wall of the car park adjacent to a number of SOU's and operable windows/doors for ventilation, which are deemed unprotected openings, as indicated in the figure below

Figure 5-2 Unprotected Openings in External Walls



5.2.1 DTS PROVISIONS OF THE BCA

Clause C3.3 of the DTS provisions of the BCA states

Figure 5-3 Clause C3.3 of the BCA

C3.3 Separation of external walls and associated openings in different fire compartments

The distance between parts of *external walls* and any openings within them in different *fire compartments* separated by a *fire wall* must not be less than that set out in Table C3.3 unless—

- (a) those parts of each wall have an FRL not less than 60/60/60 and
- (b) any openings protected in accordance with C3.4

Table C3.3 DISTANCE BETWEEN EXTERNAL WALLS AND ASSOCIATED OPENINGS IN DIFFERENT FIRE COMPARTMENTS

Angle between walls	Min Distance
0° (walls opposite)	6 m
more than 0° to 45°	5 m
more than 45° to 90°	4 m
more than 90° to 135°	3 m
more than 135° to less than 180°	2 m
180° or more	Nil

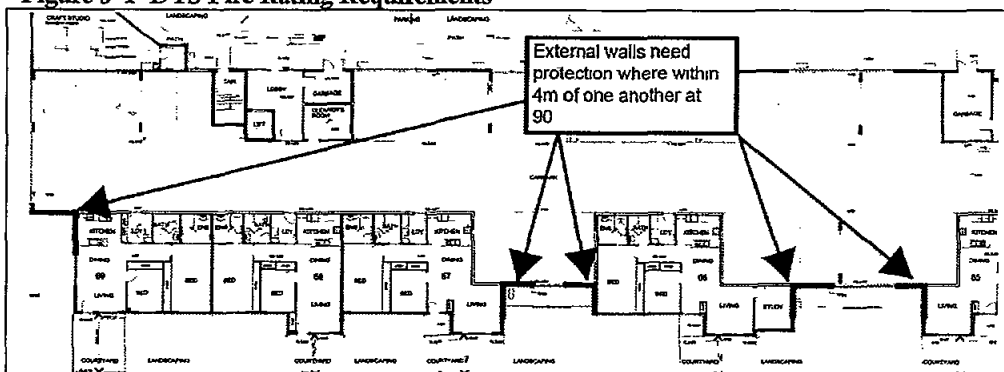
Further to this Clause C3 4(a)(iii) of the BCA states

C3 4 Acceptable methods of protection

- (iii) Other openings —
 - (A) excluding voids — internal or external wall wetting sprinklers, as appropriate, or
 - (B) construction having an FRL not less than -/60/-

Technically, to comply with the above provisions both external walls which are at 90° to one another, need to be protected such that no unprotected openings are located within 4m of one another in accordance with Clause C3 4 as indicated in the following figure

Figure 5-4 DTS Fire Rating Requirements



The Guide to the BCA states that the intent of Clause C3 3 is *“To limit the spread of fire between fire compartments through external walls and the openings in them”*

5 2 2 ALTERNATIVE SOLUTION

The DTS provisions of the BCA are generic and attempt to cater for all possible building configurations

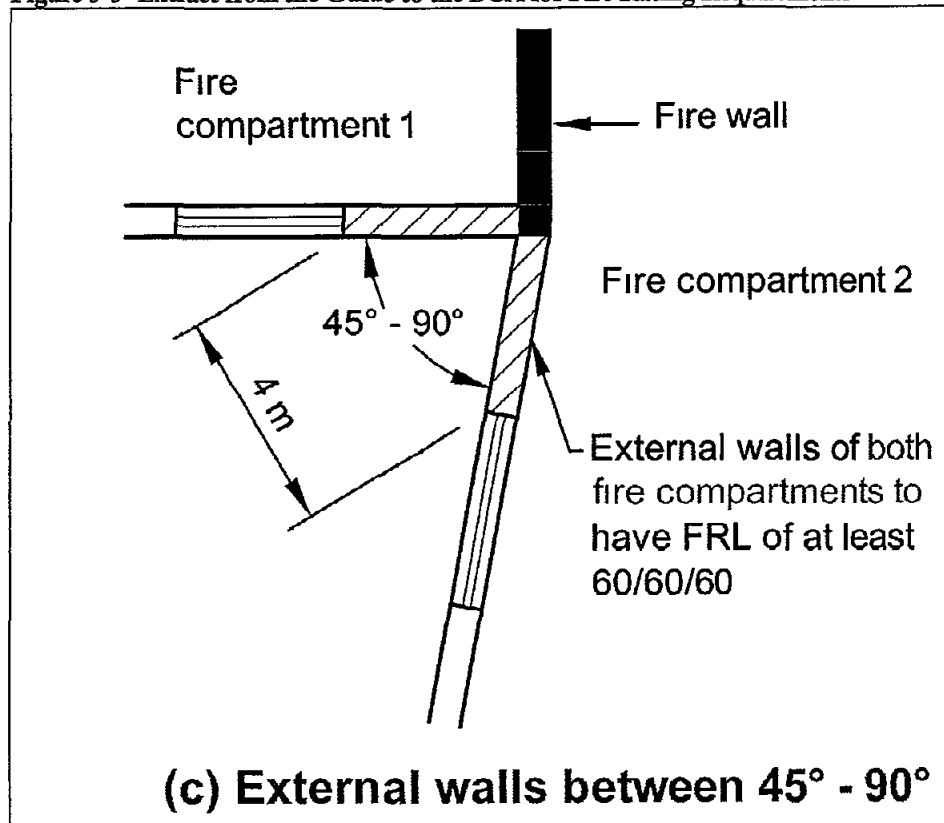
The affected areas are a number of SOU’s and the car park

The car park requires grilles for ventilation in the affected areas and as such it is not practical to provide drenchers or fire rated shutters or the like in this instance as the grilles will be louvers which will effectively be mounted in the wall leaving no room for shutters

It is very clear that the intent of Clause C3 3 is to mitigate fire spread from one fire compartment to another fire compartment through external walls and the openings in them

The guide to the BCA suggests that the following means of separation is considered acceptable to the degree necessary to mitigate fire spread from one fire compartment to the adjacent fire compartment

Figure 5-5 Extract from the Guide to the BCA for Fire Rating Requirements

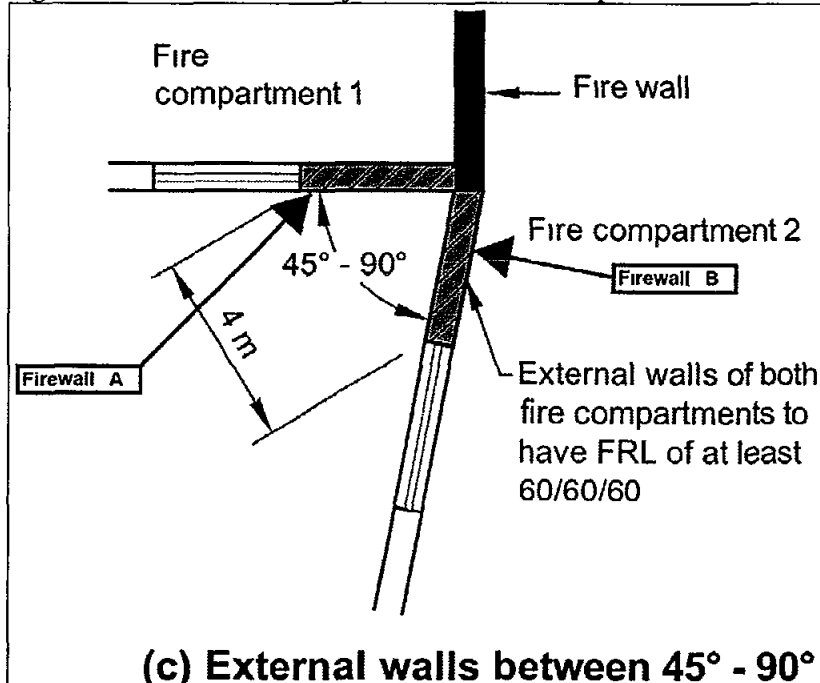


The guide states that both walls must be fire rated to achieve an FRL of 60/60/60

In essence there are two fire walls which will mitigate fire spread between the fire compartments

The following figure is provided such that the performance and the objective of the systems can be discussed, and the effects these systems will have on the overall outcome in regard to spread of fire from one compartment to the other

Figure 5-6 Performance & Objectives of DTS Fire Separation



With the above both Firewall A and Firewall B are each required to achieve an FRL of 60/60/60

The notation of 60/60/60 equates to 60 minutes for “Stability”, 60 minutes for “Integrity” and 60 minutes for “Insulation”

Each of these criteria is clarified below for ease of reference

- Stability** To meet this requirement the wall must perform its load bearing capacity and carry the applied loads for not less than 60 minutes, without structural collapse
- Integrity** To meet this requirement the wall must not develop any cracks or fissures which allow smoke or hot gases to flow through the assembly within 60 minutes
- Insulation** to meet this requirement the temperature on the cold side of the wall must not exceed a specified limit, usually an average increase of 140°C and a maximum increase of 180°C at a single point within 60 minutes

If a fire occurred in fire Compartment 1 then Firewall “A” would be expected to maintain its load bearing capacity, prevent the flow of smoke and hot gases and restrict the temperature rise on the non fire side to a maximum increase of not more than 180°C for 60 minutes

After 60 minutes these criteria need no longer apply and the wall can be deemed to fail

At this time, Firewall “B” would then be expected to maintain its load bearing capacity, prevent the flow of smoke and hot gases and restrict the temperature rise on the non fire side to a maximum increase of not more than 180°C for 60 minutes

Given this the **Performance** and the **Objective** that the DTS provisions of the BCA expect, is that as a total system, fire spread from Compartment 1 to Compartment 2 would not be expected to occur within 2 hours (120 minutes)

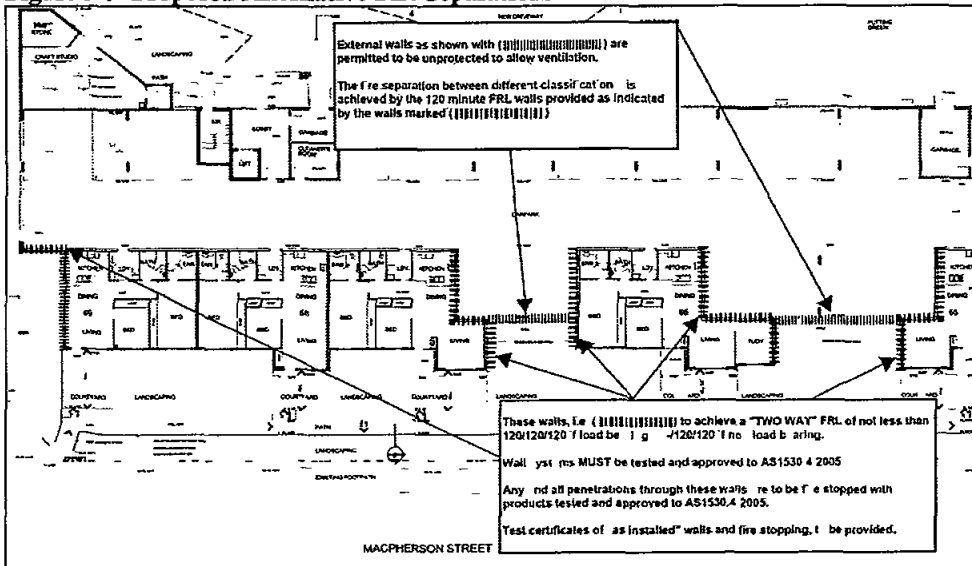
If it can be shown that an alternative solution can demonstrate an equivalent level of protection that is equivalent to the Performance and Objective criteria specified by the BCA, then design is considered to be at least equivalent to the DTS provisions of the BCA

It is therefore considered that

- A) If a fire started in the car park, fire rated construction would prevent the fire to spread to the adjacent SOU’s for a period of not less than 120 minutes
- B) If a fire started in any of the affected SOU’s, fire rated construction would prevent the fire to spread to the adjacent car park for a period of not less than 120 minutes

As such, the alternative solution proposed to mitigate fire spread between the two fire compartments for a period of not less than 120/120/120 is as shown in the figure below

Figure 5-7 Proposed Alternative Fire Separations



By fire rating the walls as indicated above, and allowing the grilles in the car park and Unit 69 for ventilation as shown, fire spread between compartments given a fire in either of those compartments would be expected to be mitigated for not less than



120/120/120 This is considered to be at least equivalent to the Performance and Objective of the DTS provisions of the BCA

5.2.3 SUMMARY

Based on the above, and given the implementation of the fire ratings as identified in Figure 5-7, fire spread between the compartments will be mitigated to a level that is at least equivalent to a DTS solution and as such it is considered that Performance Requirements CP1 & CP2 are satisfied in accordance with A0 5(b)(ii) and A0 9(c) of the BCA as summarised in the following tables

Table 5-3 Performance Requirement CP1

PERFORMANCE REQUIREMENT	ALTERNATIVE SOLUTION
A building must have elements which will to the degree necessary maintain structural stability during a fire appropriate to	
(a) The function or use of the building and	Classes 2 and 7a in the affected area
(b) The fire load and	Equivalent to DTS solution
(c) The potential fire intensity, and	Equivalent to DTS solution
(d) The fire hazard and	Equivalent to DTS solution
(e) The height of the building and	Rise in Stories of 2
(f) Its proximity to other property and	N/A
(g) Any active fire safety systems installed in the building, and	Equivalent to DTS
(h) The size of any fire compartment and	Equivalent to DTS
(i) Fire brigade intervention, and	Equivalent to DTS
(j) Other elements they support and	Equivalent to DTS
(k) The evacuation time	Egress provisions comply with the DTS provisions of the BCA



Table 5-4 Performance Requirement CP1

PERFORMANCE REQUIREMENT	ALTERNATIVE SOLUTION
A building must have elements which will, to the degree necessary avoid the spread of fire	
(a) To exits and	N/A
(b) To sole occupancy units and public corridors and	The proposed fire separations will prevent the spread of fire from the car park to the SOU s for not less than 120 minutes
(c) Between buildings and	N/A
(d) In a building appropriate to	
(i) The function or use of the building, and	Classes 2, & 7a as relates to this specific non compliance
(ii) The fire load and	Equivalent to DTS solution
(iii) The potential fire intensity, and	Equivalent to DTS solution
(iv) The fire hazard, and	Equivalent to DTS solution
(v) The number of storeys in the building, and	2
(vi) Its proximity to other property and	N/A
(vii) Any active fire safety systems installed in the building and	Equivalent to DTS
(viii) The size of any fire compartment and	Equivalent to DTS
(ix) Fire brigade intervention, and	Equivalent to DTS
(x) Other elements they support and	Equivalent to DTS
(xi) The evacuation time	Egress provisions comply with the DTS provisions of the BCA

6 REPORT BASIS INFORMATION

The report is based on the following

- (1) Architectural plan prepared by NRP Architecture Titled "Warriewood Brook Retirement Village Stage 3, 6-14 Macpherson Street Warriewood



NSW 2102, “Overall Ground Floor Plan””, Drawing Number ar – 1200,
Revision a08

- (ii) Architectural plan prepared by NRP Architecture Titled “Warriewood Brook Retirement Village Stage 3, 6-14 Macpherson Street Warriewood NSW 2102, “Overall First Floor Plan””, Drawing Number ar – 1201, Revision a03

7 CONCLUSION

This report has addressed the proposed the proposed new Warriewood Brook Retirement Village (Stage 3) in Warriewood NSW, for compliance with the relevant Performance Requirements of the Building Code of Australia (BCA) 2010

The areas of design requiring alternative solutions which have been addressed herein include the following

- Specification C1 1 Table 4 Some areas of the proposed building are located within 18m of an adjacent building
- Clause C3 3 Protection of openings in external walls The car park is proposed to have grilles for ventilation and these are perpendicular the external walls of adjacent SOU's

It has been established herein that the objective for the design, Performance Requirements CP1 & CP2 of the Building Code of Australia for each of the non compliances, have been satisfied

Where building alterations or a change use within building occurs, the validity of this fire safety engineering analysis may be compromised and further analysis may be required

8 REFERENCES

- 1 ABCB, *Building Code of Australia 2010*, Australian Building Codes Board, Sydney, Australia, 2010
- 2 Australian Building Codes Board (ABCB), *Guide to the BCA Class 2 to Class 9 Buildings*, Australian Building Codes Board, Canberra, Australia, 2010
- 3 Fire Code Reform Centre (FCRC), *Fire Engineering Guidelines, First edition*, March 1996, Fire Code Reform Centre Ltd, Sydney, Australia, March 1996
- 4 Buchanan, A. H., *Structural Design for Fire Safety*, John Wiley & Sons Ltd, 2001

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WARRIEWOOD BROOK RETIRMENT VILLAGE
STAGE 3
BCA CLASS 1, 2 or 3 BUILDING
ACOUSTIC SPECIFICATION

Prepared for Anglican Retirement Villages

Date 15 October 2010

ISSUE A
REVISION 0

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05/307/07 PARTNER

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Construction Certificate
Accredited Body Corporate #ABC1

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Appendix 1 – Acoustic Details

1 APPLICATION OF THIS SPECIFICATION

The requirements or standards contained within this acoustic specification are in addition to any other non-acoustic requirements such as structural integrity, fire rating, material compatibility, etc

Where the acoustic requirements or standards contained in this specification exceed those stated in another specification or drawing, then the requirements of this specification shall override the other requirement. Where multiple performance requirements are stated, the systems installed shall comply with all requirements.

Install all systems in accordance with the manufacturer's requirements and recommendations unless this specification requires a higher standard.

2 ARCHITECTURAL ELEMENTS

For detailed drawings of architectural elements (walls, risers, etc) refer to Appendix 1

2.1 WALLS

2.1.1 General Requirements

Select and install all walls to comply with the requirements of the Building Code of Australia unless this specification nominates a higher standard of treatment

2.1.2 Minimum Requirements

The following is a list of minimum requirements. Wet areas referred to in the Table are bathrooms, ensuites and laundries. "Discontinuous construction" in the Table has the same definition as in the current BCA

Refer also to details in appendix 1

Wall Type	Minimum Requirement
Intertenancy Walls Dividing Apartments – Wet Areas to Habitable Areas	$R_w + C_r$ 50 + Discontinuous Construction (slab to slab)
Intertenancy Walls Dividing Apartments – Habitable Areas to Habitable Areas	$R_w + C_r$ 50 (slab to slab)
Intertenancy Walls Dividing Apartments – Wet Areas to Wet Areas	$R_w + C_r$ 50 (slab to slab)
Walls Between Apartments and Common Corridors, Public Stairwells etc	R_w 50 (slab to slab)
Walls Between Apartments and Garbage Rooms	R_w 50 + Discontinuous Construction (slab to slab)
Walls Between Apartments and Plant Areas/Lift Cores	R_w 50 + Discontinuous Construction (slab to slab)
Walls Between Apartment Habitable Areas and Services Ducts/Risers	$R_w + C_r$ 40 (slab to slab)
Walls Between Apartment Bathrooms/Laundries and Services Ducts/Risers	$R_w + C_r$ 25 (slab to slab)
Meeting Room, Gym, and Consult Rooms	R_w 45
Managers Office	R_w 45
Apartment to Chiller Plant Room	R_w 60 + Discontinuous Construction
Chiller Plant Room to Corridor	R_w 50
Meeting Room, Consult Room, Lounge Room	R_w 45
Multi-Purpose Room Operable Wall	R_w 45

*Field tested performance of any wall system must be within 5 R_w points of the design ratings set out in the table above

Carry out the installation of all walls/partitions in a manner that will not reduce the performance of the walls below the Tabled requirements. This includes but is not limited to the proper filling of joints between blocks/panels, back filling with mortar any chasing of walls and sealing of wall junctions.

Unless stated otherwise, all acoustically rated walls shall be installed slab-to-slab and sealed around the perimeter.

2.2 PENETRATIONS

Acoustically treat all penetrations through walls to maintain the nominated acoustic rating as listed in the Table of minimum requirements.

No penetrations are to be made into the wall constructions unless specified or shown in the drawings. If a penetration is made where it is not required, it should be made good.

2.2.1 Wall Junctions

Unless otherwise detailed in this acoustic specification, with the exception of set plasterboard-to-plasterboard sheet joints, acoustically seal all vertical and horizontal wall junctions using a fire-rated 100% polyurethane flexible sealant (10-15mm high joint with minimum 10mm sealant bead depth, plus foam backing rod) equal to Bostik Fireban 1. Acoustically seal all vertical and horizontal junctions of plasterboard sheeting that is required to have an acoustic rating.

2.2.2 Hebel

Install Hebel in accordance with the product manufacturer's specification and technical literature.

2.2.3 Sealants

Carry out sealing of joints in acoustic walls using a fire-rated 100% polyurethane flexible sealant equal to Bostik Fireban 1. If it is proposed to use a sealant other than that nominated, then approval must first be gained from the Project Acoustic Engineer.

2.2.4 Contact with services

Prevent contact between any part of the walls or the ceiling supports with water, waste, stormwater or air conditioning ducting and piping. Maintain a minimum gap clearance.

2 3 FLOORS

2 3 1 General Requirements

Select and install all floors to comply with the requirements of the Building Code of Australia unless this specification nominates a higher standard of treatment

2 3 2 Minimum R_w Requirements

The following is a list of minimum requirements

Floor Type	Minimum Rating
Floors Separating Apartments	$R_w + C_{tr}$ 50
Between Apartments and Common Areas/Non-Residential Tenancies	$R_w + C_{tr}$ 50

Carry out the installation of floors in a manner that will not reduce the performance below the Tabled performance requirements This includes but is not limited to the proper filling of joints, back filling any chasing with non-shrink grout, and installation of ceilings where required to comply with the overall floor/ceiling rating

2 3 3 Multi-Purpose Room

Carpet floor to multi-purpose room is recommended If carpet floor is not installed, we recommend the installation of a noise absorptive surface finish to the underside of the ceiling over the room (minimum NRC 0.7)

2 3 4 PENETRATIONS

Acoustically treat all penetrations through floors to maintain the nominated acoustic rating as listed in the Table of minimum requirements

No penetrations are to be made into the floor constructions unless specified or shown in the drawings If a penetration is made where it is not required, it should be made good

2 3 5 Floor Joints

Unless otherwise detailed in this acoustic specification, seal construction joints using a fire rated 100% polyurethane flexible sealant (10-15mm high joint with minimum 10mm sealant bead depth, plus foam backing rod) equal to Bostik Fireban 1

2 3 6 Sealants

Carry out sealing of joints in floors using a fire rated 100% polyurethane flexible sealant equal to Bostik Fireban 1 If it is proposed to use a sealant other than that nominated then approval must first be gained from the Project Acoustic Engineer

2 4 CEILINGS

Refer to details in appendix 1

2 4 1 General Requirements

Select and install all ceilings to comply with the requirements of the Building Code of Australia unless this specification nominates a higher standard of treatment

2 4 2 MINIMUM R_w REQUIREMENTS

Following is list of minimum requirements Refer to architectural details for location and extent of acoustic treatment

Ceiling Type	Minimum R_w
Wet area ceilings (bath, ensuite laundry)	R_w+C_{tr} 25
Bedroom ceilings with waste or stormwater pipes in ceiling void	R_w+C_{tr} 40

Carry out the installation of all in a manner that will not reduce the performance of the ceilings below the Tabled R_w requirements This includes but is not limited to the proper filling of joints between sheets sealing of joints ceiling to wall junctions

Refer to appendix 1 for ceiling construction

2 4 3 Multi purposes room

Refer to 2 3 3 Ceiling over multi purpose room to have 75,, thick 11kg/m³ glasswool insulation

2 4 4 Penetrations

Acoustically treat all penetrations through ceilings to maintain the nominated acoustic rating as listed in the Table of minimum requirements

No penetrations are to be made into the ceiling constructions unless specified or shown in the drawings If a penetration is made where it is not required it should be made good

2 4 5 Sealants

Carry out sealing of joints in acoustic ceilings using a fire rated 100% polyurethane flexible sealant equal to Bostik Fireban 1 If it is proposed to use a sealant other than that nominated, then approval must first be gained from the Project Acoustic Engineer

2 4 6 Contact with services

Prevent contact between any part of the ceilings or the ceiling supports with water, waste, stormwater or air conditioning piping Maintain a minimum 15mm gap between the pipes/lagging and ceiling or ceiling supports, walls framing, etc

2 4 7 Resiliently Suspended Ceilings

Where resiliently suspended ceilings are required, use resilient ceiling hangers shall be equal to Embelton RHC Alternative resilient ceiling hangers shall be submitted for approval by the Project Acoustic Engineer

Install ceilings so that there is no direct contact between the ceiling and the slab above, except via the resilient hanger Acoustically seal all penetrations through the ceilings using a resilient sealing method that prevents the transfer of vibration from the ceiling to the item penetrating the ceiling

2 5 ACCESS PANELS

Install acoustically certified access panels to equal the acoustic performance of the element in which they are installed

Install access panels in ceilings over bathrooms, laundries and kitchens, under air conditioning units, and on risers containing waste pipes in bathrooms, laundries and kitchens with a minimum rating of R_w 30 *Alternatives shall be submitted to the Project Acoustic Engineer for approval*

Access panels for waste piping shall not be located on the sides of risers containing waste pipes facing habitable rooms

Access panels under ceiling mounted air conditioning units shall have the same or higher surface density as the ceiling in which they are installed

2 6 DOORS

2 6 1 General Requirements

Provide acoustically rated doors where they are installed in walls required to have an acoustic rating

2 6 2 Minimum Requirements

The following is a list of minimum requirements

Door	Minimum Requirement
Sole Occupancy Unit Entry Door Opening to Common Areas	40mm thick solid core doors
Plant Rooms	Minimum 45mm thick solid core doors set into door frames Raven RP10 door seals or Schlegel FSN 107S seals installed on top and sides with Raven RP38 or Schlegel FSN 220 seal on door bottom

2 6 3 Installation

Carry out the installation of all doors and seals in a manner that will not reduce the performance of the doors including

- Ensuring doors are installed without warps and hung with even gaps
- Installing door with minimum gap at door bottom complying with manufacturer's requirement Threshold under door seal is to be level and flat Install aluminium threshold plate under door seals where door seals close onto carpet
- Installing seals with minimum gaps at joints/junctions
- Adjusting seals so that they are acoustically effective around the full perimeter without excessive effort required to close the doors
- Ensure that the door hardware does not foul the seals, and that the seals form a continuous seal around the door perimeter

27 ACOUSTIC DETAILS / DRAWINGS

Refer to appendix 1 for recommended constructions

3 MECHANICAL SERVICES - NOISE AND VIBRATION

3.1 APPLICATION OF THIS SPECIFICATION

The requirements or standards contained within this acoustic specification are in addition to any other non-acoustic requirements such as structural integrity, fire rating, material compatibility, etc

Where the acoustic requirements or standards contained in this specification exceed those stated in another specification or drawing then the requirements of this specification shall override the other requirement. Where multiple performance requirements are stated, the systems installed shall comply with all requirements.

Install all systems in accordance with the manufacturer's requirements and recommendations unless this specification requires a higher standard.

3.2 PROJECT NOISE AND VIBRATION CRITERIA

3.2.1 Internal Noise Levels

Noise from mechanical plant inside the development shall not exceed the levels given below. Unless stated otherwise, the noise level criteria shall not be exceeded with the plant operating under normal operating conditions, and at start-up for intermittently operating plant items.

Maximum noise levels in residential apartments and other areas are listed in

Table 3 1 and Table 3 2 Areas not listed in these Tables shall be designed to comply with the relevant recommended design sound level as detailed in Australian/New Zealand Standard 2107-2000 '*Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors*'

Allow to fully comply with the internal and external noise level requirements, including noise from diffusers, grilles and louvres, ductwork and risers notwithstanding the equipment noise ratings indicated in the mechanical services specification or the acoustic treatments indicated in the mechanical services specification or drawings

Table 3 1 - Noise Level Criteria

SPACE/ACTIVITY TYPE	NOISE LEVEL dB(A)
Bedrooms and sleeping areas	35 from apartment a/c unit on medium speed 30 from all other plant other than apartment a/c unit
Living / dining areas within apartment	40 from apartment a/c unit on medium speed 30 from all other plant other than apartment a/c unit
Common Lounge / Dining Areas	40 45
Bathrooms / Toilets / Laundries	45
Meeting Rooms and Private Offices	40
Laundries	50
Basement or Garbage Rooms	65

Noise within apartments shall be free of tones or other undesirable characteristics

3 2 2 Noise during a Fire Emergency

Noise from all plant during a fire emergency shall comply with the requirements of AS 1668 1 and AS 1668 3

3 3 EXTERNAL NOISE LEVELS

3 3 1 Property Boundaries

Noise levels emitted by the mechanical plant at all property boundaries and nearby buildings on adjacent properties are not to exceed the requirements of the following authorities of whichever is more stringent

- 1 Local Council (Pittwater Council),
- 2 Any other relevant Statutory and/or Regulatory Authority

Allowable noise levels emitted by the plant at all property boundaries of nearby residential buildings are summarised below

Table 2 – Noise Emission Goals

Time of Day	Background noise level – dB(A)L ₉₀	Noise Emission Goals		
		Pittwater Council Objective (DCP) dB(A)L _{eq(Period)}	DECC Intrusiveness Objective dB(A)L _{eq(15min)}	DECC Amenity Objective dB(A)L _{eq(Period)}
Day Time (7am – 6pm)	42	47	47	55
Evening (6pm – 10pm)	38	43	43	45
Night (10pm-7am)	35	40	40	40

3 3 2 Outdoor Areas on the Development Site

Noise levels emitted by mechanical plant to terraces, balconies and outside facades containing apartment windows on the development site shall not exceed the A-weighted background noise level (i.e. the L₉₀ noise level) at any time during the day or night

3 4 PLANT NOISE LEVELS

Adjust and balance all systems so that noise above the specified levels is not created and the scheduled internal and external noise levels are complied with. The Sub-Contractor is to perform all necessary balancing works to gain compliance.

3 5 VIBRATION PRODUCED BY PLANT

Tactile structure vibration levels produced by the plant shall not exceed the criteria given in Australian Standard AS 2670 2-1990 “*Evaluation of Human Exposure to Whole-Body Vibration - Continuous and Shock-Induced Vibration in Buildings (1 to 80 Hz)*”. Where the Standard recommends a range of criteria for a particular occupancy, the low end of the range shall be used, except for residences where the base curve shall be used to assess vibration in all cases.

3 6 TESTING ON COMPLETION

Following installation the Sub-Contractor is to carry out noise tests to all apartments and perform external noise compliance measurements to confirm compliance with the criteria given in Section 3.

The locations selected for measurement shall include all critical occupancies close to plant including residences located near plant rooms, balconies and roof terraces near discharges/intakes, car park areas, lobbies/corridors and pools.

Noise levels should be measured in the worst affected part of the room/occupancy, at least 1.5m from the grilles located within the room (or the middle of the room if this is not possible).

Noise level measurements within bedrooms are to be tested whilst the bedroom door is open and the bathroom door is closed. Noise level measurements within bathrooms, laundries etc are to be tested with the bathroom door open.

The sound level meter used for the noise tests shall comply with the Type 2 instrument as defined in Australian Standard AS 1259 2-1990 "Acoustics - Sound Level Meters - Integrating - Averaging" Testing method shall be in accordance with Australian/New Zealand Standard AS/NZS 2107 2000 "Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors" Clause 5 except that all-openable windows shall be closed during the test

The Sub Contractor is to provide noise test results tabling each location with the measured and design noise levels (dB(A)) The Table should include the design and actual airflow measured from each grille

If the noise or vibration levels exceed those specified, carry out rectification work and remeasure noise levels to demonstrate compliance with the specification All testing and rectification work is at the Sub-Contractor's expense

3 7 NOISE GENERATED BY THE AIR DISTRIBUTION SYSTEM

Noise from the air distribution system shall be minimised by

- 1 Selecting grilles, diffusers, dampers and accessories to meet the specified noise levels
- 2 Balancing the system using dampers on duct branches, with dampers at grilles being used for minor adjustment of air volumes Where excessive noise levels are due to noise generated at dampers near grilles, the branch dampers shall be readjusted to eliminate excessive dampening and noise at the grilles
- 3 Installing ductwork with a minimum number of bends, offsets, etc Flexible ducts should not be kinked or have excessive bends, particularly near grilles, etc Ensure there are no protrusions inside the duct that could generate noise Unless indicated otherwise, install turning vanes in tee's and bends or use long radius bends to minimise turbulence Spigots on plenum boxes should maintain the full internal cross section of the duct connecting into the plenum box
- 4 Seal duct joints adequately so there is no noise resulting from air leakage
- 5 Ensure plenums behind supply and exhaust grilles are correctly sized to ensure even flow over the grille/diffuser
- 6 Flexible duct diameters shall be selected so as not to exceed the following velocities (including velocity at plenum spigot)

Space Noise Criterion (dB(A))	Maximum Velocity (m/s)
35	2.75
40	3.3
45	4.0

3 8 STRUCTURE BORNE NOISE AND VIBRATION

Minimise the transmission of vibration to the building structure to ensure the noise and vibration criteria are achieved by

1 Statically and dynamically balancing rotating plant and equipment. Out of balance not to exceed 0.03mm/kg of rotating element after installation. Where specified, provide balancing test certificates.

2 Providing isolation mounts or hangers for vibrating plant and equipment.

3 Providing inertia blocks where indicated to limit the vibration amplitude.

4 Isolating piping, electrical conduit, etc subject to vibration from the building structure.

5 Providing flexible connections where ducts and piping is connected to vibrating plant and machinery.

Submit a schedule of isolation mounts for approval by Project Acoustic Engineer indicating make, model, rated load and static deflection, actual load and static deflection, unloaded height and fully loaded height.

Sub Contractor to undertake all isolation works as specified herein. Any treatments installed by Stockland Development Division (NSW) are to be assumed to provide no additional isolation.

3.9 ANTI-VIBRATION MOUNTS AND ISOLATORS

3.9.1 Selection of Equipment Isolation Mounts

Select isolation mount type and minimum static deflection according to the following Table (refer below for isolator types).

Table 3 - Isolator Schedule

PLANT	ISOLATOR TYPE	MINIMUM STATIC DEFLECTION
Water tanks	M1/H1/HE1	2 mm
Hot Water Units	M2	6 mm
In line Centrifugal Fans and Small Axial Fans	M3/H1	10 mm
Axial Fans (450mm or > diameter), Centrifugal Fans	M4	25 mm
Axial Fans (<450mm diameter),	M3/H1	10 mm
Fan/coil units	M3/H1	2 mm
Chillers	M4	25mm
Cooling towers	M3	10mm
Condensing Units	M3	10 mm
Pumps	M4	25 mm
Condensers	M1	2-3mm

3 9 2 Piping

Vibration isolate all refrigerant piping using a flexible 12mm thick foam sleeve between the pipe and the clamp similar to Poron 4701-12-20250 1604 (2 layers) (suppliers Mason Grogan 9748 3838) fitted between the pipe and the clamp. The clamp should then be tightened just sufficiently to hold the pipe, but not over tightened. Any chased-in piping should be completely wrapped in foam.

Piping within 25m of pumps, cooling towers or chillers (except small diameter piping runouts to fan/coil units) shall be vibration isolated using type M4 or H2, 25mm static deflection isolators for piping fixed to the plant room floor slab or walls of the apartments, type M3/H1, 10mm static deflection mounts elsewhere within 20m of the pumps or chillers.

Isolate any other small diameter piping runouts to fan coil units within 20m of pumps or chillers using a flexible 12mm thick foam sleeve between the pipe and the clamp similar to Poron 4701-12-20250-1604 (2 layers) (suppliers Mason Grogan 748 3838) fitted between the pipe and the clamp. The clamp should then be tightened just sufficiently to hold the pipe, but not over tightened.

Isolate piping within 20m of cooling towers or any other main piping runs fixed to the walls of the units using type M3/H1, 10mm static deflection mounts.

3 9 3 Isolation Mount Types

Type M1 - Waffle Pad Mounts

Waffle pad mounts shall be minimum 17mm thick neoprene rubber (nitrile rubber where oil contamination is possible), cross ribbed with alternately raised ribs on both faces of the pad, loaded within the load range of the isolator with a minimum static deflection of 1.5mm.

Type M2 - Multiple Layer Waffle Pad Mounts

Multiple layer waffle pad mounts incorporating, specified number of layers of Type M1 Waffle Pad Mount, 1 5mm thick metal shim plate between the pad layers, minimum 1 5mm static deflection per layer

Type M3 - Neoprene Mounts

Neoprene mounts should be selected to give the static deflections under load nominated for the item of plant and incorporate separate steel top and base plates completely embedded in elastomer, elastomer colour coded for identification of load rating, non-skid mounting surfaces, bolt holes for bolting down plant

Type M4 - Spring/Neoprene Mounts

Spring/neoprene mounts should be selected to give the static deflections under load nominated for the item of plant and be laterally stable without any housing or other lateral support, be capable of an additional travel to solid of at least 50% of the rated static deflection, incorporate a levelling facility, a spring diameter not less than 0 8 of the loaded height, incorporate a 6mm thick neoprene base pad to isolate acoustical frequencies Isolators exposed to weather should have zinc plated springs and housings coated with a flexible epoxy to prevent corrosion

3 9 4 Isolation Hanger Types

Type HE1 - Neoprene Hanger Elements

Neoprene hanger elements should be selected to give the static deflections under load nominated for the item of plant and incorporate separate steel top and base plates completely embedded in elastomer which should interlock in the event of fire or mechanical failure, elastomer colour coded for identification of load rating, hole for locating hanger and a lip to locate the element within in the mounting hole

Type H1 - Neoprene Hangers

Neoprene hanger elements should be selected to give the static deflections under load nominated for the item of plant and incorporate Type HE1 - Neoprene Hanger Element located within a galvanised steel cage with provision for threaded hanger rods to screw into the hanger element, provide sufficient clearance around the threaded hanger rod to ensure it cannot touch the hanger cage

Type H2 - Spring/Neoprene Hangers

Spring/neoprene hangers should be selected to give the static deflections under load nominated for the item of plant and be laterally stable without any housing or other lateral support, be housed in a galvanised steel cage, be capable of an additional travel to solid of at least 50% of the rated static deflection, incorporate a levelling facility, a spring diameter not less than 0 8 of the loaded height, incorporate a neoprene base pad to isolate acoustical frequencies Isolators exposed to weather should have zinc plated springs and housings coated with a flexible epoxy to prevent corrosion, and self-draining cups

3 9 5 EQUIPMENT BASES AND PLINTHS – PUMPS AND CHILLERS

Mount equipment on rigid bases The bases shall be sufficiently rigid not to deform under the weight of the machinery or during operation and reduce the effectiveness of the isolation mounts

All pumps and chillers shall be installed on concrete plinths which are themselves isolated from the building structure on a layer of 10mm thick Embelton Impactamat 750 kg/m² or equal

The mass of the base shall be at least 1.5 times the mass of the equipment being supported including pipe fittings, etc. Bases shall minimise the height of the centre of gravity of the machine/base.

3.10 INSTALLATION OF VIBRATION ISOLATION MOUNTS

Level the mounts once the equipment is fully loaded in its operating condition with a minimum clearance between the machine and the structure of 20mm, and adjusted to ensure that the isolators are loaded correctly. Ensure that the isolators are not bridged by mounting bolts or contact between any part of the machine or an unisolated part of the isolation mounts and the structure.

Select the number and spacing of the mountings to minimise machine rocking. Consider static and dynamic forces during operation and start-up when selecting the mounts.

Where there is a possibility of significant lateral loads occurring use hold down bolts, lateral restraints, or housed mounts to locate equipment.

3.11 PENETRATIONS

3.11.1 General

Duct, pipe and electrical penetrations through walls, floors etc shall not

- Decrease the required sound rating/isolation rating of the wall, floor, ceiling, etc.
- Allow the transmission of vibration from pipes and ducts to the wall, floor, etc.

Do not penetrate full height walls around bedrooms, and full height walls separating bathrooms/laundries from other rooms, with flexible ducts unless unavoidable. Where ducts pass through above ceiling barriers or full height walls, the main sheet metal duct should be taken through the penetration to over the room served by the flexible duct and the flexible duct run out to the grille connected. Alternatively, for penetrations through full walls around wet areas and bedrooms, the flexible duct may be drawn through a 300mm long sheet metal sleeve that is grouted into the wall using a non-shrink grout. An insulated 4 zero fire rated flexible duct should be used and the outside diameter of the sleeve should be the same as the flexible duct outside diameter.

Return air openings in the walls above the ceiling shall only be made in the locations indicated on the architectural drawings.

Any grille/diffuser plenum located within a sound rated wall, bulkhead or ceiling shall be sealed into the wall as required for ducting generally. The plenum shall be internally insulated (with perforated foil faced 25kg/m³ density glass wool) sheet metal. A sound rated wall is a wall dividing a bathroom/ensuite/laundry from another room, bedroom wall, plant room wall, or external wall, or within 3m of air conditioning unit.

In addition, all grilles within approximately 3m of an air conditioning unit or located in a double layer plasterboard ceiling or bulkhead shall be fitted with a 90 degree sheet metal plenum internally insulated with 25mm thick, 25kg/m³ density glass wool faced with perforated metal or black faced tissue/binder and sealed into the ceiling as for ducting generally. If a 90 degree plenum is not possible, then a straight through plenum with minimum length of 500mm is required.

3.12 DUCT PENETRATIONS

Seal ducts penetrating slabs, walls and above ceiling baffles as follows.

SPACES	WALL/FLOOR CONSTRUCTION	SEAL TYPE
All	Masonry	Type DA or DB seal
All	Plasterboard	Type DA or DB or Type DC

Where the building element penetrated consists of one or more leaves then all leaves shall be acoustically sealed

Fire damper flanges may be used to acoustically seal duct penetrations provided they are fully caulked into the wall/floor using a flexible fire rated 100% polyurethane sealant equal to Bostik Fireban 1

3 13 ELECTRICAL WIRING

Individual electrical cables can be sealed with Bostik Fireban 1 sealant Bunches of cables shall be drawn through a 5mm thick, 600mm long PVC conduit tightly packed with polyester fibre, glass wool or Rockwool insulation Seal around the conduit by filling with a non-shrinking grout

3 13 1 Location of Penetrations in Acoustically Rated Walls

Wherever possible, where pipes and cables running through ceiling voids enter or pass through an acoustically rated wall (or pass into a wall cavity forming part of an acoustically rated wall) the pipe/cable shall be located as close as possible to the head of the wall

Locate pipe and duct penetrations away from corners, hard to the underside of slabs and other inaccessible locations that prevent access to seal the penetration

3 14 SILENCERS AND INTERNALLY LINED DUCTING - GENERAL

3 14 1 Lined Ducting

Internal duct insulation should be resin bonded mineral wool insulation in a batt or board form having a minimum density of 32kg/m³ Lining acoustic absorption shall exceed the following performance when measured in accordance with Australian Standard AS1045-1988

INSULATION THICKNESS	MINIMUM ABSORPTION COEFFICIENT					
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
25mm	0 08	0 30	0 64	0 90	0 90	0 90
50mm	0 35	0 72	0 95	0 95	0 95	0 95
75mm	0 45	0 8	0 95	0 95	0 95	0 95
100mm	0 5	0 9	0 95	0 95	0 95	0 95

Insulation shall be either factory faced with perforated aluminium foil similar to Sisilation 450 or faced with 30% open area perforated zinc anneal steel sheet Perforated steel sheet shall be used whenever airflow velocities in the duct exceed 10m/s, or where specified elsewhere

3 14 2 Flexible Ducting

All flexible ducting for air conditioning within apartments and commercial units to be 4 zero fire rated acoustic flexible duct equal to Bradford AcoustiFlex with minimum 25mm thick insulation and a minimum 1.5m length

3 15 SILENCERS

3 15 1 Performance

Unless stated otherwise, comply with the scheduled minimum silencer performance requirements for insertion loss, airflow pressure drop and regenerated noise

3 16 CONSTRUCTION

3 16 1 General

Acoustic silencers shall be manufactured by a specialist manufacturer approved by the acoustic consultant and shall comprise

- 1 A minimum 1.6mm thick galvanised outer casing, stiffened as required to ensure that deformation of the silencer does not occur during installation and operation
- 2 Acoustically absorbent internal splitters constructed of perforated zinc anneal steel sheet with acoustically absorbent, heavy density mineral fibre infill. The ends of the splitters shall be shaped to minimise airflow resistance and regenerated noise
- 3 Heavy gauge flanges where the silencer is to be connected to ducting. Flanges shall be corrosion protected with an approved finish

Allow for duct transition sections before and after the silencers if required. Select and install silencers to ensure that airflow generated noise levels do not cause exceedances of the specified levels in Section 3.1. Where silencers are installed in risers, behind louvres etc seal around the perimeter of the silencer to the building opening with minimum 1.6mm thick sheet metal, fixed and caulked in a similar to that indicated in the "PB" duct penetration detail

3 16 2 Silencers in Odour Exhaust Systems

Wherever possible, quiet running kitchen exhaust fans are to be selected for kitchen exhausts to avoid the need for silencer treatment. Where required, silencers used in kitchen exhaust ducts or other ducts carrying contaminated air shall have a 12µm thick Melinex sheet between the splitter perforated metal facings and the absorptive infill to prevent the ingress of grease, dirt, etc into the infill material. Connect silencers to ductwork and maintain access so that the silencers are easily removable for cleaning

3 16 3 Silencers and Internally Lined Ductwork Exposed To Moisture

Use hydrophobic grade Rockwool absorbent lining faced with perforated zinc anneal steel sheet in all silencers and all internally insulated ductwork carrying moisture laden air or that are internally exposed to the weather. Alternatively, use Bradford Ultraphon or equal insulation with factory applied weatherproof acoustically transparent facing retained behind perforated metal

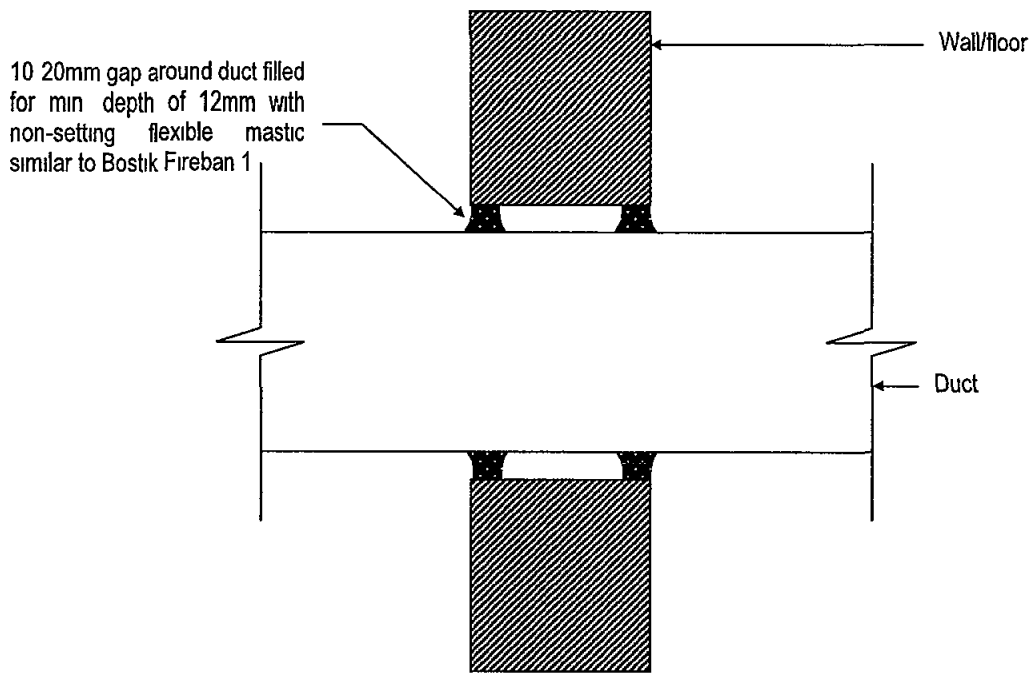
3 17 ELECTRICAL

3 17 1 Belt Driven Plant

Fit belt driven intermittently operating plant having motors rated at greater than 2.5kW with motor starters that limit the build up in motor speed at start-up. These are required to eliminate the possibility (especially in the future after belt wear has occurred) of belt squeal being audible in occupied spaces having a noise criterion of 45dB(A) or lower, on adjacent properties and on residential terraces/external spaces.

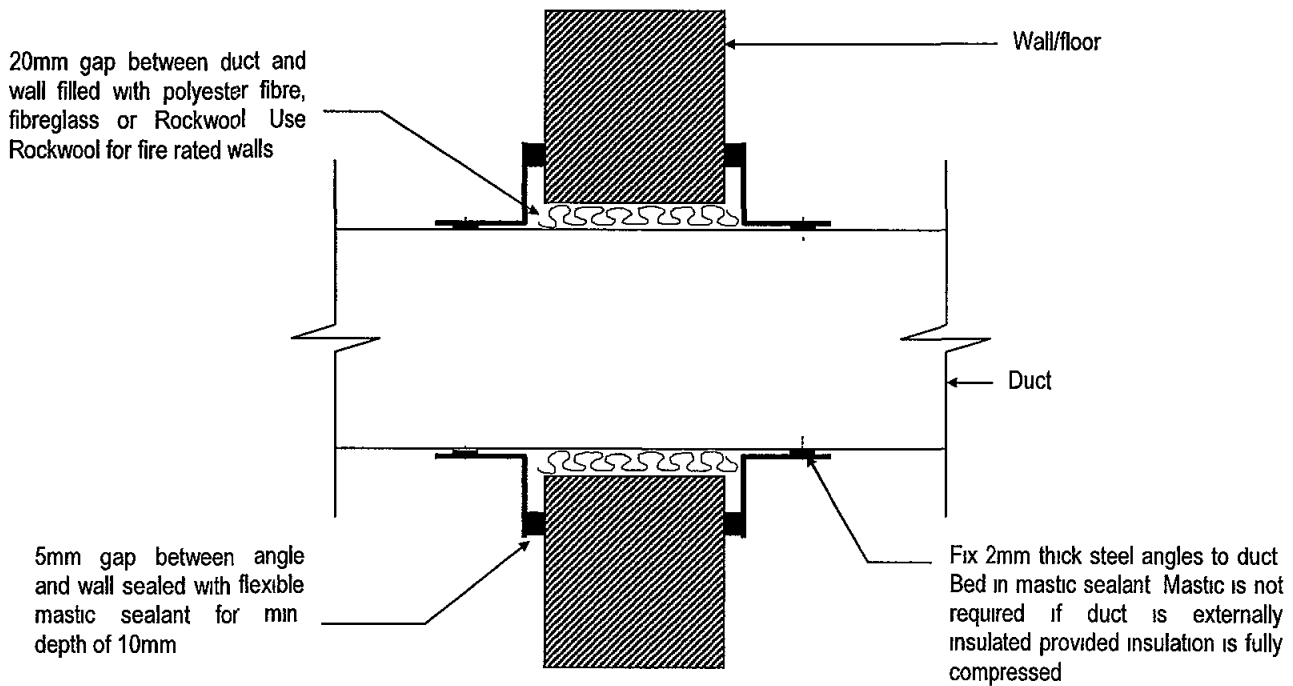
3 17 2 Contactors / Starters / Controllers

Noise from contactors, starters and controllers shall be inaudible inside rooms having a noise of 45dB(A) or lower, on adjacent properties and on residential terraces/external spaces. Provide enclosures around these items and/or vibration isolate the items from building elements where they may give rise to the transmission of structure-borne noise.



TYPE DA DUCT SEAL

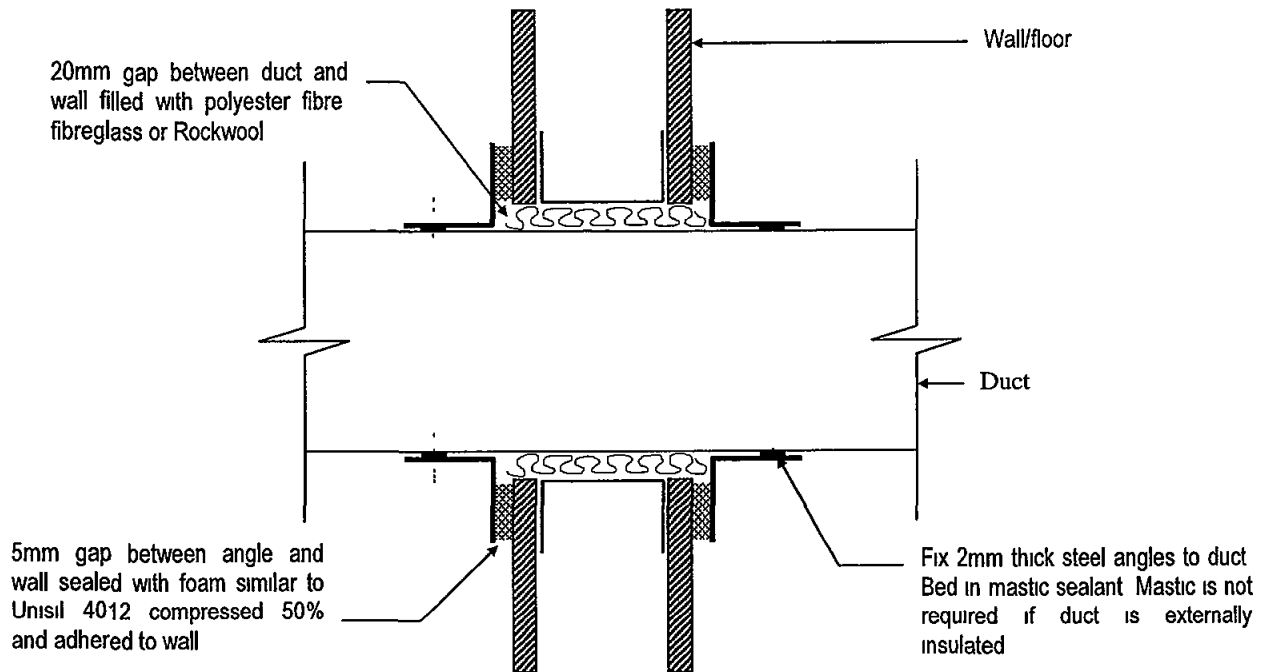
(Note Typical fire damper detail is also adequate provided any gaps are sealed with Bostik Fireban 1)



TYPE DB DUCT SEAL

(Note Typical fire damper detail is also adequate provided flange is sealed to wall with Bostik Fireban 1)

NOTE These details describe the general intent For specific requirements refer also to architectural details



TYPE DC DUCT SEAL

(Note Typical fire damper detail is also adequate for fire rated walls provided flange is sealed to wall with Bostik Fireban 1)

NOTE These details describe the general intent For specific requirements refer also to architectural details

3 18 ALC RECOMMENDED ACOUSTIC TREATMENTS TO SPECIFIC PLANT ITEMS

To be determined following completion of plant selection and layouts

4 HYDRAULICS AND FIRE SERVICES - NOISE AND VIBRATION

4.1 APPLICATION OF THIS SPECIFICATION

The requirements or standards contained within this acoustic specification are in addition to any other non acoustic requirements such as structural integrity, fire rating, material compatibility, etc

Where the acoustic requirements or standards contained in this specification exceed those stated in another specification or drawing then the requirements of this specification shall override the other requirement. Where multiple performance requirements are stated the systems installed shall comply with all requirements.

Install all systems in accordance with the manufacturer's requirements and recommendations unless this specification requires a higher standard.

4.2 PROJECT NOISE AND VIBRATION CRITERIA

4.2.1 Internal Noise Levels

Noise from hydraulics plant inside the development shall not exceed the levels given below. Unless stated otherwise, the noise level criteria shall not be exceeded with the plant operating under normal operating conditions, and at start-up for intermittently operating plant items.

Maximum noise levels in residential apartments and other areas are listed in Table 4.1 and **Error! Reference source not found**. Areas not listed in these Tables shall be designed to comply with the relevant recommended design sound level as detailed in Australian/New Zealand Standard 2107-2000 "Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors".

Allow for any additional treatment to fully comply with the internal and external noise level requirements notwithstanding the equipment noise ratings indicated or the acoustic treatments indicated in the hydraulics services specification or drawings.

Table 4.1 - Noise Level Criteria

SPACE/ACTIVITY TYPE	NOISE LEVEL dB(A)
Bedrooms and sleeping areas	35 from apartment a/c unit on medium speed 30 from all other plant other than apartment a/c unit
Living / dining areas within apartment	40 from apartment a/c unit on medium speed 30 from all other plant other than apartment a/c unit
Common Lounge / Dining Areas	40-45
Bathrooms / Toilets / Laundries	45
Meeting Rooms and Private Offices	40
Laundries	50

Basement or Garbage Rooms	65
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It is noted that noise within apartments shall be free of tones or other undesirable characteristics

4 2 2 Noise During a Fire Emergency

Noise from all plant during a fire emergency shall comply with the requirements of AS 1668 AS 1668 requires that noise levels during a fire emergency not exceed 80dB(A) within fire isolated passageways or 65dB(A) within occupied spaces, and 50 dB(A) within apartments Noise levels inside the fire control room shall not exceed 65dB(A) during a fire emergency

4 3 EXTERNAL NOISE LEVELS

4 3 1 Property Boundaries

Noise levels emitted by the mechanical plant at all property boundaries and nearby buildings on adjacent properties are not to exceed the requirements of the following authorities of whichever is more stringent

- 3 Local Council (Pittwater Council),
- 4 Any other relevant Statutory and/or Regulatory Authority

Allowable noise levels emitted by the plant at all property boundaries of nearby residential buildings are summarised below

Table 2 – Noise Emission Goals

Time of Day	Background noise level – dB(A) _{L₉₀}	Noise Emission Goals		
		Pittwater Council Objective (DCP) dB(A) _{L_{eq}(Period)}	DECC Intrusiveness Objective dB(A) _{L_{eq}(15min)}	DECC Amenity Objective dB(A) _{L_{eq}(Period)}
Day Time (7am – 6pm)	42	47	47	55
Evening (6pm – 10pm)	38	43	43	45
Night (10pm 7am)	35	40	40	40

4 3 2 Outdoor Areas on the Development Site

Noise levels emitted by mechanical plant to terraces, balconies and outside facades containing apartment windows on the development site shall not exceed the A-weighted background noise level (i.e. the L₉₀ noise level) at any time during the day or night

4 4 PLANT NOISE LEVELS

Adjust and balance all systems so that noise above the specified levels is not created and the scheduled internal and external noise levels are complied with. The Sub-Contractor is to perform all necessary balancing works to gain compliance.

4 5 VIBRATION PRODUCED BY PLANT

Tactile structure vibration levels produced by the plant shall not exceed the criteria given in Australian Standard AS 2670 2-1990 "Evaluation of Human Exposure to Whole-Body Vibration - Continuous and Shock-Induced Vibration in Buildings (1 to 80 Hz)". Where the Standard recommends a range of criteria for a particular occupancy, the low end of the range shall be used, except for residences where the base curve shall be used to assess vibration in all cases.

4 6 TESTING ON COMPLETION

Following installation the Sub-Contractor is to carry out as a minimum noise tests to all apartments adjacent to plant rooms, plus a minimum of a further 10% of the remaining apartments randomly selected and covering all typical apartment layouts, and external compliance measurements to confirm compliance with the criteria given in Section 4 2.

The locations selected for measurement shall include all critical occupancies close to plant including residences located near plant rooms, balconies and roof terraces near discharges/intakes, car park areas, lobbies/corridors and pools. Noise levels should be measured in the worst affected part of the room.

The sound level meter used for the noise tests shall comply with the Type 2 instrument as defined in Australian Standard AS 1259 2 1990 "Acoustics - Sound Level Meters - Integrating - Averaging". Testing method shall be in accordance with Australian/New Zealand Standard AS/NZS 2107 2000 "Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors" Clause 5 except that all-openable windows shall be closed during the test.

If the noise or vibration levels exceed those specified carry out rectification work and remeasure noise levels to demonstrate compliance with the specification. All testing and rectification work is at the Sub-Contractor's expense.

4 7 NOISE GENERATED BY THE HYDRAULICS SYSTEM

Noise from the hydraulics system should be minimised by

- 1 Limiting pipe velocities in water systems to not more than 1.5m/s
- 2 Laying out pipes to minimise the number of changes in direction and installing pipes so that the effective cross-sectional area of the pipe is maintained at pipe bends and junctions
- 3 Selecting valves and fittings that minimise the generation of noise
- 4 Installing pressure reducing stations, as required to eliminate excessive pressure at the terminal valves
- 5 Controlling structure-borne noise (i.e. plant and pipe vibration transmitted into the building structure) with the use of plant isolation mounts, resilient sleeves, etc

- 6 Routing piping to avoid noise sensitive locations such as apartment bedrooms and living rooms
Avoid routing of piping serving one apartment running through an apartment of separate occupancy
- 7 Provision of long radius bends to all piping located within ceiling spaces and framed walls
- 8 Fixing piping and caulking stud penetrations to prevent pipe movement within studwork
- 9 Locate waste pipe floor penetrations so that they do not fall within or near sound rated walls
- 10 Do not run piping along the head of walls, or in front of the head of sound rated walls that prevents access to the wall for caulking

4 8 STRUCTURE BORNE NOISE AND VIBRATION

Minimise the transmission of vibration to the building structure to ensure the noise and vibration criteria are achieved by

- 1 Statically and dynamically balancing rotating plant and equipment Out of balance shall not exceed 0.03mm kg/kg of rotating element after installation Where specified, provide balancing test certificates
- 2 Providing isolation mounts or hangers for vibrating plant and equipment
- 3 Providing inertia blocks where required to limit the vibration amplitude
- 4 Isolating piping, electrical conduit, etc subject to vibration from the building structure
- 5 Providing flexible connections where piping is connected to vibrating plant and machinery
- 6 Where piping is fixed to stud walls no part of the part of the piping, fixtures and valves or noggings to support these pipes and valves shall contact or bridge between the stud wall and any other independently supported wall element

4 9 ANTI VIBRATION MOUNTS AND ISOLATORS

4 9 1 Isolation Mounts

Type M1 Waffle Pad Mounts

Waffle pad mounts shall be minimum 17mm thick neoprene rubber (nitrile rubber where oil contamination is possible), cross ribbed with alternately raised ribs on both faces of the pad, loaded within the load range of the isolator with a minimum static deflection of 1.5mm

Type M2 - Multiple Layer Waffle Pad Mounts

Multiple layer waffle pad mounts incorporating, specified number of layers of Type M1 Waffle Pad Mount, 1.5mm thick metal shim plate between the pad layers, minimum 1.5mm static deflection per layer

Type M3 - Neoprene Mounts

Neoprene mounts should be selected to give the static deflections under load nominated for the item of plant and incorporate separate steel top and base plates completely embedded in elastomer, elastomer colour coded for identification of load rating, non-skid mounting surfaces, bolt holes for bolting down plant

Type M4 - Spring/Neoprene Mounts

Spring/neoprene mounts should be selected to give the static deflections under load nominated for the item of plant and be laterally stable without any housing or other lateral support, be capable of an additional travel to solid of at least 50% of the rated static deflection, incorporate a levelling facility, a spring diameter not less than 0.8 of the loaded height, incorporate a 6mm thick neoprene base pad to isolate acoustical frequencies. Isolators exposed to weather should have zinc plated springs and housings coated with a flexible epoxy to prevent corrosion.

4.9.2 Isolation Hanger Types

Type HE1 - Neoprene Hanger Elements

Neoprene hanger elements should be selected to give the static deflections under load nominated for the item of plant and incorporate separate steel top and base plates completely embedded in elastomer which should interlock in the event of fire or mechanical failure, elastomer colour coded for identification of load rating, hole for locating hanger and a lip to locate the element within in the mounting hole.

Type H1 - Neoprene Hangers

Neoprene hanger elements should be selected to give the static deflections under load nominated for the item of plant and incorporate Type HE1 Neoprene Hanger Element located within a galvanised steel cage with provision for threaded hanger rods to screw into the hanger element, provide sufficient clearance around the threaded hanger rod to ensure it cannot touch the hanger cage.

Type H2 - Spring/Neoprene Hangers

Spring/neoprene hangers should be selected to give the static deflections under load nominated for the item of plant and be laterally stable without any housing or other lateral support, be housed in a galvanised steel cage, be capable of an additional travel to solid of at least 50% of the rated static deflection, incorporate a levelling facility, a spring diameter not less than 0.8 of the loaded height, incorporate a neoprene base pad to isolate acoustical frequencies. Isolators exposed to weather should have zinc plated springs and housings coated with a flexible epoxy to prevent corrosion, and self-draining cups.

4.9.3 EQUIPMENT BASES AND PLINTHS – PUMPS AND CHILLERS

Mount equipment on rigid bases. The bases shall be sufficiently rigid not to deform under the weight of the machinery or during operation and reduce the effectiveness of the isolation mounts.

All **pumps** shall be installed on concrete plinths which are themselves isolated from the building structure on a layer of 10mm thick Embelton Impactamat 750 kg/m² or equal.

The mass of the base shall be at least 1.5 times the mass of the equipment being supported including pipe fittings, etc. Bases shall minimise the height of the centre of gravity of the machine/base.

4 10 ANTI-VIBRATION MOUNTS AND ISOLATORS

4 10 1 Selection of Equipment Isolation Mounts

Select isolation mount type and minimum static deflection according to the following table (refer above for isolator types)

Table 4 3 - Isolator Schedule

PLANT	ISOLATOR TYPE	MINIMUM STATIC DEFLECTION
Water tanks	M1/H1/HE1	2 mm
Hot Water Units	M2	6 mm
In-line Centrifugal Fans and Small Axial Fans	M3/H1	10 mm
Axial Fans (450mm or > diameter), Centrifugal Fans	M4	25 mm
Axial Fans (<450mm diameter),	M3/H1	10 mm
Pumps	M4	25 mm

4 10 2 Piping Isolation Mounts

Piping within 25m of pumps shall be vibration isolated using type M4 or H2, 25mm static deflection isolators for piping fixed to the plant room floor slab or walls of the apartments, type M3/H1, 10mm static deflection mounts elsewhere

4 10 3 Flexible Pipe Connections

Flexible connections shall be fitted to all pump piping connections. These shall be reinforced braided stainless steel connectors (refer hydraulics and fire services specification), be capable of withstanding internal pressure and other forces and be compatible with the fluid in the pipe

4 11 INSTALLATION OF VIBRATION ISOLATION MOUNTS

The mounts shall be levelled once the equipment is fully loaded in its operating condition with a minimum clearance between the machine and the structure of 15mm, and adjusted to ensure that the isolators are loaded correctly. Ensure that the isolators are not bridged by mounting bolts or contact between any part of the machine or an unisolated part of the isolation mounts and the structure

The number and spacing of the mountings shall be selected to minimise machine rocking. Static and dynamic forces during operation and start-up shall be considered when selecting the mounts

During construction, pump isolation mounts shall be bridged with a timber block to prevent the possibility of overloading of the mounts during the installation of the piping

Piping hangers and mounts shall be adjusted so that there is minimum strain on piping with the system operating in its normal condition

Where there is a possibility of significant lateral loads occurring use hold down bolts, lateral restraints, or housed mounts to locate equipment

4 12 PENETRATIONS

4 12 1 General

Pipe and electrical penetrations through walls, floors etc shall not

- 1 Decrease the sound rating isolation rating of the wall, floor, etc
- 2 Allow the transmission of vibration from pipes and ducts to the wall, floor, etc

4 13 PIPE PENETRATIONS

Seal pipes penetrating slabs or walls, as follows

SITUATION	SEAL TYPE
Domestic water within 25m of Pump	Type PB seal
Elsewhere including waste pipes and all other pipes	Type PA or PB seal

Where the building element penetrated consists of one or more leaves then all leaves shall be acoustically sealed

4 14 ELECTRICAL WIRING

Individual electrical cables can be sealed with Bostik Fireban 1 sealant or equal Bunches of cables shall be drawn through a 5mm thick, 600mm long PVC conduit tightly packed with polyester fibre, glass wool or Rockwool insulation Seal around the conduit by filling with a non shrinking grout Wherever possible, the cables should be spread to facilitate sealing rather than bunching the cables

4 14 1 Location of Penetrations in Acoustically Rated Walls

Wherever possible, where pipes and cables running through ceiling voids enter or pass through an acoustically rated wall (or pass into a wall cavity forming part of an acoustically rated wall) the pipe/cable shall be located as close as possible to the head of the wall

Locate pipe and duct penetrations away from corners and other inaccessible locations that prevent access to seal the penetration

4 15 WASTE AND STORMWATER PIPES

Unless a higher standard is specified, all waste pipes shall be treated to comply with the requirements of the Building Code of Australia

Refer to details in appendix 1, in particular AC003a, AC003b, AC003c, AC004 and AC005 for required acoustic treatment to hydraulic services

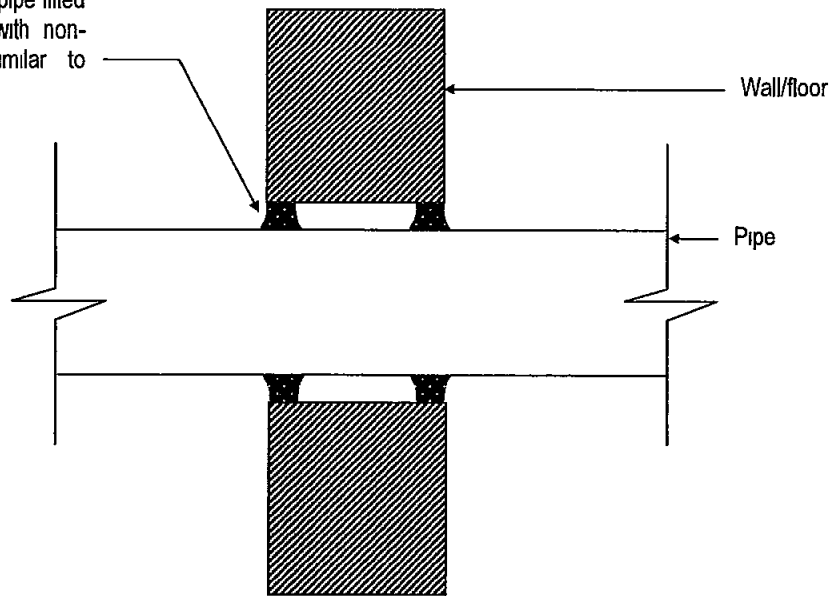
With regard to details AC003a and AC003b – builder/client must decide which pipe treatment option is to be adopted, and coordinate plumbing and plasterboard contractors accordingly

Pipes required to be externally lagged using 5 or 8 kg/m² loaded vinyl shall have an outer aluminium foil backing. The loaded vinyl shall be separated from the pipe with a layer of minimum 25mm thick open cell foam. Overlap all joints by a minimum of 50mm and tape airtight with aluminium tape. In addition all pipes that are required to be lagged which penetrate slab soffits, walls, risers or like shall have the pipe lagging flanged (minimum 50mm lap) to the meeting surface or sealed with a flexible sealant equal to Bostik Fireban 1. Lagging shall be equal to Acoustic Supplies Vibralag as applicable.

Where pipes pass from a ceiling where piping is required to be lagged to a ceiling space where lagging is not required, continue the lagging for a minimum of 75mm into the ceiling space.

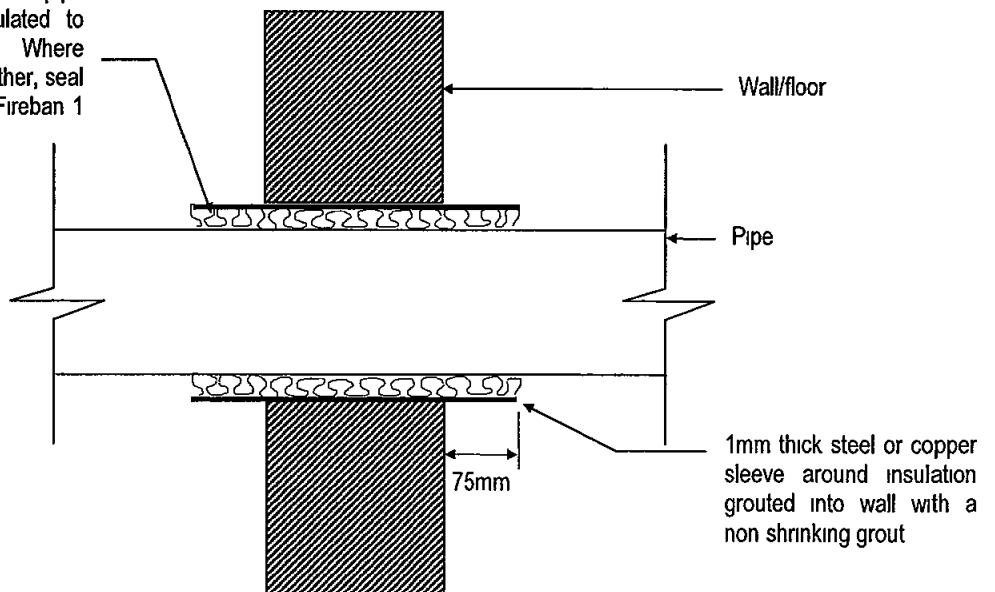
All waste pipes/lagging shall be kept a minimum of 20mm clear of any part of the structure including walls, ceilings, ceiling hangers, etc. Waste pipe penetrations shall be sealed as recommended above for pipe penetrations. Mortar or render shall be kept clear of the penetrations so as to prevent any bridging between the pipe and the wall.

10 15mm clear gap around pipe filled for min depth of 12mm with non-setting flexible mastic similar to Bostik Fireban 1



TYPE PA PIPE SEAL

25mm thick Rockwool sectional pipe sleeve insulation around pipe. Rockwool is to be encapsulated to prevent loss of fibres. Where penetration is exposed to weather, seal end of Rockwool with Bostik Fireban 1 sealant to depth of 5mm.



TYPE PB PIPE SEAL

Note For pipe penetrations within the apartment's, minimum 10mm thick Softlon 3000 foam without the steel sleeve taped to the pipe, or the loaded vinyl/foam waste pipe lagging may be used

4 16 ELECTRICAL

4 16 1 Belt Driven Plant

Belt driven intermittently operating plant having motors rated at greater than 2.5kW shall be fitted with motor starters that limit the build-up in motor speed at start-up. These are required to eliminate the possibility (especially in the future after belt wear has occurred) of belt squeal being audible in occupied spaces having a noise criterion of 45dB(A) or lower, on adjacent properties and on residential terraces/external spaces.

4 16 2 Contactors/Starters/Controllers

Noise from contactors, starters and controllers shall be inaudible inside rooms having a noise of 45dB(A) or lower, on adjacent properties and on residential terraces/external spaces. Provide enclosures around these items and/or vibration isolate the items from building elements where they may give rise to the transmission of structure-borne noise.

5 ELECTRICAL SERVICES – NOISE AND VIBRATION

Penetrations in sound rated ceilings or walls or floors or risers should maintain the acoustic performance of the ceiling/wall/floor/riser. Where required provide acoustic boxes or other treatment.

Refer to appendix 1 for requirements regarding wall and ceiling penetrations.

Where penetrations are made in sound rated walls for either GPO's or light switches, these should be backed using the HPM 430 Fire/Acoustic wall box. The boxes may be used in a back to back arrangement. Boxes are not required on core-filled concrete block walls provided "back to back" boxes are offset by at least 200mm.

As an alternative for GPO's - Individual electrical cables can be sealed with Bostik Fireban 1 sealant or equal. Bunches of cables shall be drawn through a 5mm thick, 600mm long PVC conduit tightly packed with polyester fibre, glass wool or Rockwool insulation. Seal around the conduit by filling with a non-shrinking grout.

Wherever possible, where pipes and cables running through ceiling voids enter or pass through an acoustically rated wall (or pass into a wall cavity forming part of an acoustically rated wall) the pipe/cable shall be located as close as possible to the head of the wall with the cables spread to facilitate sealing.

6 GLAZING AND BUILDING SHELL CONSTRUCTION

6.1 ACOUSTIC CRITERIA

Building shell has been acoustically designed so as to reduce external noise to levels complying with AS2107 recommended levels, as summarised below

Table 4 - Internal Noise Level Criteria (AS2107)

LOCATION	CRITERIA
Bedrooms (10pm-7am)	35-40 dB(A) _{Leq(worst 1 hour)}
Living areas (7am-10pm)	40-45 dB(A) _{Leq(worst 1 hour)}

6.2 MEASURED TRAFFIC NOISE LEVELS

Traffic Noise Levels are documented below

Table 5 – Measured Noise Levels

LOCATION	Daytime Level (7am-10pm) dB(A) _{Leq(worst 1 hour)}	Night Time Noise Level dB(A) _{Leq(worst 1 hour)}
Macpherson St Façade	61	54

6.3 RECOMMENDED CONSTRUCTIONS

The recommended glazing assemblies are presented below. In all cases, the selected glazing type reduces traffic noise to levels complying with the nominated criterion.

The glazing thicknesses recommended are those needed to satisfy acoustic requirements and do not take into account other requirements such as structural, safety or other considerations. These additional considerations may require the glazing thickness to be increased beyond the acoustic requirement.

Glazing to all units not listed in the table may be 4mm thick float or 5mm toughened glass for windows and doors, respectively, no acoustic seals.

Table 6 - Glazing Requirements

Façade	Room Type	Glazing Requirement	Acoustic Seals
South (Macpherson Street)	All	6mm float / toughened	Yes
North, East and West	All	4mm float / toughened	Yes

In addition to meeting the minimum glazing thickness requirements given, the design of the window louvres, perimeter seals and the installation of the windows/doors in the building openings shall not reduce the STC rating of the glazing assembly below the values nominated in Table 8. Note that mohair type seals will not be acceptable for the windows requiring acoustic seals.

It is recommended that only window systems have test results indicating compliance with the required ratings obtained in a certified laboratory be used where windows with acoustic seals have been recommended.

Any windows not referred to in the table below may be constructed using 4mm glass without acoustic seals.

Table 7 - Minimum STC of Glazing

Glazing Assembly	Minimum STC of Installed Window
4 mm	27
6mm	29

*If bi-fold doors are proposed, these shall be equivalent to Capral Artisan Series bi-folding doors with STC rating for that door/window system equal to the corresponding glass thickness in the table above.

6.3.1 Acoustic Sealing of Window Frames

Where glazing is required to achieve a nominated acoustic performance the perimeter of the window frame shall be acoustically sealed into the window opening so there is no leakage of noise between the window frame and the building opening. The sealing method selected shall take into account and allow for any movement of the window frame relative to the building opening and so that the acoustic performance is maintained.

One of the following two methods shall be used to seal the gap between the window and the building opening. These shall be followed even if there is internal or external cladding butting against the window frame.

Method 1

A 10-15mm wide gap shall be left between the window frame and the building opening

The gap between the window frame and the building opening shall be caulked with an elastomeric sealant having a cured density of not less than 1000 kg/m³. Minimum 10mm thick caulking shall be applied near the external face of the mullion with additional 10mm thick caulking near the inner face

Provide backing rods and bond breaker tapes as specified or required by sealant manufacturer

If the gap between the mullion and the building opening exceeds 15mm the gap shall be packed with 8 kg/m³ fibreglass or polyester fibre insulation

Method 2

A 10-15mm wide gap shall be left between the window frame and the building opening. This gap shall be covered with 3mm thick aluminium angles for all 12 38mm thick (or greater) single glazing, and 1 5mm thick angles for single glazing less than 12 38mm thickness

The flange of the angle sections shall seat onto the building opening, and the other flange shall seat onto the window mullion. The angle flanges should be fixed in position, with the faces of the flanges seating against the mullion and building opening bedded in flexible sealant to seal all gaps

One set of angles is required on the inside face of the window and one set is required on the outside face of the window frame

If the gap between the mullion and the building opening exceeds 15mm the gap shall be packed with 8 kg/m³ fibreglass or polyester fibre insulation

6.3.2 Sprinkler Pipes

The following treatment is required where sprinkler pipes are required to penetrate the cover/in-fill plate between the mullion and the building opening at the top of windows, in rooms required to have a sound rating

- 1 The cover/in-fill plate where the pipes pass through shall be min 3mm thick aluminium for all double glazing and 10 38mm thick single glazing, and 1 5mm thick for single glazing less than 10 38mm thickness. One cover/in-fill plate shall be provided on the external face of the mullion and one cover/in-fill plate shall be provided on the inside face of the window mullion
- 2 The cover/in-fill plate should seat against flanges fixed into the building opening and onto the window mullion. All gaps shall be fully sealed using a flexible sealant
- 3 A 2-5mm wide gap should be left around the sprinkler pipe that shall be fully caulked on both cover/in-fill plates between the window frame and the building opening using a flexible sealant
- 4 The gap between the mullion and the building opening shall be packed with 8 kg/m³ fibreglass or polyester fibre insulation

6 3 3 Roof/Ceiling Construction

Any top floor apartment ceilings with light weight roofing materials (metal deck roofing) to living areas and bedrooms are to be built according to Figure 1

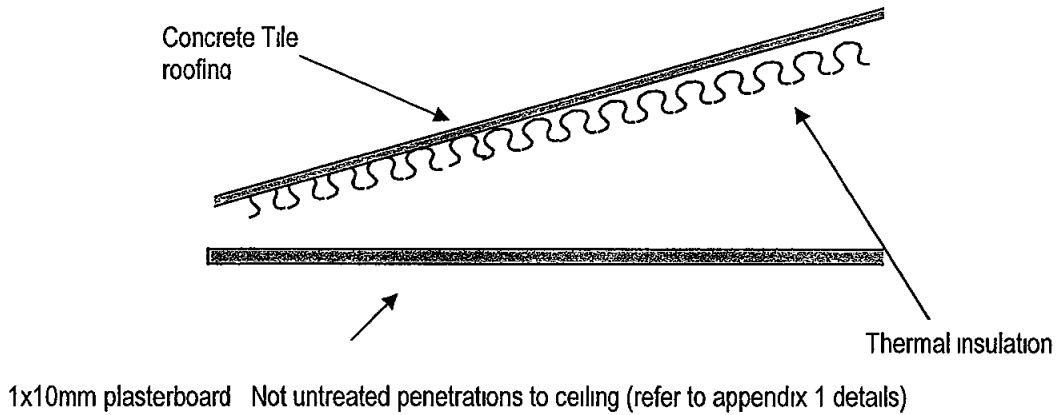
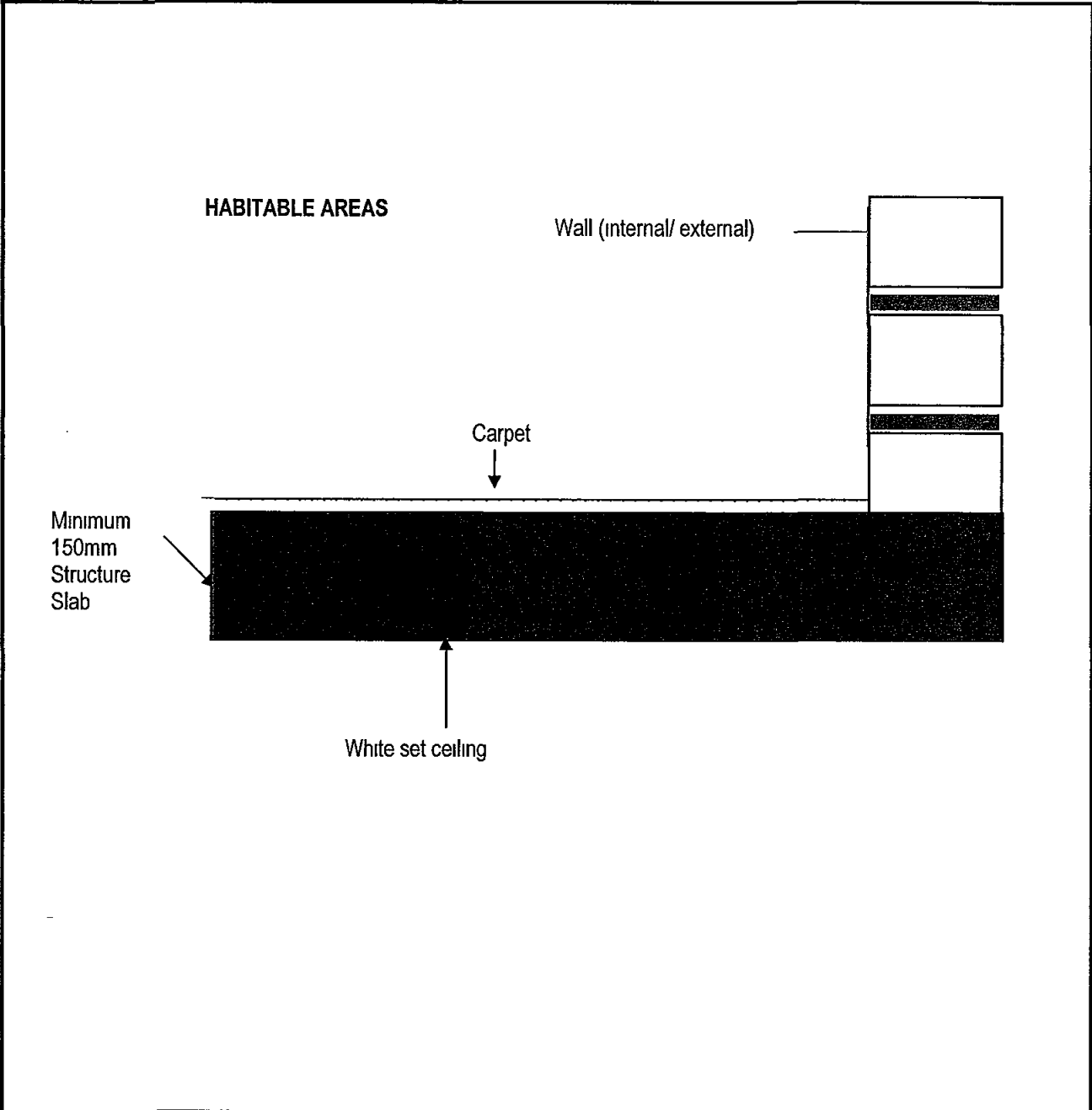


Figure 1 – Roof/Ceiling Construction

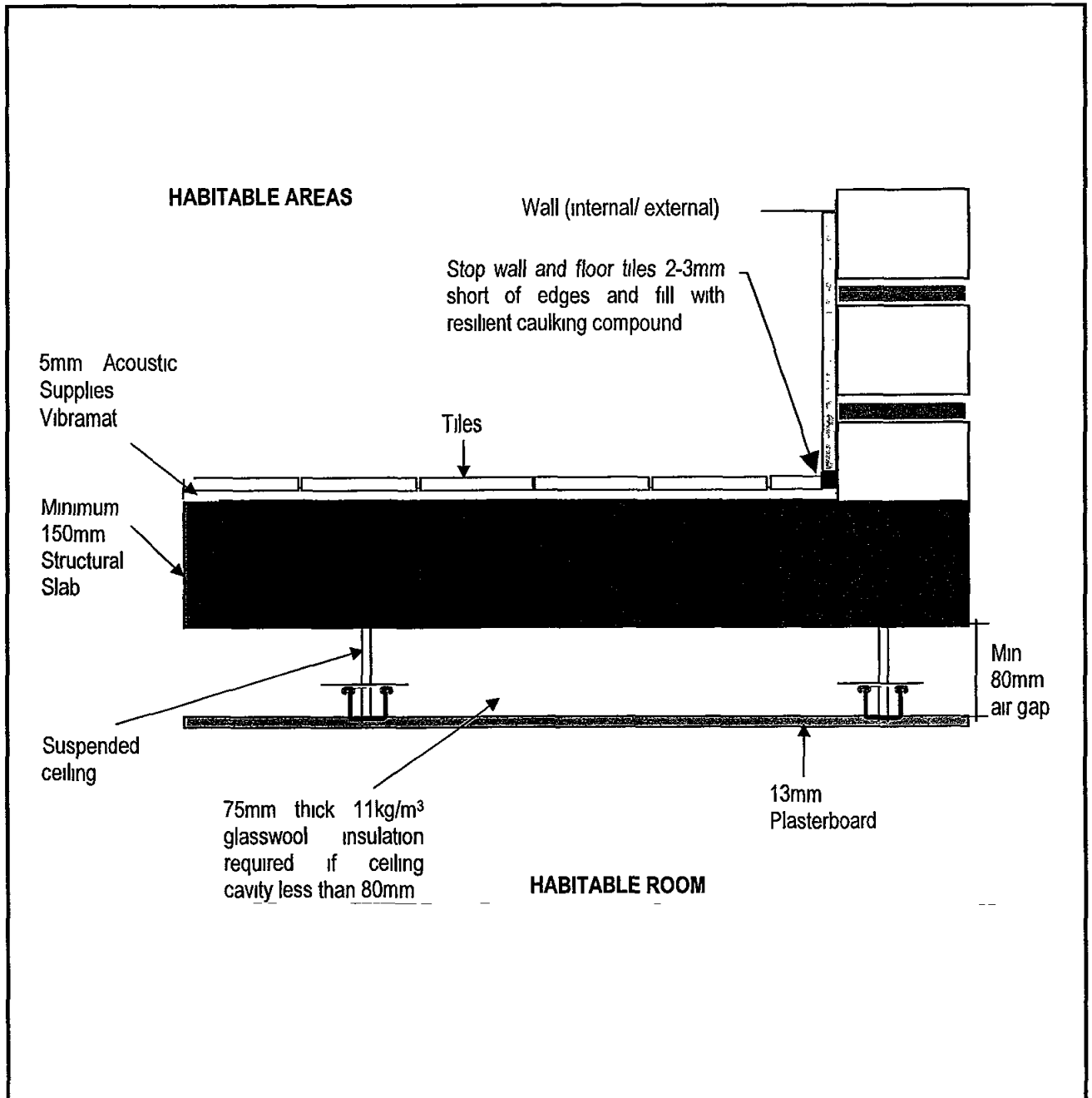
6 4 SAMPLES AND TEST DATA

Samples of glazing systems shall be submitted to the builder and developer's representative prior to installation in the building. In addition, submit Laboratory test data performed in accordance with AS 1191-1985 providing evidence that the proposed window systems comply with the requirements of the brief. Only windows having laboratory test data indicating compliance with the specification STC requirements will be accepted.

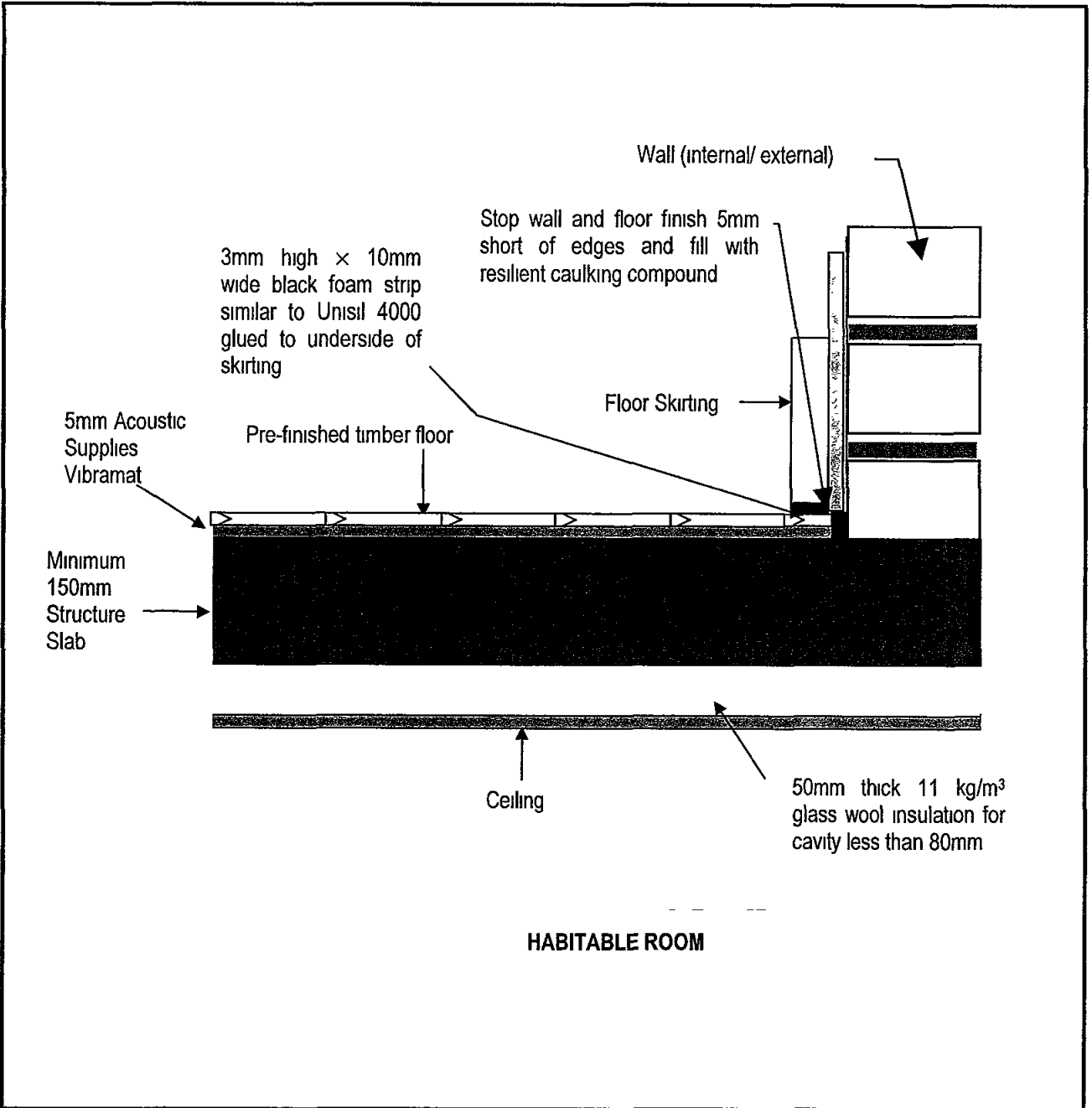
APPENDIX **DETAILS**



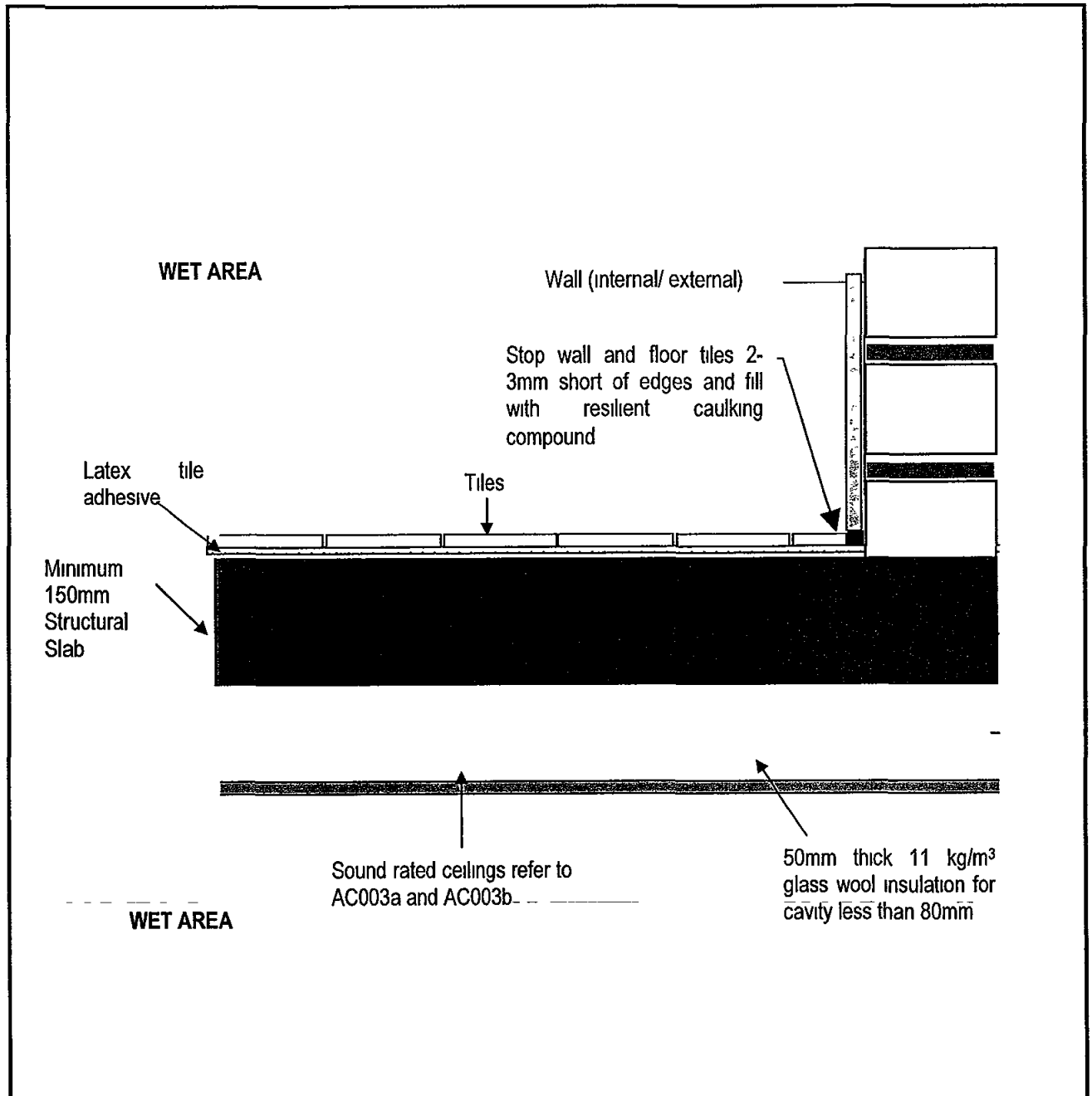
CEILING ELEVATION SHOWING HABITABLE ROOMS WITH CARPET FINISHES			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC001a
Issue	Scale	Approved		
	NTS			



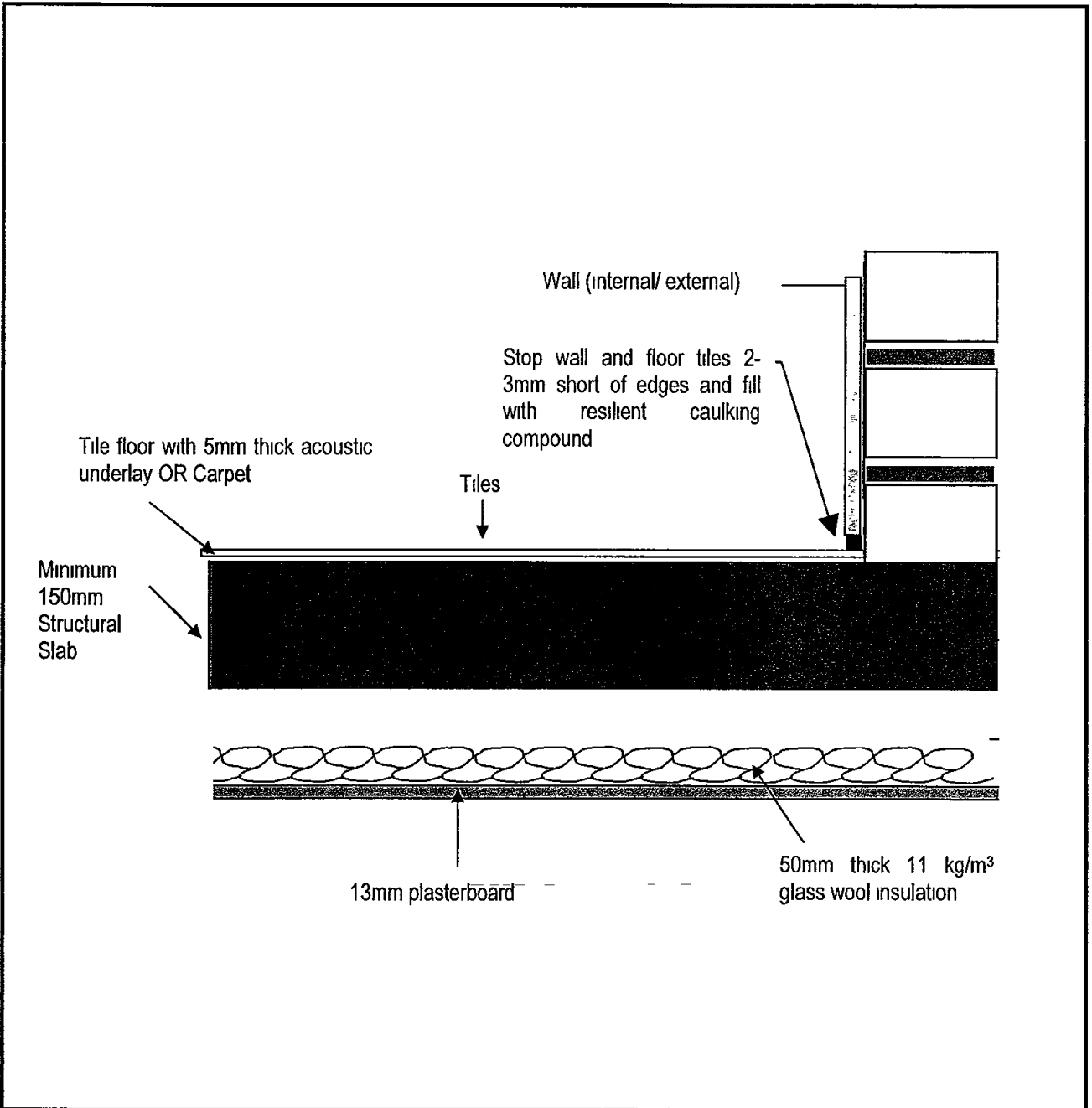
CEILING ELEVATION SHOWING HABITABLE ROOMS WITH TILED FLOOR FINISHES AND SUSPENDED CEILINGS			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC001b
Issue	Scale	Approved		
	NTS			



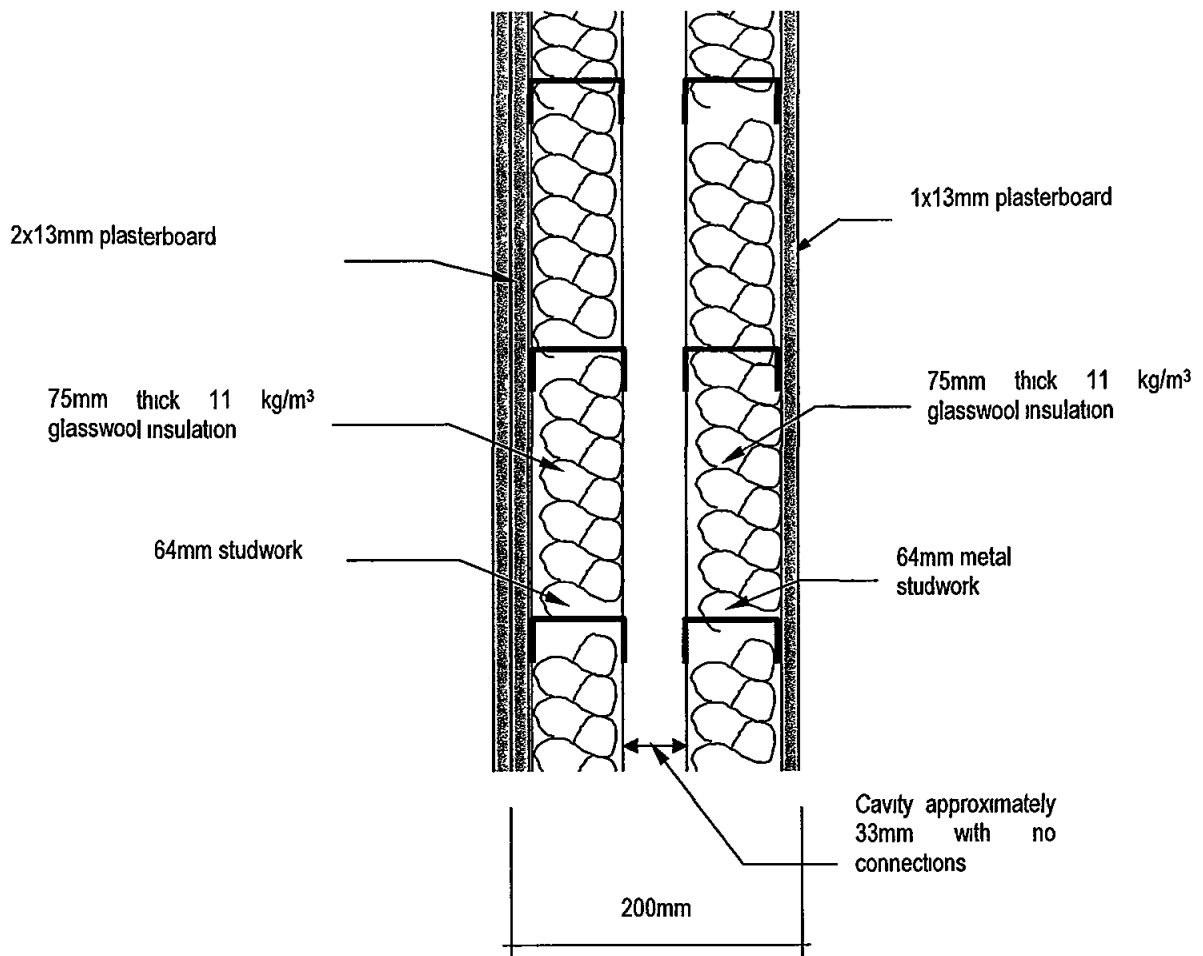
CEILING ELEVATION SHOWING HABITABLE ROOMS WITH TIMBER FLOOR FINISHES			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC001c
Issue	Scale	Approved		
	NTS			



CEILING ELEVATION FROM WET AREA TO WET AREA WITH TILED FLOOR FINISHES			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC001d
Issue	Scale	Approved		
	NTS			

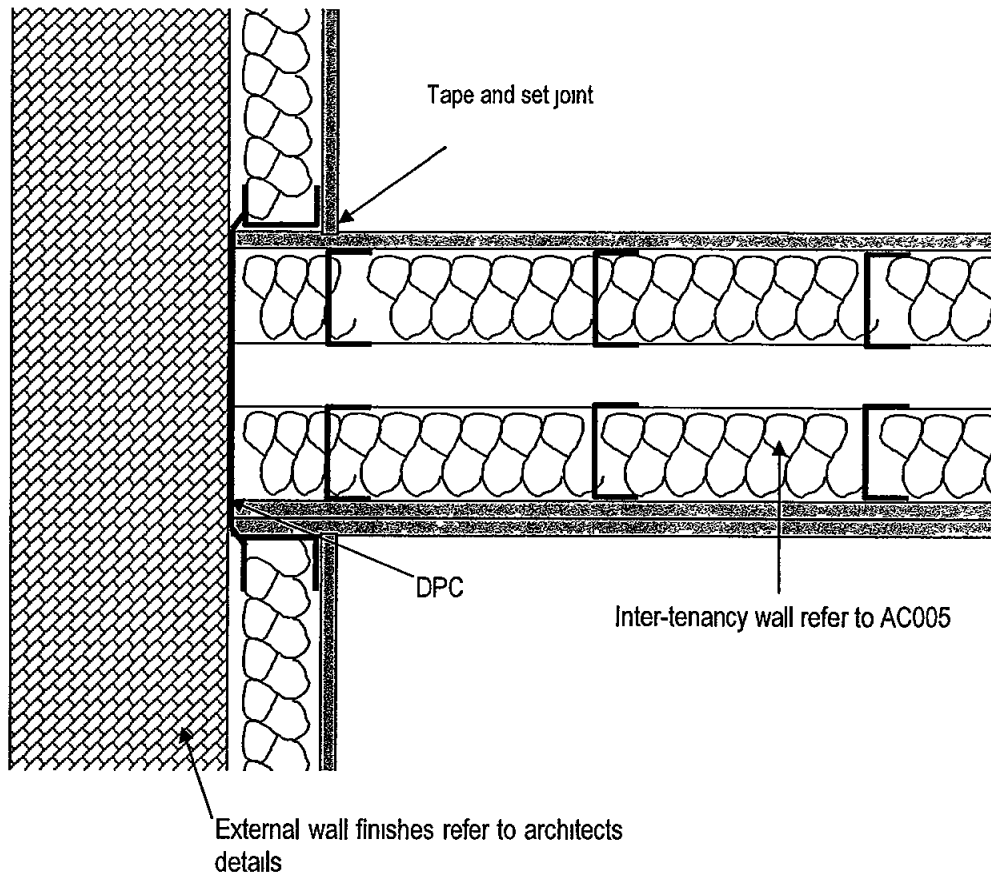


CEILING ELEVATION – APARTMENT OVER MULTIPURPOSE ROOM			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC001e
Issue	Scale	Approved		
	NTS			



Note – Wall must run full height, caulked at base and head

PLAN SECTIONAL VIEW $R_w + C_{tr} 50$ INTERTENANCY WALL			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			Project WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC002a
Issue	Scale	Approved		
NTS				



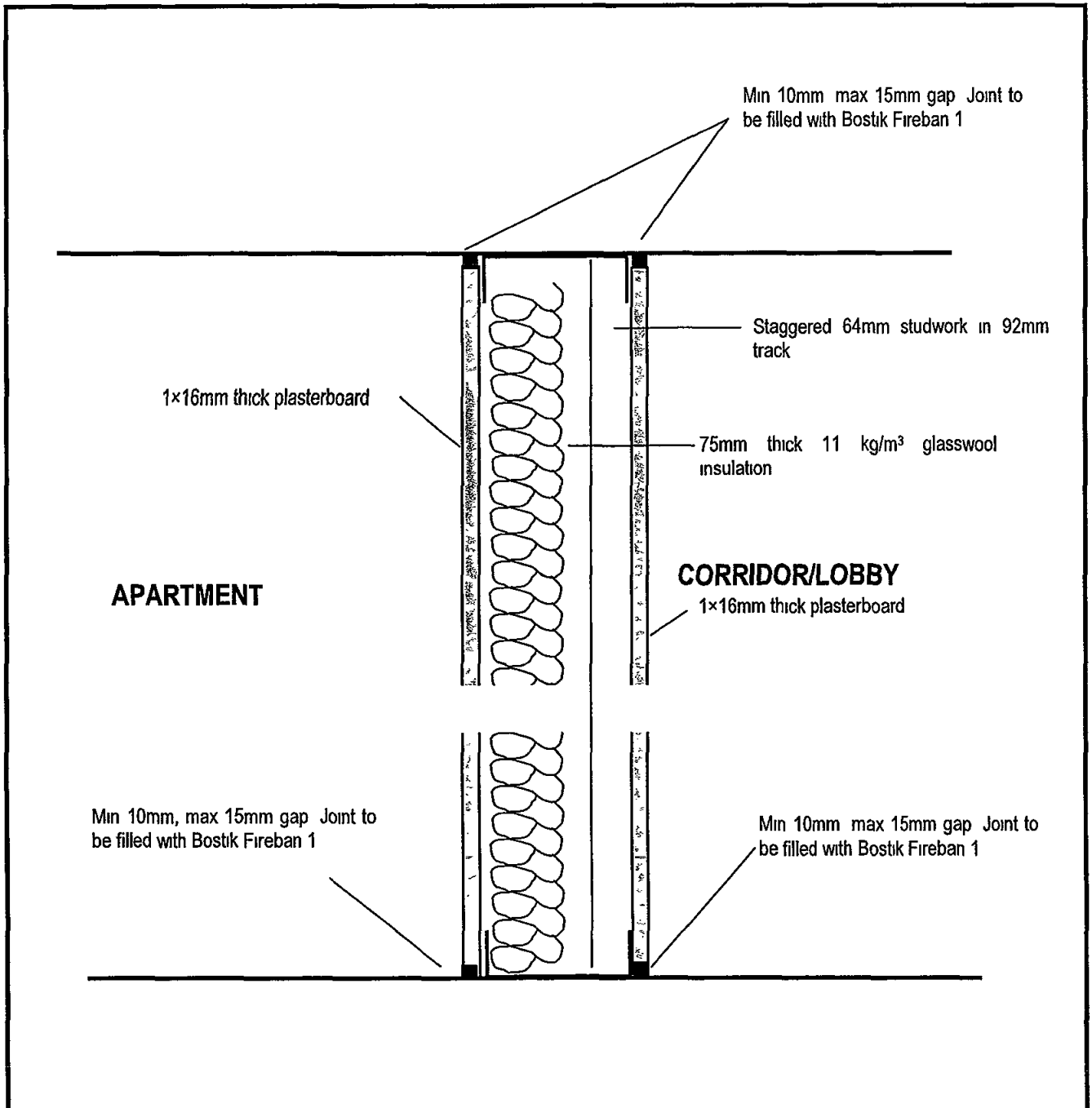
**PLAN SECTIONAL VIEW
 INTERTENANCY WALL/ EXTERNAL
 WALL JUNCTION**

Acoustic Logic Consultancy Pty Ltd
 9 Sarah St, Mascot
 Tel 8338 9888 Fax 8338 8399

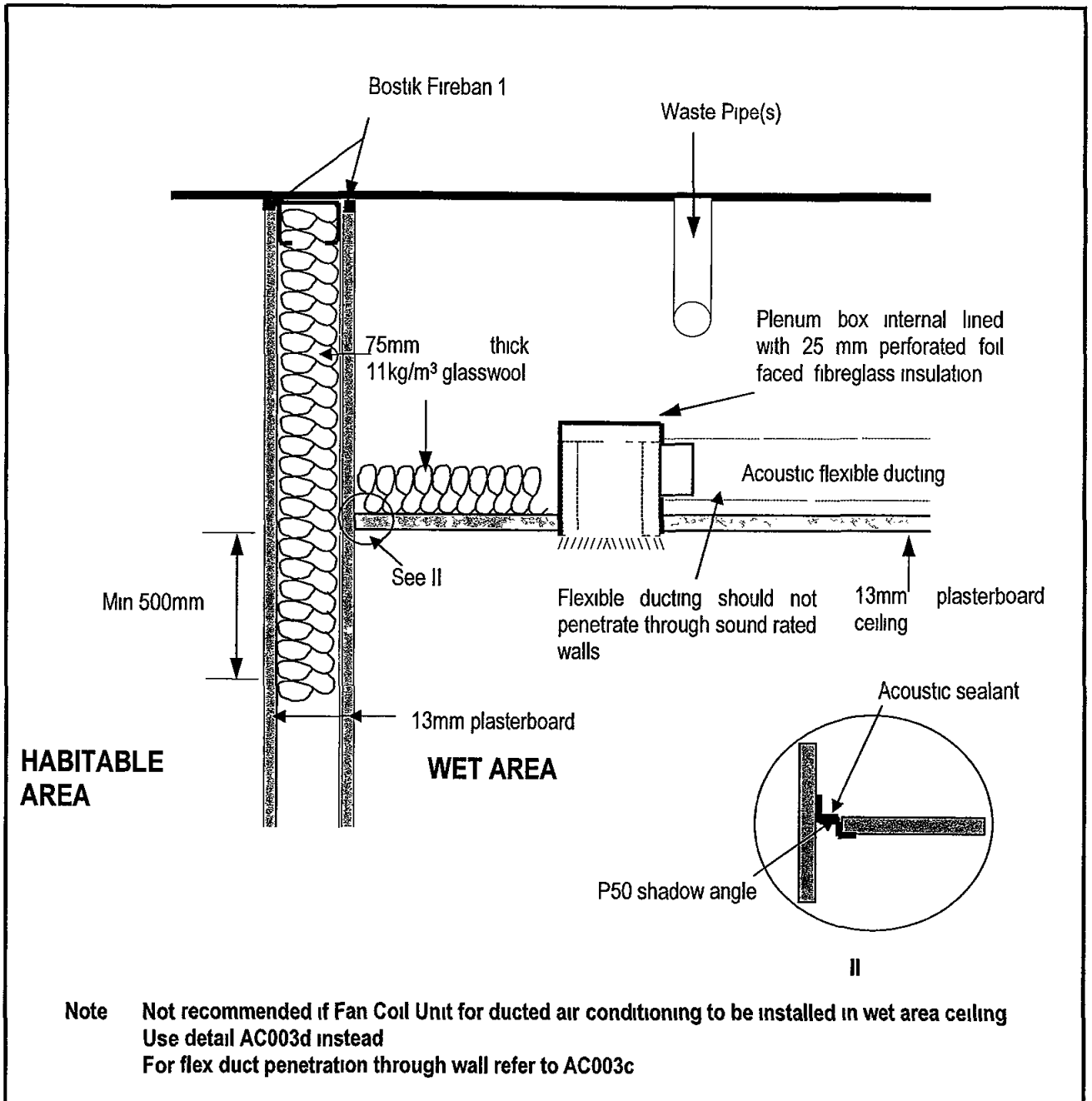
Project

WARRIEWOOD BROOK STAGE 3

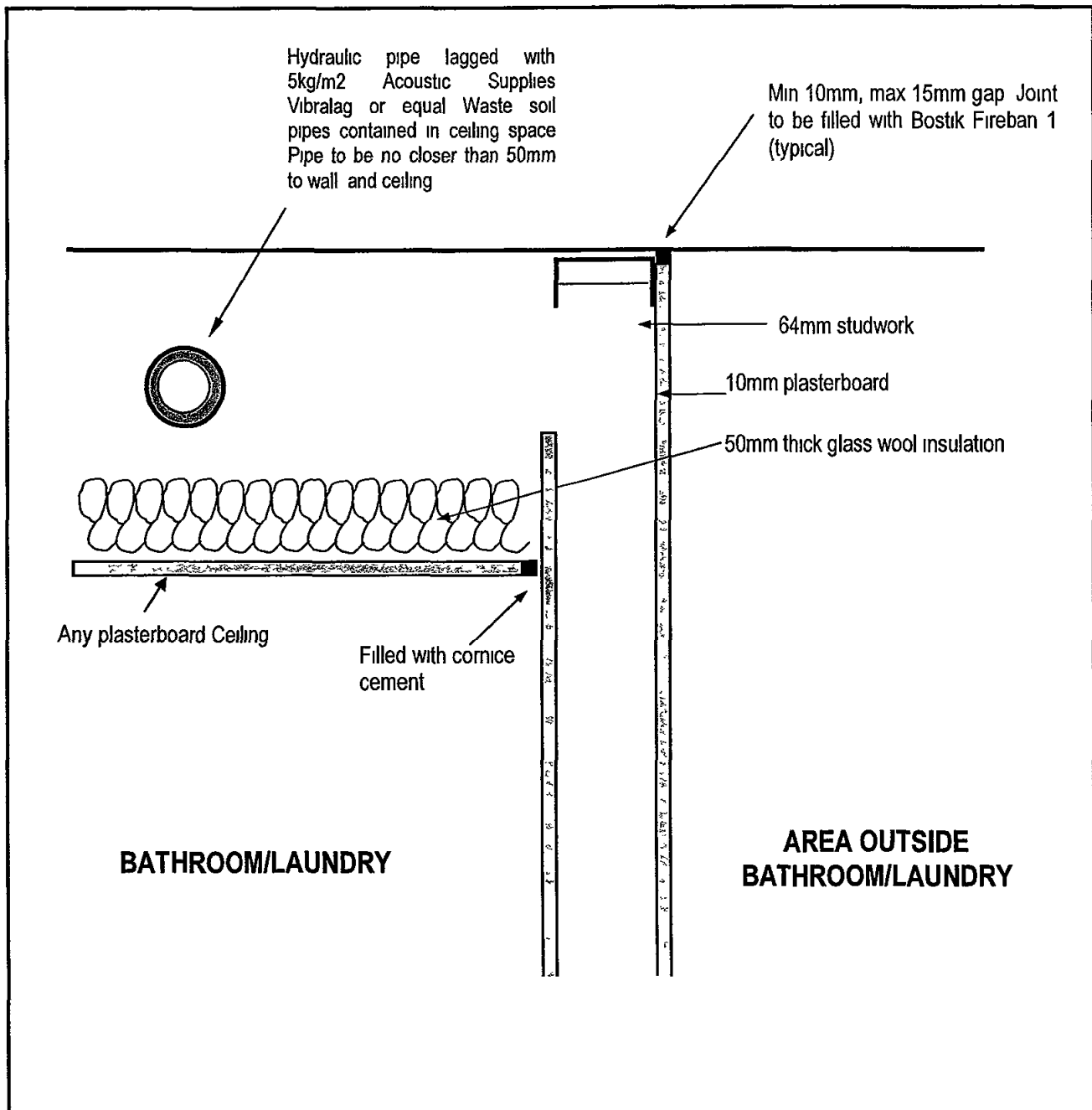
Date	Drawn	Checked	Project No	Drawing No
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Issue	Scale	Approved		
NTS				



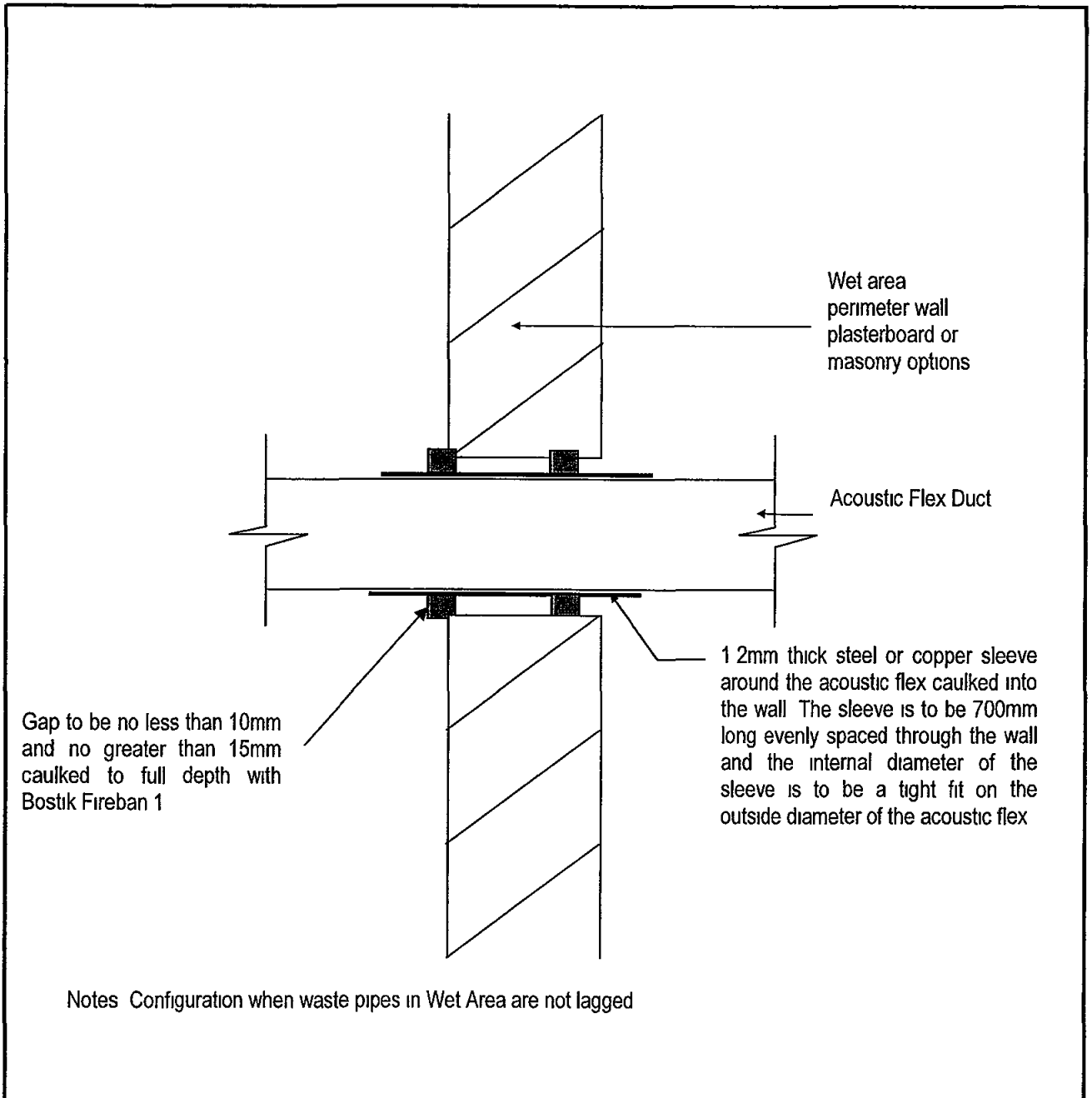
PLAN SECTIONAL VIEW R_w 50			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIWOOD BROOK STAGE 3	
APARTMENT TO CORRIDOR/STAIR/ LOBBY WALL/POOL				
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC002c
Issue	Scale	Approved		
NTS				



INTERNAL UNIT WALL BETWEEN WET AREA AND NON-WET AREA Pipes Not Wrapped Option BUILDER/CLIENT MUST CONFIRM WHICH OPTION TO BE ADOPTED			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC003a
Issue	Scale	Approved		
	NTS			



SECTIONAL ELEVATION OF WALL/ CEILING REQUIREMENTS FOR WET AREA PERIMETER WALL (INTRA- APARTMENT) Pipes Wrapped Option BUILDER/CLIENT MUST CONFIRM WHICH OPTION TO BE ADOPTED			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS			
Issue	Scale	Approved	2010738	AC003b
	NTS			

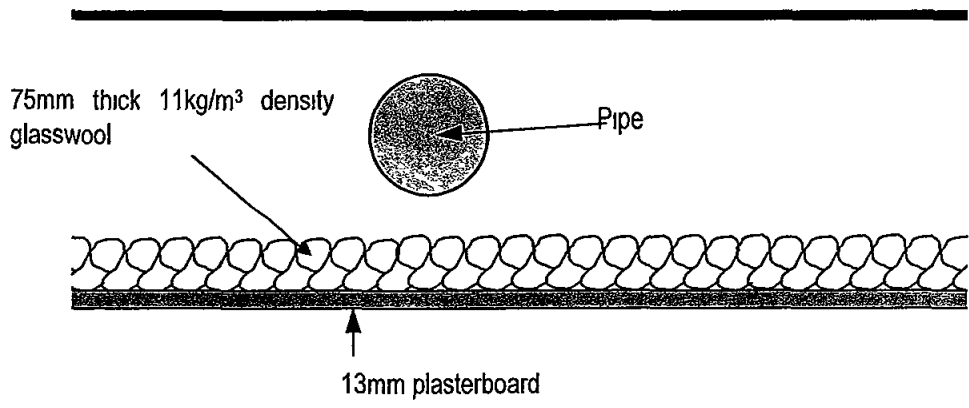


FLEX DUCT PENETRATION THROUGH A WET AREA PERIMETER WALLS

Acoustic Logic Consultancy Pty Ltd
 9 Sarah St, Mascot
 Tel 8338 9888 Fax 8338 8399

WARRIEWOOD BROOK STAGE 3

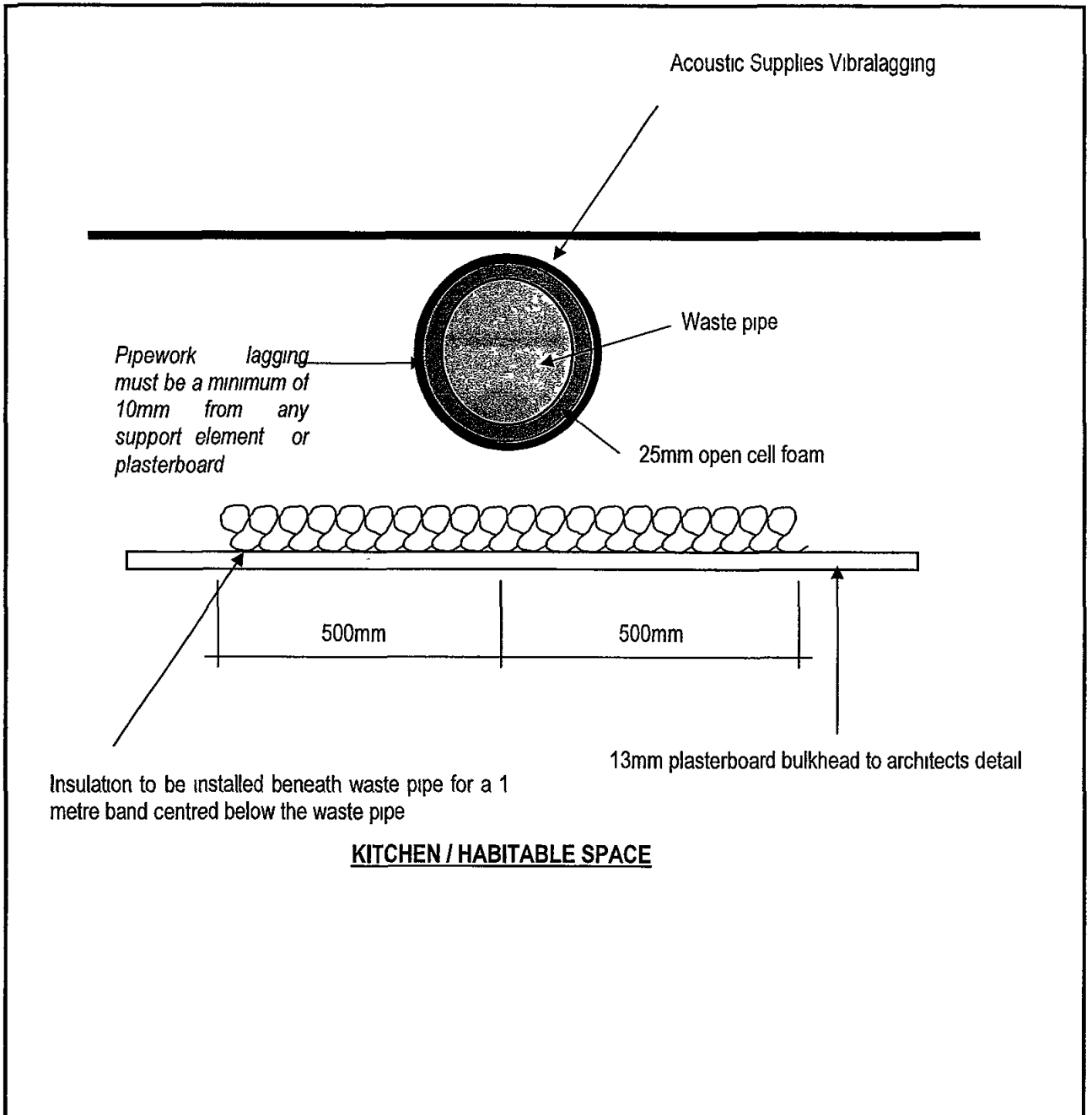
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August 2010	KS		2010738	AC003c
Issue	Scale	Approved		
	NTS			



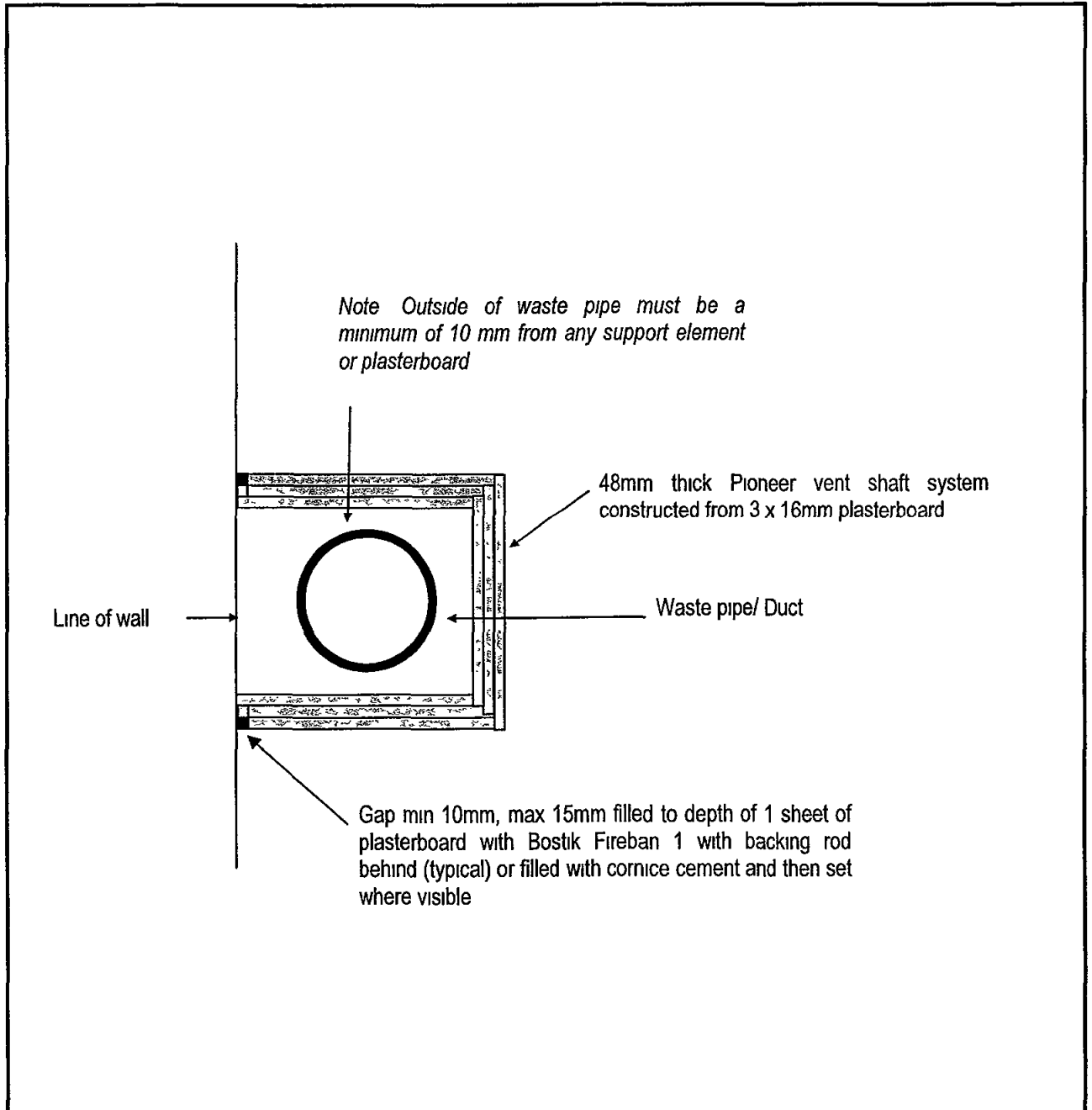
Pipework must be a minimum of 10mm from any support element or plasterboard

And downlights shall be non gimballed

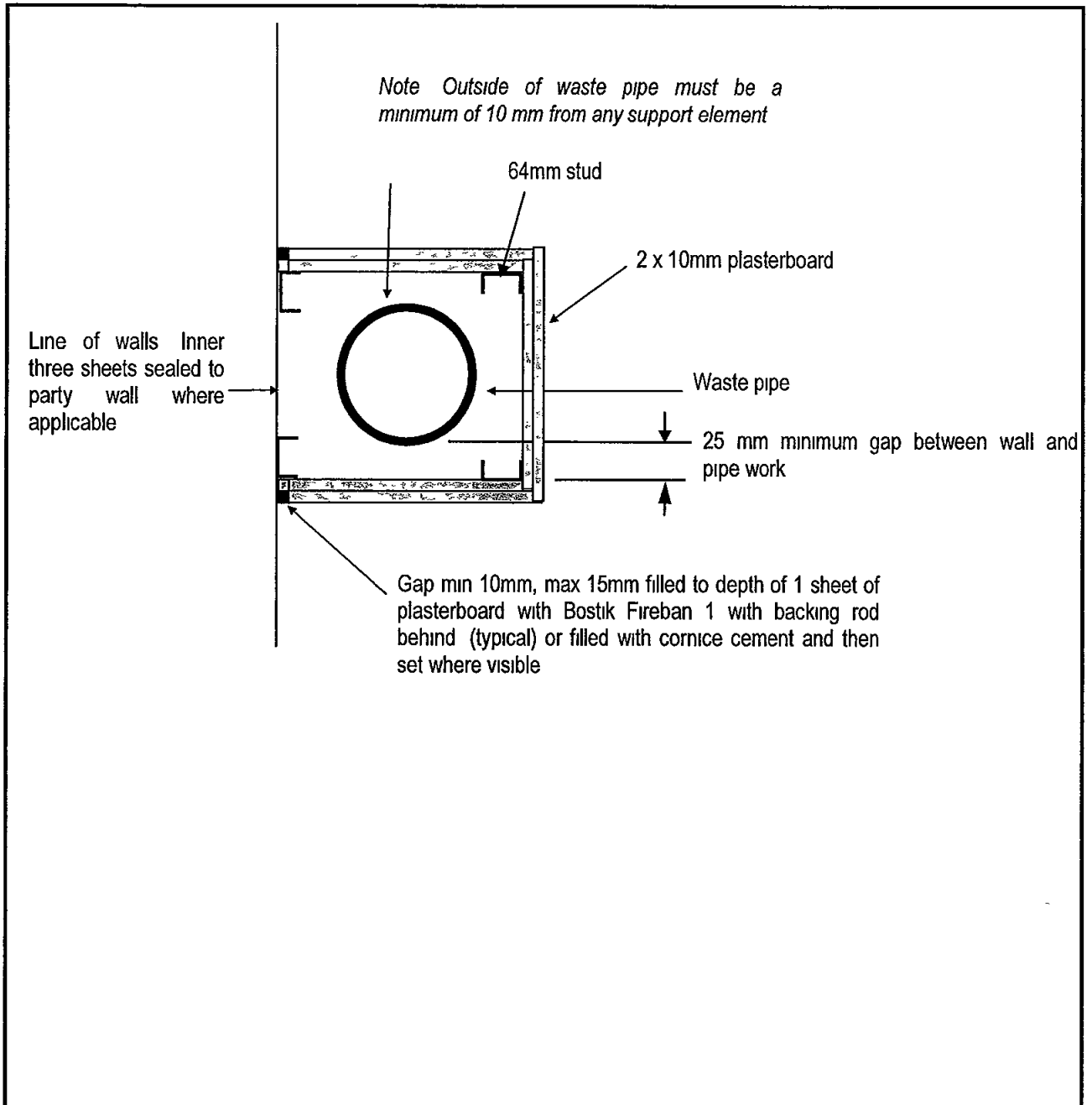
HYDRAULIC PIPE TREATMENT ABOVE WET AREAS $R_{wt} + C_{tr} 25$			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC004
Issue	Scale	Approved		
	NTS			



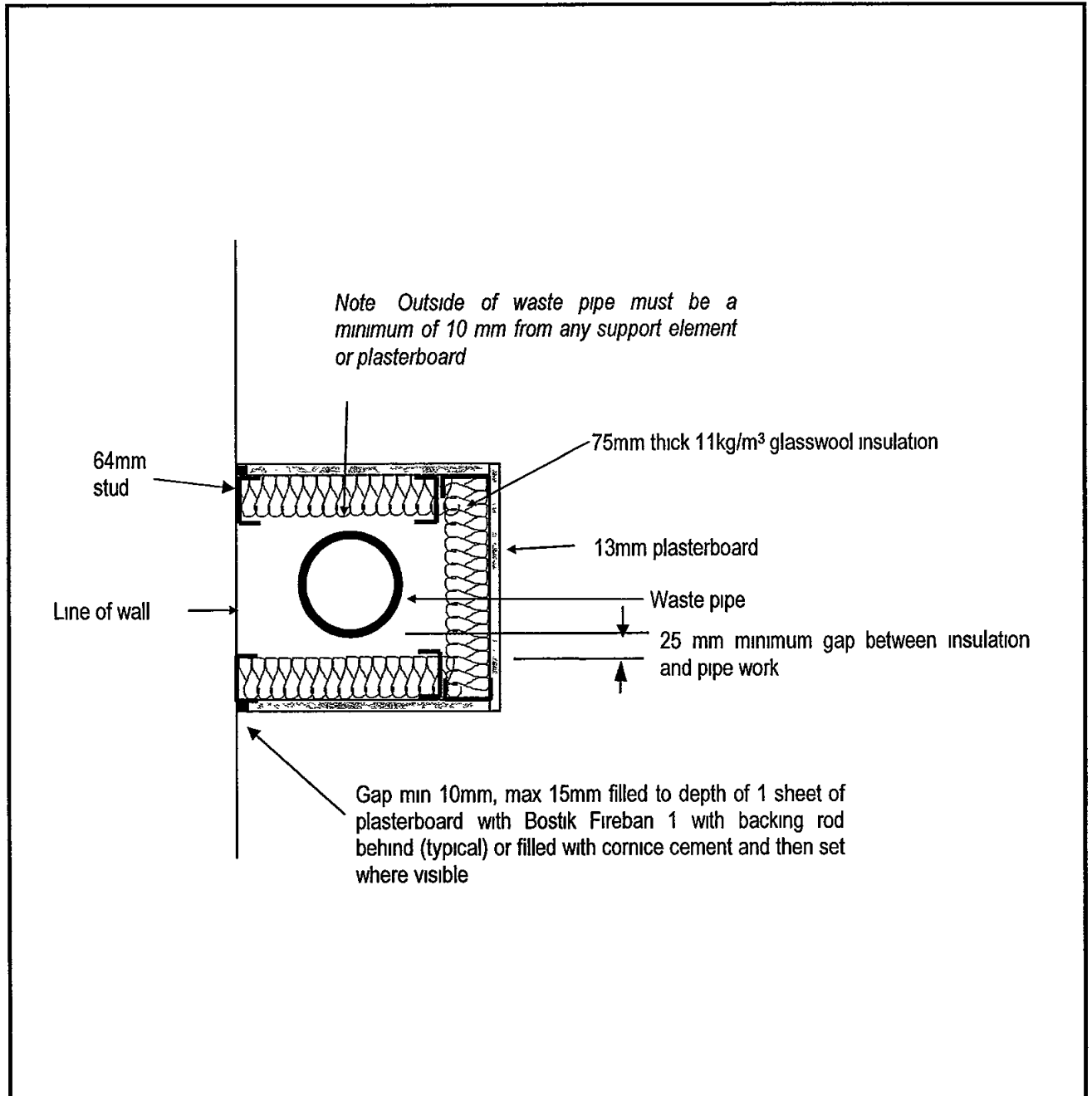
HYDRAULIC PIPE TREATMENT OUTSIDE OF WET AREAS $R_{wt}C_{tr} 40$			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC005
Issue	Scale	Approved		
	NTS			



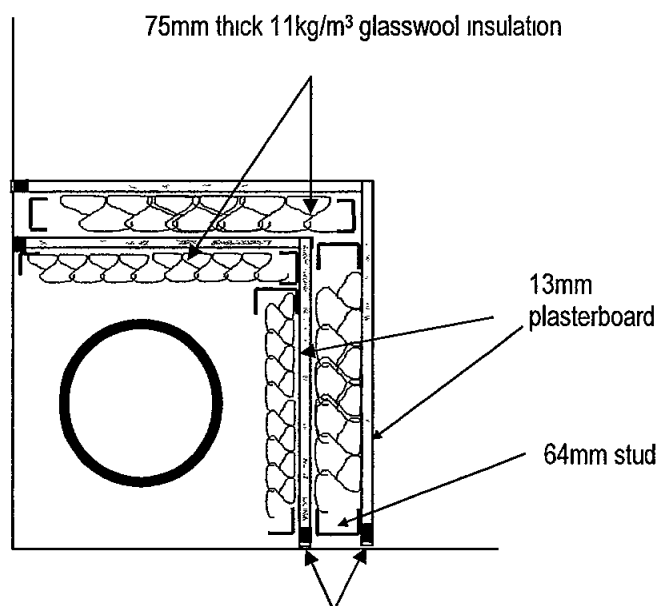
FIRE RATED HYDRAULIC RISER LOCATED SOLELY WITHIN WET AREA – R_w +C_{tr} 25			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC006a
Issue	Scale	Approved		
	NTS			



HYDRAULIC RISER LOCATED SOLELY WITHIN WET AREA - R_w + C_{tr} 25 OPTION 1 (NON FIRE RATED)			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC006b
Issue	Scale	Approved		
	NTS			

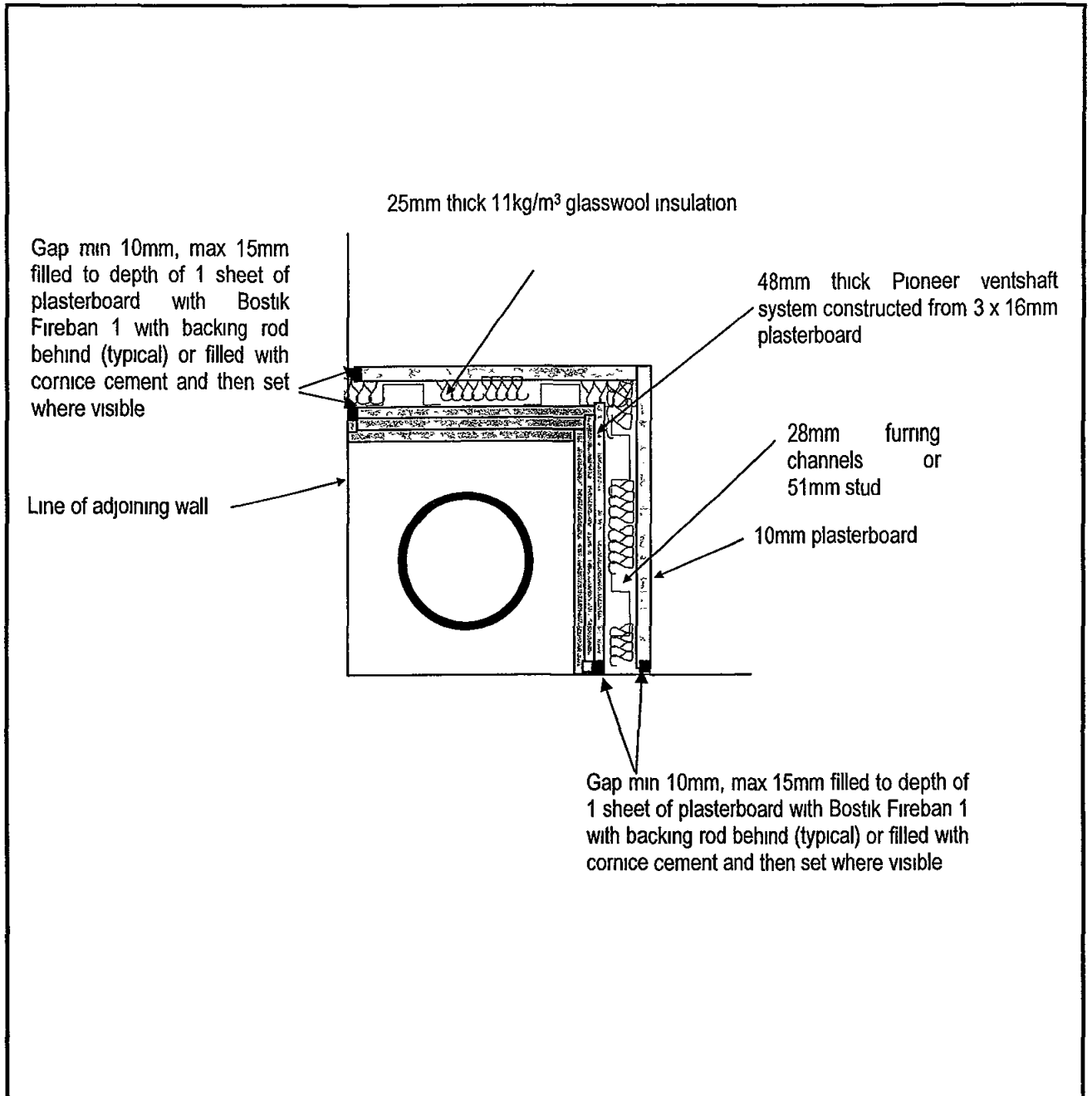


HYDRAULIC RISER LOCATED SOLELY WITHIN WET AREA - $R_w + C_{tr}$ 25 OPTION 2 (NON FIRE RATED)			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC006c
Issue	Scale	Approved		
	NTS			



Gap min 10mm, max 15mm filled to depth of 1 sheet of plasterboard with Bostik Fireban 1 with backing rod behind where required (typical)

HYDRAULIC RISER LOCATED OUTSIDE WET AREA (BATHROOM AND LAUNDRY) - R_w +C_{tr} 40 <u>NON- FIRE RATED OPTION 3</u>			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC007a
Issue	Scale	Approved		
	NTS			



FIRE RATED HYDRAULIC RISER LOCATED OUTSIDE WET AREAS $R_w + C_{tr} 40$ (Equivalent)			Acoustic Logic Consultancy Pty Ltd 9 Sarah St Mascot Tel 8338 8399 Fax 8338 8399	
			WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC007b
Issue	Scale	Approved		
	NTS			

3x13mm plasterboard

75mm thick 11 kg/m³
glasswool insulation

64mm studwork

3x13mm plasterboard

75mm thick 11 kg/m³
glasswool insulation

64mm metal
studwork

Gap approximately
20mm with no
connections

Note – Wall must run full height caulked head and base

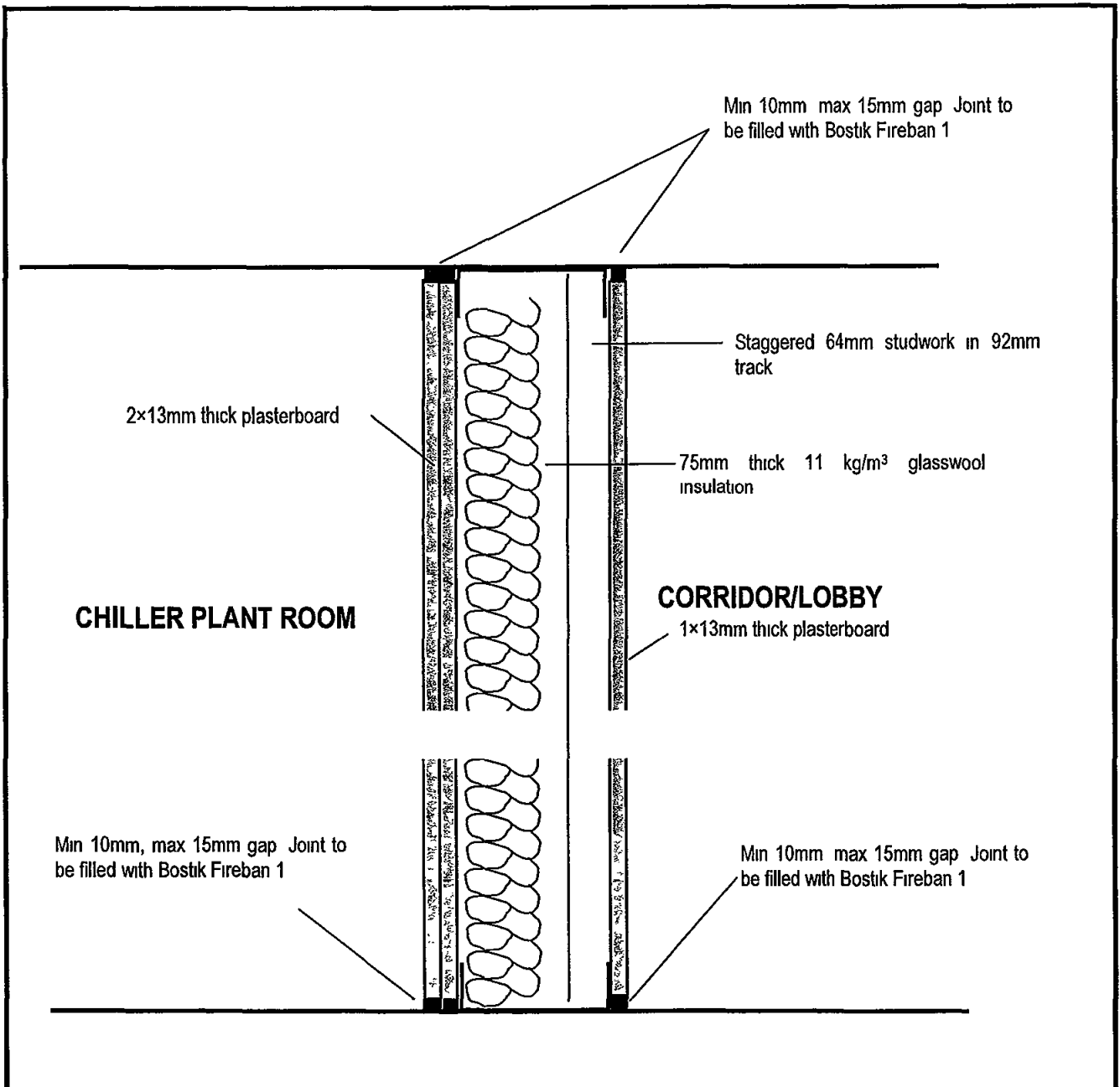
Chiller Plant Room to Apartment Wall

Acoustic Logic Consultancy Pty Ltd
9 Sarah St, Mascot
Tel 8338 9888 Fax 8338 8399

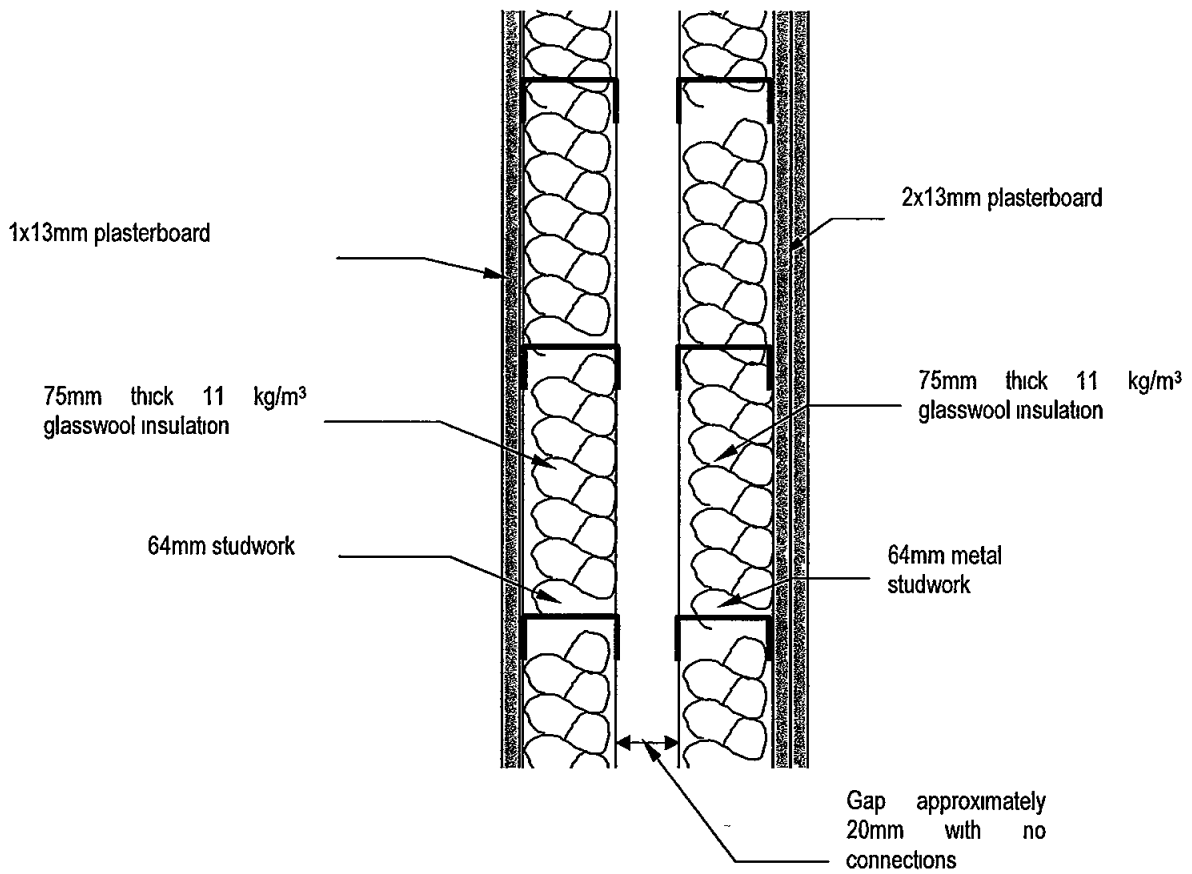
Project

WARRIEWOOD BROOK STAGE 3

Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC008
Issue	Scale	Approved		
NTS				



Chiller Plant Room to Corridor Wall			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			Project WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC009
Issue	Scale	Approved		
NTS				



Note – Wall must run full height, caulked head and base

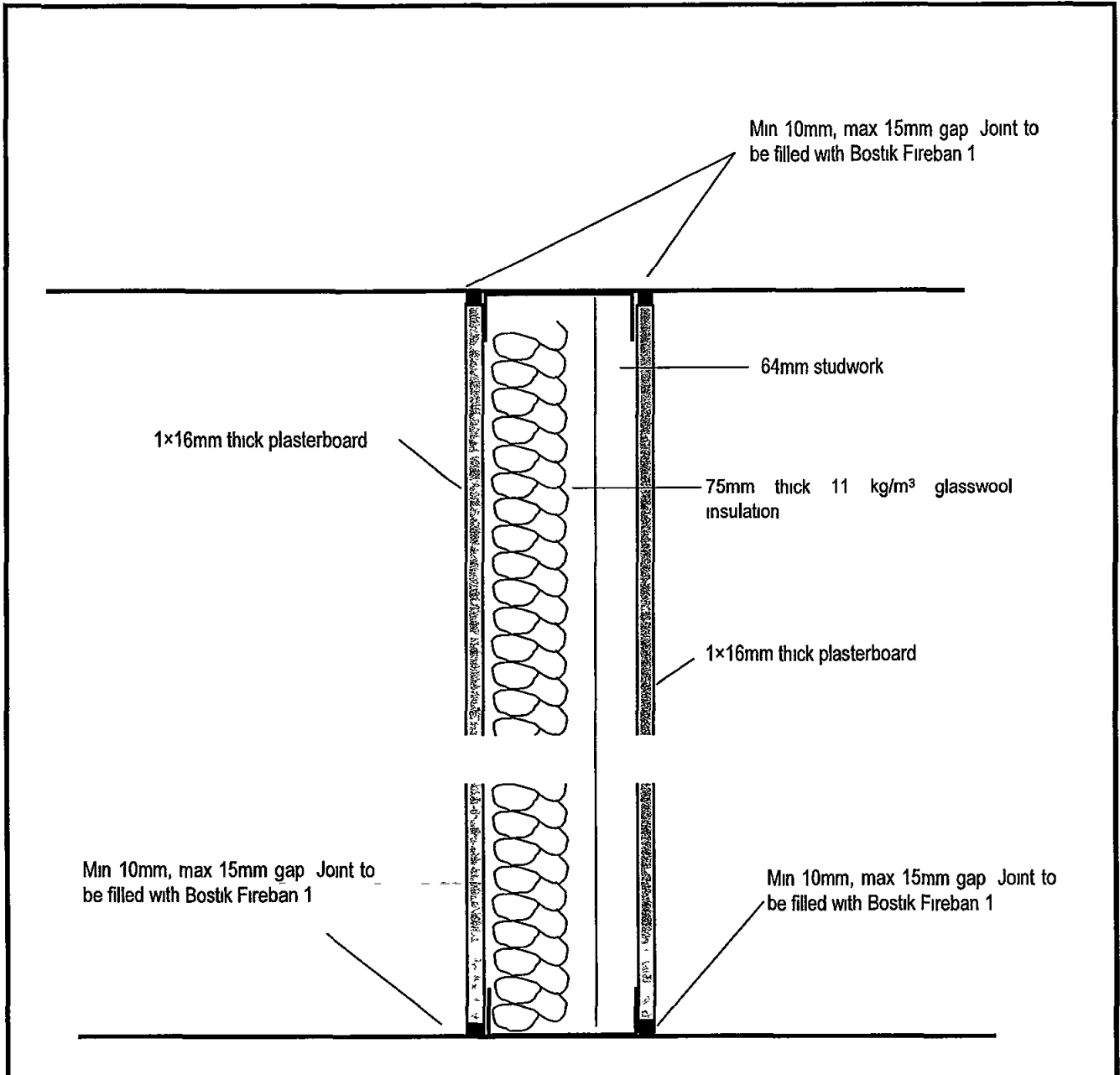
**Plant Room to Apartment Wall
(Other than Chiller Plant Room)**

Acoustic Logic Consultancy Pty Ltd
9 Sarah St, Mascot
Tel 8338 9888 Fax 8338 8399

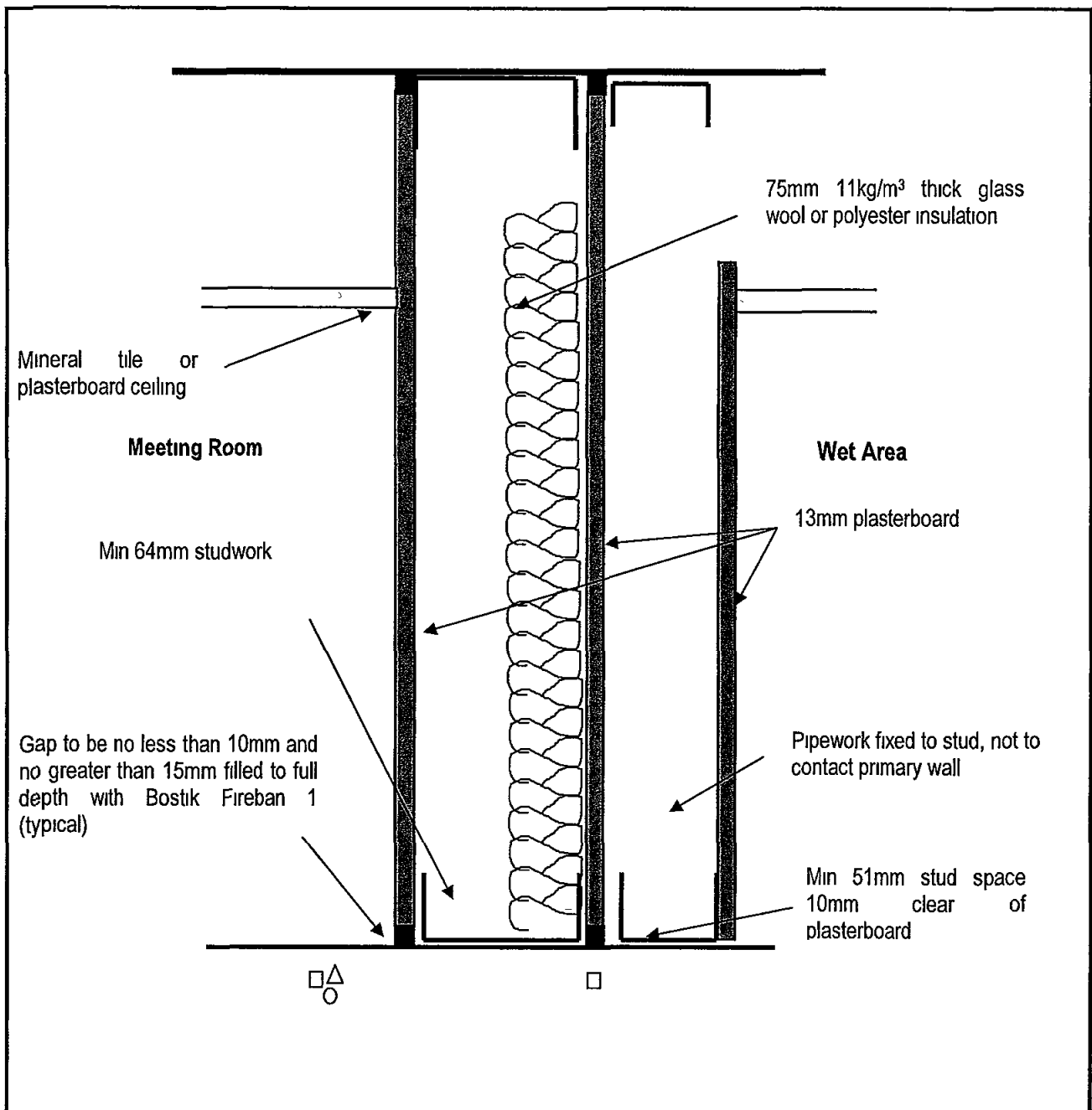
Project

WARRIEWOOD BROOK STAGE 3

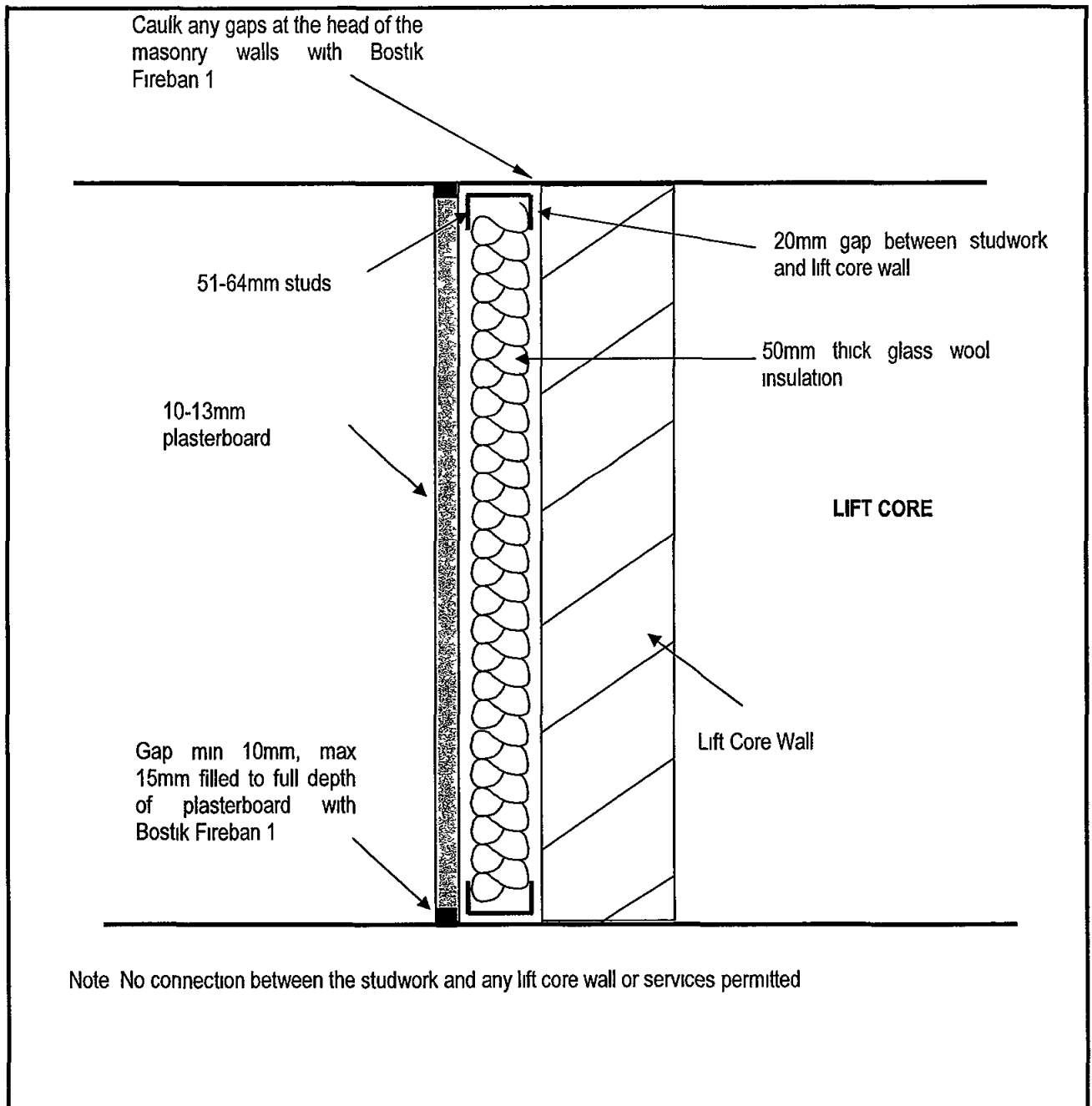
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC010
Issue	Scale	Approved		
NTS				



Consult, Meeting Room, Gym Wall			Acoustic Logic Consultancy Pty Ltd 9 Sarah St, Mascot Tel 8338 9888 Fax 8338 8399	
			Project WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
August 2010	KS		2010738	AC011
Issue	Scale	Approved		
NTS				



Toilet to Meeting Room Wall			Acoustic Logic Consultancy Pty Ltd 9 Sarah Street, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
March 2010	TT		2010738	AC012
Issue	Scale	Approved		
	NTS			

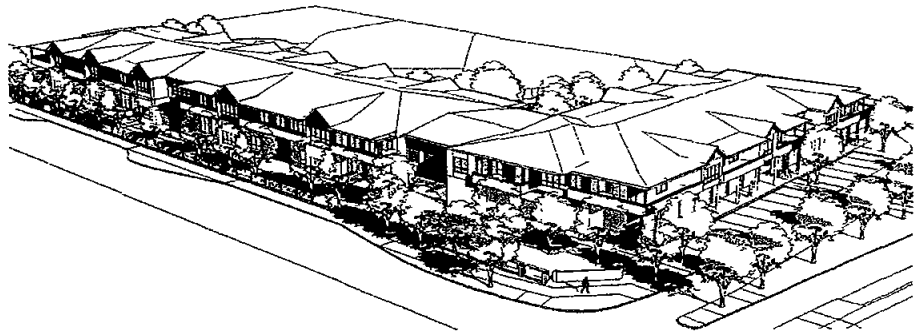


Apartment to Lift Wall Detail			Acoustic Logic Consultancy Pty Ltd 9 Sarah Street, Mascot Tel 8338 9888 Fax 8338 8399	
			WARRIEWOOD BROOK STAGE 3	
Date	Drawn	Checked	Project No	Drawing No
March 2010	TT		2010738	AC013
Issue	Scale	Approved		
	NTS			

CUNDALL

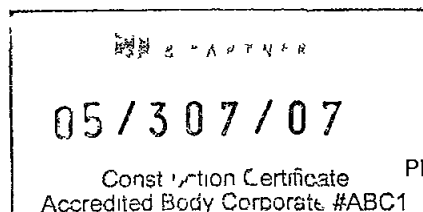
Monday 18 October 2010

Warriewood Brook Retirement Village Stage 3



BCA Section J1 & J2 Deemed-to-Satisfy Review Fabric & Glazing Requirements

Prepared for
ARV



Prepared by
CUNDALL
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Phone +61 2 8424 7000
Fax +61 2 8424 7099
Please contact Hannah Morton

BCA Section J Deemed-To-Satisfy Review

This report has been prepared to demonstrate the minimum requirements for Warriewood Brook Retirement Village Stage 3 to comply with Section J1 (fabric) and Section J2 (glazing) of the Building Code of Australia (BCA) 2010 in order to obtain valid construction and operational certificates

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1 2	Responsible Designer	4
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Introduction

The BCA 2010 Section J energy efficiency provisions are required to be included in the design of the Warriewood Brook Retirement Village Stage 3

The purpose of this review is to identify any major non-compliances and in particular check that proposed glazing and shading meet the BCA Section J1 & J2 requirements. Should there be conflicts with a particular element of the BCA's deemed-to-satisfy (DTS) provisions these can either be addressed within the design, or proven using a performance based solution under Section JV3. The general advice is to incorporate the minimum provisions where possible and the performance based approach only where these conditions conflict with the design intent.

As such the designers are recommended to include the minimum performance standards and advise Cundall of any non-compliances that require validation using an alternative performance based approach.

The development is located in Climate zone 5. The Building and Sustainability Index (BASIX) covers the residential component of the development (Independent Living Units or ILU s), therefore the requirements outlined in subsequent sections are intended to deal with the following building classifications.

Area	Classification
Office (Admin)	5
Cafe	6
Community Centre	9b

1 Part J1 – Building Fabric

1.1 Overview

Insulation reduces the radiation and convection of heat between internal and external conditions reducing heating, cooling and thus total energy loads over the course of the building's life. This has a two-fold saving through a smaller plant capacity along with direct energy consumption savings.

1.2 Responsible Designer

The responsible designers for this part of the BCA are the architect and the facade engineer (where applicable). The BCA minimum requirements for insulation are recommended to be incorporated as they will assist with improving thermal performance.

1.3 Summary of Requirements

Part J1 requires establishing minimum construction and performance requirements, which vary depending on the climate zone and type of building construction, for the following:

- Installation of insulation (J1.2)
- Roof / ceiling insulation (J1.3)
- Roof lights (J1.4)
- Wall insulation (J1.5)
- Floor insulation (J1.6)

Insulation to meet BCA deemed-to-satisfy requirements is recommended as it will generally assist with meeting the building's energy performance target.

1.4 Application of Part J1

This part is applicable to this project.

1.5 Installation of Insulation

Installation of insulation must comply with section J1.2 of the BCA. The installation must ensure that the insulation creates a continuous thermal barrier to reduce the energy losses. Additionally, it is important that the insulation must not hinder the safe or effective operation of any service or fitting. Specific installation requirements are outlined in Part J1.2 for reflective and bulk insulation.

The insulation used must comply with AS4859.1.

1 6 Roof & Ceiling

The deemed-to-satisfy provisions for Classes 5, 6 & 9b in climate zone 5 specify insulation requirements to achieve

Building Class	Direction of heat flow	Minimum Total R-Value for Roof ¹
5 6 9b	Down	3 2

1 7 Roof Lights

There are no roof lights proposed in the design based on Development Application (DA) documentation

1 8 Walls

For each part of an external wall that is part of the envelope, the following must be satisfied

Building Class	Climate Zone	Minimum Total R-Value for external walls
5, 6, 9b	5	2 8

A minimum total R-value of 2 8 applies, however this can be reduced in the following circumstances

(i) The minimum R-value is reduced,

By 0 5 for walls with a surface density of not less than 220kg/ m²,

By 0 5 for walls facing south,

By 0 5 if shaded with a projection shade angle from 30-60 degrees or by 1 0 if shaded with a projection angle of more than 60 degrees

Note Where the only space for insulation is provided by a furring channel, top hat section, batten or the like

(i) Achieve a minimum Total R-Value of 1 4, and

(ii) Satisfy glazing energy index of 0 145

1 9 Floors

No insulation is required for slab on ground floors in Climate Zone 5 (unless an in-slab heating or cooling system is installed)

¹ Where roof solar absorptance is 0 5 or less) Insulation requirements increase for higher solar absorptances

2 Part J2 – External Glazing

2.1 Overview

Glass has a significant impact on the energy performance of a building. The method of glazing analysis considers the area of the glass and orientation on a level by level basis.

2.2 Responsible Designer

The responsible designer for this part of the BCA is the architect.

2.3 Summary of Requirements

Part J2 requires established minimum glazing system performance requirements, which vary depending on the climate zone and the orientation and shading of the glazing.

The glazing conductance (U-value) and solar heat gain coefficient (SHGC) and shading devices are assessed together and calculated for each façade orientation. These are then added together to give an Air Conditioning Energy Value. To comply this must be less than the *Energy Index target*.

The calculation involves numerous factors and is typically undertaken using the glazing calculator developed by the Australian Building Codes Board (ABCB).

2.4 Application of Part J2

This part is applicable to this project.

2.5 Glazing Performance

The architectural facade requirements are summarised in the following table².

Facade Orientation	Location	U value	SHGC
N	Cafe Space	7.0	0.70
W	Cafe Space	5.0	0.43
E	Cafe Space	7.0	0.70
N	Community Centre	7.0	0.35
E	Community Centre	7.0	0.63
S	Community Centre	7.0	1.00
E	Community Centre	4.0	0.75
E	Office	7.0	0.54

The current design has been assessed to determine the required performance characteristics to comply with the Deemed to Satisfy Provisions for external glazing. The results for each elevation for each storey are summarised overleaf.

² **Notes** Shading is as per DA architectural plans. Glazing performance characteristics are total values for the glazing system i.e. glass and frame combined. Any glazing specified must achieve this minimum performance in order to comply.

Class 6 Cafe/Kitchen Glazing

Warrewood Brook Retirement/Cafe space		other	5
Storey	Facade areas		
Ground	N	E	SE
Option A	72.9m	65.6m	30.4m
Option B	35.4m	22.2m ²	20m ²

Application (as per Table J2.4a)
Select the program at Application
if the option is set.

Number of rows preferred in table below **8** (as currently displayed)

GLAZING ELEMENTS		ORIENTATION SECTOR		SIZE AND PERFORMANCE CHARACTERISTICS				SHADING		CALCULATED OUTCOMES OK (if inputs are valid)						
Glazing element		Facing sector		Size			Performance		P&H or device		Shading		Multipliers		Size	Outcomes
ID	Description (optional)	Option A facades	Option B facades	Height (m)	Width (m)	Area (m ²)	Total U Value (AFRC)	SHGC (AFRC)	P (m)	H (m)	P/H	G (m)	Heating (S _c)	Cooling (S _c)	Area used (m ²)	Element share of % of allowance used
1	N-2	N		2.70	4.10		7.0	0.70	3.000	2.700	1.11	0.00	0.00	0.26	11.07	31% of 35%
2	N-3	N		2.70	4.60		7.0	0.70	3.000	2.700	1.11	0.00	0.00	0.26	12.15	34% of 35%
3	N-4	N		2.70	4.50		7.0	0.70	3.000	2.700	1.11	0.00	0.00	0.26	12.15	34% of 35%
4	W-1	W		2.70	7.40		6.0	0.43	3.000	2.700	1.11	0.00	0.27	0.42	19.98	100% of 100%
5	E-1	E		2.70	4.70		7.0	0.70	3.000	2.700	1.11	0.00	0.14	0.39	12.69	60% of 64%
6	E-2	E		2.70	2.40		7.0	0.70	3.000	2.700	1.11	0.00	0.14	0.39	6.48	31% of 64%
7	E-3	E		0.90	1.70		7.0	0.70	3.000	0.900	3.33	0.00	0.00	0.25	1.53	5% of 64%
8	E-4	E		0.90	1.70		7.0	0.70	3.000	0.900	3.33	0.00	0.00	0.25	1.53	5% of 64%

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if inputs are valid



Class 9b Community Centre Glazing

Warrewood Brook Retirement/Community Centre		other	5
Storey	Facade areas		
Ground	N	E	S
Option A	39m	118m ²	149m ²
Option B	26.5m ²	65.6m	49.1m ²

Application: other, Climate zone: 5

Number of rows preferred in table below **17** (as currently displayed)

GLAZING ELEMENTS		ORIENTATION SECTOR		SIZE AND PERFORMANCE CHARACTERISTICS				SHADING		CALCULATED OUTCOMES OK (if inputs are valid)						
Glazing element		Facing sector		Size			Performance		P&H or device		Shading		Multipliers		Size	Outcomes
ID	Description (optional)	Option A facades	Option B facades	Height (m)	Width (m)	Area (m ²)	Total U Value (AFRC)	SHGC (AFRC)	P (m)	H (m)	P/H	G (m)	Heating (S _c)	Cooling (S _c)	Area used (m ²)	Element share of % of allowance used
1	N-1	N		2.70	2.70		7.0	0.35	10.800	2.700	4.00	0.00	0.00	0.19	7.29	100% of 99%
2	N-5	N		2.70	7.10		7.0	0.35				0.00	1.00	1.00	19.17	100% of 99%
3	W-3	W		2.70	9.10		4.1	0.39	4.912	3.900	1.26	1.20	0.76	0.64	21.57	38% of 100%
4	W-2	W		2.70	3.20		4.1	0.39	4.760	3.900	1.22	1.20	0.77	0.65	8.64	13% of 100%
5	W-4	W		2.70	2.60		4.1	0.39	2.330	3.900	0.60	1.20	0.94	0.88	7.02	14% of 100%
6	W-5	W		2.70	5.70		4.1	0.39				0.00	1.00	1.00	15.39	35% of 100%
7	E-5	E		2.70	3.80		7.0	0.63	3.000	2.700	1.11	0.00	0.14	0.39	10.26	16% of 99%
8	E-6	E		2.70	4.20		7.0	0.63	3.000	2.700	1.11	0.00	0.14	0.39	11.34	17% of 99%
9	E-7	E		2.70	2.10		7.0	0.63	3.000	2.700	1.11	0.00	0.14	0.39	5.67	9% of 99%
10	E-9	E		2.70	3.50		7.0	0.63	3.000	2.700	1.11	0.00	0.14	0.39	9.45	14% of 99%
11	E-10	E		2.70	10.70		7.0	0.63	3.000	2.700	1.11	0.00	0.14	0.39	28.89	44% of 99%
12	S-1	S		2.70	7.70		7.0	1.00				0.00	1.00	1.00	20.79	43% of 81%
13	S-2	S		2.70	2.40		7.0	1.00				0.00	1.00	1.00	6.48	13% of 81%
14	S-3	S		2.70	2.10		7.0	1.00	2.600	2.700	0.96	0.00	0.75	0.65	5.67	11% of 81%
15	S-4	S		2.70	2.10		7.0	1.00				0.00	1.00	1.00	5.67	12% of 81%
16	S-5	S		2.70	1.50		7.0	1.00	0.300	2.700	0.11	0.00	0.97	0.94	4.05	8% of 81%
17	S-6	S		2.70	2.40		7.0	1.00	0.300	2.700	0.11	0.00	0.37	0.94	6.48	13% of 81%

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Class 5 Office Glazing

BCA VOLUME ONE GLAZING CALCULATOR (first issued with BCA 2010)



Building name/description: Warriewood Brook Retirement/Office
 Application: other
 Climate zone: 5

Storey: Ground
 Facade areas table:
 Option A: 38.6m
 Option B: 25.4m²
 Glazing area (A): 25.4m²

Number of rows preferred in table below: 2 (as currently displayed)

GLAZING ELEMENTS		ORIENTATION		SECTOR		SIZE and PERFORMANCE CHARACTERISTICS				SHADING		CALCULATED OUTCOMES OK (if inputs are valid)				
Glazing element		Facing sector		Size		Performance		P&H or device		Shading		Multipliers		Size	Outcomes	
ID	Description (optional)	Option A facades	Option B facades	Height (m)	Width (m)	Area (m ²)	Total U Value (AFRC)	SHGC (AFRC)	P (m)	H (m)	P/H	G (m)	Heating (S _w)	Cooling (S _c)	Area used (m ²)	Element share of % of allowance used
1	E B	E		2.70	9.40		7.0	0.54	3.000	2.700	1.11	0.00	0.14	0.39	25.38	100% of 100%

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The glazing analysis requires revision to demonstrate compliance at construction certificate stage

Project DA Checklist

DA #	Issue	Deliverables prior to CC	Deliverables prior to commencement of works	Deliverables during construction	Deliverables prior OC	Independent approval required if no who?
51	Medical treatment rooms to comply with Infection Control Guidelines for Oral Health Care Settings published by NSW Health	Plans to be submitted to SWP			Letter of confirmation to be submitted to SWP	
52	Pool Fencing to be designed located and maintained in accordance with the Swimming Pool Act 1992				Inspection to be carried out by SWP	
53	Resuscitation Chart to be installed and maintained adjacent to Pool				Letter of confirmation to be submitted to SWP	
a)	Warning Sign to Contain appropriate lettering and wording				To be inspected on site	
b)	Simple flow sequence to be displayed				To be inspected on site	
54	Multi purpose room is for sole use of ARV					
55	No works to be commence on adjoining sites					
56	Existing dish drain in Brands Lane to be removed and replaced with gutter to Councils requirements				Inspection to be carried out by SWP	
57	BASIX Certified to be fulfilled and maintained for the life of the building	BASIX certificate to be submitted to SWP			Inspection to be carried out by SWP	
C	Matters to be satisfied prior to the issue of the Construction Certificate					
1	Engineering Details showing Water Reuse Scheme	Engineering details of Water Reuse Scheme to be submitted to SWP				
2	Construction Plans and Specifications	Approved DA stamped plans to be submitted to SWP				
3	Quick Check Plans	Stamped Sydney Water Quick Check plans to be submitted to SWP				Sydney Water
4	Details of Kitchen Cafe & Kiosk	Approved details and plans to be submitted to SWP				
5	Driveway Access Plans and Details					
6	Updated Waste Management Report	Updated Waste Management Report to be submitted to SWP Design Certificate to be submitted to SWP				
7	Flood Management System to meet the requirements of the Warrumbidgee Valley Integrated Water Management Strategy and Warrumbidgee Valley Water Management Specification With the inclusion of a Stormwater Management System	Approved Flood Management System and Stormwater Management System to be submitted to SWP Design Certificate to be submitted to SWP			Confirmation certificate to be submitted to SWP	
8	Updated Water Management Report	Updated Water Management Report to be submitted to SWP Design Certificate to be submitted to SWP				
9	Construction Plans and Specifications	Approved DA stamped plans to be submitted to SWP				
10	Erosion and Sediment Management Plan	Erosion and Sediment Management Plan to be submitted to SWP Design Certificate to be submitted to SWP				
11	Waste Management Plan as per Appendix 4 of the Warrumbidgee Valley Urban Land Release Context and Criteria	Waste Management Report to be submitted to SWP Design Certificate to be submitted to SWP				
12	Detailed landscape plans	Detailed landscape plans to be submitted to SWP Design Certificate to be submitted to SWP				
	Landscape Report				Report prepared by Qualified Landscape to be submitted to SWP Design Certificate to be submitted to SWP	
13	Notice of Requirements Sydney Water Section 73 Certificate	Notice of Requirements to be submitted to SWP				Sydney Water
14	Structural Engineer Schedule of Works	Schedule of works prepared by a qualified structural engineer to be submitted to SWP Design Certificate to be submitted to SWP				
15	Accessibility Control	Certificate prepared by the Accredited Access Adviser to be submitted to SWP				
16	Plans & details in accordance with the BASIX Certificate	Plans and details fulfilling the BASIX certificate requirements to be submitted to SWP				
17	Design Details in accordance with the Access Report	Design Details & technical specifications in accordance with the Access Report to be submitted to SWP				
D	Matters to be satisfied prior to the commencement of works and maintained during the works					
1	No works to be undertaken without the written approval of Council					

Note	Status early works CC	Status CC	Status WOC	Check MR Commence?	Status during	Status OC	Check MR OC?
		Plans received from NPR Architecture dated 02 06 11				Outstanding	
						Outstanding	
						Outstanding	
						Outstanding	
Note							
Note							
						Outstanding	
		BASIX plans received from ABSA dated 08 10 10				Outstanding	
		Page 37 38 of Hydraulic Services Specifications from GDK dated 20 10 10					
		Plans received from NPR Architecture dated 02 05 11					
		Stamped Sydney Water Quick Check plan dated 12 04 11					
		Statement for condition B29 addresses this					
Not Applicable							
		Waste Management Plan received from Hansen Yuncken dated on the 27 04 11					
		Update Report to Water Management Report Version 4 from GHD dated June 2011				Outstanding	
		Update Report to Water Management Report Version 4 from GHD dated June 2011					
		Plans received from NPR Architecture dated 02 06 11					
		Sediment and Erosion Control Plan received from GHD dated 08 10 10					
		Waste Management Plan received from Hansen Yuncken dated on the 27 04 11					
		Landscape plans received from Taylor Brammer dated 19 10 10					
						Outstanding	
		Notice of Requirements received from Sydney Water dated 10 05 11					
		Structural Certificate received from Mott MacDonald Hughes Trueman dated 28 04 11					
		Access Design Certificate received from Midson Group Pty Ltd dated 27 04 11					
		Plans received from NPR Architecture dated 02 06 11					
		Plans received from NPR Architecture dated 02 06 11					
Note							



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Certificate of Compliance

Development Stage 3 Warriewood Brook Retirement Village – 8 Macpherson Street Warriewood

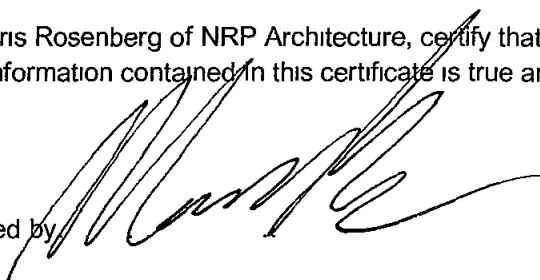
Owners Anglican Retirement Villages

Owners Address 62 Norwest Bvd, Baulkham Hills, NSW

Condition A1

The building has been designed to comply with the Building Code of Australia 2010

I Morris Rosenberg of NRP Architecture, certify that to the best of my knowledge and belief, the information contained in this certificate is true and accurate

Signed by 

Date 28 April 2011



27th April 2011

Andrew Rys
Senior Building Regulation Consultant
for Steve Watson & Partners Pty Ltd
Level 5, 432 Kent Street, Sydney NSW 2000

Attn Andrew Rys

To whom it may concern,

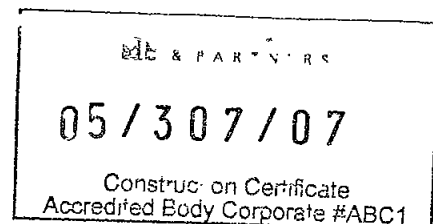
CERTIFICATE OF DESIGN COMPLIANCE – Landscape Architecture

SUBJECT PREMISES ARV Warriewood Stage 3
6-14 MacPherson Street Warriewood (Lots A & B DP400488 Lot 22 DP
5464 Lots 5 6 7 and 8 DP 1115877 and Lots A & B 358765)
CONSENT DA NUMBER No **DA/0634/10**

DEVELOPMENT APPLICATION

Pursuant to the provisions of **Clause A2 2 of the Building Code of Australia**, I hereby certify that the above design is in accordance with normal engineering practice and meets the requirements of the Building Code of Australia, any relevant fire safety engineering report, the Environmental Planning and Assessment Regulation, relevant Australian Standards and relevant conditions of the Development Consent. In particular the design will comply with the following

- B 4 Any vegetation planted outside approved landscape zones is to be consistent with
- a) Species listed in the Ecological Sustainability Plan or Bushland Management Plan
 - b) Species listed from the Endangered Ecological Community and
 - c) Locally native species growing onsite and/or selected from the list pertaining to the vegetation community growing in the locality as per the vegetation mapping and native plants for your garden link available from www.pittwater.nsw.gov.au
- B 7 Any new fencing is to be made passable to native wildlife. As a guideline, hole dimensions should be 150mm wide x 100mm long at ground level spaced at 6 metre intervals



taylor brammer landscape architects ptly ltd abn 61 098 724 988 www.taylorbrammer.com.au

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e rloughman@taylorbrammer.ae

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Sydney
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Woollahra NSW 2025 Australia
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e sydney@taylorbrammer.com.au

B 13 Only locally native canopy trees are to be planted on the site. Canopy tree species are to be from the vegetation community(s) on the site as per the Warneewood valley master plan available from Council and on Pittwater Web Site. All native trees are to be retained for the life of the development, or for their safe natural life. Trees that die or are removed must be replaced with another locally native canopy tree.

C 12 Detail landscape plans to be prepared by a qualified landscape architect showing detail of landscape works generally in accordance with Landscape plan LA01 as prepared by Taylor Brammer Landscape Architects. Landscape plans to include the following elements:

- Setback to MacPherson Street to maximise use of all areas for screening shrub/tree planting. Turf/paved areas to be minimised with intensive shrub planting 2 – 3m in height to be densely planted with trees at 10m centres along the entire frontage.
- All trees to Brands Lane, MacPherson Street and internal access Road frontages to be 400 litres in size. Native palms to be 3-5m clear trunk height. Shrub planting as per planting schedule (Taylor Brammer LA01). Mounding up to 500mm to the frontage to assist screening of the built form would be accepted.
- Report from a qualified landscape architect independently certifying that works as installed are to be in accordance with detail landscape plans is to be submitted and approved by nominated certifier to release of occupation certificate.

Plan Numbers

- LF01 Landscape Finishes
- LP01 Landscape Planting Plan
- LD01 Landscape Details
- LD02 Landscape Details
- LD03 Landscape Details

Landscape plans are to be updated to reflect revisions to the architecture. These updated plans will maintain the integrity of the current landscape design and incorporate all conditions of consent and local authority regulations and guidelines.

I possess Indemnity Insurance to the satisfaction of the building owner or my principal.

Full Name of Designer	James Heron
Qualifications	BLarch UNSW (Hons 1), Dip Hort (UK)
Address of Designer	218 Oxford Street WOOLLAHRA NSW 2025
Business Telephone No	02 9387 8855 Fax No 02 9387 8155

Name of Employer	Matthew Taylor Director
Signature	

DM Taylor



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Street Warriewood

Owners Anglican Retirement Villages

Owners Address 62 Norwest Blvd, Baulkham Hills, NSW

Condition B17

External glazing to the building will have a maximum reflectivity index of 25%

I Morris Rosenberg of NRP Architecture, certify that to the best of my knowledge and belief,
the information contained in this certificate is true and accurate

Signed by

A handwritten signature in black ink, appearing to read 'Morris B', written over a white background.



Date 28 April 2011

Waste Management Plan

Form 1

Land Use or Activity

OUTLINE OF PROPOSAL

Site Address

6 – 14 Macpherson Street, Warriewood NSW 2102

Applicants Name and Address

Anglican Retirement Villages

PO Box 284, Baulkham Hills NSW 1765

Tel 9421 5318

Fax 9421 2217

Buildings and other structures currently on site

Existing retirement village including RACF (Residential Aged Care Facility) and 2 off ILU

(Independent Living Unit) buildings in the northern corner of the site

Brief description of proposal

Construction of seniors living ILU development including 25 independent living units

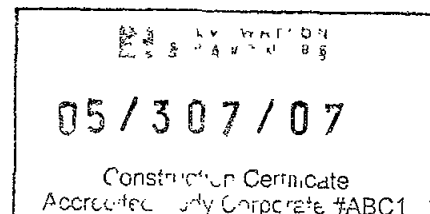
community centre with multipurpose space, cafe, gym, indoor swimming pool, medical

consulting rooms External site works including landscaping, driveway, and ground level

car parking

Prepared By Hansen Yuncken Pty Ltd

Date 27th April 2011



MATERIALS ON SITE			DESTINATION			
			Reuse and Recycling		OFF-SITE Specify contractor and recycling outlet	Disposal
Type of Materials	Estimated		ON-SITE Specify proposed reuse or on-site recycling methods	Specify contractor and recycling outlet			Specify contractor and landfill site
	Vol (m ³)	Wt (t)				
Concrete	60 m ³		-	-	Waste generated during construction will be removed off site by a selected waste contractor and disposed of at a local land fill site	
Brickwork	12 m ³		-	-	As above	
Steel Framing	3 m ³		-	-	As above	
Metal Roofing	3 m ³		-	-	As above	
Plasterboard	6 m ³		-	-	As above	
Tiles	2 m ³		-	-	As above	
Carpet	2 m ³		-	-	As above	
Bitumen	3 m ³		-	-	As above	
Other (plastics, tins and general waste)	10 m ³		-	-	As above	

TYPE OF WASTE TO BE GENERATED	EXPECTED VOL PER WEEK	PROPOSED ON-SITE STORAGE AND TREATMENT FACILITIES	DESTINATION
<i>Please specify eg food waste glass paper metal off-cuts, etc</i>	Litres or m ³	<i>eg Waste storage and recycling area, garbage chute on-site composting compaction equipment</i>	<i>Recycling disposal specify contractor</i>
General Waste	80L per unit	Stored in garbage bins in a designated area	Disposal to landfill by ARV's selected waste contractor
General Recyclables	40L per unit	Stored in recycle bins in a designated area	Recycled by ARV's selected waste contractor
Administration/ Communal Areas – General Waste	240L	Stored in garbage bins in a designated area	Disposal to landfill by ARV's selected waste contractor
Administration/ Communal Areas – General Recyclables	240L	Stored in recycle bins in a designated area	Recycled by ARV's selected waste contractor
Kitchen/Cafe General Waste	2 x 240L	Stored in garbage bins in a designated area	Disposal to landfill by ARV's selected waste contractor

Describe how you intend to ensure ongoing management of waste on-site (eg, lease conditions, caretaker/manager onsite)

Units General waste and recycling 'Sulo' type bins will be stored in a designated waste holding room adjacent the car park on ground level. Two separate waste holding rooms have been designed with internal access provided from the main lobbies. Residents will be responsible for taking their waste to the appropriate bins in the holding room. Waste is collected weekly from the waste holding rooms by ARV's contracted waste collector.



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Owners Anglican Retirement Villages

Owners Address 62 Norwest Bvd, Baulkham Hills, NSW

Condition B27

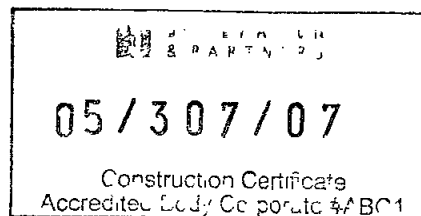
The building will be designed with garbage enclosures of solid materials with cement rendered walls. Floor will be an impervious material covered at walls and graded and drained to approve floor wastes.

Rooms will be ventilated, and hot and cold water hose cocks will be provided.

I Morris Rosenberg of NRP Architecture, certify that to the best of my knowledge and belief, the information contained in this certificate is true and accurate.

Signed by

A handwritten signature in black ink, appearing to read 'Morris Rosenberg', is written over a light grey background.



Date 28 April 2011

C4



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Owners Anglican Retirement Villages

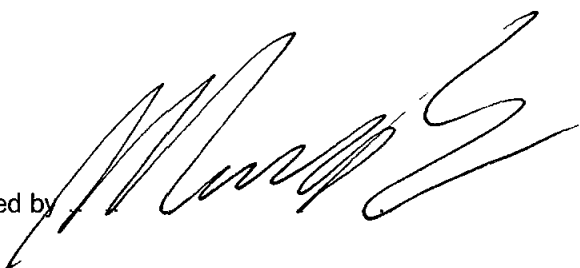
Owners Address 62 Norwest Bvd, Baulkham Hills, NSW

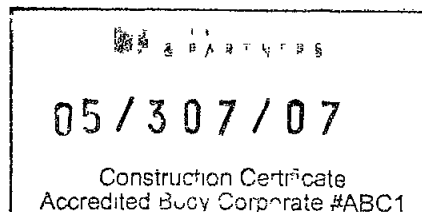
Condition B29

The Kitchen to the Community Centre will be designed to comply with AS 4674 – 2004 Design construction and fitout of food premises

It will also be designed to The Food Safety Standard 3 2 3 required by the Food Regulation 2004

I Morris Rosenberg of NRP Architecture, certify that to the best of my knowledge and belief, the information contained in this certificate is true and accurate

Signed by 



Date 28 April 2011



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Street Warriewood

Owners Anglican Retirement Villages

Owners Address 62 Norwest Blvd, Baulkham Hills, NSW

Condition B30

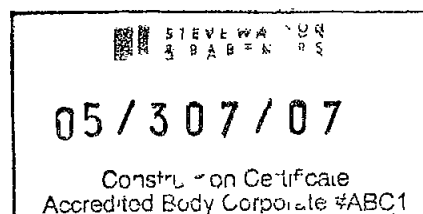
The walls to the Kitchen in the Community Centre will be of solid masonry construction

I Morris Rosenberg of NRP Architecture, certify that to the best of my knowledge and belief,
the information contained in this certificate is true and accurate

Signed by

A handwritten signature in black ink, appearing to read 'Morris Rosenberg', is written over a light grey background.

Date 28 April 2011



Rosenberg Architects Pty Limited ABN 21 083 698 882 trading as NRP ARCHITECTURE
Director / Nominated Architect Morris Rosenberg B Arch (Hons) FRAIA (Reg No 3308)



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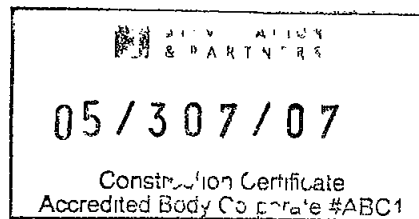
Condition B31

The floors to the Kitchen in the Community Centre will be appropriate to the area and will be able to be effectively cleaned

I Morris Rosenberg of NRP Architecture, certify that to the best of my knowledge and belief, the information contained in this certificate is true and accurate

Signed by

A handwritten signature in black ink, appearing to read 'Morris Rosenberg', is written over a light blue horizontal line.



Date 28 April 2011



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Owners Anglican Retirement Villages
Owners Address 62 Norwest Blvd, Baulkham Hills, NSW

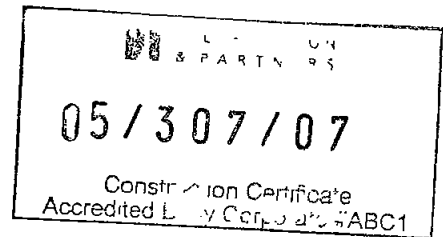
Condition B32

The building will be designed with coves to wall and floor junctions to the Kitchen on the Community Centre

I Morris Rosenberg of NRP Architecture certify that to the best of my knowledge and belief, the information contained in this certificate is true and accurate

Signed by

A handwritten signature in black ink, appearing to read 'Morris Rosenberg', written over a white background.



Date 28 April 2011



NRP ARCHITECTURE
ABN 21 083 698 882

Level 8/15 Help Street Chatswood NSW 2067
PO Box 5036 West Chatswood NSW 1515

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E mail@nrparchitecture.com

Certificate of Compliance

Development Stage 3 Warriewood Brook Retirement Village – 8 Macpherson Street Warriewood

Owners Anglican Retirement Villages

Owners Address 62 Norwest Blvd, Baulkham Hills, NSW

Condition B33

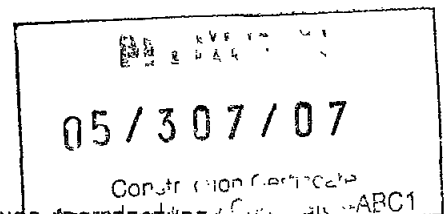
The building will be designed with cupboards, cabinets and counter construction free of voids, cracks and crevices, and designed to be easily cleaned and not give harborage for vermin

I Morris Rosenberg of NRP Architecture, certify that to the best of my knowledge and belief, the information contained in this certificate is true and accurate

Signed by

A handwritten signature in black ink, appearing to read 'Morris Rosenberg', written over a light grey background.

Date 28 April 2011



Rosenberg Architects Pty Limited ABN 21 083 698 882 trading as NRP ARCHITECTURE
Director / Nominated Architect Morris Rosenberg B Arch (Hons) FRAIA (Reg No 3308)



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Owners Anglican Retirement Villages

Owners Address 62 Norwest Blvd, Baulkham Hills, NSW

Condition B34

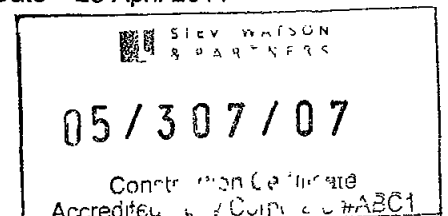
The building will be designed with fixtures, fittings and equipment designed in accordance with the requirements given in Table 4.3 & 4.4 of AS 4674-2004 Design, construction & fit-out of food premises

I Morris Rosenberg of NRP Architecture, certify that to the best of my knowledge and belief, the information contained in this certificate is true and accurate

Signed by

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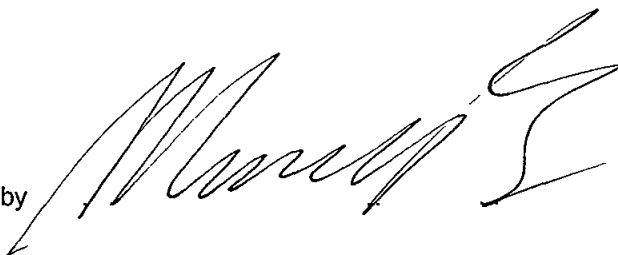
Owners Anglican Retirement Villages

Owners Address 62 Norwest Bvd, Baulkham Hills, NSW

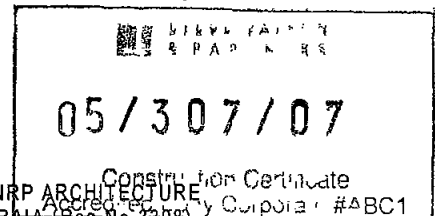
Condition B35

The building will be designed with the ceiling over the kitchen to the Community Building and will be non-perforated and finished free of open joints, cracks and crevices, and finished with a light coloured, washable and impervious

I Morris Rosenberg of NRP Architecture, certify that to the best of my knowledge and belief, the information contained in this certificate is true and accurate

Signed by 

Date 28 April 2011



Rosenberg Architects Pty Limited ABN 21 083 698 882 trading as NRP ARCHITECTURE
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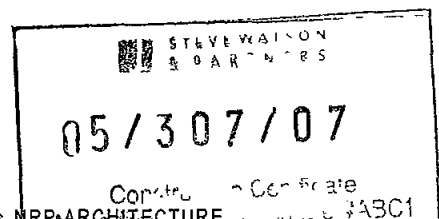
Condition B36 & 37

The kitchen to the Community Building will be designed with a hand wash basin, and provided with an adequate supply of potable warm running water delivered through a single spout, a supply of liquid soap, and single use hand towel

I Morris Rosenberg of NRP Architecture, certify that to the best of my knowledge and belief, the information contained in this certificate is true and accurate

Signed by 

Date 28 April 2011



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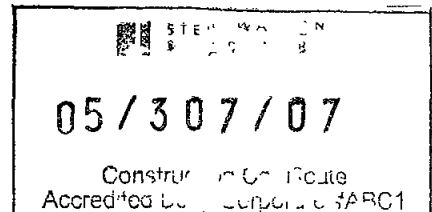
Condition B38 & 39

The kitchen to the Community Building will be designed with cleaning and sanitizing equipment complying with tables 4.4 and 4.2 of AS 4674-2004, and with dishwashers and glass washers compliant with AS 2945

I Morris Rosenberg of NRP Architecture, certify that to the best of my knowledge and belief, the information contained in this certificate is true and accurate

Signed by 

Date 28 April 2011



Rosenberg Architects Pty Limited ABN 21 083 698 882 trading as NRP ARCHITECTURE
Director / Nominated Architect Morris Rosenberg B Arch (Hons) FRAIA (Reg No 3308)

B41 D
C1

HYDRAULIC SERVICES
DESIGN, DOCUMENT & CONSTRUCT SPECIFICATION

FOR

ANGLICAN RETIREMENT VILLAGES
WARRIEWOOD BROOK RETIREMENT VILLAGE
AND RESIDENTIAL AGED CARE FACILITY
STAGE 3

JOB NO
9183

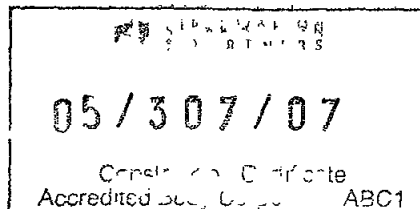
DATE
20 October, 2010

ISSUE
A
TENDER ISSUE

HYDRAULIC AND FIRE SERVICES CONSULTANTS



SUITE 6, 17 BURWOOD ROAD
BURWOOD NSW 2134
Phone (02) 9745 0700 Fax (02) 9745 0722



GENERAL REQUIREMENTS

1 GENERAL

1 1 GENERAL

Precedence

Requirements of individual technical worksections of the specification override conflicting requirements in this worksection

1 2 REFERENCED DOCUMENTS

Current editions

Use referenced documents which are editions, with amendments, current 3 months before the closing date for tenders, except where other editions or amendments are required by statutory authorities

Contractual relationships

Responsibilities and duties of the principal, contractor and contract administrator are not altered by requirements in referenced documents

General standards

Plumbing and drainage To AS/NZS 3500 2 2

Water supply To AS/NZS 3500 1 2

Stormwater To AS/NZS 3500 3

Fire Hydrants To AS 2419 1

Fire Hose Reels To AS 2441

Fuel Gas To AS 5601

Bushfire protection To AS 3959

Degree of Electrical protection To AS 1939

1 3 INTERPRETATION

General

Unless the context otherwise requires, the following definitions apply

Approved "Approved", "reviewed", "directed", "rejected", "endorsed" and similar expressions mean "approved (reviewed, directed, rejected, endorsed) in writing by the contract administrator"

Give notice "Give notice", "submit", "advise", "inform" and similar expressions mean "give notice (submit, advise, inform) in writing to the contract administrator"

Obtain "Obtain", "seek" and similar expressions mean "obtain (seek) in writing from the contract administrator"

Proprietary "Proprietary" mean identifiable by naming manufacturer, supplier, installer, trade name, brand name, catalogue or reference number

Provide "Provide" and similar expressions mean "supply and install"

Samples Includes samples, prototypes and sample panels

Supply "Supply", "furnish" and similar expressions mean "supply only"

Technical

Zinc coated steel Includes zinc coated steel, zinc/iron alloy-coated steel, and aluminium/zinc coated steel

Pipe Includes pipe and tube

Tests

Except where otherwise defined in referenced documents, the following definitions apply

- Pre completion tests Tests carried out before completion tests

Type tests Tests carried out on an item identical with a production item, before delivery to the site

Production tests Tests carried out on the purchased equipment, before delivery to the site

Site tests Tests carried out on site

Completion tests Acceptance tests and final tests

Acceptance tests Tests carried out on completed installations or systems and, except for final tests, before the date for practical completion, to demonstrate that the installation or system, including components, controls and equipment, operates correctly, safely and efficiently, and meets performance and other requirements

Final tests Acceptance tests carried out before completion of the maintenance period

Maintenance period

Co extensive with the defects liability period

Abbreviations

CFCs Chlorofluorocarbons

GRP Glass-fibre reinforced polyester

MIMS Mineral-insulated metal-sheathed

NATA National Association of Testing Authorities

NEBB National Environment Balancing Bureau

SSL Scientific Services Laboratory

UPVC Unplasticised polyvinyl chloride

UV Ultra violet light

1 4 CONTRACT DOCUMENTS

General

Diagrammatic layouts Layouts of service lines, plant and equipment shown on the drawings are diagrammatic only, except where figured dimensions are provided or calculable Before commencing work, obtain measurements and other necessary information

Levels Spot levels take precedence over contour lines and ground profile lines

1 5 DESIGN

Space requirements

Check space requirements of equipment and services indicated diagrammatically in the contract documents and submit a report on consequent variations to the design

Electrical supply system

As required

Fault level protection

To withstand the fault level of the incoming supply at the equipment location

Rotating and reciprocating machinery noise and vibration

Vibration severity At least Satisfactory, to AS 2625 3 or AS 2625 4

Earthquake loads

General Design structures, installations and components to resist local earthquake forces and other applicable forces

Standard To AS 1170 4

- Earthquake design category

2 QUALITY

2 1 INSPECTION

Notice

Witness points If notice of inspection is to be given in respect of parts of the works, advise if and when those parts are to be concealed

Hold points If notice of inspection is to be given in respect of parts of the works, do not conceal those parts without approval

Minimum notice for inspections to be made 4 hours for on site inspectors, otherwise 2 working days

Concealed services Give notice so that inspection may be made of services to be concealed

2 2 TESTS

Notice

General Give sufficient notice so that designated tests may be witnessed

Hold points Do not carry out designated tests without approval

Minimum notice for tests to be witnessed

- 5 working days for site tests, and
10 working days for local pre delivery tests

Testing authorities

General Except for site tests, have tests carried out by authorities accredited by NATA to test in the relevant field, or an organisation outside Australia recognised by NATA through a mutual recognition agreement Cooperate as required with testing authorities

Site tests Use instruments calibrated by authorities accredited by NATA

Reports

General Submit copies of test reports, including certificates for type tests, showing the observations and results of tests and compliance or non compliance with requirements

Number of copies of test certificates 3

Endorsement

If tests are to be carried out on parts of the works, do not conceal those parts and do not commence further work on those parts until the tests have been satisfactorily completed and compliance verified

2.3 PRE-COMPLETION TESTS

Motor rotation

Check correct motor rotation while maintaining correct phase sequence at the switchgear and control gear assembly, and if necessary alter connections

Type tests and production tests

Mechanical sound power level tests To AS 1217.5 and AS 1217.7

2.4 SAMPLES

Timing

Delays Coordinate submissions of related samples Do not cause delays by making late submissions or submitting inadequate samples

Quantity

General Submit a sample of each designated item and 2 copies of supporting documentation Include ancillary items such as fasteners, flashings and seals

Identification

Identify the project, contractor, subcontractor or supplier, manufacturer, applicable product, model number and options, as appropriate and include pertinent contract document references Include service connection requirements and product certification Identify non-compliances with project requirements, and characteristics which may be detrimental to successful performance of the completed work

Approval

General Do not commence work affected by samples until the samples have been approved Submit further samples as necessary

Retention

Keep approved samples in good condition on site, until practical completion

Incorporation

Incorporate in the works samples which have been approved for incorporation Do not incorporate other samples

Criteria

Match approved samples throughout the works

2.5 SUBMISSIONS

Timing

General Submit documents in a timely manner, to suit the construction program Advise if any of the documents are to be returned

Delays Coordinate submissions of related items Do not cause delays by making late or inadequate submissions

Quantity

Bound documents 3 copies

Loose documents up to and including A3 One copy

Loose documents larger than A3 One transparency on heavyweight plastic film the same size as the standard contract drawings

Standard contract drawing size B1

Identification

Identify the project, contractor, subcontractor or supplier, manufacturer, applicable product, model number and options, as appropriate and include pertinent contract document references. Include service connection requirements and product certification. Identify non-compliances with project requirements, and characteristics which may be detrimental to successful performance of the completed work.

Endorsement

Witness points Give notice before commencing work affected by contractor's submissions, unless the submissions have been endorsed as satisfactory.

Hold points Do not commence work affected by contractor's submissions until, if appropriate, the submissions have been endorsed as satisfactory,

Errors If a document contains errors, submit a new or amended document as appropriate, indicating changes since the previous submission.

Design

General If part or all of an installation is to be designed by the contractor, submit documents showing the layout and details of the installation.

Variation documents If it is proposed to change the installation from that shown on the contract documents, or if changes are required by statutory authorities, submit variation documents showing the proposed changes.

Shop drawings

General Submit dimensioned drawings showing details of the fabrication and installation of services and equipment, including relationship to building structure and other services, cable type and size, and marking details.

Diagrammatic layouts Coordinate work shown diagrammatically in the contract documents, and submit dimensioned set-out drawings.

Site copies Amend the drawings during the defects liability period to correct errors or omissions and to show changes after submission. Resubmit amended copies.

Authorities

Correspondence Submit copies of correspondence and notes of meetings with authorities.

Authorities' approvals Submit documents showing approval of the authorities whose requirements apply to the work.

Tests

Tests program Submit a testing and commissioning program which is consistent with the construction program. Include particulars of test stages and procedures.

Test records For designated tests, including pre-delivery tests, record results and submit reports or certificates in a form suitable for inclusion in operation and maintenance manuals.

Samples

If it is intended to incorporate samples into the works, submit proposals.

Materials and components

Product data For proprietary equipment, submit the manufacturer's product data including

technical specifications and drawings,

type test reports,

- performance and rating tables, and

- recommendations for installation and maintenance

Proposed products schedules For major products not specified as proprietary items, within 3 weeks of site possession submit a schedule of those proposed for use

Product certification If products must comply with product certification schemes, submit evidence of compliance

Execution

Fixing of services Submit typical details of locations, types and methods of fixing of services to structure, before installation

Embedded services Submit proposals for embedding services in concrete walls or floors, or chasing into concrete or masonry walls

Inaccessible services If services will be enclosed and not accessible after completion, submit proposals for location of service runs and fittings

Acceptance of substrate Submit installers' statements verifying that the substrate is satisfactory for receiving the installation

3 MATERIALS AND COMPONENTS

3.1 GENERAL

Proprietary items

Implication Identification of a proprietary item does not necessarily imply exclusive preference for the item so identified, but indicates the necessary properties of the item

Alternatives If alternatives are proposed, submit proposed alternatives and include samples, available technical information, reasons for proposed substitutions and cost. If necessary, provide an English translation. State if provision of proposed alternatives will necessitate alteration to other parts of the works and advise consequent costs

Manufacturers' or suppliers' recommendations

General Select, if no selection is given, and transport, deliver, store, handle, protect, finish, adjust, prepare for use, and provide manufactured items in accordance with the current written recommendations and instructions of the manufacturer or supplier

Instructions Submit the recommendations and instructions, and advise of conflicts with other requirements

Project modifications Advise of activities that supplement, or are contrary to, manufacturer's or suppliers' written recommendations and instructions

Product certification If products must comply with product certification schemes, provide them in accordance with the certification requirements

Sealed containers

If materials or products are supplied by the manufacturer in closed or sealed containers or packages, bring the materials or products to point of use in the original containers or packages

Consistency

For the whole quantity of each material or product use the same manufacturer or source and provide consistent type, size, quality and appearance

3.2 ELECTRIC MOTORS

General

Dimensions and performance To AS 1360 11

Installation To AS 1359 107

Motors ≥ 0.75 kW Three phase

Noise and vibration Support motors to minimise noise and vibration

Noise and vibration limits To AS 1359 109 and AS 1359 114

Motor selection

Select motors in accordance with AS 1359 101, motor manufacturers' recommendations and the following

- Starting performance To IEC 60034-12 and AS 1359 41
- Speed and torque To suit required by the driven equipment Ensure each motor develops torque relative to the starting load of the driven machine such that it runs up to full speed steadily and within a time period compatible with motor winding temperatures, class of insulation and rating of the starting equipment
- Starting method As specified or, if none specified, appropriate to the driven equipment, electrical services infrastructure and supply authority requirements
- Motor operation Select motor for mode of operation, appropriate to the duty eg continuous, frequent starting and stopping
- Motor power rating The greater of
 - The specified minimum motor capacity and
 - 110% of the maximum load of the driven equipment
- Temperature rating Select motors for continuous operation at an ambient $\geq 40^{\circ}\text{C}$
- Motor enclosure As specified or, if none specified, as appropriate to the environment in which the motor operates Enclosure classification to conform to AS 1359 20 and AS 1939

Motors supplied from variable frequency drives

Select for low noise and vibration under all operating conditions

- Provide Class F insulation, with Class B temperature rise or better

Overload protection

Provide each motor with overload protection

Motors ≥ 22 kW Fit embedded winding temperature thermistors complying with AS 1023 1 in each phase Match trip operating temperature to motor winding insulation classification

Motor efficiency and power factor

Motors specified as high efficiency To AS/NZS 1359 5 Section 3

All other motors To AS/NZS 1359 5 Section 2

Power factor Not less than the value in the **Minimum power factor table** for the respective motor size

Minimum power factor table

Rated output kW	Minimum power factor at rated output
≤ 0.37	0.72
> 0.37 to ≤ 0.55	0.76
> 0.55 to ≤ 3.0	0.83
> 3.0 to ≤ 18.5	0.86
> 18.5 to ≤ 37	0.87
> 37	0.88

4 EXECUTION

4.1 INSTALLATION

General

General Install equipment and services plumb, fix securely and organise reticulated services neatly. Allow for movement in both structure and services.

Arrangement Arrange services so that services running together are parallel with each other and with adjacent building elements. Under suspended ground floors, keep services at least 150 mm clear above ground surface, additional to insulation, and ensure access is not impeded.

Lifting Provide permanent fixtures attached to the equipment, for lifting heavy items of equipment, as recommended by the manufacturer.

4.2 SERVICES CONNECTIONS

Statutory authorities' requirements

If the authorities elect to perform or supply part of the works, make the necessary arrangements. Install equipment supplied, but not installed, by the authorities.

Connections

Connect to statutory authorities' services or service points. Excavate to locate and expose connection points. On completion reinstate the surfaces and facilities which have been disturbed.

4.3 SYSTEM INTEGRATION

General

Interconnect system elements so that the installations perform their designated functions.

4.4 SERVICES COORDINATION

General

Documentation Prepare detailed drawings of the proposed positioning of plant and equipment.

- Ensure coordination with other building and service elements
- Show adjusted positions on the shop and record drawings
- Provide details of all loadings imposed on the structure

4.5 BUILDING PENETRATIONS

Piping sleeves

General Provide metal sleeves formed from pipe sections, for piping penetrations through building elements.

Sleeve diameter (for non fire rated building elements) Sufficient to provide an annular space around the pipe or pipe insulation of at least 12 mm.

Minimum sleeve thickness

- Metal 1 mm

Sleeve terminations

- If cover plates are fitted Flush with the finished building surface
In floors draining to floor wastes 50 mm above finished floor
In fire rated and acoustic rated building elements 50 mm beyond finished building surface
- Elsewhere 5 mm beyond finished building surface

Finish Prime paint ferrous surfaces

Cable sleeves

Provide UPVC sleeves formed from pipe sections, for penetrations through floor slabs and beams and external walls by cables not enclosed in conduit. In addition, for MIMS cables, provide sleeves for penetrations through masonry

Fire rated building elements

Seal penetrations with a system conforming to AS 4072.1

Non-fire rated building elements

Seal penetrations around conduits and sleeves. Seal around cables within sleeves. If the building element is acoustic rated, maintain the rating

Limitations

General Do not penetrate or fix to the following without approval

- Structural building elements including external walls, fire walls, fire doors and access panels, other tested and rated assemblies or elements, floor slabs and beams
 - Membrane elements including damp proof courses, waterproofing membranes and roof coverings
- Membranes If approval is given to penetrate membranes, provide a waterproof seal between the membrane and the penetrating component

4.6 FIXING
General

If equipment and services are not suitable for fixing to non structural building elements, fix directly to structure and trim around holes or penetrations in non structural elements

4.7 UNDERGROUND METAL PIPING
Corrosion protection

General Provide corrosion protection for

- underground ferrous piping, and
underground non ferrous metal piping in corrosive areas

Protection methods Select from the following

- Impermeable flexible plastic coating
Sealed polyethylene sleeve
Continuous wrapping using proprietary petroleum taping material

- Cathodic protection Sacrificial anodes or impressed current Incorporate a facility for periodic testing

Standard Comply with the recommendations of AS 2832 1

4 8 PIPING

Cleaning

General Before installation, remove loose scale, burrs, fins and obstructions

Protection During construction, prevent the entry of foreign matter into the piping system by temporarily sealing the open ends of pipes and valves with purpose made covers of pressed steel or rigid plastic

Installation

General Install piping in straight lines at uniform grades with no sags Arrange to prevent air locks Provide sufficient unions, flanges and isolating valves to allow removal of piping and fittings for maintenance or replacement of plant

Arrangement Arrange and support piping so that it remains free from vibrations whilst permitting necessary movements Minimise the number of joints

Spacing Provide at least 25 mm clear between pipes and between pipes and building elements, additional to insulation

Dissimilar metals Join dissimilar metals with fittings of electrolytically compatible material

Accessibility

Provide access and clearance at fittings which require maintenance or servicing, including control valves and joints intended to permit pipe removal Arrange piping so that it does not interfere with the removal or servicing of associated equipment or valves or block access or ventilation openings

Embedded piping

Expansion and contraction Sheath or sleeve metal piping chased into masonry or encased in concrete so that expansion or contraction can take place without damage to the pipe or to the material or surface finish of the surrounding element

Cover plates

If piping emerges from exposed building surfaces, provide cover plates of non ferrous metal, finished to match the pipe, or of stainless steel, close fitting and firmly fixed in place

Cover plate sizes table

Nominal pipe size, DN	Cover plate diameter
< 20	65 mm
∅ 20, < 50	100 mm
∅ 50	50 mm larger than pipe

Support system

General Provide proprietary support systems of galvanised or zinc-coated steel construction

Vertical pipes Provide anchors and guides to maintain long pipes in position, and supports to balance the mass of the pipe and its contents

4 9 CONCRETE PLINTHS

Construction

General Provide galvanized steel surround at least 75 mm high and 1.6 mm thick, fixed to floor with masonry anchors Fill with concrete

Reinforcement Single layer of F62 fabric

Concrete Grade N20

- Finish Steel float flush with the surround

4 10 VIBRATION SUPPRESSION

General

Minimise the transmission of vibration and noise from rotating or reciprocating equipment to other building elements

Services connections

Provide flexible connections to rotating machinery and assemblies containing rotating machinery Isolate ducts by flexible connections Isolate pipes by incorporating sufficient flexibility into the pipework or by use of proprietary flexible pipe connections installed so that no stress is placed on pipes due to end reaction

Services speeds

Where no maximum speed is prescribed do not exceed 1500 rpm for direct driven equipment

Equipment requiring vibration isolation mountings

Except for external equipment which is not connected to the structure of any building, support rotating or reciprocating equipment on mountings as follows

For static deflections < 15 mm Single or double deflection neoprene in-shear mountings incorporating steel top and base plates and a tapped hole for bolting to equipment

For static deflections \geq 15 mm Spring mountings

Selection of vibration isolation mountings

Select mountings to achieve 95% isolation efficiency at the normal operating speeds of the equipment

Spring mountings

Type Free standing laterally stable springs with at least 12 mm clearance between springs and other members such as bolts and housing

Characteristics

- Ratio of mean coil diameter to compressed length at the designated minimum static deflection ≥ 0.8

Minimum travel to solid of at least 150% of the designated minimum static deflection

- Levelling bolts and lock nuts

5 mm neoprene acoustic isolation pads between baseplate and support

Vertical resilient limit stops To prevent spring extension when unloaded, to serve as blocking during erection, and which remain out of contact during normal operation

Snubbing Snub the springs to prevent bounce at start-up

Installation

Set and adjust vibration isolation mounting supports to give adequate clearance for free movement of the supports

Inertia bases

General Provide inertia bases with mass appropriate to the required level of vibration isolation

Construction Steel, or steel framed reinforced concrete Position foundation bolts for equipment before pouring concrete

Supports Support on vibration isolation mountings using height saving support brackets

4 11 SERVICES SEIMIC PROVISIONS

General

Standard To AS 1170 4

Provisions

Comply with the following as a minimum

Arrange all components to resist earthquake loads

- Restrain all components against seismic loads other than pipes and ducts exempted in AS 1170 4 clause 5 1 4

Plant and equipment Securely fix all plant and equipment to the building structure

- Fixings Fix components to withstand earthquake loads determined in accordance with AS 1170 4 Do no rely on gravity and friction to resist seismic forces

Anti vibration mounts Use horizontally restrained type

- Components Do not use components that will be damaged by earthquake conditions Protect systems against the adverse effects of components such as mercury switches which, although not damaged by earthquake, may malfunction

4 12 SERVICES SITE PAINTING

General

If exposed to view, paint new services and equipment including in plant rooms, except chromium, anodised aluminium, GRP, UPVC, stainless steel, non metallic flexible materials and normally lubricated machined surfaces Repair proprietary items only if damaged

Standard

General Comply with the recommendations of AS/NZS 3211 Sections 3, 6 and 7, or AS/NZS 2312 Sections 5, 8 and 10, as applicable

Combinations

Do not combine paints from different manufacturers in a paint system

Protection

Remove fixtures before starting to paint, and refix in position undamaged on completion

Paint application

Apply the first coat immediately after substrate preparation and before contamination of the substrate can occur Ensure each coat of paint or clear finish is uniform in colour, gloss, thickness and texture, and free of runs, sags, blisters, or other discontinuities

Repair of galvanizing

If galvanized surfaces have been cut or welded after galvanizing, prime the affected area using zinc rich organic binder to GPC C-29/16

4 13 MARKING

General

General Mark equipment, electrical wiring, piping, valves, conduits and ducts, to provide a ready means of identification

Piping, conduits and ducts To AS 1345, as applicable

Labels

Type Select from the following

For indoor applications only, engraved two colour laminated plastic

Engraved and black filled lettering on stainless steel or brass, minimum thickness 1 mm

Cast metal

Label edges If labels exceed 1.5 mm thickness, radius or bevel the edges

Minimum lettering heights

Equipment nameplates 40 mm

Valve and pump identification 20 mm

Warning notices 7 mm

Automatic controls and electrical equipment 5 mm

Isolating switches 5 mm

Inside electrical enclosures 3.5 mm

Other 3 mm

Location

General Locate labels so that they are easily seen and are either attached to, below or next to the item being marked

Exposed locations Provide durable materials

Fixing

General Mechanical fixing Do not penetrate vapour barriers

Valves and pumps Screw fix to body or attach by key ring to valve handwheels

Contents

General Match terminology of record drawings

Valves and pumps Correlate pumps to starters and valves

Pressure vessels

Mount manufacturer's certificates in glazed frames on wall next to the vessel

Piping

Identify throughout its length, including in concealed spaces

Electrical

Mark operable control devices, indicators, isolating switches and outlets to provide a ready means of identification

5 COMPLETION

**5.1 GENERAL
Samples**

Remove unincorporated samples on completion

Contractor's submissions

Within 2 weeks after practical completion, submit 3 copies of designated documents

Warranties

General Name the principal as warrantee Register with manufacturers as necessary Retain copies delivered with components and equipment

Warranty period to extend for **two years**

Commencement Commence warranty periods at practical completion or at acceptance of installation, if acceptance is not concurrent with practical completion

Approval of installer If installation is not by manufacturer, and product warranty is conditional on the manufacturer's approval of the installer, submit the manufacturer's written approval of the installing firm

5 2 RECORD DRAWINGS

General

Submit record drawings Show the "as installed" locations of building elements, plant and equipment Show off-the grid dimensions where applicable

Services

Show dimensions, types and location of equipment, cables, piping and ductwork in relation to permanent site features and other underground services Include relationship to building structure and other services, and changes made during commissioning and the maintenance period Include diagrammatic drawings of each system showing piping and wiring, and principal items of equipment

Quantity

Provide record drawings in the following quantities and formats

- Paper prints

Number of sets	3
CAD files	
Number of copies	3
Electronic format	Autocad

Accuracy

Documents Incorporate all modifications made during the progress of the work and testing period Show any provisions for the future

Endorsement Sign and date all record drawings Keep one set of shop drawings on site at all times expressly for the purpose of marking changes made during the progress of the works

Drawing layout

Use the same borders and title block as the contract drawings

5 3 OPERATION AND MAINTENANCE MANUALS

General

General Submit operation and maintenance manuals for installations

Authors and compilers Personnel experienced in the maintenance and operation of equipment and systems installed, and with editorial ability

Subdivision By installation or system, depending on project size

Referenced documents If referenced documents or technical worksections require that manuals be submitted, include corresponding material in the operation and maintenance manuals

Manufacturer's technical literature as appropriate Register with manufacturer as necessary Retain copies delivered with equipment

Detailed recommendations for preventative maintenance frequency and procedures

Safe trouble shooting, disassembly, repair and reassembly, cleaning, alignment and adjustment, balancing and checking procedures Provide logical step by step sequence of instructions for each procedure

Schedule of spares recommended to be held on site, being those items subject to wear or deterioration and which may involve the principal in extended deliveries when replacements are required Include complete nomenclature and model numbers, and local sources of supply

- Certificates

Copies of manufacturers' warranties

Certificates from authorities

Product certification

- Drawings

Record drawings, full size

Contents - services

Include the following in addition to *Contents - general*

- Installation description General description of the installation

- Systems descriptions Technical description of the systems installed, written to ensure that the principal's staff fully understand the scope and facilities provided Identify function, normal operating characteristics, and limiting conditions

- Systems performance Technical description of the mode of operation of the systems installed

- Equipment descriptions

Manufacturers' technical literature for equipment installed, assembled specifically for the project, excluding irrelevant matter Mark each product data sheet to clearly identify specific products and component parts used in the installation, and data applicable to the installation

Supplements to product data to illustrate relations of component parts Include typed text as necessary

- Operation procedures

Safe starting up, running in, operating and shutting down procedures for systems installed Include logical step by-step sequence of instructions for each procedure

Control sequences and flow diagrams for systems installed

Legend for colour coded services

Schedules of fixed and variable equipment settings established during commissioning and maintenance

Procedures for seasonal changeovers

Maintenance procedures

Schedule of normal consumable items, local sources of supply, and expected replacement intervals up to a running time of 40,000 hours. Include lubricant and lubrication schedules for equipment

Instructions for use of tools and testing equipment

Emergency procedures, including telephone numbers for emergency services, and procedures for fault finding

Material safety data sheets (MSDS)

Certificates

Copies of test certificates for the mechanical installation and equipment used in the installation

Test and balancing reports

Drawings

Switchgear and control gear assembly circuit schedules including electrical service characteristics, controls and communications

Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams

Timing and quantity

Draft manuals Submit 2 draft manuals 8 weeks before the date for practical completion to enable the principal's staff to familiarise themselves with the installation. Include provisional record drawings and preliminary performance data

Format As for the final manuals, with temporary insertions for items which cannot be finalised until the installation is commissioned and tested

Revised draft manuals Submit revised draft manuals 2 weeks before commissioning

Progressive For equipment put into service during construction and operated by principal, submit manuals within 2 weeks after acceptance

Final drafts Submit for review after completion of commissioning and no later than 2 weeks before the date for practical completion. If available, include certificates from authorities, and warranties

Final copies Submit 3 sets of final volumes within 2 weeks after practical completion. Incorporate feedback from review and from training of principal's staff, including preparation and insertion of additional data

Revisions Submit 3 sets of loose leaf amendments for insertion in the manuals, incorporating feedback from the maintenance period, within 2 weeks after completion

5.4 TRAINING

General

Operation and maintenance manuals Use items and procedures listed in the final draft operation and maintenance manuals as the basis for instruction. Review contents with the principal's staff in detail

Format Conduct training at agreed time, at system or equipment location

Operation

Immediately after practical completion, explain and demonstrate to the principal's staff the purpose, function and operation of the installations

Maintenance

Immediately after practical completion, explain and demonstrate to the principal's staff the purpose, function and maintenance of the installations

Demonstrators

Qualified manufacturer's representatives who are knowledgeable about the installations

Seasonal operation

For equipment requiring seasonal operation, demonstrate during the appropriate season and within 6 months

SERVICE TRENCHING

1 GENERAL**1 1 CROSS REFERENCES****General**

Refer to the *General and Contract requirements* worksection

Read and note all clauses in the General Conditions of Contract, Preliminaries and Technical Specification – General Requirements as applicable to this trade

Provide all drawings and calculations complete, plant, labour and materials to complete the works and co ordinate and co operate with all other trades associated with this trades work

Related sections

Refer to the following worksections

General Requirements
Stormwater
Wastewater
Freshwater
Hydrants
Hose Reels
Fuel Gas

2 QUALITY**2 1 INSPECTION****Witness points**

Give sufficient notice so that inspection may be made at the following stages

- Service trenches excavated before laying the service
- Services laid in trenches and ready for backfilling

2 2 TESTS**Bedding density tests**

Testing authority Have density tests of pipe bedding carried out by an authority accredited by NATA

Test methods

Field dry density AS 1289 5 3 2 or AS 1289 5 3 5

Maximum dry density AS 1289 5 1 1

- Dry density ratio AS 1289 5 4 1

Density index AS 1289 5 6 1

3 SERVICE TRENCHES**3 1 EXCAVATING****Existing surfaces**

Before excavating trenches, saw cut existing concrete and bituminous surfaces on each side of the trench to provide a straight even joint Lift and store unit paving for later reinstatement

Excavation

Excavate for underground services, to required lines, levels and grades Generally make the trenches straight between personnel access ways, inspection points and junctions, with vertical sides and uniform grades

Trench widths

Keep trench widths to the minimum consistent with the laying and bedding of the relevant service and construction of personnel access ways and pits

Trench lengths

Excavate trenches in sections of suitable length

Trench depths

General As required by the relevant service and its bedding method

Notice If excavation is necessary below the level of adjacent footings, give notice, and provide necessary support for the footings

Obstructions

Clear trenches of sharp projections Cut back roots encountered in trenches to at least 600 mm clear of services Remove other obstructions including stumps and boulders which may interfere with services or bedding

Dewatering

Keep trenches free of water Place bedding material, services and backfilling on firm ground free of surface water

Excess excavation

If trench excavation exceeds the correct depth, reinstate to the correct depth and bearing value using compacted bedding material or grade N20 concrete

3 2 BORING

Subcontractor

If under road boring is required in lieu of trenches, engage a suitably qualified subcontractor to do the work

Process

Ensure a tight fit to the service pipes If voids are encountered, fill by pressure grouting

3 3 BACKFILLING

General

Backfill service trenches as soon as possible after the service has been laid and bedded, if possible on the same working day Place the backfill in layers ≤ 150 mm thick and compact to the density which applies to the location of the trenches to minimise settlement, and so that pipes are buttressed by the trench walls

Marking services

Underground marking tape To AS/NZS 2648 1

Backfill material

General General fill with no stones greater than 25 mm occurring within 150 mm of the service, or other materials as required for particular services or locations Well graded, inorganic, non perishable material, maximum size 75 mm, plasticity index $\leq 55\%$

Under roads and paved areas and within 4 m of buildings Coarse sand, controlled low strength material or fine crushed rock

In topsoil areas Complete the backfilling with topsoil for at least the top 50 mm

In reactive clay In sites classified M, H or E to AS 2870, provide an impervious material where trenches fall towards footings

All pipework below concrete slabs is to be backfilled with 20 sand to 1 cement mix

3 4 REINSTATEMENT OF SURFACES

General

Reinstate existing surfaces removed or disturbed by trench excavations to match existing and adjacent work

Lawn areas

Provide 150 mm of loam and resow the lawn over the trench and other disturbed areas

Paving and roads

Reinstate to match adjacent work, paved surfaces and assets disturbed or removed during excavation of trenching

Concrete surfaces

Reinstate concrete surfaces to the original level. If necessary, provide steel reinforcement keyed to the adjacent concrete and laid to prevent the reinstalled concrete from subsiding and cracking

Bituminous surfaces

General Provide crushed rock base and subbase to match the existing pavement. Prime coat the edges of the existing surfacing with bitumen. Lay and compact hot mix asphalt so that the edges are flush and the centre is cambered 10 mm above the existing pavement. If hot pre mix is not available, cold pre mix may be used

Minimum asphalt thickness 50 mm or the adjacent pavement thickness, whichever is thicker

Unit paving

Provide sand bedding and, if necessary, compacted crushed rock base. Reinstate the paving units

STORMWATER**1 GENERAL****1 1 CROSS REFERENCES****General**

Refer to the *General and Contract requirements* worksection

Read and note all clauses in the General Conditions of Contract, Preliminaries and Technical Specification – General Requirements as applicable to this trade

Provide all drawings and calculations complete, plant, labour and materials to complete the works and co ordinate and co operate with all other trades associated with this trades work

Related sections

Refer to the following worksections

General Requirements
Service Trenching
Wastewater
Freshwater
Hydrants
Hose Reels
Fuel Gas

1 2 STANDARD**Stormwater drainage**

General To AS/NZS 3500 3 2

1 3 INTERPRETATION**Definition**

Pipe surround Includes pipe overlay, pipe side support, side zone and haunch zone

2 QUALITY**2 1 INSPECTION****Witness points**

Give sufficient notice so that inspection may be made at the following stages

- Excavated surfaces
- Concealed or underground services

2 2 SAMPLES**General**

Submit samples of the following

- Each type of pipe material

2 3 SUBMISSIONS

Provide full shop drawings, record drawings as installed, operation and maintenance instructions as per General and Contract requirements

3 EXECUTION**3 1 STORMWATER DRAINS****General**

General Provide stormwater drains to connect downpipes, surface drains and drainage pits to the outlet point or point of connection

This Section relates to Courtyard areas and some downpipe drainage as indicated on the plans

Refer to Civil Engineers drawing for civil stormwater drainage

Refer to Civil Drawings and Specification for all other Stormwater Drainage requirements

Downpipe connections Turn up branch pipelines with bends to meet the downpipe, finishing 50 mm (nominal) above finished ground or pavement level Seal joints between downpipes and drains

Tolerances Comply with the **Pipeline tolerances table** These tolerances are conditional on falls to outlets being maintained and no part of a pipeline being at less than the designated gradient

Pipeline tolerances table

	Permissible angular deviation from alignment	Permissible displacement from alignment
Horizontal	1 in 300	15 mm
Vertical	1 in 500	5 mm

Stormwater pipeline schedule

Inground

Up to and including 225mm diameter

Unplasticised Polyvinylchloride UPVC to AS 1260

Aboveground

Downpipes

Refer to specification for roof drainage and downpipes

Identification

Lay a detectable strip or plastic tape in the trench after pipelaying, testing and initial backfilling

Pipe underlay

General Bed piping on a continuous underlay of bedding material, minimum depth 300 mm, overwrapped with geotech material Grade the underlay evenly to the gradient of the pipeline

Chases If necessary, form chases to prevent projections such as sockets and flanges from bearing on the trench bottom or underlay

Pipe surrounds

General Place the material in the pipe surround in layers ≤ 200 mm loose thickness, and compact without damaging or displacing the piping

Pipe surround and backfill material in external locations shall be sand

Pipe surround and backfill material under buildings shall be stabilized 20 1 sand cement

Pipe bedding schedule

Bedding material shall be blue metal aggregate minimum depth 300 mm, overwrapped with geotech material

Anchor blocks

If necessary, provide anchor blocks which restrain lateral and axial movement of the pipelines at junctions and changes of grade or direction

Encasement

General If necessary, encase the pipeline in concrete at least 150 mm above and below the pipe, and 150 mm each side or the width of the trench, whichever is the greater

Concrete Grade N20 to AS 1379

3 2 SPOON DRAIN OUTLETS

Provide spoon drain outlets with 100mm grate

3 3 PLANTER DRAIN OUTLETS

Planter drain outlet shall be Speciality Plumbing Supplies 100mm outlet truflo cast iron body with bronze flat grate and bronze membrane ring

Provide 450mm x 450mm precast riser with a 300mm x 300mm galvanised mild steel grate as detailed

3 4 RAINWATER OUTLETS

Rainwater outlets to courtyards shall be Specialty Plumbing Services Truflo Rainwater Outlet (two piece grate and membrane clamp)

Provide 300mm x 300mm stormwater pit extension riser with 300mm x 300mm stainless steel heel proof grate

3 5 PITS

Finish to exposed surfaces

General Provide a smooth, seamless finish, using steel trowelled render or concrete cast in steel forms

Corners Cove or splay internal corners

Metal access covers and grates

Standard To AS 3996

Supply and fix Class D sump frames and grates, galvanised mild steel equal to Icon Metals HSG99D WHP

All grates shall be hinged and provided with heel proof mesh

Cover levels Top of cover or grate, including frame and concrete surround

In concrete or paved areas Flush with the concreted or paved surface

Gratings taking surface water runoff Locate to receive runoff without ponding

- In landscaped areas 25 mm above finished surface

3 6 GRATED TRENCH

Trench grates shall be formed into concrete slabs complete with rebates for installation of frames and grates

Supply and fix Class D cast iron frames and grates of longitudinal pattern, equal to Icon Metals Model CITL3012D, grade base of trench to outlet

3 7 SAMPLES

Submit copies of data sheets showing grate surrounds, type and capacity of grates prior to ordering and submitting for approval

WASTEWATER

1 GENERAL**1 1 CROSS REFERENCES****General**

Refer to the *General and Contract requirements* worksection

Read and note all clauses in the General Conditions of Contract, Preliminaries and Technical Specification – General Requirements as applicable to this trade

Provide all drawings and calculations complete, plant, labour and materials to complete the works and co ordinate and co operate with all other trades associated with this trades work

Support all sewer drainage pipes in filled or water charged ground on 300mm bedding material over wrapped with geotech material to form a continuous support beneath the sewer pipework and sewer manholes where located external to buildings, or where under buildings, 150mm continuous concrete support beam with hangers cast into concrete floors all in accordance with Sydney Water Corporation requirements

Related sections

Refer to the following worksections

- General Requirements
- Service Trenching
- Stormwater
- Freshwater
- Hydrants
- Hose Reels
- Fuel Gas

1 2 STANDARD**Sanitary plumbing and sanitary drainage**

General To AS/NZS 3500 2 2

2 QUALITY**2 1 INSPECTION****Witness points**

Give sufficient notice so that inspection may be made at the following stages

- Excavated surfaces
- Concealed or underground services

2 2 SUBMISSIONS

Provide full shop drawings, record drawings as installed, operation and maintenance instructions as per General and Contract requirements

3 MATERIALS AND COMPONENTS**3 1 AUTHORISED PRODUCTS****Standard**

To SAA MP52, unless otherwise required by the statutory authority

3 2 SANITARY FIXTURES**General**

Provide the accessories necessary for correct installation

Sanitary fixtures and fittings schedule

Fixture Type	Fixtures	Fittings
	Fixtures as per Architect's Schedule Basins to be sealed to wall or vanity top with approved sealant Note all basin waste pipes to be concealed in walls or in service duct Pans to be bedded on sand/cement mortar in accordance with Manufacturer's instructions	Fittings as per Architect's Schedule All spouts to be aerated
RTD In wall tundish All areas	Mod Tech in wall tundish 316 grade stainless steel, complete with removable stainless steel cover with window and 50mm top inlet	

4 EXECUTION**4.1 SANITARY PLUMBING****General**

Provide complete sanitary plumbing system as required

Sanitary plumbing piping schedule

Sanitary Soil & Waste UPVC Polyvinylchloride where waste discharge can not exceed 45 50°C

Copper tube Table B (chrome plated where exposed)

Vent Pipe UPVC Polyvinylchloride

Pipe support schedule

Unistrut P1000

Provide 4mm PVC strips to separate dissimilar metals

Traps

Type Universal pattern 'S' or 'P' trap

Material Copper chrome plated where exposed and stainless steel from stainless steel sinks etc

Dimensions (mm) As required

Vent pipes

Staying to roof If fixings for stays penetrate the roof covering, seal the penetrations and make watertight

Terminations Provide vent cowls of the same material as the vent pipe

4.2 SANITARY DRAINAGE

Dispose of waste through HDPE, vitrified clay pipelines and/or UPVC pipelines laid, bedded and jointed as necessary

Pipeline identification

Lay detectable plastic warning tape, 300 mm above buried piping, for the full length of the piping

Sanitary drainage piping schedule**Inground pipework**

HDPE or Vitrified Clay Pipe VCP (Hepworth) is to be used where waste discharge can exceed 45 50°C (from kitchen dishwasher, kitchen sinks, grease waste drainage etc completely through to the main external sewer drainage) and for trade waste from pool drainage, pool floor wastes etc through to the arrestor pits

Unplasticised Polyvinylchloride UPVC sewer pipe – sewer generally

External location**Pipe underlay**

General Bed piping on a continuous underlay of bedding material, minimum depth 300 mm, overwrapped with geotech material Grade the underlay evenly to the gradient of the pipeline

Chases If necessary, form chases to prevent projections such as sockets and flanges from bearing on the trench bottom or underlay

Pipe surrounds

General Place the material in the pipe surround in layers ≤ 200 mm loose thickness, and compact without damaging or displacing the piping

Pipe surround and backfill material in external locations shall be sand

Pipe surround and backfill material under buildings shall be stabilized 20 1 sand cement

Pipe bedding schedule

Bedding material shall be blue metal aggregate minimum depth 300 mm, overwrapped with geotech material

4 3 PIPING**Finishes**

General Finish exposed piping, including fittings and supports, as follows

In internal locations such as bathrooms, en suites, toilet and kitchen areas Chrome plate copper piping to AS 1192 service condition 2, bright

Externally, and steel piping and iron fittings internally Paint

- In concealed but accessible spaces (including cupboards and non habitable enclosed spaces) Leave copper and plastic unpainted except for identification marking Prime steel piping and iron fittings

Valves Finish valves to match connected piping

4 4 DISCHARGE FROM AIR HANDLING SYSTEMS**Trays, sumps and drainage**

Standard To AS/NZS 3666 1

4 5 PITS-EXECUTION**Finish to exposed surfaces**

General Provide a smooth, seamless finish, using steel trowelled render or concrete cast in steel forms

Corners Cove or splay internal corners

Metal access covers and grates

Standard To AS 3996

Cover levels Top of cover or grate, including frame

- In paved areas Flush with the paving surface
- In landscaped areas 25mm above finished surface
- Gratings taking surface water runoff Locate to receive runoff without ponding

4 6 FLOOR WASTES

Provide self cleaning pot gully with 100mm riser, safe tray and fitted with SPS heavy duty type chrome plated grate

4 7 CLEAN OUTS (CO)

Provide clean out complete with heavy duty stainless steel plate in internal locations

4 8 GREASE ARRESTORS

Provide BCP Precast precast concrete 1,500 Lt grease arrestors complete with extension risers as required for invert level of pipe and finished RL and gas/air tight Class D cover with cast iron clear out covers

Grease Arrestor to be as per Sydney Water authorised pre treatment products list

4 9 BUCKET TRAP FLOOR WASTES

Provide SPS LG150 A SS or equal deep body cast iron bucket trap floor waste suitable for vinyl floor and/or tile/concrete finish where required with 150 diameter stainless steel basket strainer and fixed secondary strainer and hinged stainless steel grate

4 10 KITCHEN SINKS

Provide in line basket arrestor to kitchen sink wastes in main servery kitchen as per Sydney Water trade waste requirements

4 11 GENERAL PURPOSE ARRESTOR

Provide BCP Precast precast concrete 1,000 Lt GP arrestor model GPP-01000 with SAL 51000 GMS lid Allow for precast makeup risers to suit height to existing ground level Allow to modify top makeup piece, complete with extension risers as required for invert level of pipe and finished RL

General purpose arrestor to be as per Sydney Water authorised pre treatment products list

4 12 DRY ARRESTOR PIT

Provide BCP dry arrestor Pit Model PTC DAP with GMS checkerplate lid

Dry arrestor to be as per Sydney Water authorised pre treatment products list

FRESHWATER

1 GENERAL**1.1 CROSS REFERENCES****General**

Refer to the *General and Contract requirements* worksection

Read and note all clauses in the General Conditions of Contract, Preliminaries and Technical Specification – General Requirements as applicable to this trade

Provide all drawings and calculations complete, plant, labour and materials to complete the works and co ordinate and co operate with all other trades associated with this trades work

Provide backflow protection devices in accordance with Water Authority requirements such as Reduced Pressure Zone Device RPZD at cleaners rooms and hose cock vacuum breakers etc

Related worksections

Refer to the following worksections

- General Requirements
- Service Trenching
- Stormwater
- Wastewater
- Hydrants
- Hose Reels
- Fuel Gas

1.2 STANDARDS**Water supply**

General To AS/NZS 3500 1 2

Hot water supply

General To AS/NZS 3500 4 2

Installation of mineral wool insulation

Comply with the AMWU/CFMEU/CEPU/FARIMA Industry Code of Practice for the Safe Use of Glass Wool and Rock Wool Insulation

Marking Deliver mineral wool products to site in packaging labelled FBS 1 BIO SOLUBLE INSULATION

1.3 INTERPRETATIONS**Definitions**

Mineral wool (including glasswool and rockwool) Entangled matt of fibrous non crystalline material derived from inorganic oxides or minerals, rock, slag or glass, processed at high temperatures from a molten state

2 QUALITY**2.1 INSPECTION****Witness points**

Give sufficient notice so that inspection may be made at the following stages

Services laid in trenches and ready for backfilling

Hydrostatic pressure testing

2 2 PRE-COMPLETION TESTS

Production tests

Water heating system storage containers Factory test uninsulated vessels at not less than 1.25 x the maximum working pressure of the system. Maintain the test pressure for 24 hours without loss.

Site tests

Test system for leaks, including pipe joints, valve seats, tap washers and strainers. Repair as necessary, replace if damaged, and retest.

Early fire hazard indices

Spread of flame index To AS/NZS 1530.3

Smoke developed index To AS/NZS 1530.3

Flammability index To AS 1530.2

2 3 SAMPLES

General

Submit samples of accessories identified by proprietary item, including the following:

Pipework & fittings

Valves

Insulation

Instruments, including gauges and thermostats

- Means of identification, including adhesive labels and engraved disks or plates

2 4 SUBMISSIONS

Provide shop drawings, record drawings-as installed, operation and maintenance instructions as per General and Contract requirements.

Shop drawings

Submit drawings and schedules showing the layout and details of the system, including:

- location, type, grade and finish of piping, fittings, valves, meters and pipe supports,
- location, capacity, type and other relevant details of water heaters, including supports and safe trays,
- details of control panels including control and power diagrams,
- insulation of piping, fittings and tanks, and
- access openings, cover plates, valve boxes and access pits

3 MATERIALS AND COMPONENTS

3 1 AUTHORISED PRODUCTS

Standard

To SAA MP52, unless otherwise required by the statutory authority.

3 2 PRESSURE CONTROL VALVES

Type

Provide reduction valves, pressure limiting valves, or ratio valves, which produce the necessary reduction in pressure.

- 3 3 LINE STRAINERS**
Description
 Type Low resistance, Y form bronze bodied type, with screen of dezincification resistant brass, corrosion resistant stainless steel, or monel
 Screen perforations 0.8 mm maximum
- 3 4 PRESSURE GAUGES**
General
 Provide gauges with full scale reading in kPa, a minimum nominal diameter of 63 mm and capable of reading pressures at least 25% higher than the maximum static pressure of the system
Standard
 Bourdon tube gauges To AS 1349
 Accuracy grade Industrial
Installation
 Comply with the recommendations of AS 1349 Appendix B. Locate at inlet and outlet sides of cold water pumps. Isolate from pump vibration and provide complete with gauge cock on inlet
- 4 PUMPS**
- 4 1 HOT WATER CIRCULATING PUMPS**
General
 General Provide for the hot water systems (residential and commercial) a dual system consisting of two pumps and by pass as in-line circulator pumps and motors with bronze housing and stainless steel or corrosion-resistant interior fittings complete for the hot water system, system to be provided with a control panel incorporating indication lights, time clock and alarm
 Standard To BS EN 1151
Hot Water Circulating Pumps
 Hot water pumps – Grundfos UPS series 240v pumps mounted on a galvanised frame and pre wired to the control panel
 Duty As required by calculations, for each of residential and commercial systems
Hot Water Circulating Pumps Control Panel
 Main isolating switch
 Duty selector switch
 Manual/off/auto selector switch for each pump
 Automatic pump alteration
 Lights for - Power on 1 off
 Pump run 2 off
 Pump fail 2 off
 Volt free contacts for BMS connection
 DOL contractors with thermal overloads
 Time clock with 24hr settings and 100hr battery backup
 All in a sheet metal powder coated non-weatherproof cabinet
Noise and vibration
 Minimise noise and vibration, using anti vibration mountings

5 EXECUTION

5 1 MAINS CONNECTION**General**

Connect the cold water supply system to the existing main through a stop valve

5 2 RETICULATION**Cold water system**

Provide the cold water supply system, installed from the cold water service to the draw off points or connections to other services

Cold water piping system schedule

Pipeline location	Material	Nominal size	Jointing method
Above ground	Copper Table B	As required	Silver solder
Below ground	Copper Table B with polyethylene sleeve	As required	Silver solder

Bedding

Sand to 150mm above pipes

Hot water system

Provide the hot water system, installed from the cold water connection points to the draw off points or connections to other services

Hot water piping system schedule

Pipeline location	Material	Nominal size	Jointing method
All locations	Copper Table B	As required	Silver solder

5 3 FITTINGS AND ACCESSORIES**General**

Provide the fittings necessary for the proper functioning of the water supply system, including taps, valves, backflow prevention devices, pressure and temperature control devices, strainers, gauges and automatic controls and alarms

Tap and valve heads

Vandalproof heads If available, provide vandalproof or anti tampering devices for the designated types

Metal heads and handles Provide brass fittings or suitably bush to prevent electrolysis and growth

Tap positions

Locate hot tap to the left of, or above, the cold tap

Valve spindles

If practicable, install in a vertical position

Isolating valves schedule

Johns valves – gate valves

Control cocks – full way loose jumper valve

Accessories schedule
Refer to Fixtures and Fittings Schedule within Wastewater Section

5 4 PIPING**Material identification marking**

Pipes with grade or class identification markings Install so that the markings are visible for inspection

Finishes

General Finish exposed piping, including fittings and supports, as follows

In internal locations such as toilet and kitchen areas Chrome plate copper piping to AS 1192 service condition 2, bright

- Externally, and steel piping and iron fittings internally Paint

In concealed but accessible spaces (including cupboards and non-habitable enclosed spaces) Leave copper and plastic unpainted except for identification marking Prime steel piping and iron fittings

Valves Finish valves to match connected piping

5.5 PIPING INSULATION**General**

Application Fit insulation tightly to piping surfaces without gaps Close butt ends of insulation sections Minimise number of joints If the insulation is in half-sections, make only half circumferential joints at any one place Seal longitudinal seams in foil laminate and fix insulation at maximum 500 mm centres with polypropylene, zinc-coated steel or aluminium straps

Unions and other items requiring service Install the insulation so that it is readily removable

Fittings Provide insulation of thermal resistance equivalent to the piping insulation

Insulation material

Provide insulation material as listed in **Insulation schedule**

Polyolefin foam Cross linked closed cell polyolefin foam faced with factory bonded aluminium foil laminate

Early fire hazard indices

- Spread of flame index 0
- Smoke developed index ≤ 3

Aluminium foil laminate sheet

Physical characteristics

- Tensile strength (minimum)
 - Machine direction 14.5 kN/m
 - Lateral direction 9.8 kN/m

Water vapour permeance

Creased ≤ 2.26 ng/N s

Uncreased ≤ 1.13 ng/N s

Early fire hazard indices

Spread of flame index 0

Smoke developed index 0

Flammability index ≤ 5

Aluminium foil laminate tape

Adhesive Non-toxic, high tack synthetic pressure sensitive type

Liner Silicone coated paper

Backing Aluminium foil laminate

Minimum width 50 mm

Physical properties

- Tensile strength 4.8 kN/m (average minimum)
- Shear adhesion To Table 3.2 of SMACNA Fibrous Glass Duct Construction Standards
- Peel adhesion at 180° 0.68 kN/m (average minimum)

Water vapour permeance

- Creased ≤ 2.26 ng/N s
- Uncreased ≤ 1.13 ng/N s

Metal sheathing

Provide metal sheathing to all piping insulation

In plant rooms

- Where exposed to weather
- Where exposed to view
- Where subject to mechanical damage

On valves, pipeline components and pumps in sheathed pipework

General Cover piping with metal sheathing sprung over the insulation in one piece with laps at least 30 mm wide, and fastened with self tapping screws or snap head rivets at 150 mm maximum centres. Preform the sheathing to match the shape of the insulated pipe and fittings. Position laps to avoid water penetration. In external locations weatherproof the joints and fixings using a non-setting mastic.

Material 0.5 mm thick zinc coated steel sheet

Surface preparation

Clean the surfaces to remove scale, rust, grease and dirt and prepare surfaces to suit the insulation. Restore surface coatings, which have been damaged or affected by welding.

Testing

Do not install insulation until the piping has been tested.

Insulation schedule

Pipelines location	Material	Thickness (mm)	Outer jacket
All locations	Fire retardant flexible closed cell polyethylene foam	32mm	Overwrapped with 450 sisalation

- 5 6 PIPE SUPPORTS**
Insulated pipe
General Provide supports formed to fit around the insulation

Protection For pipes DN 25 either

protect the insulation at the support point with metal sheathing, or

replace the insulation at the support point with a shaped wooden spacer block Butt the insulation up to the wooden block and seal with silicone compound Clad the block and insulation in 0.5 mm zinc-coated steel sheet extending 100 mm each side of the support
- 5 7 VALVE BOXES**
General
Provide cast-iron valve boxes with removable covers for access to underground gate valves
Provide cast iron sluice valve covers for access to sluice valves

Installation
Set beneath each box a shaft formed of UPVC pipe to give clear access to the valve wheel or spindle Set top flush with pavement surface, or 15 mm above unpaved surfaces, and encase in formed concrete box 150 mm thick, with top surface trowelled smooth
- 5 8 PITS**
General
Install below ground water meters, stop valves and control valves, in concrete access pits with removable pit covers

Construction
Internal dimensions To give 300 mm clear space all around the fittings in the pit

Concrete Grade N20 to AS 1379, 100 mm thick, reinforced with F82 fabric

Pit covers To AS 3996

Installation
Grade floor to a point on one side and drain to the stormwater drainage system Carry the pit walls up to 50 mm above finished ground level Cast in the pit cover frame flush with the top Trowel the top smooth
- 5 9 MARKING**
Notice plate
Provide a notice plate containing condensed emergency instructions, legibly printed or engraved on durable material resistant to defacement, at least 3 mm thick or mounted on board at least 3 mm thick, permanently fixed in a convenient position at the control valves
- 5 10 LINE MARKERS**
Provide directional marker plates to underground services at each change of direction
- 5 11 PIPE IDENTIFICATION**
Provide identification to all pipes to conform with AS 1345
- 5 12 CORE HOLES AND SLEEVES**
Provide all necessary core holes and sleeves

6 WATER HEATING SYSTEMS

6 1 PROPRIETARY WATER HEATERS

Provide Rheem heavy duty gas indoor water heaters (2 for each system, minimum) as a centralised hot water plant for the residential system and the commercial system to provide hot water, complete with valves, manifolds temperature and pressure relief drains, tundish draining to sewer, twin skin stainless steel gas flues, vent cowls and flashings

Residential - 2 x 621265 gas indoor hot water heaters

Commercial 2 x 621275 gas indoor hot water heaters

Temperature gauges to be provided on hot water flow and on hot water return lines

Provide a complete solar re heat system consisting of 8 (eight) Rheem Model SBT200 solar collectors, 4 (four) Rheem variable pitch flat roof stands and solar storage consisting of 2 (two) Rheem Model 610 430 storage units, complete with all valves, flow and return pipework, circulating pumps etc

Provide 100mm high concrete plinth under all plant & equipment

7 WATER HAMMER ARRESTORS

7 1 GENERAL

Provide water hammer arrestors and isolation valves to both the hot and cold water supply to each of the washing machines

Water hammer arrestors shall be Zurn Shoktrol Model Z1700 Series 500, stainless steel construction suitable for both hot and cold water

8 REDUCED PRESSURE ZONE DEVICE

8 1 GENERAL

Provide reduced pressure zone devices at locations as shown on the drawings and as required by Sydney Water and Australian Standards

RPZD's to be RMC909 Series installed in accordance with manufacturer's instructions including isolation valves, strainers and drain to discharge over tundish and be suitable for both hot (80°C) and cold water

8 2 TESTING

Provide Certification and Test Certificates for each RPZD prior to hand over

9 COMPLETION

9 1 GENERAL**Pressure booster system**

Test the system on completion

Charging

On completion of installation, commissioning, testing and disinfection, fill the system with water, turn on control and isolating valves and the energy supply and leave the water supply system in full operational condition

10 RECYCLED RAIN WATER

10 1 GENERAL

Provide a complete system of pressure pumps to pressurise the system and deliver recycled rain water to all toilets for toilet flushing, external hose taps and the irrigation system

10 2 TANK FITTINGS

Provide cast in fittings with puddle flanges to the rain water collection tank

10 3 TANK STRAINERS

Provide tank strainers incorporating stainless steel baskets having a free suction area not less than the cross sectional area of the tank suction pipes

10 4 LEVEL SWITCHES

Provide probe type level switches inside each roof water tank to control the operation of the pressure set

The switches shall cut off the pressure pumps at low water level and energise to open the solenoid valve in the back up cold water supply

Install level probes inside UPVC wave barriers

Level switches are to operate at low voltage

10 5 RECYCLED RAIN WATER PRESSURE SET

Provide to the recycled rain water system for toilet flushing and landscape watering, a dual system consisting of 2 Vogal hydrovar variable speed pump and motor sets with pressure vessel and operated by an inter connected automatic control mechanism

Factory assemble the units on steel frames mounted on steel base plates

Recycled rain water system

Duty to suit the calculations

Coupling Connect suction and discharge pipe with flexible pipe of maximum pressure rating 2 x the system design pressure

Pressure vessels Diaphragm pressure tanks to AS 2971 of fabricated steel construction, epoxy coated on metal surfaces in contact with water Precharge the tanks with air

Control mechanisms Provide a device which alternates the pumps after each cycle of operation, starts the idle pump if the other fails, and activates an audible alarm and a flashing warning light to indicate a failure

Control panel Mount the control panel on the wall inside the room in which the system is installed, next to the door Degree of protection IP54 or better

Alarm bells Mount on an external wall Provide bells which can be muted

Warning lights Mount on the control panel, to indicate the following

- Pump no 1 failure
- Pump no 2 failure
- Mains pressure low
- Power on

Selector Provide manual/automatic pump selector for on/off control of the pumps

Cut out circuit Provide an over riding automatic cut out circuit with manual restart which operates when suction pressure falls below the stated limit

Isolating switches Provide an isolating switch next to each pump motor

Overload Provide necessary power surge and thermal overload protection

Meters Provide an hours-run meter to each motor

10 6 AUTOMATIC BACKWASH FILTER

Provide on the rainwater supply service a BWT 50 micron Multipur RFA 65 automatic backwash filter complete with red bronze housing, filter and backwashing elements, flanges, with stainless steel filter fabric (Waterflow Controls Pty Ltd)

Provide stop valves on the inlet and outlet of the water filter

10 7 RETICULATION

Recycled rain water system

Provide the recycled rain water supply system installed from the pressure system to the draw off points or connections to other services

Recycled water piping system schedule

Pipeline location	Material	Nominal size	Jointing method
All areas	PVC pressure pipe and fittings	As required	Solvent cement

10 8 GENERAL

Pressure booster system

Test the system on completion

Charging

On completion of installation, commissioning, testing and disinfection, fill the system with water, turn on control and isolating valves and the energy supply and leave the water supply system in full operational condition

HYDRANTS

1 GENERAL**1 1 CROSS REFERENCES****General**

Refer to the *General and contract requirements* worksection

Read and note all clauses in the General Conditions of Contract, Preliminaries and Technical Specification – General Requirements as applicable to this trade

Provide all drawings and calculations complete, plant, labour and materials to complete the works and co ordinate and co operate with all other trades associated with this trades work

Provide a complete Fire Hydrant system from a connection point to the existing main and reticulate to the external fire hydrant locations as required

Related worksections

Refer to the following worksections

- General Requirements
- Servicing Trenching
- Stormwater
- Wastewater
- Freshwater
- Hose Reels
- Fuel Gas

1 2 DESIGN AND INSTALLATION**General**

Standard To AS 2419 1 and Building Code of Australia

2 QUALITY**2 1 INSPECTION****Witness points**

Give sufficient notice so that inspection may be made of the following

Connection branch to Authority water main

Pipes installed in trenches and ready for backfilling

2 2 SAMPLES**General**

Submit samples of accessories not specified as proprietary items, including the following

Fire hydrant valve all brass

- Vandal resistant canister enclosures

3 MATERIALS AND COMPONENTS**3 1 AUTHORISED PRODUCTS****General**

Provide equipment listed in the SSL Register of Accredited Products Fire Protection Equipment

3 2 FIRE HYDRANT SYSTEMS**General**

System To AS 2419 1

Below ground metal seated isolating valves To AS/NZS 2638 1

Below ground resilient seated isolating valves To AS/NZS 2638 2

Above-ground pipes

Material Galvanised Steel (medium)

Below-ground pipes

Material Copper Tube Table A for 150mm,
with polyethylene sleeve

Copper Tube Table B for 100mm,
with polyethylene sleeve

Concrete thrust blocks to be installed and be suitable for encountered ground conditions

Any flange connections underground to copper risers are to be provided with stainless steel bolts

Bedding

Sand to 150mm above pipe

Hydrant Valve type

65mm all brass with approved Storz coupling

Fixing

External location fixing to hydrant pipework, provide galvanised masonry anchors, chemical type

4 EXECUTION

4 1 INSTALLATION

General

System To AS 2419 1

5 COMPLETION

5 1 COMMISSIONING

General

System To AS 2419 1

Fire hydrant valves To AS 2419 2

5 2 MAINTENANCE

General

System To AS 1851 4

HOSE REELS

1 GENERAL**1 1 CROSS REFERENCES****General**

Refer to the *General and Contract requirements* worksection

Read and note all clauses in the General Conditions of Contract, Preliminaries and Technical Specification – General Requirements as applicable to this trade

Provide all drawings and calculations complete, plant, labour and materials to complete the works and co-ordinate and co operate with all other trades associated with this trades work

Extend from the Cold Water Service and provide a fire hose reel service and fire hose reels

Related worksections

Refer to the following worksections

- General Requirements
- Servicing Trenching
- Stormwater
- Wastewater
- Freshwater
- Hydrants
- Fuel Gas

2 QUALITY**2 1 INSPECTION****Witness points**

Give sufficient notice so that inspection may be made of the mains supply

3 MATERIALS AND COMPONENTS**3 1 AUTHORISED PRODUCTS****General**

Provide equipment listed in the SSL Register of Accredited Products - Fire Protection Equipment

3 2 FIRE HOSE REELS**General**

Standard To AS/NZS 1221

StandardsMark To be indicated on hose reel

Type Swivel hose guide

4 EXECUTION**4 1 INSTALLATION****Fire hose reels**

Standard To AS 2441

5 COMPLETION**5 1 MAINTENANCE****Fire hose reels**

General To AS 1851 2

6 FIRE EXTINGUISHERS

Supply and install hand held fire extinguishers and fire blankets

All fire extinguishers shall be fully charged at date of handing over

All fire extinguishers and fire blankets shall be complete with appropriate mounting boards, mounting brackets, horns, nozzles, operating instructions and location signs as per AS 2444 as amended

Where fire extinguishers and fire blankets are nominated at fire hose reels they shall be installed in the fire hose reel cupboards

Supply and install necessary fire extinguishers and fire blankets in accordance with authority and standards requirements

All fire extinguishers and fire blankets to be maintained to AS 1851

Fire extinguishers shall be manufactured in accordance with AS 1841

Fire blankets shall be manufactured in accordance with AS 3504 and shall be min 1.5m x 1.5m in size

Supply co-ordinated drawings confirming location of fire extinguishers and fire blankets and gain approval prior to installation

Tenderers shall nominate in their tender the number and type of extinguishers included in their tender offer

FUEL GAS

1 GENERAL**1 1 CROSS REFERENCES****General**

Refer to the *General and Contract requirements* worksection

Read and note all clauses in the General Conditions of Contract, Preliminaries and Technical Specification – General Requirements as applicable to this trade

Provide all drawings and calculations complete, plant, labour and materials to complete the works and co ordinate and co operate with all other trades associated with this trades work

Extend from the gas service supply to the points of connection as required

Related sections

Refer to the following worksections

General Requirements
Servicing Trenching
Stormwater
Wastewater
Freshwater
Hydrants
Hose Reels

1 2 STANDARDS**Reticulated gas systems**

General To AG 601

Commercial appliances

General To AS 3814

2 QUALITY**2 1 INSPECTION****Witness points**

Give sufficient notice so that inspection may be made at the following stages

- Excavated surfaces
- Concealed or underground services

2 2 SUBMISSIONS

Provide shop drawings, record drawings as installed, operation and maintenance instructions as per General and Contract requirements

Certificate of appliance approval

Appliances with gas inputs < 500 MJ/hour For each appliance where an approval code exists, submit a certificate from the manufacturer stating that the appliance has AGA/ALPGA approval for operation with the designated gas type

Exposed piping

Submit proposals for location

3 EXECUTION

3.1 PIPING

Concealment

If practicable, install piping so that it is concealed within service ducts or non-habitable enclosed spaces and does not appear on external walls. Otherwise, provide metal piping mounted on metal brackets and provide metal cover plates at penetrations.

Piping valve schedule

Provide control valves equal to Richards spherical ball valves to isolate main reticulation lines and to all appliances.

Piping regulator schedule

Provide gas regulators equal to Jeavons complete with over pressure shutoff valve.

Embedded piping

For piping embedded in concrete, install in continuous lengths without fittings. Do not lay across joints between adjoining sections of concrete through which reinforcement does not extend.

Gas type Natural Gas

Gas pipeline schedule

Location	Pipe material	Grade or class	Jointing	Nominal size
All Locations	Copper Tube	Table B	Silver Solder	All sizes

Finishes

General Finish exposed piping, including fittings and supports, as follows:

- In internal locations such as toilet and kitchen areas: Chrome plate copper piping to AS 1192 service condition 2, bright.
- Externally, and steel piping and iron fittings internally: Paint.
- In concealed but accessible spaces (including cupboards and non-habitable enclosed spaces): Leave copper and plastic unpainted except for identification marking. Prime steel piping and iron fittings.

Valves: Finish valves to match connected piping.

3.2 VALVE BOXES

General

General: Provide cast iron valve boxes with removable covers for access to underground valves.

Identification: Mark the box covers with the word "GAS".

Installation

Set beneath each box a shaft formed of UPVC pipe to give clear access to the valve wheel or spindle. Set top flush with pavement surface, or 15 mm above unpaved surfaces, and encase in formed concrete box 150 mm thick, with top surface trowelled smooth.

3.3 WALL BOXES

General

Provide wall boxes to house above ground valves and regulators.

Construction

Body 1 2 mm galvanized steel plate continuous welded box construction with leading edge folded twice at 90° to form 25 x 25 mm frontal surround

Fixing Fix to masonry backing with four 10 mm galvanized masonry bolts

Drainage and ventilation relief Set the bottom of the box to fall outward Form four 10 mm diameter holes in the frontal surround section at box floor level

Sleeves Provide, to the box floor inlet and outlet pipes, sleeves formed of 1 2 mm thick steel pipe with 1 2 mm galvanized flanges to pipe diameter plus 50 mm Bed each flange on epoxy mortar and rivet to the floor of the box with four 3 mm diameter rivets

Doors to boxes Metal frame, glazed with 2 5 mm clear float glass Provide lock, keys and two 100 mm brass hinges

Marking Adhere to the glass a 200 x 100 mm white laminated plastic label, engraved with red letters "IN CASE OF EMERGENCY BREAK GLASS AND SHUT VALVES"

3 4

PITS**General**

If below ground, house control valves and regulators in concrete access pits with removable pit covers

Construction

Internal dimensions To give 300 mm clear space all around the fittings in the pit

Concrete Grade N20 to AS 1379, 100 mm thick, reinforced with F82 fabric

Pit covers To AS 3996

Marking Mark pit covers with the word "GAS"

Installation

Grade floor to a point on one side and provide a gravity drain to remove water from the pit Do not connect the drain to other substructures or drains Carry the pit walls up to 50 mm above finished ground level Cast in the pit cover frame flush with the top Trowel the top smooth

3 5

MARKING**Underground installations**

General During backfilling lay plastic warning tape 300 mm above buried piping, for the full length of the piping

Warning tape Minimum 100 mm width, with "GAS PIPE UNDER" marked continuously

Marker plates Provide galvanized steel or brass marker plates at ground level at each change of direction in the underground pipeline, engraved to show the direction of the line and name of the service Inset marker plates in 150 x 150 x 150 mm concrete blocks, with the tops set flush with ground level

4

COMPLETION

4 1

MANUALS**General**

Submit recommendations for the operation, care and maintenance of gas appliances, valves, regulators and their associated fittings

4 2 GENERAL

Commissioning

General On completion of installation and testing, turn on isolating and control valves, and purge and charge the system

Purging Comply with the recommendations of AS 5601

Appliances Commission appliances

Charging

General Hand over the system fully charged with gas

TENDER FORM

T1

I/WE hereby tender for the detailed design documentation, supply, installation, testing and commissioning of Hydraulic Services in the abovementioned complex all in accordance with the Design Drawings and Specification prepared by GDK Hydraulics Consulting Pty Ltd

ITEMISED LUMP SUM TENDER PRICES

Complete Design, Document, Co ordinate, Supply, Installation, Testing and Commissioning of

<u>HYDRAULIC SERVICES</u>		Fixed Price
1	Sewer Drainage System	\$
2	Stormwater Drainage System excluding Civil Stormwater	\$
3	Cold Water Services & Fire Hose Reel Service	\$
4	Hot Water Services including hot water plants	\$
5	Sanitary Plumbing	\$
6	Fire Hydrant System	\$
7	Sanitary Fixtures & Fittings	\$
8	Natural Gas System	\$
9	Re Cycled Rain Water System	\$
10	Maintenance Manual and As Built Drawings	\$
Total		\$ _____

Total in words

Dollars

I/we

Unconditionally guarantee of plant, equipment and system performance as detailed in the specification and tender drawings and completion in accordance with the building programme

NAME ON TENDER

SIGNATURE

COMPANY POSITION

WITNESS

DATE

SCHEDULE OF RATES

The following schedule shall be completed by the Tenderer and shall include the supply and installation of the completed operational pipework together with bedding, backfilling, brackets, clips, offsets, joints, testing etc

Rates for pipes 32mm and under shall include for tees, bends, sockets, and all other such fittings

Schedule of rates will be used for assessing minor additions and deletions from the contract price

Rates include for excavation in rock to levels as indicated on the Drawings

Item	Cost
300mm UPVC Pipe	\$ per meter
300 mm UPVC Fittings	\$ each
225mm UPVC Pipe	\$ per meter
225 mm UPVC Fittings	\$ each
150mm UPVC Pipe	\$ per metre
150mm UPVC Fittings	\$ each
100mm UPVC Pipe	\$ per metre
100mm UPVC Fittings	\$ each
65mm UPVC Pipe	\$ per metre
65mm UPVC Fittings	\$ each
50mm UPVC Pipe	\$ per metre
50mm UPVC Fittings	\$ each
225mm VCP Pipe	\$ per metre
225mm VCP Fittings	\$ each
150mm VCP Pipe	\$ per metre
150mm VCP Fittings	\$ each
100mm VCP Pipe	\$ per metre
100mm VCP Fittings	\$ each
150mm Copper Tube Table "A"	\$ per metre
100mm Copper Tube Table "B"	\$ per metre
80mm Copper Tube Table "B"	\$ per metre
65mm Copper Tube Table "B"	\$ per metre

Item	Cost	
50mm Copper Tube Table "B"	\$	per metre
40mm Copper Tube Table "B"	\$	per metre
32mm Copper Tube Table "B"	\$	per metre
25mm Copper Tube Table "B"	\$	per metre
150mm Galvanised Steel Pipe Medium	\$	per metre
100mm Galvanised Steel Pipe Medium	\$	per metre
150mm Galvanised Steel Fittings	\$	each
100mm Galvanised Steel Fittings	\$	each
150mm Copper Tube Table "A" Fittings	\$	each
100mm Copper Tube Table "B" Fittings	\$	each
80mm Copper Tube Table "B" Fittings	\$	each
65mm Copper Tube Table "B" Fittings	\$	each
50mm Copper Tube Table "B" Fittings	\$	each
40mm Copper Tube Table "B" Fittings	\$	each
32mm Copper Tube Table "B" Fittings	\$	each
25mm Copper Tube Table "B" Fittings	\$	each
150 Gate valve	\$	each
100 Gate valve	\$	each
65 Control valves	\$	each
50 Control valves	\$	each
40 Control valves	\$	each
32 Control valves	\$	each
25 Control valves	\$	each
20 Control valves	\$	each
Hose cock brass external	\$	each
Vacuum breaker	\$	each
Hose cock internal	\$	each
Vent cowl and flashing	\$	each

Item	Cost	
Lagging as specified installed on 80mm pipe	\$	per metre
Lagging as specified installed on 65mm pipe	\$	per metre
Lagging as specified installed on 50mm pipe	\$	per metre
Lagging as specified installed on 40mm pipe	\$	per metre
Lagging as specified installed on 32mm pipe	\$	per metre
Lagging as specified installed on 25mm pipe	\$	per metre
Hydrant valves (double)	\$	each
100mm Bucket Trap Floor Waste	\$	each
Inwall Tundish (RTD)	\$	each
Exposed Tundish chrome plated	\$	each
40mm Chrome plated "S" Trap & pipe	\$	each
50mm Chrome plated "S" Trap & pipe	\$	each
Fixtures and Fittings complete, installed Provide a seperate Schedule	\$	each
Hot water system as specified	\$	
Excavation in Rock	\$	per cubic metre
Labour Costs for Items not covered by Unit Rates		
Plumber	\$	per hour
Plumber's Labourer	\$	per hour
3 5kg CO2	\$	
5 kg CO2	\$	
Wet Chemical	\$	
Fire Blanket	\$	

Name of Tenderer

Signature

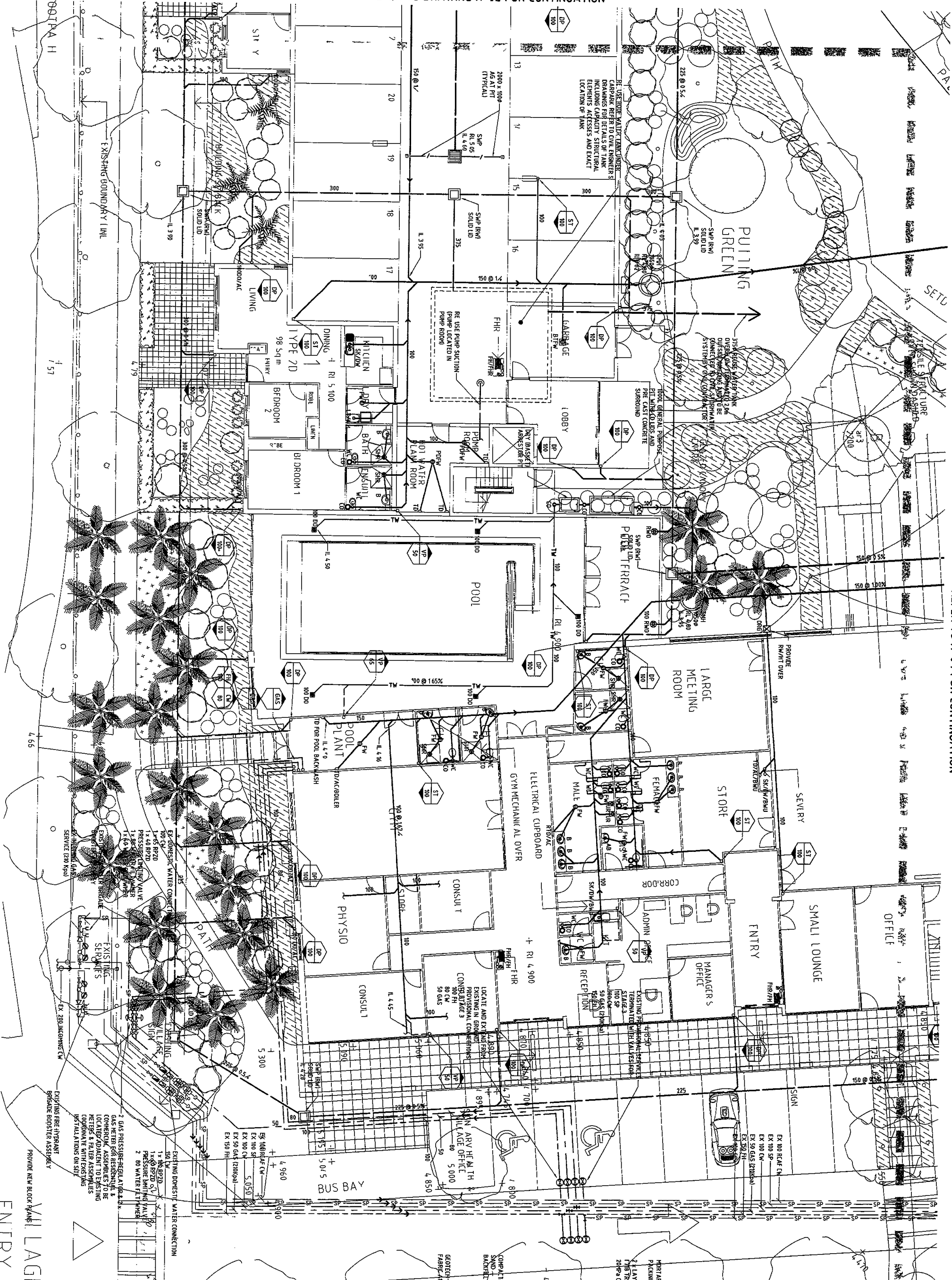
Witness

Date

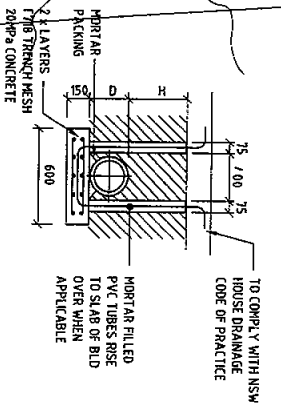


REFER TO H-04 FOR CONTINUATION

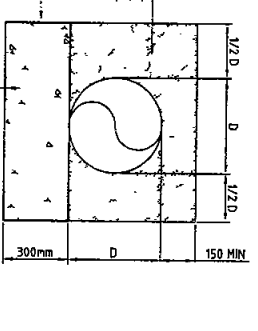
REFER TO DRAWING H-02 FOR CONTINUATION



No.	Description	Date
1	Approved	2010
2	Revised	2010



FILLED GROUND DRAINAGE SUPPORT RAFT
FOR ALL DRAINAGE UNDER GROUND FLOOR SLAB ON GROUND



SEWER AND STORMWATER FILLED AND WATER CHARGED GROUND SUPPORT EXTERNAL LOCATIONS

NOTES

- TEMPERING VALVES TO BE PROVIDED UNDER LAUNDRY TUB AND UNDER SINK IN ALL WALL UNITS
- PROVIDE SEAM WATER CONNECTION TO THE FIBRE IN PREHEAT UNITS
- PROVIDE A HOSE TAP TO THE BALCONY FOR ALL UNITS
- DISPENSER TO WASTE TO CONNECT TO SIGHT ON SINK WASTE TO PREHEAT UNITS
- TUNDRY TO BE PROVIDED UNDER LAUNDRY TUB IN PREHEAT UNITS

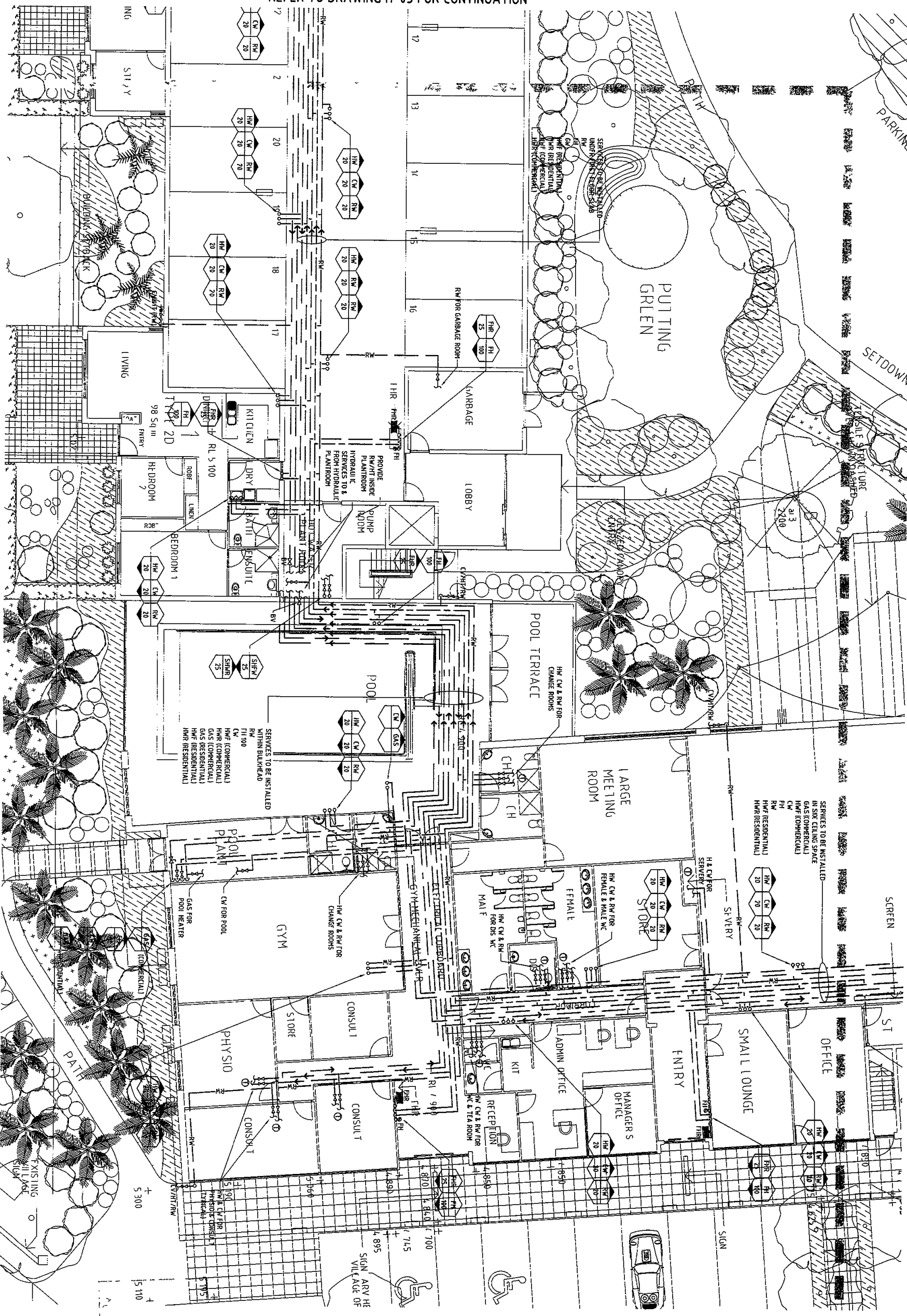
HYDRAULIC SERVICES SHEET 2
Hydraulic & Fire Protection Consultant



Scale: 1:100 (G.A.I.)
Date: 2010
Drawing No: 9183 H 03

REFER TO DRAWING H-07 FOR CONTINUATION

REFER TO DRAWING H-05 FOR CONTINUATION



REFER TO DRAWING H-07 FOR CONTINUATION

SERVICES ON THE DRAWING ARE SHOWN AT POSITIVE UNITS	
NO.	DATE
1	2010
APPROVED A. FENTENESSER DATE 2010	

NOTES

1. THERPING VALVES TO BE PROVIDED UNDER LAUNDRY TUB AND UNDER SINK IN ALL WALL UNITS
2. PROVIDE SHAM WATER CONNECTION TO THE FROGE IN PREMIUM UNITS
3. PROVIDE A HOSE TAP TO THE BALCONY FOR ALL UNITS
4. DISHWASHER TO WASTE TO CONNECT TO SPROUT ON SINK WASTE
5. TUBS TO BE PROVIDED UNDER LAUNDRY TUB IN PREMIUM UNITS

The client warrants that the information provided to the consultant is true and correct. The consultant warrants that the design and construction of the system shall conform to the applicable codes and standards.

Project
 WARRIWOOD DELIGHTMENT VILLAGE
 SHOPS
 WARRIWOOD

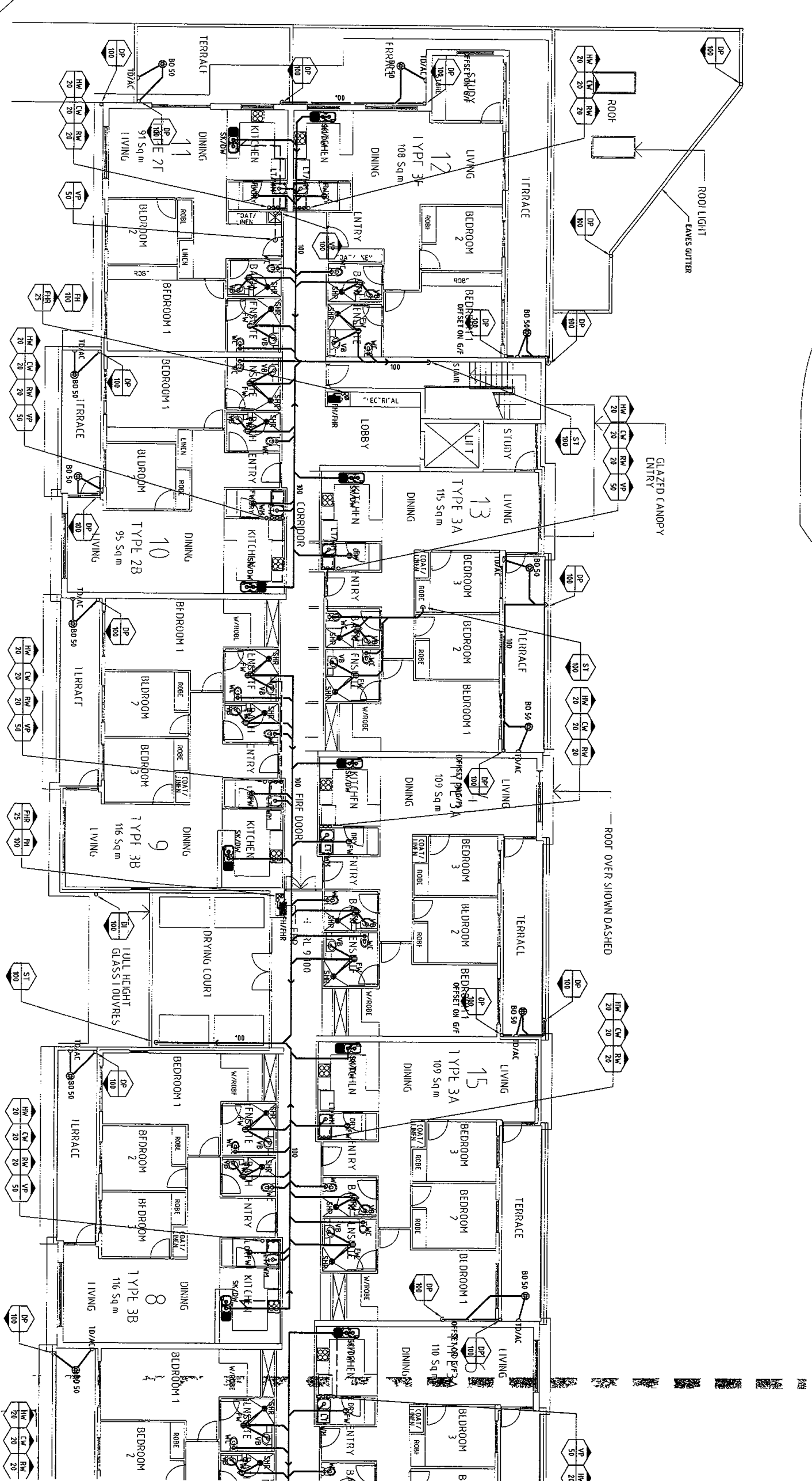
Drawing
 HYDRAULIC SERVICES
 GROUND FLOOR WATER AND GAS
 SHEET 2

Hydraulic & Fire Protection Consultant

S. B. S. 306
 114 Woodland Drive
 Warrimoo NSW 2570
 Ph: (02) 9232 1000
 Fax: (02) 9232 1001
 Email: info@gdh.com.au

GDH
 Hydra I Co. Sutting

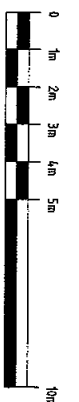
16/03/2010
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 9183 H 06



STAGE 3 BOUNDARY

REFER TO DRAWING H-09 FOR CONTINUATION

NOTE
BALCONY TD/AC CONDENSATE DRAINS 20mm
SHALL BE CAST IN SLAB



REVISIONS	
No	Description
1	ISSUED FOR PERMITS
2	REVISED PER COMMENTS
3	REVISED PER COMMENTS
4	REVISED PER COMMENTS
5	REVISED PER COMMENTS
6	REVISED PER COMMENTS
7	REVISED PER COMMENTS
8	REVISED PER COMMENTS
9	REVISED PER COMMENTS
10	REVISED PER COMMENTS

- NOTES**
1. TIGHTENING VALVES TO BE PROVIDED UNDER LAUNDRY TUB AND UNDER SINK IN ALL WALL UNITS
 2. PROVIDE 5mm WATER CONNECTION TO THE FRONT IN PREMIUM UNITS
 3. PROVIDE A ROSE TAP TO THE BALCONY FOR ALL UNITS
 4. DISHWASHER TO MAINTAIN CONNECTION TO SHROUD ON SINK WASTE
 5. LAUNDRY TUB TO BE PROVIDED UNDER LAUNDRY TUB IN PREMIUM UNITS

Project: WARRENWOOD RETIREMENT VILLAGE
STAGE 3
WARRENWOOD

Client: WARRENWOOD RETIREMENT VILLAGE
Contract No: 1100 (GAT)
Date: 05/20/11
Scale: 1:100 (GAT)

Drawn by: J.M.N.
Checked by: J.M.N.
Project Engineer: J.M.N.

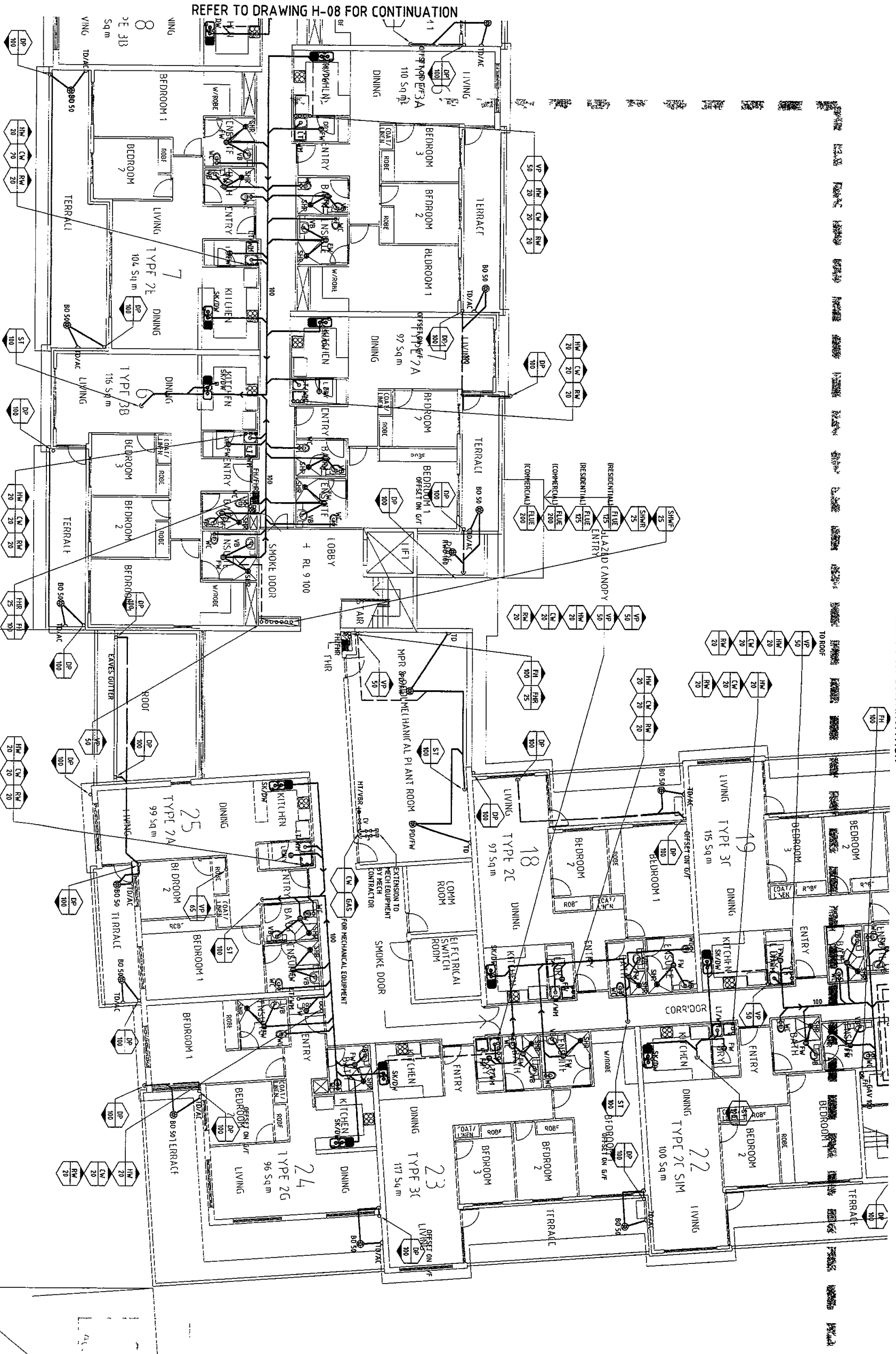
Hydraulic & Fire Flowed on Core Units

GDPH
Hydraulic & Fire Flowed on Core Units

94 St. Andrew Street
Luton, Bedfordshire, UK
Tel: 01455 531111
Fax: 01455 531112
Email: info@gdp.co.uk
Website: www.gdp.co.uk

9183 H 08

REFER TO H-10 FOR CONTINUATION



REFER TO DRAWING H-08 FOR CONTINUATION

No.	Amendment	Date
A	TENDER ISSUE	20/10

NOTES

- TEMPERING VALVES TO BE PROVIDED UNDER LAUNDRY TUB AND UNDER SINK IN ALL WALK UNITS
- PROVIDE 50mm WATER CONNECTION TO THE FRONT IN PREMIUM UNITS
- PROVIDE A HOSE TAP TO THE BALCONY FOR ALL UNITS
- DISHWASHER TO WASTE TO CONNECT TO SINK ON SINK WASTE TRUNCHED TO BE PROVIDED UNDER LAUNDRY TUB IN PREMIUM UNITS

GPDPH
Hydrotech & Flow Production Consultants

Scale: 1:100 (Overall)
Scale: 1:50 (Mechanical)

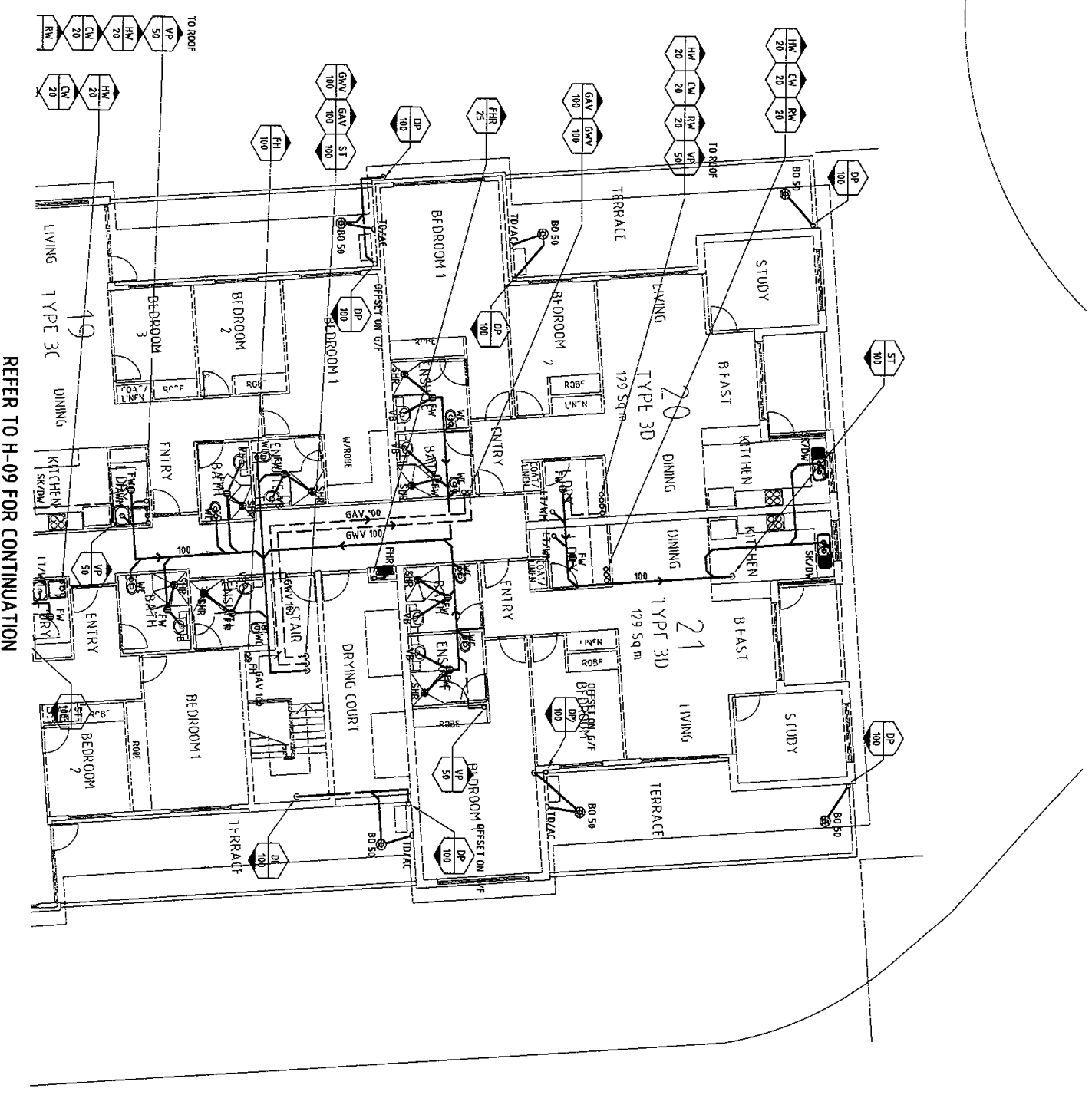
10m
5m
2m
1m

100m

10m
5m
2m
1m

NOTE: BALCONY TOTAL CONDENSATE DRAINS 20mm SHALL BE CAST IN S/CB

SERVICES ON THE DRAWING AND SIGNING SHALL BE:		
No.	Appointed	Date
1	ENGINEER/SUE	2010



REFER TO H-09 FOR CONTINUATION

- NOTES**
- 1 TEMPERING VALVES TO BE PROVIDED UNDER LAUNDRY TUB AND UNDER SINK IN ALL WALL UNITS
 - 2 PROVIDE 15mm WATER CONNECTION TO THE FRIDGE IN PREMIUM UNITS
 - 3 PROVIDE A HOSE TAP TO THE BALCONY FOR ALL UNITS
 - 4 DISHWASHER TO WASTE TO CONNECT TO SPLIT ON SINK WASTE
 - 5 TINDER TO BE PROVIDED UNDER LAUNDRY TUB IN PREMIUM UNITS

0 1m 2m 3m 4m 5m
10m

Project: WARRENWOOD RETIREMENT VILLAGE, WARRENWOOD

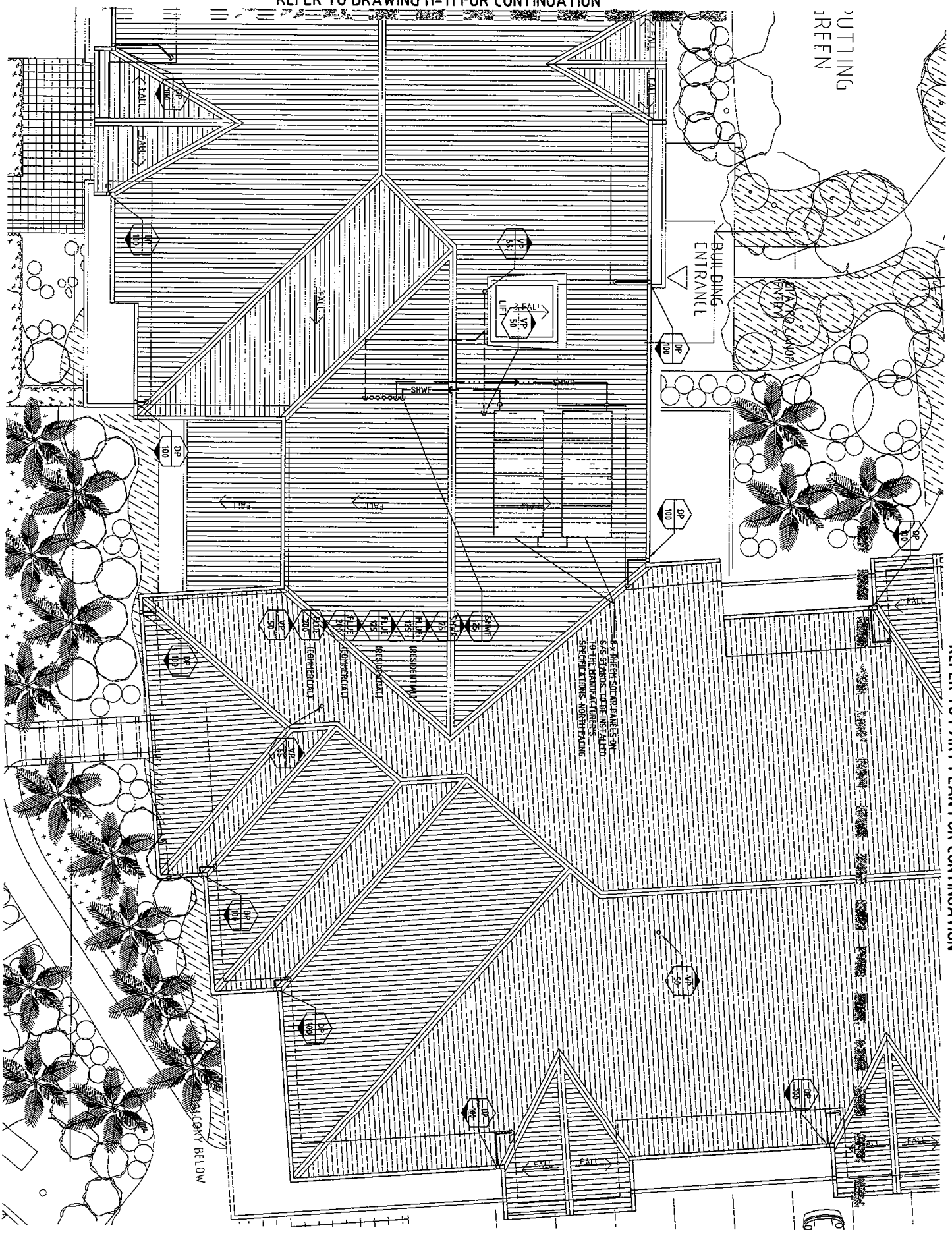
Drawing: HYDRAULIC SERVICES, SHEET 2, FLOOR PLAN

Hydraulic & Fire Protection Consultants

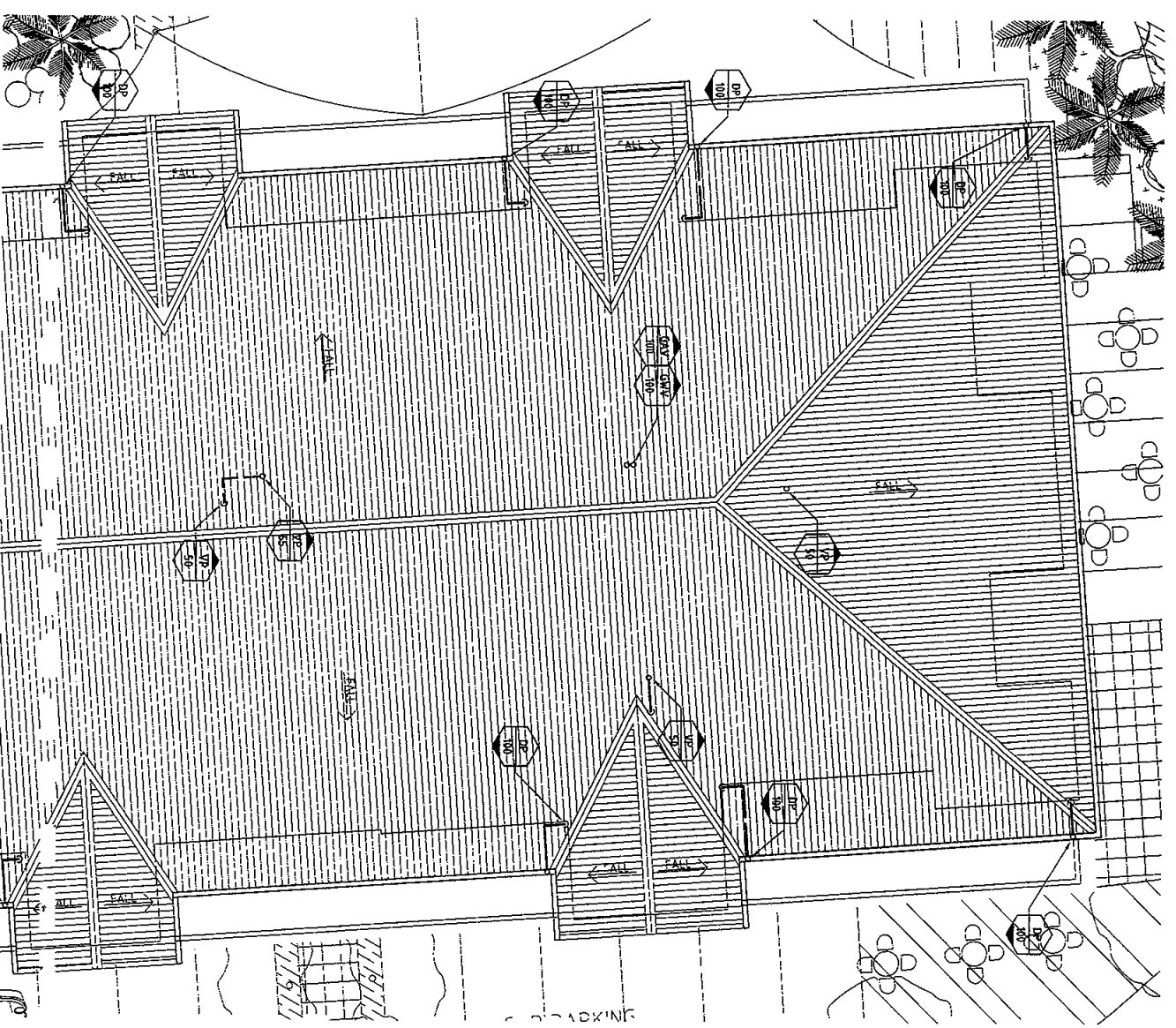
GDH
Hydra I
Coor: H11, G

1, 219, 45, 600
1, 803, 9, 582
1, 1, 1, 102, 824
1, 1, 1, 1, 1, 1, 1, 1
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1

REFER TO DRAWING H-11 FOR CONTINUATION



REFER TO PART PLAN FOR CONTINUATION



SHEET OF THE DRAWING HAS SHOWN BELOW SHEET NO.	
No. Amendment	Date
A. TENDR ISSUE	20/10

The drawing is to be read in accordance with the provisions of the Building Code of the City of Hyderabad.

Project: WARRERWOOD RT THE NEEM VILLAGE STAGE 8 WARRERWOOD

DRAWING: ROOF PLAN SHEET 2

Prepared by: G. Srinivas Reddy

Checked by: G. Srinivas Reddy

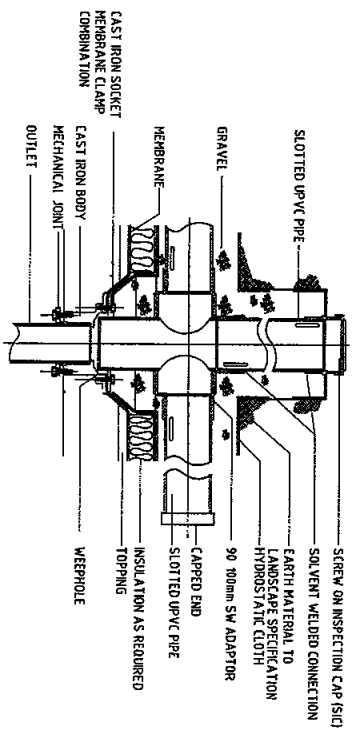
Date: 20/10/2010

Scale: 1/8" = 1'-0"

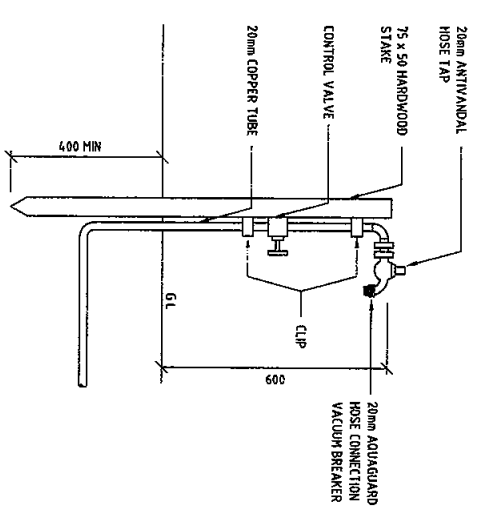
Drawing No: 9183 H 12

G.D.H. Hyderabad

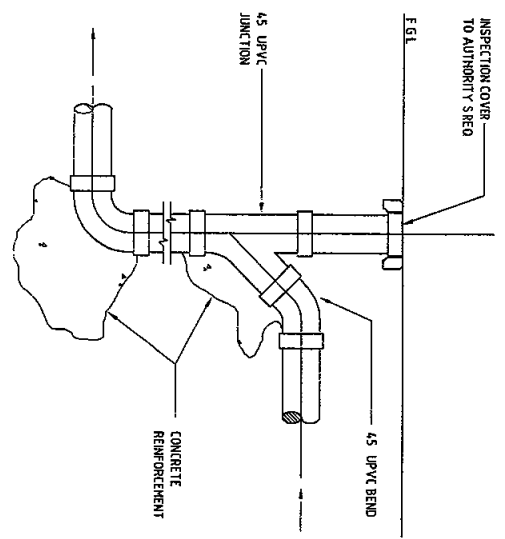
0 1m 2m 3m 4m 5m



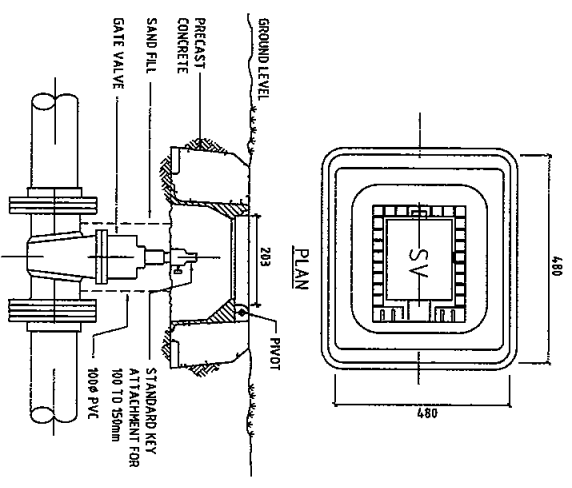
TYPICAL PLANTER BOX OUTLET DETAIL
NOT TO SCALE



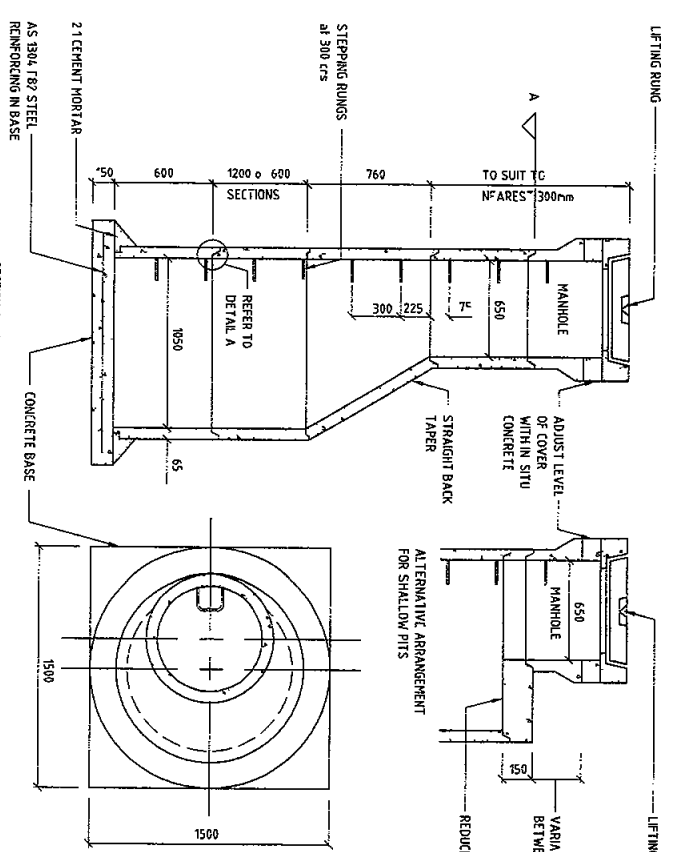
TYPICAL INSTALLATION OF EXTERNAL HOSE CONNECTION WITH VACUUM BREAKER
NOT TO SCALE



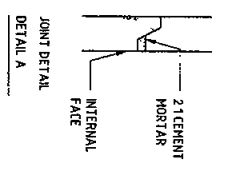
TYPICAL SEWERAGE VERTICAL
NOT TO SCALE



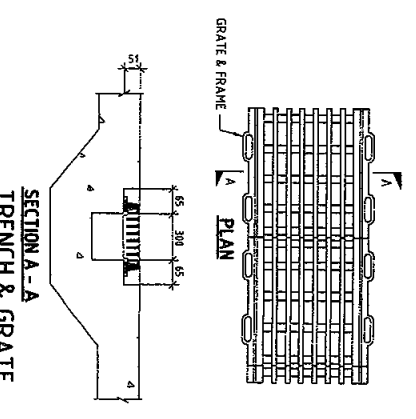
100 TO 150 VALVE IN PATHBOX
NOT TO SCALE



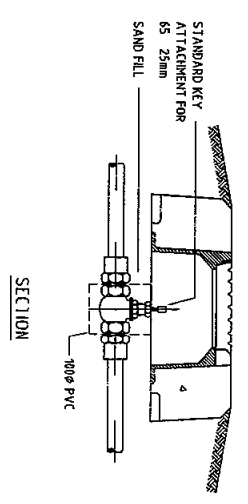
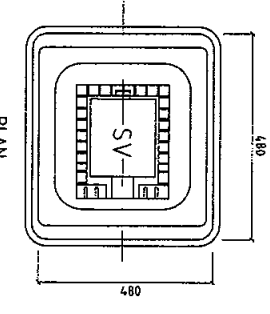
TYPICAL PRECAST MANHOLE DETAIL
NOT TO SCALE



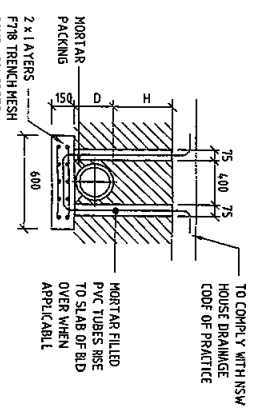
NOTES
DEPTH OF MANHOLE TO BE DETERMINED BY THE INVERT OF THE PIPES
MANHOLE & CHAMBER UNIT TO BE SUPPLIED IN 300 600 OR 720mm LENGTHS & SUPPLIED WITH GALV STEPPING RINGS



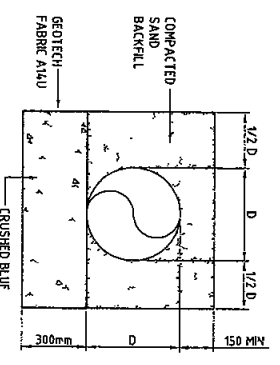
SECTION A-A TRENCH & GRATE
NOT TO SCALE



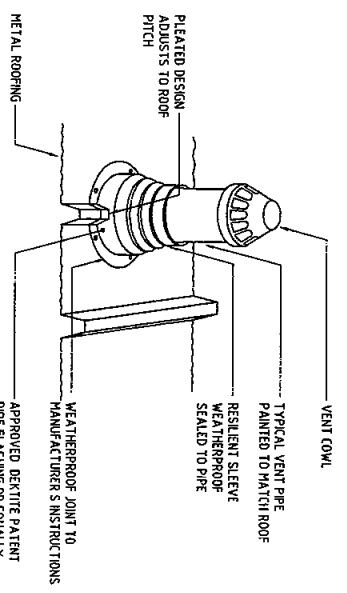
25 - 65mm VALVE IN PATHBOX
(LESS THAN 80mm)
NOT TO SCALE



FILLED GROUND DRAINAGE SUPPORT RAFT
FOR ALL DRAINAGE UNDER GROUND FLOOR SLAB ON GROUND

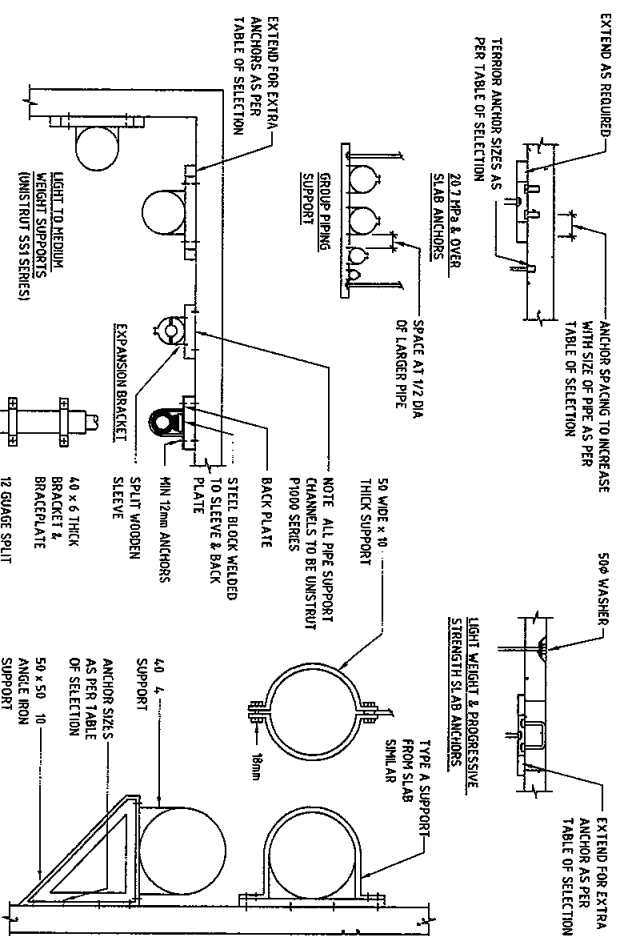


SEWER AND STORMWATER FILLED AND WATER CHARGED GROUND SUPPORT
EXTERNAL LOCATIONS

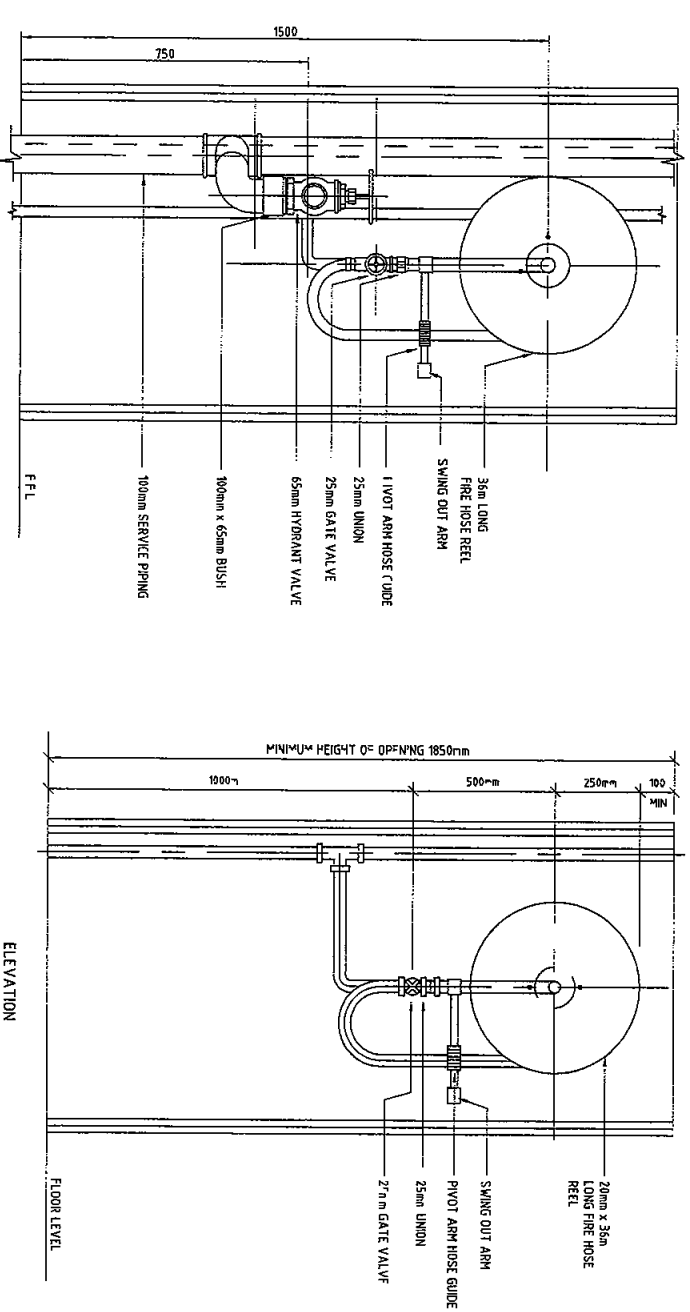


TYPICAL VENT TERMINATION DETAIL
NOT TO SCALE

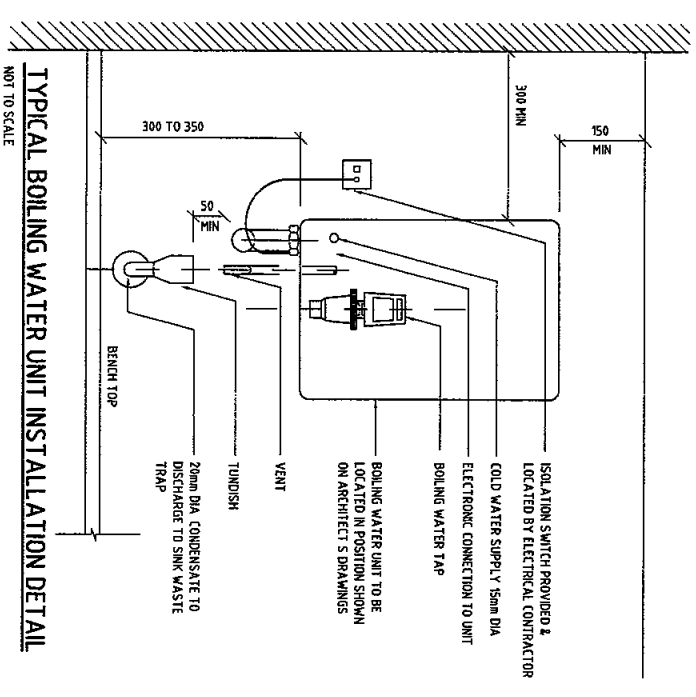
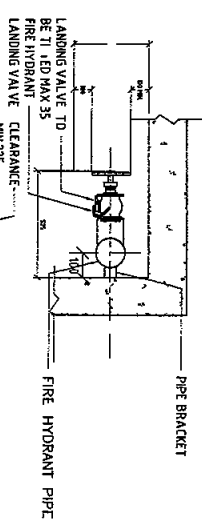
No.	Amendment	Date
A	TENDER ISSUE	20/10



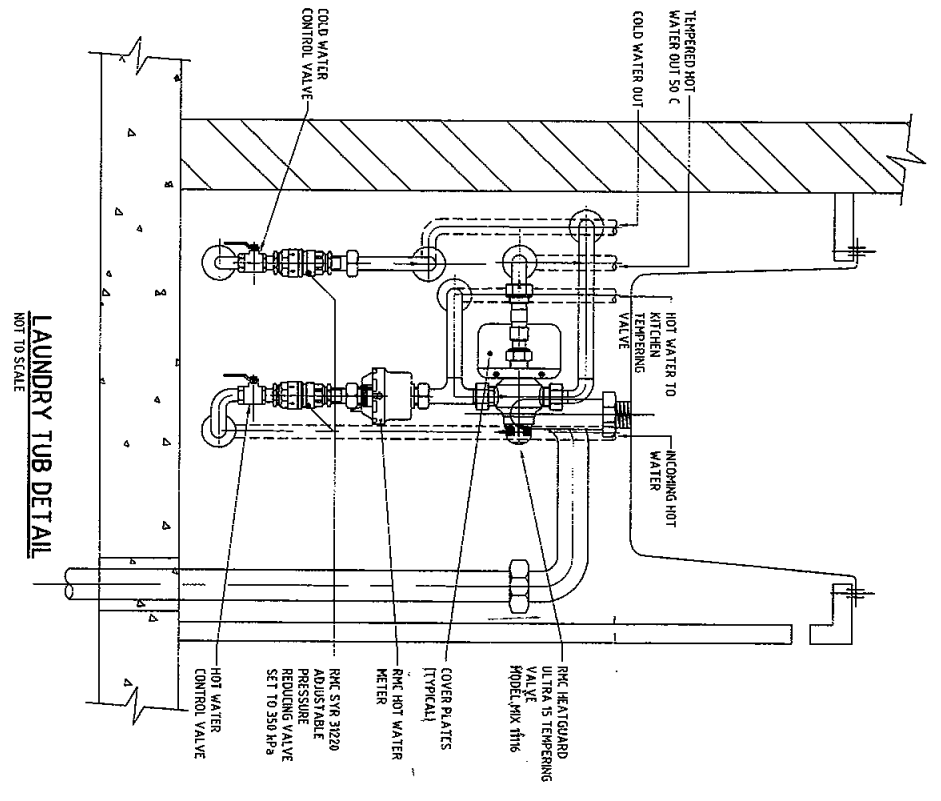
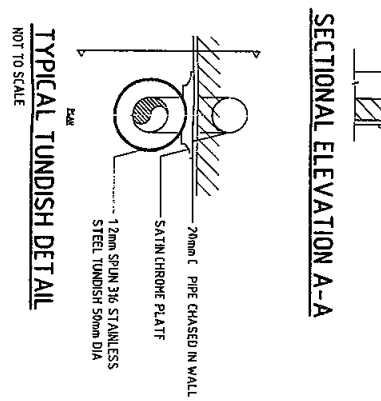
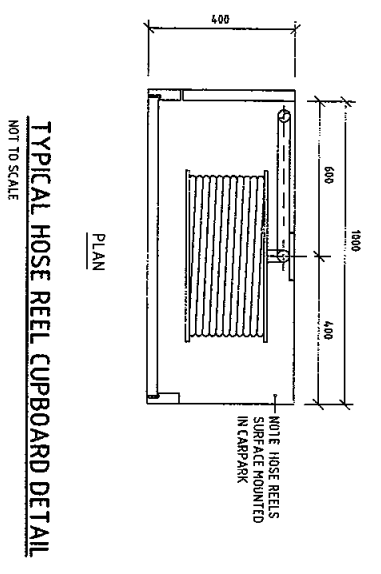
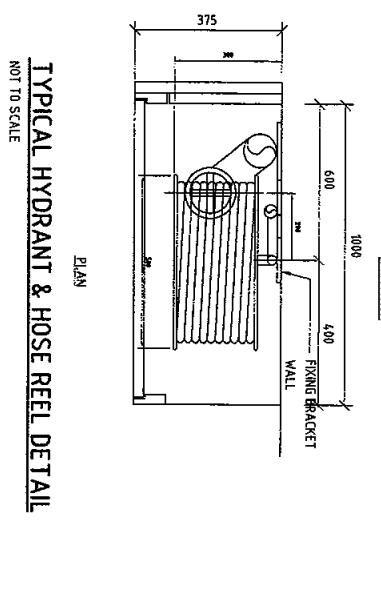
TYPICAL PIPE SUPPORT & CONCRETE ANCHOR DETAILS
NOT TO SCALE



TYPICAL FIRE HYDRANT LANDING VALVE INSTALLATION DETAILS
NOT TO SCALE



No.	Amendment	Date
1	TENDRIL F.S.E.	20/10/11



Drawing
HYDRAULIC SERVICES
 DETAIL SHEET NO. 2
 Hydraulic & Fire Protection Consultants
 GPDH
 Hydraulics Co. Salford
 Tel: 0161 2942090
 Fax: 0161 2942092
 Email: info@gdph.co.uk
 Website: www.gdph.co.uk
 Scale: N.T.S. (As Shown)
 Date: 09/20/10
 Drawn: J.S.
 Checked: J.S.
 9183 H 14



NRP ARCHITECTURE
ABN 21 083 698 882

Level 8/15 Help Street Chatswood NSW 2067
PO Box 5036 West Chatswood NSW 1515

T 61 (0)2 8966 6001 F 61 (0)2 8966 6126
E mail@nrparchitecture.com

Certificate of Compliance

Development Stage 3 Warriewood Brook Retirement Village – 8 Macpherson Street Warriewood

Owners Anglican Retirement Villages

Owners Address 62 Norwest Blvd, Baulkham Hills, NSW

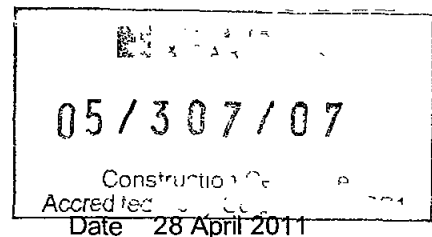
Condition B45 - 47

The building has been designed with a ventilated room for the storage of garbage containers, and containers for recyclable materials. The floor will be an impervious material covered at the wall floor junction and graded and drained to the sewerage system. Wall will be smooth and impervious.

I Morris Rosenberg of NRP Architecture, certify that to the best of my knowledge and belief, the information contained in this certificate is true and accurate.

Signed by

A handwritten signature in black ink, appearing to read 'Morris Rosenberg', written over a white background.



Rosenberg Architects Pty Limited ABN 21 083 698 882 trading as NRP ARCHITECTURE
Director / Nominated Architect Morris Rosenberg B Arch (Hons) FRAIA (Reg No 3308)

Assessor Certificate

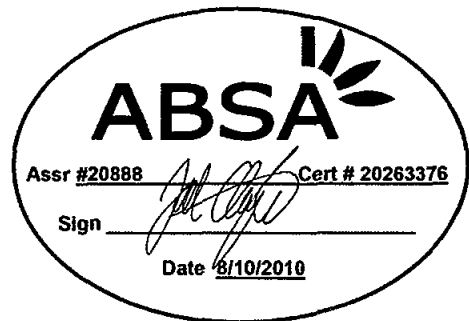
Multiple Dwellings

Certificate Version 6.1 Prior versions not valid after 1 March 2006

Issued in accordance with
BASIX Thermal Comfort Simulation Method



Assessor			
Name	Joel Clayton	Company	Cundall
Address	Level 7, 657 Pacific Highway ST LEONARDS 2065		
Phone	(02) 8424 7000	Fax	(02)8424 7099
Email	jclayton@cundall.com.au		
ABSA #	20888		
Declaration of interest The Assessor has provided design advice to the Applicant			
Client			
Name	Michael Viskovich	Company	ARV
Address	Level 2, Century Corporate Centre, 62 Norwest Boulevard Baulkham Hills NSW 2153		
Phone	02 9421 5316	Fax	02 9421 2217
Email	michael.viskovich@arv.org.au		
Project			
Address	6 Macpherson St, Randwick, Warneewood NSW 2102		
Applicant	ARV	LGA	Pittwater
Assessment			
Date	07/10/2010	File ref	1002801
Software	AccuRate	Version	1.1.4.1
Documentation			
All details upon which this assessment has been based are included in the project documentation that has been stamped and signed by the Assessor issuing this certificate as identified below			
Thermal Performance Spec			
Affixed to drawings Page#		arsk0001	
Drawings			
arsk0001 → arsk0003			
Building Specifications (Title Ref # Revision Issue date etc)			



ABSAs Assessor Certificate Assessor # 20888 Certificate # 20263376 Issued: 07/10/2010

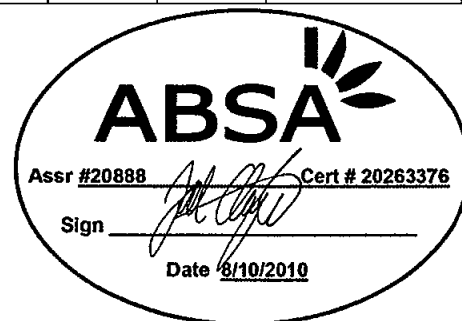
Thermal performance specifications

Page 1 of 2

Unit number(s)	Certificate number	Floor area (M ²)		Predict loads (MJ/M ² /y)		U Value	SHGC	Qualify for ventilation bonus
		Cond	Uncond	Heat	Cool (Sens & Lat)			
1	20263376	98.5	5.5	37.7	5.6	5.83	0.75	
2	88151981	108.4	5.5	47.8	7.0	5.83	0.75	
3	83615361	98.5	5.5	36.2	6.5	5.83	0.75	
4	26280344	93.6	5.94	22.5	9.0	5.83	0.75	
5	75425186	83	3.73	32.7	17.9	5.83	0.75	
6	58634777	122	3	56.7	16.2	2.32	0.65	
7	81258518	113.3	4	60.7	18.9	2.32	0.65	
8	71441316	122	3	58.2	18.0	2.32	0.65	
9	99518857	122	3	62.4	16.2	2.32	0.65	

05/307/07
Construction certificate
Affixed to the body Corporate Plan

Unit number(s)	Certificate number	Floor area (M ²)		Predict loads (MJ/M ² /y)		U Value	SHGC	Quality for ventilation bonus
		Cond	Uncond	Heat	Cool (Sens & Lat)			
10	46314912	101.6	3	57.8	16.8	2.32	0.65	
11	80256064	86.7	3.73	55.7	31.5	5.83	0.75	
12	54660865	107.7	5	42.1	10.6	5.83	0.75	
13	11749397	121.5	3	47.9	13.1	5.83	0.75	
14	75575601	107	3	41.2	10.8	5.83	0.75	
15	18749392	112	3	52.1	10.7	5.83	0.75	
16	21234473	112	3	54.9	11.0	5.83	0.75	
17	57602197	95.4	3	36.3	9.8	5.83	0.75	
18	62265123	106.9	3	62.0	9.3	5.83	0.75	
19	66882164	106.9	3	62.1	9.6	5.83	0.75	
20	44615433	109.2	3.53	51.4	17.0	5.83	0.75	
21	67902567	109.2	3.53	65.9	11.7	5.83	0.75	
22	26834754	96.6	3.53	58.8	9.3	2.32	0.65	
23	74316273	118.4	3	47.8	6.8	2.32	0.65	
24	57640045	95.4	2.6	51.9	14.8	2.32	0.65	
25	17379854	95.4	3	62.0	6.2	2.32	0.65	



Assessor # 20888	Certificate # 20263376	Issued 08/10/2010
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Thermal Performance Specifications

These are the Specifications upon which the Certified Assessment is based. If details included in these Specifications vary from other drawings or written specifications these Specifications shall take precedence. If only one specification option is detailed for a building element that specification must apply to all instances of that element for the project. If alternate specifications are detailed for a building element the location and extent of alternate specifications must be detailed below and / or clearly indicated on referenced documents.

Windows	Product ID	Glass	Frame	U value	SHGC	Detail
---------	------------	-------	-------	---------	------	--------

		Single Clear	Aluminium	5.83	0.75	All except below
		Double Clear	Aluminium	2.32	0.65	6.10 22-25

Skylights	Product ID	Glass	Frame	U value	SHGC	Area M ²	Detail
-----------	------------	-------	-------	---------	------	---------------------	--------

None

Window and skylight U and SHGC values if specified are according to NFRC 100. Alternate products or specifications may be used if their U value is lower and the SHGC value is less than 10% higher or lower than the U and SHGC values of the product specified above.

External walls	Construction	Insulation	Colour - solar abs	Detail
----------------	--------------	------------	--------------------	--------

Brick Veneer		R2.5	Dark	All Units
--------------	--	------	------	-----------

Timber (Exposed Studs) + Brick Veneer		R2.5	Dark	Units 6-25
---------------------------------------	--	------	------	------------

Internal walls	Construction	Insulation	Detail
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Plasterboard on studs		None	
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Floors	Construction	Insulation	Covering	Detail
--------	--------------	------------	----------	--------

Concrete		None	Carpet & Tile	As per Plan
----------	--	------	---------------	-------------

Ceilings	Construction	Insulation	Detail
----------	--------------	------------	--------

Timber Lining		None	
---------------	--	------	--

Roof	Construction	Insulation	Colour - solar abs	Detail
------	--------------	------------	--------------------	--------

Metal Deck		R4.0	Dark	As per Plan
------------	--	------	------	-------------

Window cover	Internal (curtains)	External (awnings shutters etc)
--------------	---------------------	---------------------------------

None		None
------	--	------

Fixed shading	Eaves (width inc gutters ht above windows)	Verandahs Pergolas (type description)
---------------	--	---------------------------------------

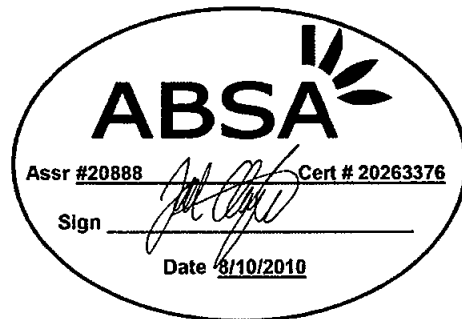
		Balconies
--	--	-----------

Overshadowing	Overshadowing structures	Overshadowing trees
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Orientation, Exposure, Ventilation and Infiltration

Orientation of nominal north	Varies
Terrain category	Suburban
Roof ventilation	Unventilated
Cross ventilation	Standard
Subfloor	Open/Enclosed
Living area open to entry	Yes
Doors separate living areas	No
Stair open to heated areas	No
Seals to windows and doors	Yes
Exhaust fans without dampers	No
Ventilated skylights	No
Open fire unflued gas heat	No
Vented downlights	No
Wall and ceiling vents	No

ABSA Assessor stamp



Thermal Performance Specifications

This is the Specification which has been prepared by the Assessor in accordance with the provisions of the Building Act 2004 and the Building Regulations 2006. It is intended to be used in conjunction with the drawings and specifications for the project. The Assessor is not responsible for the design or construction of the project.

Product ID	U-value	SHGC	g/L	SHGC	g/L
Single Glaz	5.83	0.75	None	All except below	6.10 22.25
Double Glaz	2.32	0.65	None	6.10 22.25	

Product ID	U-value	SHGC	g/L	SHGC	g/L
Single Glaz	5.83	0.75	None	All except below	6.10 22.25
Double Glaz	2.32	0.65	None	6.10 22.25	

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Double Glaz	2.32	0.65	None	6.10 22.25	

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Product ID	U-value	SHGC	g/L	SHGC	g/L
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Double Glaz	2.32	0.65	None	6.10 22.25	

Product ID	U-value	SHGC	g/L	SHGC	g/L
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Double Glaz	2.32	0.65	None	6.10 22.25	

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Double Glaz	2.32	0.65	None	6.10 22.25	

Product ID	U-value	SHGC	g/L	SHGC	g/L
Single Glaz	5.83	0.75	None	All except below	6.10 22.25
Double Glaz	2.32	0.65	None	6.10 22.25	

Product ID	U-value	SHGC	g/L	SHGC	g/L
Single Glaz	5.83	0.75	None	All except below	6.10 22.25
Double Glaz	2.32	0.65	None	6.10 22.25	

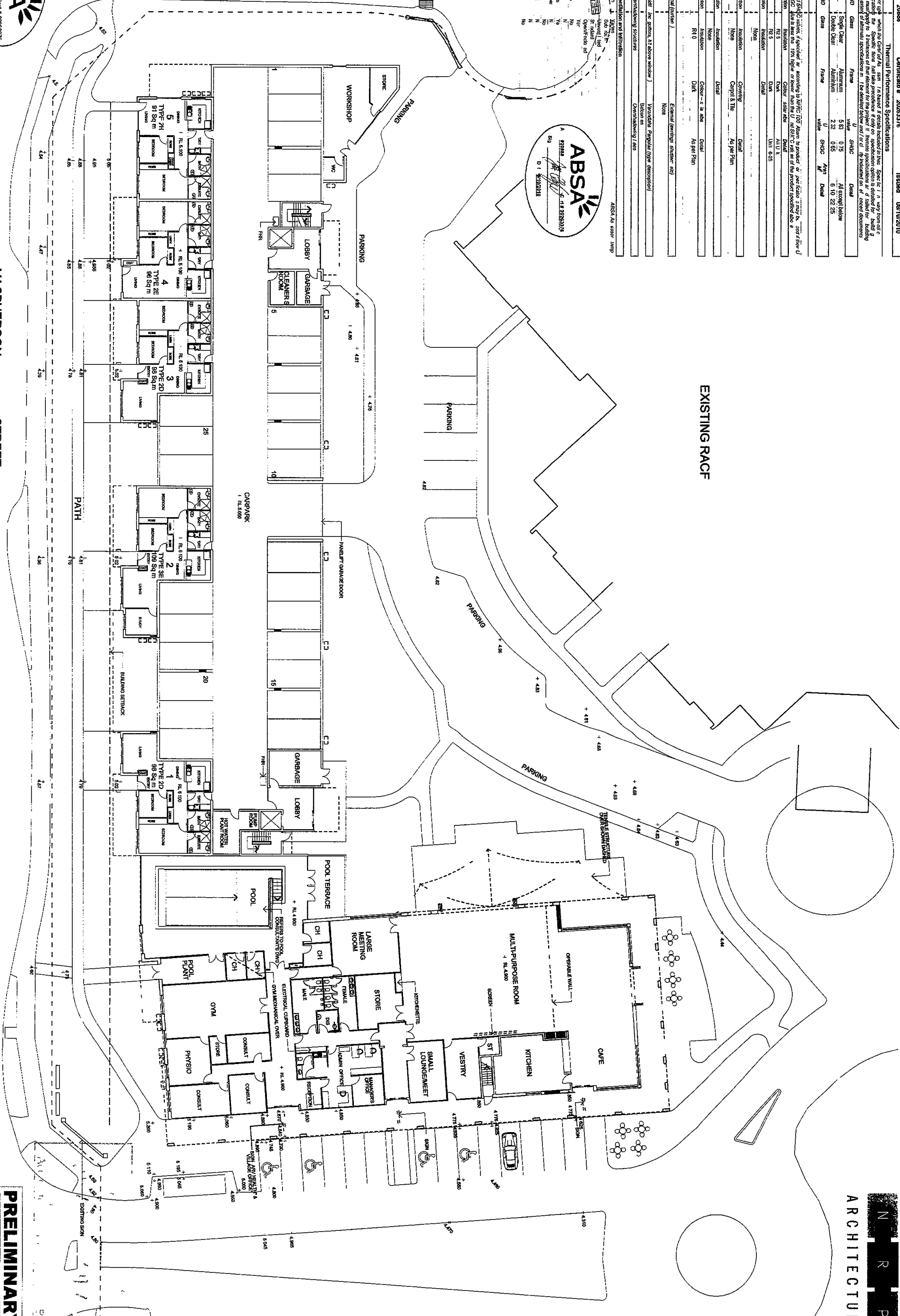
Product ID	U-value	SHGC	g/L	SHGC	g/L
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Double Glaz	2.32	0.65	None	6.10 22.25	

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Single Glaz	5.83	0.75	None	All except below	6.10 22.25
Double Glaz	2.32	0.65	None	6.10 22.25	



EXISTING RACF



PRELIMINARY

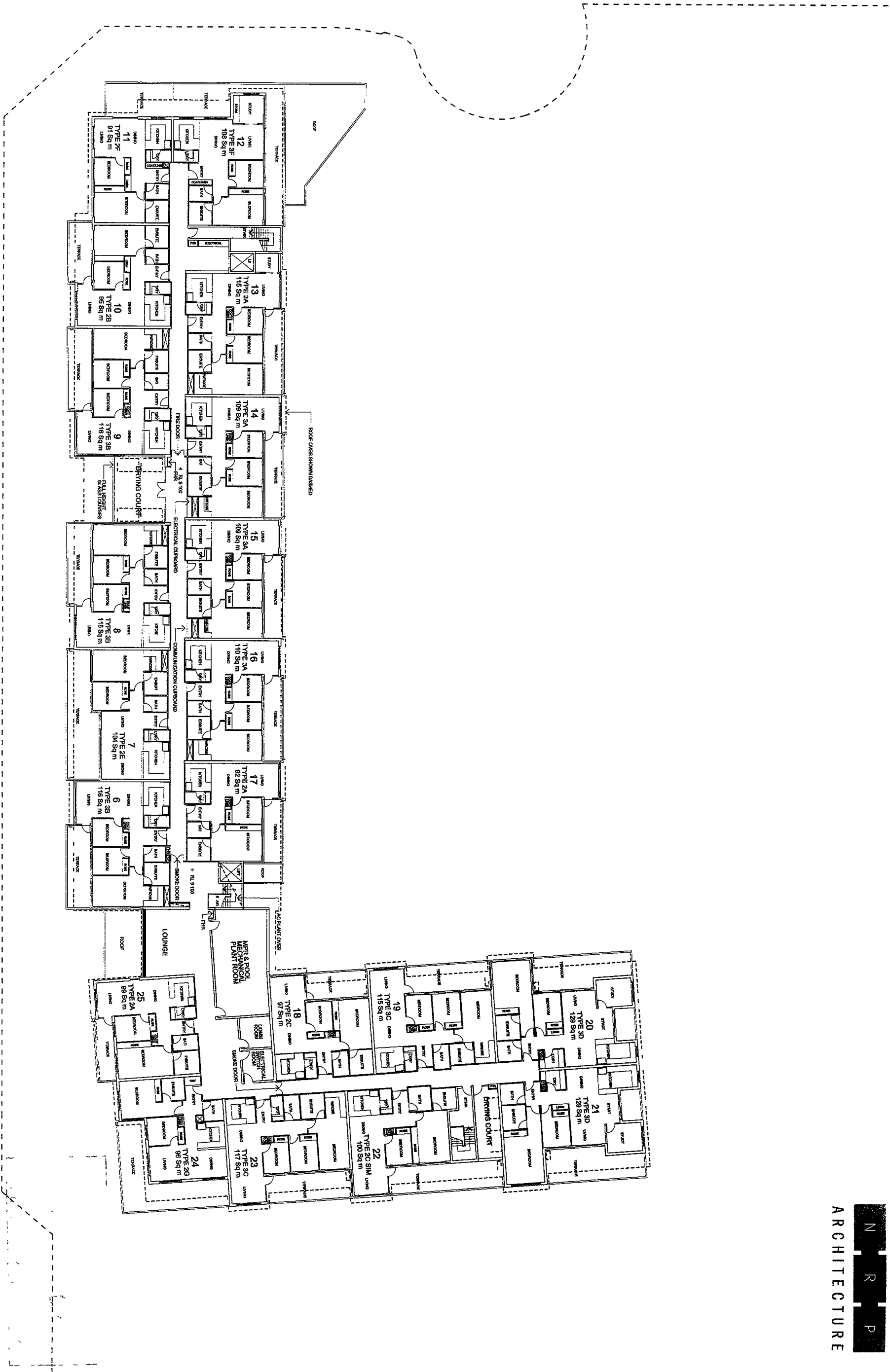
GROUND FLOOR PLAN

WARRIEWOOD BROOK RETIREMENT VILLAGE STAGE 3

MACPHERSON STREET

22-09-10 1:200

nrp architecture
1 (02) 9866 8001 f (02) 9866 6125



BOUNDARY

PRELIMINARY

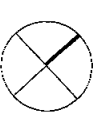
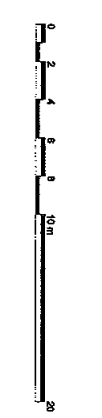


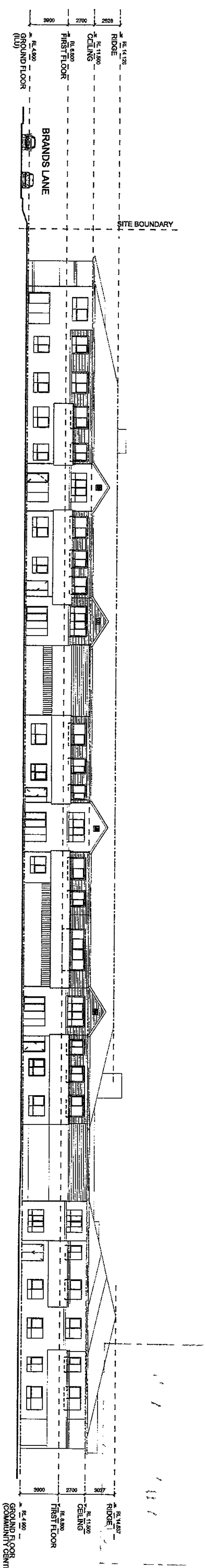
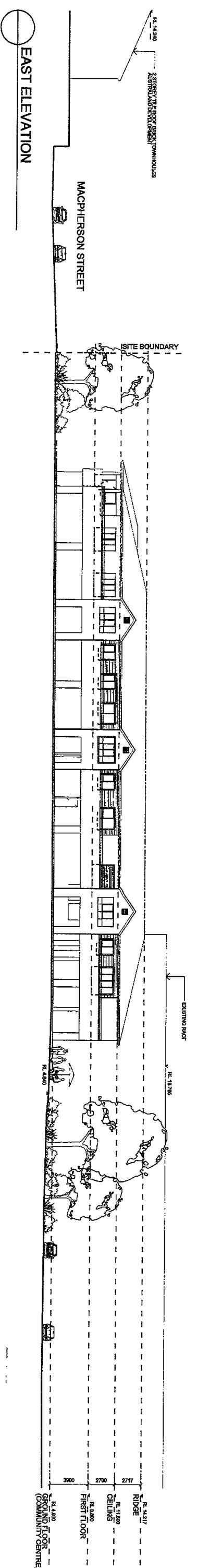
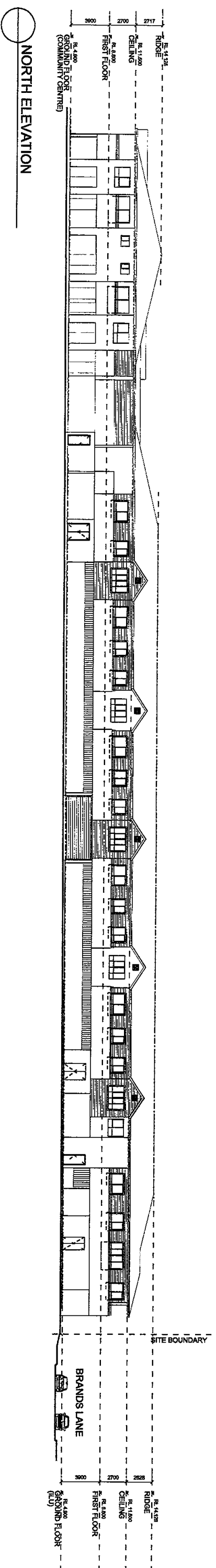
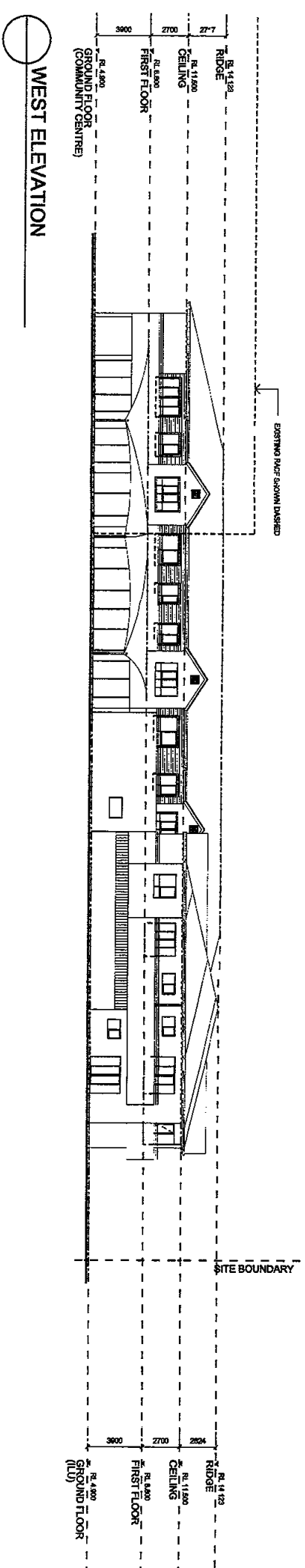
ABS SA
ARCHITECTS & ENGINEERS
Date: 6/10/2010
Sign: [Signature]
Asst: 6/10/2010

WARRIEWOOD BROOK RETIREMENT VILLAGE STAGE 3

FIRST FLOOR PLAN

DATE: 22-09-10 1:200
DRAWN BY: [Name]
PROJECT NO: 5105-01
MPP ARCHITECTURE
LEVEL 8 15 HALL STREET CHALSWOOD NSW 2087

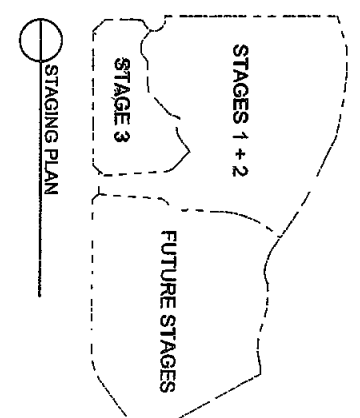
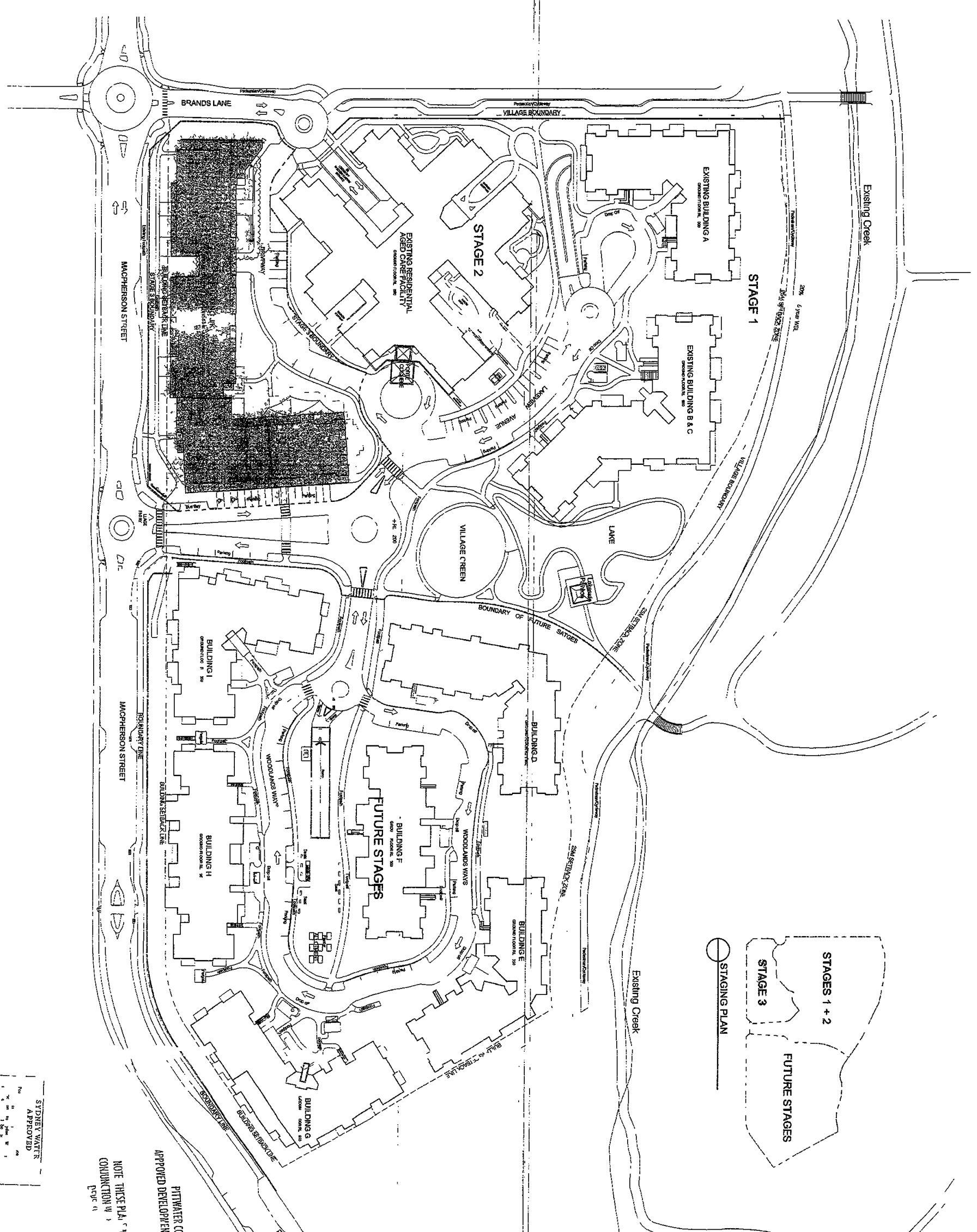




WARRIEWOOD BROOK RETIREMENT VILLAGE STAGE 3

ELEVATIONS

PRELIMINARY



NO.	DESCRIPTION	DATE	BY	CHECKED
1	PRELIMINARY DESIGN	10/10/01	...	...
2	FINAL DESIGN	10/10/01	...	...
3	CONSTRUCTION	10/10/01	...	...
4	OPERATIONAL	10/10/01	...	...



ARCHITECTURE

110 151A B...
 100 3888 8801
 10 11
 10 11

**WARRIEWOOD BROOK
 RETIREMENT VILLAGE
 STAGE 3**
**6 14 MACPHERSON ST
 WARRIEWOOD**



NOTE THESE PLANS MUST BE READ IN CONJUNCTION WITH THE CONDITIONS OF THE VILLAGE SITE PLAN

DATE: 3.8.01
 BY: 1500 YL
REF 3 0100
 A04

NO.	DESCRIPTION	DATE	BY	CHECKED
1	PRELIMINARY DESIGN	10/10/01	...	...
2	FINAL DESIGN	10/10/01
3	CONSTRUCTION	10/10/01
4	OPERATIONAL	10/10/01

05/11/01

60417
C8

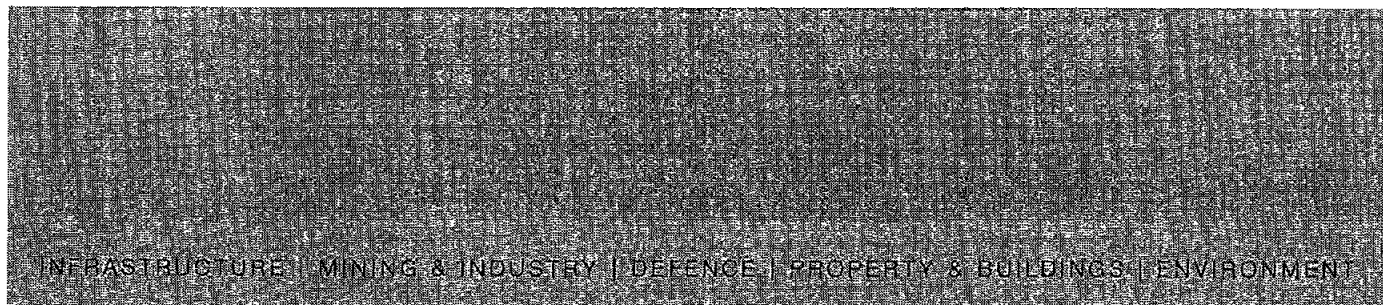
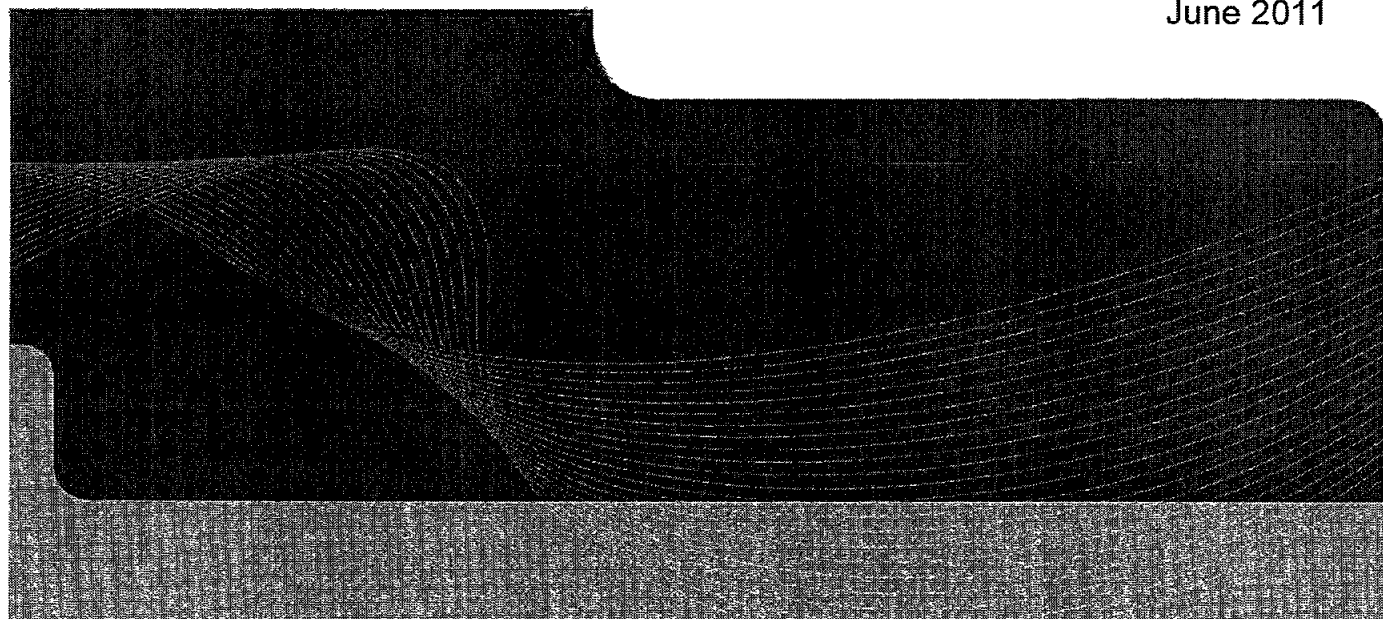


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STEVENSON
05/307/07
Construction Certificate
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Anglican Retirement Villages
Report for Warriewood Retirement
Village
Update Report to Water Management
Report (Version 4, December 2006)

June 2011



INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT



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- 2 may only be used and relied on by ARV*
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- 4 may only be used for the purpose of water management at the ARV site in Warriewood and must not be used for any other purpose*

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The services undertaken by GHD in connection with preparing this Report

- were limited to those specifically detailed in each section of this Report*

The opinions conclusions and any recommendations in this Report are based on assumptions made by GHD when undertaking services and preparing the Report

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1 Introduction

1.1 Background

Anglican Retirement Villages (ARV) is developing land in the Warriewood Valley (see Table 1, Figure 1 and Appendix A), encompassing a number of sectors, buffer areas and sub-sectors. This Water Management Report (WMRU) provides an update to the original Water Management Report (WMR) for the site, issued in December 2006 (Version 4).

It is important to note that the December 2006 WMR responded to the redevelopment of the entire site, as was proposed at that time. Development has occurred since that time and currently Stages 1 and Stage 2 (RACF) have been constructed. Stage 3 construction is about to commence, and future stages have not as yet been determined. This WMRU therefore presents an interim position in comparison to the December 2006 WMR.

Table 1 Sectors, Buffer areas and Sub-sectors

Site	Sector	Buffer Area	Sub-sector
14 Macpherson Street	3	na	na
12 to 8 Macpherson Street	4	2	102
6 Macpherson Street	C	2	102

The land forms part of the Warriewood Valley Urban Land Release. The process of development of each buffer area/sector generally comprises five administrative and approval stages:

- ▶ Rezoning Application,
- ▶ Development Application
- ▶ Construction Certification
- ▶ Occupation Certificate and
- ▶ Handover

Water quantity and quality management requirements for developments in the Warriewood Valley are identified in the Warriewood Valley Urban Land Release Water Management Specification (WMS) adopted by Pittwater Council in February 2001. This requires that the Applicant provide a single WMR at each stage of the process listed above. Also required are Status Reports during the construction period.

The WMS lists the water management requirements at each stage of the development approval process. The WMS also provides a water management checklist for each stage, which needs to be included in each report.



1 2 Key Documentation

Key documents of relevance are

- ▶ Warriewood Valley Urban Land Release, Water Management Specification Revised Version Pittwater Council, February 2001 (WMS)
- ▶ DCP 30 Development Control Plan 30 Pittwater Flood Risk Management Pittwater Council, December 2002,
- ▶ Flood Risk Management Policy for Pittwater, Pittwater Council December 2002
- ▶ Warriewood Valley Urban Release Area, Landscape Masterplan and Design Guidelines, September 2004,
- ▶ Warriewood Valley Flood Study, Flood Study Report (April 2005) and Addendum 1 (July 2005) and

Apart from these documents there are a number of other documents of relevance to development in the Warriewood Valley which have been referenced in the WMR

1 3 WMR Checklist

The relevant checklist as required by the WMS for the DA stage is provided in Appendix B

1 4 Key WMS Parameters applicable to the ARV Site

The WMS and Warriewood Valley Flood Study and Addendum 1 (April 2005 and July 2005) lists a number of key hydrological parameters applicable to the ARV site which set flood levels and flood peaks applicable to the site

In terms of flood planning levels, given that the development is a retirement village, the WMS requires building floor levels to be at or above the PMF level for habitable buildings and underground car park entries. For non-habitable buildings floor levels need to be above the 100-year ARI level plus freeboard. This has required the developed form to be raised significantly compared to existing conditions. The raising however needed to make allowance for the conveyance of the PMF through the site, to ensure off-site impacts (raised flood levels) are minimised.

A more recent requirement of Council has been to make provision for climate change impacts.

As part of the works, the WMS required rehabilitation and construction of Narrabeen Creek.

FIGURE 1

LEGEND

--- ARV Site



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CLIENT	ARV
PROJECT	Warriewood Water Management Report
TITLE	Locality Plan
DWG NO	24135727M-001
DATE	10/10/2005
SIZE	A4



	DRAWN	RRB	REVISION
	CHECKED		SCALE
			SEE SCALE BAR
			DATE
			SIZE
			A4



2 Site Description

2.1 Location and Description

Buffer Area 2 of the Warriewood Valley Urban Land Release area is located between Warriewood Road to the north and Macpherson Street to south and is bisected by Narrabeen Creek. Referring to Figure 1 the ARV site within the buffer area is located south of Narrabeen Creek and is bounded on the north-west by Brands Lane and on the south-east by an adjacent allotment (Lot 4) off Macpherson Street. It includes five properties along the south bank of Narrabeen Creek. The lots that define the subject study site are No 14, 12, 10, 8, and 6 Macpherson Street. The total site area is 6.65 ha.

The ARV site is approximately 600m upstream of the Warriewood Wetlands, and as such is characterised by a flat, low-lying topography. The site generally drains towards Narrabeen Creek along the northern boundary. An elevated area is located at the southern site boundary on No 8 and 6 Macpherson Street rising to levels of RL 9.2 m AHD.

2.2 Completed Development undertaken at the Site

The development undertaken to date and the latest staging plan footprint is provided in Appendix C. The current development comprises a Retirement Village of a number of buildings containing independent living units and a Retirement Age Care Facility (RACF). Buildings are serviced by internal access roads and the development includes a village green. Numerous footpaths link the buildings and provide access across the site. Additional to stages 1 and 2 the following items have also been completed:

- ▶ Rehabilitation of Narrabeen Creek,
- ▶ The village green
- ▶ The lake, and
- ▶ Brands Lane

As part of the development of Stage 1 and Stage 2 (RACF) the site has been filled to levels specified in the WMR. The current as built site topography is provided in Appendix D.

2.3 Proposed Development for Stage 3

The proposed Stage 3 development (Appendix D) comprises a number of independent living units and community facilities which include a multi-purpose room and pool.



3 Water Cycle Assessment

The December 2006 WMR undertook a water cycle assessment for the development using MUSIC. In accordance with the WMR, simulations were undertaken for the following scenarios:

- ▶ Pre-development: assessing the existing site, and
- ▶ Post-development: both without re-use strategies and incorporating water re-use strategies

The MUSIC model was re-simulated by replacing the previously proposed buildings and occupancies with what is now proposed under Stage 3 (namely 50 residents).

The results of the modelling (see table below) show that the revised Stage 3 proposal has negligible impact on the water balance, and that the conclusion stated in the 2006 Water Management Report remains valid. These are restated below:

The results indicate a significant increase in the annual runoff from 37.8 ML/yr to 45.6 ML/yr on account of increased impervious areas due to the development. These are mitigated using the proposed storage and re-use strategies, resulting in post-development runoff being less than pre-development conditions. For an average year, post-development runoff will be similar to pre-development runoff. In a wet year, post-development runoff could be expected to be marginally more than pre-development conditions, while in a dry year, post-development runoff could be expected to be less than pre-development conditions.

While the contribution to runoff in the creek from the site during dry years could be reduced, this effect on creek runoff adjacent to the site would need to be evaluated in light of the overall catchment runoff draining to the creek at that position. The ARV site makes up approximately 3% of the entire valley upstream of Brands Lane, and thus the impact of reduced runoff from the ARV site during a dry year is expected to be small.

Table 2 Water Yield Results

Year	Annual Rainfall (mm)	Existing (ML/yr)	2006 DA Developed No Reuse (ML/yr)	2006 DA Developed with Reuse (ML/yr)	2010 Stage 3 Developed with Reuse (ML/yr)
Software Version		Music V3	Music V3	Music V4	Music V4
1987 (avg)	1126	28.4	36.8	27.7	27.6
1988 (wet)	1820	62.8	72.4	63.0	62.8
1989	1645	55.6	64.6	56.2	55.9
1990	1712	62.8	70.9	61.5	61.2
1991	917	24.5	30.8	22.5	22.3
1992	916	20.1	27.2	19.8	19.6
1993 (dry)	670	10.7	16.9	8.3	8.1



Year	Annual Rainfall (mm)	Existing (ML/yr)	2006 DA Developed No Reuse (ML/yr)	2006 DA Developed with Reuse (ML/yr)	2010 Stage 3 Developed with Reuse (ML/yr)
Average	1258	37.8	45.6	37.0	36.8

3.1 Site Stormwater Proposal

The December 2006 WMR undertook a stormwater assessment for the development using the MUSIC and DRAINS software. On the basis that the building layout and impervious areas between the 2006 DA proposal and the current Stage 3 proposal are similar, changes to the stormwater management for the overall site are envisaged to remain unaltered.



4 Flooding

4.1 100-year and PMF SOBEK Simulations

The WMS requires management of flooding at the Warriewood Retirement Village site in particular the impact of the proposed development on flooding on and off-site. This flooding has been assessed for the 100-year ARI event and the PMF by considering the proposed development footprint for Stage 3 (see Appendix E) and the works constructed to date. Use was made of Council's SOBEK flood model operated by their consultants Cardno Lawson and Treloar. A number of flood model iterations were undertaken. The results in Appendix E show that

- ▶ In a PMF, the development undertaken to date and future proposed Stage 3 works would decrease flood levels internally at the site in Macpherson Street, at the site entrance and at a location, where Brands Lane abuts the creek. The majority of these flood level decreases are in the range of approximately 70mm to 90mm at offsite locations,
- ▶ In a PMF, flood level increases are noted in isolated areas across the site and for a small portion of Brands Lane. The majority of these increases are approximately in the range of 50mm to 60mm. In one location a small area of increases extends slightly north of Brands Lane however these increases are mostly 52 to 56mm in this location.
- ▶ In a 100-year ARI event flood levels in Narrabeen Creek are reduced upstream of the site, extending to approximately midway along the length of the site, and
- ▶ A small area of increased flood levels is noted approximately midway along the creek adjacent to the site and in the area upstream of Macpherson Street. These increases however are limited to approximately 22 to 25mm.

For evaluation of flood level impacts, Council previously acknowledged that 50mm in a PMF and 20mm in a 100-year event would be considered acceptable given the general modelling accuracies. Given that the above increases are only a few millimetres outside these specifications and that only a portion of the site would have been developed at the completion of Stage 3 it is considered that these results are acceptable.

In terms of flood planning levels the WMS requires building floor levels to be at or above the PMF level for habitable buildings and underground car park entries. For non-habitable buildings floor levels need to be above the 100-year ARI level plus freeboard.

4.2 Climate Change

On the subject of climate change Council provided the following extract from advice on 28 February 2011

- ▶ The use of the Narrabeen Creek Sea Level Rise Investigation Area is generally limited to Council's strategic land use planning strategy and, as stated in NSW Government guidance, is not to be used for the assessment of development proposals. Therefore the Sea Level Rise Investigation Area is not relevant to the DA at 6-14 Macpherson Street, Warriewood.
- ▶ Preliminary estimates of the impacts of climate change (sea level rise and increased rainfall intensity) on flood levels in the Narrabeen Lagoon catchment have been determined by Cardno and their advice to Council is as follows.



- It is conservatively estimated that a 0.9 metre sea level rise may result in a 0.2 metre increase in PMF levels at the ARV site
- It is not considered appropriate to undertake any adjustments to the PMF rainfall based on climate change. Therefore, the only impact on flood levels at the ARV site will be due to sea level rise

4.3 Assessment of Floor Levels for Stage 3

Referring to Appendix D and Appendix E

- ▶ At the entrances of the building, the habitable floor levels of the ground floor independent living units (ILU) range from 5.9m AHD to 5.7m AHD. This is 0.2m above the PMF flood levels, along the periphery of the site and at entrances to ILU's and
- ▶ The proposed floor levels to the habitable ILUs are thus at and/or above the 2100 Climate Change Scenario for the PMF condition

4.4 Evacuation and Flood Emergency Management

All proposed dwelling floor levels are above the PMF flood level. As such, the need for evacuation is unlikely, and a "stay-put" evacuation strategy is proposed. The site generally grades towards Narrabeen Creek. The proposed dwellings should not create any significant additional burdens on the SES or emergency services during flood times. In addition, it is expected that Macpherson Street will be significantly inundated in the vicinity of Brands Lane and at the Narrabeen Creek crossing, preventing site access to emergency vehicles during a PMF event.

For the non-habitable areas of the Stage 3 building, the floor level is located some 0.5m above the Narrabeen Creek flood level, some distance away and separated by non-flooded areas of the site. A detailed Emergency Response Plan, to be implemented in a Management Plan and by the staff, would need to be compiled for the site before occupation.



5 Water Quality Monitoring and Results

Water quality monitoring was initiated in August 2004 to provide baseline data for this WMR and ongoing sampling as required by the WMS. Monitoring has been undertaken in accordance with the requirements listed in the 2001 Water Management Specification. There are three sites as follows:

- ▶ Site NC3 is located on the boundary of Sector 2 and 4
- ▶ Site NC4 is located on or near the boundary of Sector 4 and Sector C, and
- ▶ An intermediate site S4 has been established in the creek within the Sector 4 area to enable sampling of stormwater runoff during wet weather sampling periods

A number of sampling events have been completed to date and are reported in Appendix F. These include sampling reports:

- ▶ Report of sampling up to December 2008
- ▶ Report of sampling March 2009 to June 2009
- ▶ Report of sampling July 2009 to October 2009,
- ▶ Report of sampling November 2009 to February 2010
- ▶ Report of sampling March 2010 to June 2010 and
- ▶ Report of sampling June 2010 to June 2011

The results of the sampling need to be reviewed in light of the long-term water quality records for Narrabeen Creek. It is understood that this task is generally undertaken by Council's consultants Cardno Lawson and Treloar.



6 Summary

- ▶ Anglican Retirement Villages (ARV) is currently planning the development of land in the Warriewood Valley. This Water Management Report (WMRU) provides an update to the original Water Management Report (WMR) for the site, issued in December 2006 (Version 4)
- ▶ The ARV site, is located south of Narrabeen Creek and is bounded on the north-west by Brands Lane and on the south-east by an adjacent allotment (Lot 4) off Macpherson Street. It includes five properties along the south bank of Narrabeen Creek. The lots that define the subject study site are No 14, 12, 10, 8, and 6 Macpherson Street. The total site area is 6.65 ha.
- ▶ The development undertaken to date and the latest staging plan footprint is provided. The current development comprises a Retirement Village of a number of buildings containing independent living units and a Retirement Age Care Facility (RACF). Numerous footpaths link the buildings and provide access across the site. Additional to stages 1 and 2 the following items have also been completed
 - Rehabilitation of Narrabeen Creek
 - The village green
 - The lake, and
 - Brands Lane
- ▶ The December 2006 WMR undertook a water cycle assessment for the development using MUSIC. The MUSIC model was re-simulated by replacing the previously proposed buildings and occupancies with what is now proposed under Stage 3 (namely 50 residents). The results of the modelling show that the revised Stage 3 proposal has negligible impact on the water balance, and that the conclusion stated in the 2006 Water Management Report remain valid.
- ▶ The December 2006 WMR undertook a stormwater assessment for the development using the MUSIC and DRAINS software. On the basis that the building layout and impervious areas between the 2006 DA proposal and the current Stage 3 proposal are generally similar, changes to the stormwater management for the site are envisaged to remain unaltered.
- ▶ Flooding has been assessed for the 100-year ARI event and the PMF by considering the proposed development footprint for Stage 3 and the works constructed to date. Use was made of Council's SOBEK flood model operated by their consultants Cardno Lawson and Treloar. A number of flood model iterations were undertaken. It was found that the proposed floor levels to the habitable ILUs are at and/or above the 2100 Climate Change Scenario for the PMF condition, and
- ▶ Water quality monitoring was initiated in August 2004 to provide baseline data for this WMR and ongoing sampling as required by the WMS. Monitoring has been undertaken in accordance with the requirements listed in the 2001 Water Management Specification, with results provided in the appendices.



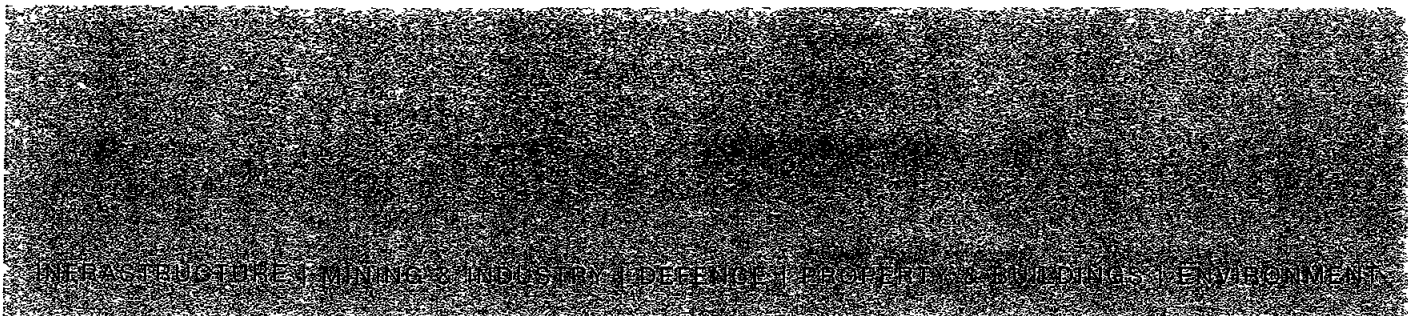
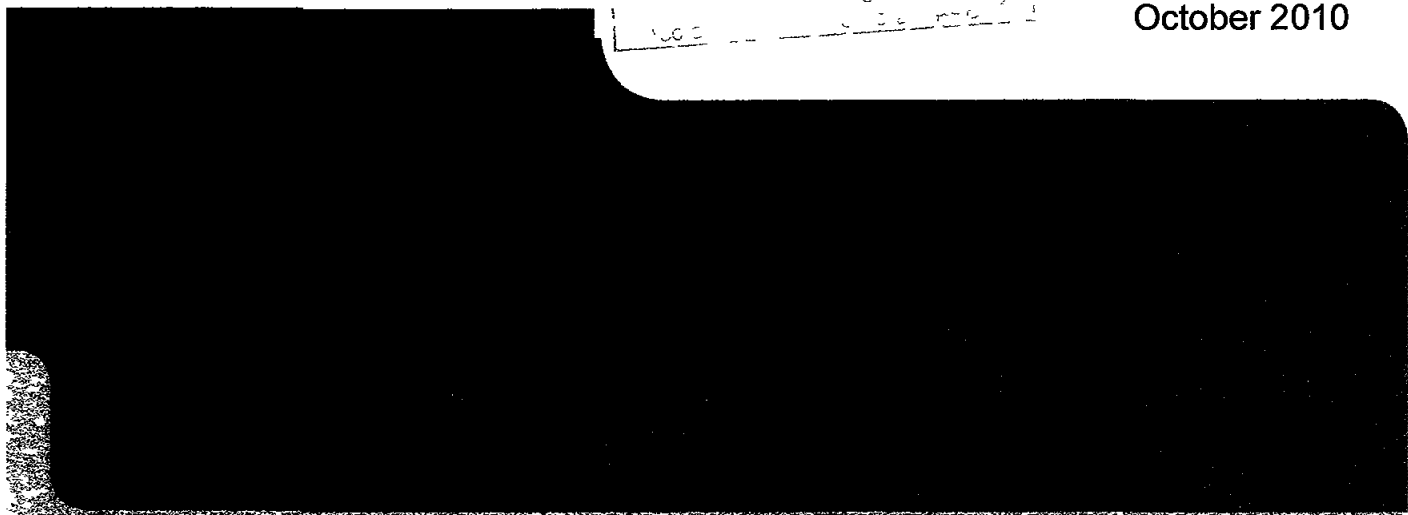
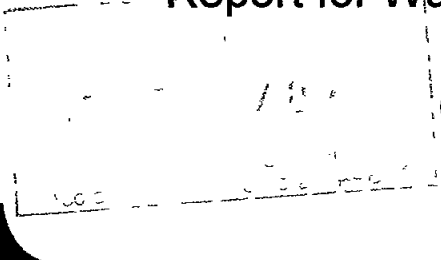
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Anglican Retirement Villages

Report for Warriewood Brook
Stage 3

Civil Specification

October 2010





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Appendices



A Drawings



Stormwater The contractor shall develop the stormwater design and construct a stormwater system in accordance with the Flood Management Report

Road Works Road works include the design and construction of a flexible pavement for the proposed Stage 3 access road and street parking facilities. The village entrance road (Existing Road 1 identified on Drawing 21-19822-C001) shall be reconstructed to provide compliant on grade access to the proposed building. The existing Port Cochere alignment shall be modified to widen the access to the Stage 3 internal road.

Flood Risk At all stages of construction the Contractor is to be mindful of stockpile locations and shall plan ahead, referring to the Flood Management Report and seeking permission in advance.

1 3 Drawings

The following concept design drawings are included in Appendix A

- ▶ Drawing No 21-19822-C001 Site Stormwater Management Plan
- ▶ Drawing No 21-19822-C002 Concept Stormwater Drainage Layout
- ▶ Drawing No 21-19822-C003 Sediment and Erosion Control Plan

1 4 Quality

All design and construction works shall be done in a sound, efficient and workmanlike manner and in accordance with latest relevant Australian Standards, Codes of Practice and Construction Guidelines.

1 4 1 Inspection

Notice

Hold points If notice of inspection is to be given in respect of parts to the works, do not conceal those parts without approval.

Minimum notice for inspections to be made 4 hours for on-site inspectors, otherwise 2 working days.

Witness points If notice of inspection is to be given in respect of parts of the works, advise if and when those parts are to be concealed.

Attendance

Provide attendance.

1 4 2 Tests

Notice

Hold points If notice of inspection is to be given in respect of parts of the works, do not test those parts without approval.



1 General Requirements

1.1 Description of the Site

This specification is for the provision of all necessary design and construction services materials, equipment and labour for the civil works for Stage 3 of the Anglican Retirement Village at Warriewood

The site is situated off Macpherson St in the suburb of Warriewood Sydney Anglican Retirement Villages (ARV) is developing a retirement village on a 6ha block of land in the Warriewood Valley in a staged development Stage 1 and 2 of the village is complete Stage 3 is the next scheduled stage of the works Macpherson Street bounds the plot on the south-western side on the northwest Brands Lane and on the northeast Narrabeen Creek The overall site is a consolidation of 5 lots previously used for market gardening Much of the low-lying land toward Narrabeen Creek was raised with fill material in the 1950s and 1960s in order to reclaim and level it

This document provides the Specification for the Civil Works associated with the Stage 3 works The nature and extent of the site including the Stage 3 works is reflected on drawing 21-19822-C101

The successful Tenderer for the Stage 3 Works shall take possession of the concept design, develop the detailed design and construct the proposed development

The site's overriding feature that shall define the civil design work is the potential for flooding of the Narrabeen Creek The Flood Management Report for this site is available for inspection at GHD's Castlereagh Street Sydney office It is important for the Tenderer to understand that the design site levels (both interim and final) are strictly dictated by the Flood Management Report The placing of any stockpiled material on the site will be strictly controlled

The contractor shall perform asbestos and PASS management for the Stage 3 works on an as required basis This Civil Works Specification volume forms part of a complete set of contract documentation The Tenderer should read this Civil Works Specification in conjunction with all other tender documents A list of reports on the site including PASS management, Asbestos management and geotechnical investigations is listed elsewhere in this tender documentation

1.2 Scope of Works

Stage 3 Works broadly includes construction of the Stage 3 building onsite roads and stormwater reticulation as contained within the Stage 3 boundary, offsite road works along the Macpherson Street site frontage and construction of offsite stormwater reticulation along Brands Lane to Narrabeen Creek

Bulk Earthworks The Stage 3 contractor is required to carry out all bulk earthworks within the Stage 3 boundary The contractor is required to interface with existing levels at the Stage 3 boundaries, ensuring adequate drainage measures



Minimum notice for inspections to be made 4 hours for on-site inspectors, otherwise 2 working days

Witness points If notice of testing is to be given in respect of parts of the works, advise if and when those parts are to be concealed

Testing Authorities

Except for site tests have tests carried out by authorities accredited by NATA to test in the relevant field or an organisation outside Australia recognised by NATA through a mutual recognition agreement Cooperate as required with testing authorities

Except for site tests, have tests carried out by a Registered testing authority

- ▶ Reports Submit copies of test reports, including certificates for type tests showing the observations and results of tests and conformance or non-conformance with requirements
- ▶ Site tests Use instruments calibrated by authorities accredited by a Registered testing authority

1 4 3 Submissions

Authorities

Authorities approvals If required submit documents showing approval by the authorities whose requirements apply to the work

Correspondence Submit copies of correspondence and notes of meetings with authorities

Design

General Submit design calculations parameters and assumptions and documents showing the layout and details of the installation for review/comment

Variation documents If it is proposed to change the installation from that shown on the contract documents or if changes are required by statutory authorities submit variation documents showing the proposed changes

Electronic Submissions

File format pdf dwg

Transmission medium email or CD

Errors

If a submission contains errors make a new or amended submission as appropriate, indicating changes made since the previous submission

Identification

Identify the project contractor subcontractor or supplier, manufacturer, applicable product model number and options, as appropriate and include pertinent contract document references Include service connection requirements and product



certification Identify non-compliances with project requirements and characteristics that may be detrimental to successful performance of the completed work

Inspection and Testing Plan

Submit an inspection and testing plan that is consistent with the construction program Include particulars of test stages and procedures

Materials and Components

Product certification If products must conform to product certification schemes submit evidence of conformance

Product data For proprietary equipment submit the manufacturer's product data including

- ▶ Technical specifications and drawings
- ▶ Type test reports
- ▶ Performance and rating tables and
- ▶ Recommendations for installation and maintenance

Proposed products schedules If major products are not specified as proprietary items submit a schedule of those proposed for use within 3 weeks of site possession

Notice

Minimum notice 5 working days for offsite submissions otherwise 10 working days

Submission points If a submission is required for a part of the works, do not commence work on the part until the submission is endorsed that the work may proceed Coordinate related submissions and do not cause delays by making late or inadequate submissions

Quantity

Bound documents 3 copies

Loose documents up to and including A3 One copy

Samples One of each designated item including ancillary items such as fasteners flashings and seals and two copies of supporting product data

Samples

Incorporation of samples If it is intended to incorporate samples into the works submit proposals Incorporate samples in the works that have been endorsed for incorporation Do not incorporate other samples

Retention of samples Keep endorsed samples in good condition on site until practical completion



Shop Drawings

General If required submit dimensioned drawings showing details of the fabrication and installation of services and equipment including relationship to building structure and other services cable type and size and marking details

As executed drawings Amend the drawings during the defects liability period to correct errors or omissions and to show changes made after submission Resubmit amended copies

Diagrammatic layouts Coordinate work shown diagrammatically in the contract documents and submit dimensioned setout drawings

1 5 Setting out of the Works

The Contractor shall be responsible for the setting out of all permanent and temporary works under the Contract The Contractor shall confirm the alignment of the road and the locations of stormwater infrastructure with the Principal's Representative, prior to commencement of work The Principal will not provide any centreline or other pegs for the use of the Contractor

It shall be the Contractor's responsibility to carry out the work in re-establishing, recovering or transferring any survey or setting out pegs or marks which are disturbed by the Contractor or which cannot be found due to works carried out by the Contractor in the course of the Contract in accordance with instructions from the Principal's Representative The Contractor shall immediately advise the Superintendent of any disturbance to established survey marks

Provide all labour, material and other assistance that the Superintendent may require at any time to check the setting out of the works

1 6 Access to the Site and Temporary Works

Access to the site and location of contractor's amenity shall be agreed with the Superintendent before commencement of the works

The Contractor shall be responsible for providing and maintaining a detailed erosion and sedimentation control plan Drawing 21-19822-C003 shows an indication of the minimum requirements of what shall be provided for the Stage 3

Existing Services

The Contractor shall be responsible for completing any necessary service investigations prior to any work being carried out

1 7 Bad Ground and Dewatering

Bad ground is defined in clause 3 1 4 of this Specification and might be encountered beneath proposed structures such as roads, buildings and basements Bad ground may be identified visually or through proof rolling (ref clauses 3 3 2 3 3 3 & 3 3 4) and should bad ground be encountered the Superintendent shall be immediately notified Generally reparations can be made by removal of the bad ground and replacement



with Approved Fill Select Fill or material similar to the material in the layer to be placed above this layer However, caution should be observed not to over excavate needlessly without seeking guidance from the Principal s Representative

All excavation work shall include all necessary excavation support and dewatering measures necessary to facilitate excavation to the specified levels and to maintain the finished surface until the placement of the pavement layers

Keep ground free of water Provide and maintain slopes, crowns and drains on excavations and embankments to ensure free drainage Place construction, including fill masonry, concrete and services on ground from which free water has been removed Prevent water flow over freshly laid work

Keep groundworks free of water Dispose of groundwater and surface water in a manner approved by the Local Authority and Environmental Protection Agency Arrange excavations to drain to collection points equipped with pumps and filtration system prior to pumping Generally the builder is deemed to have allowed for all de-watering required to undertake all works detailed on contract documents This includes all trenching indicated on drawings regardless of depth

Clause 4 1 6 calls for the Contractor to submit method statements for (amongst other things) dewatering

1 8 Noise and Vibration Control

Restrict dust and noise to the minimum Take precautions including but not limited, to the use of silenced compressors and jackhammers Ensure mobile plant and equipment are fitted with effective silencers Cover loads of excavated material before departure from site Remove soil from trucks prior to leaving site Any soil or dirt on adjacent roads is to be cleaned up immediately



2 Erosion and Sediment Control

2.1 Scope of Work

The scope of work includes but is not limited to,

- ▶ Construction of temporary erosion control measures, including a detailed Plan,

2.2 General

The Stage 3 erosion and sediment control measures shall conform to Aus-Spec Pittwater edition available from Pittwater Council

Refer to Pittwater Council Edition AUS-SPEC-1\NSW-C211 Control of Erosion and Sedimentation for comprehensive specification requirements

Perimeter control measures shall be placed prior to or in conjunction with the first phase of works. Construction shall be staged so that land disturbance is confined to areas of workable size. This will limit the duration for which disturbed areas are exposed to erosion. Stabilisation measures shall be applied on the disturbed section before the next section is opened up.

Topsoil stockpiles shall be located outside hazard areas such as drainage depressions.

All areas not subject to construction works shall be retained free from disturbance or damage for the duration of the Contract. Should these areas become disturbed or damaged the Contractor at no cost to the Principal shall reinstate them.

2.3 Sediment and Erosion Control Devices

Where shown on the Drawings or otherwise specified, sediment and erosion control devices shall be constructed and maintained. Unless the device is a permanent structure, it shall be removed when the areas above it have been stabilised.

2.4 Maintenance

All sediment and erosion control devices shall be maintained in a satisfactory working order throughout the Contract or until such time as the area above has been stabilised and the Superintendent directs that the device be removed.

The Contractor shall inspect the devices after each storm for structural damage or clogging by silt and other debris and make prompt repairs, replace or clean the devices as may be required.

All sediment deposited within ponded areas shall be periodically removed to a disposal area as directed by the Principal's Representative.

Gravel or other filter materials shall be cleaned and re-stacked or replaced when directed by the Superintendent to maintain effective performance.



2.5 Restoration of Disturbed Areas

Unless otherwise directed by the Principal's Representative the following principles shall be applied for the control of erosion and sedimentation

- ▶ Stabilisation of denuded areas shall commence within 30 days of the areas being disturbed
- ▶ All temporary earth diversion channels/banks and sediment basin embankments shall be seeded within 25 days of completion of their earthworks
- ▶ All stabilisation measures shall be undertaken prior to issue of the Certificate of Practical Completion



3 Earthworks

3.1 Scope of Work

The scope of works includes but is not limited to

- ▶ Bulk excavation to achieve nominated levels
- ▶ Removal of topsoil
- ▶ Removal of surplus or unsuitable materials from site in accordance with environmental engineers reports and advice
- ▶ Compaction of all subgrade elements
- ▶ Detailed excavation
- ▶ Preparation of a site management plan
- ▶ All activities and quality requirements associated with site regrading, cut and filling to achieve formation levels
- ▶ Excavation with batters/shoring as necessary, and disposal of existing fill and rock
- ▶ Removal and disposal of any existing services found

3.2 General

This section covers all minor earthworks likely to be encountered by the Civil Works contractor, including the proof rolling of road subgrade, removal of poor material and replacement with selected fill material etc

The Stage 3 contractor is required to carry out all bulk earthworks within the Stage 3 boundary. The contractor is required to interface with existing levels at the stage boundaries ensuring adequate drainage measures.

The Stage 3 pavement design and construction shall conform to Aus-Spec Pittwater edition available from Pittwater Council.

Refer to Pittwater Council Edition AUS-SPEC-1\NSW-C213 Earthworks for comprehensive specification requirements.

3.2.1 Aims

Responsibilities

General Provide earthwork surfaces for building, pavement and landscaping works that are as follows:

- ▶ In conformance with the level tolerances specified
- ▶ Have been tested by a NATA registered geotechnical testing authority at frequencies as specified in Section 3.2.10
- ▶ In conformance with the compaction requirements specified



3 2 2 Cross References

General

Conform to the *General requirements Pavements and Landscaping* work section

3 2 3 Interpretation

Definitions

- ▶ **General** For the purposes of this work section the definitions given below apply
- ▶ **Standard** To AS 1348
- ▶ **Description and classification of soils** To AS 1726
- ▶ **Bad ground** Ground unsuitable for the purposes of the works including fill liable to subsidence ground containing cavities faults or fissures ground contaminated by harmful substances and ground which is or becomes soft wet or unstable
- ▶ **Base** One or more layers of material usually constituting the uppermost structural element of a pavement and on which the surfacing may be placed which may be composed of fine crushed rock natural gravel broken stone stabilised material asphalt or Portland cement concrete
- ▶ **Discrepancy** A difference between contract information about the site and conditions encountered on the site including but not limited to discrepancies concerning the following
 - The nature or quantity of the material to be excavated or placed
 - Existing site levels
 - Services or other obstructions beneath the site surface
- ▶ **Line of influence** A line extending downward and outward from the bottom edge of a footing slab or pavement and defining the extent of foundation material having influence on the stability or support of the footings, slab or pavement
- ▶ **Rock** Monolithic material with volume greater than 0.5 m³ that cannot be removed until broken up either by explosives or by rippers or percussion tools
- ▶ The following classifications of excavation will be made when solid rock rock in ledges rock-hard cementitious aggregate deposits large boulders or other similar obstructions are encountered
 - Earth Excavation
 - Rock Excavation in Trenches and Pits
 - Rock Excavation in Open Excavations

"Earth Excavation" includes Removal and disposal of obstructions the extent of which is visible on ground surface Removal and disposal of underground structures and utilities the extent of which is indicated, reflected or referred to in the Contract Documents and Removal and disposal of earth and other materials encountered, of any classification except rock as defined below



"Rock Excavation in Trenches and Pits" includes Removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with a Caterpillar Model No 215C LC equipped with a short stick and a 1070 mm wide rock bucket, or equivalent modern, track-mounted power excavator rated at not less than 86 kW flywheel power and 142 kN drawbar pull, without prior drilling or blasting (Trenches in excess of 3 m in width and pits in excess of 9 m in either length or width will be classified as open excavation)

"Rock Excavation in Open Excavations" includes Removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with a Caterpillar Model No 973 or equivalent modern track-mounted heavy-duty excavating equipment rated at not less than 157 kW flywheel power and 183 kN breakout force (with rock bucket) without prior drilling blasting or ripping Intermittent drilling blasting or ripping performed to increase production and not necessary to perform the Work will be classified as earth excavation

- ▶ *Sub base* The material laid on the subgrade below the base either for the purpose of making up additional pavement thickness required, to prevent intrusion of the subgrade into the base or to provide a working platform
- ▶ *Subgrade* The trimmed or prepared portion of the formation on which the pavement or slab is constructed Generally taken to relate to the upper line of the formation

3 2 4 Geotechnical and Environmental Site Investigation

Reports

Geotechnical Surveys and Environmental Site Reports have been undertaken by Jeffery & Katauskas (Geotech) and GHD (Geotech & Environmental) These reports are supplied in electronic format as part of this specification

The geotechnical and environmental site investigation report provided is for information only The geotechnical information and information on contaminants given is information on the nature of the ground at each tested location It is not a complete description of conditions existing at or below ground level Any additional geotechnical investigation deemed necessary by the contractor to fully characterise the site shall be carried out at the contractor s expense

3 2 5 Notice

As Found Site Conditions

General If the following are encountered give notice immediately and obtain instructions before carrying out any further work in the affected area

- ▶ Bad ground (refer to definition above)
- ▶ Discrepancies
- ▶ Rock (refer to definition above)



- ▶ Springs seepages
- ▶ Topsoil > 100 mm deep

3 2 6 Records of Measurement

Excavation and Backfilling

Agreed quantities If a schedule of rates applies provisional quantities are specified or there are variations to the contract levels or dimensions of excavations, do not commence backfilling or place permanent works in the excavation until the following have been agreed and recorded

- ▶ Depths of excavations related to the datum
- ▶ Final plan dimensions of excavations
- ▶ Quantities of excavations in rock

Method of measurement To be by registered surveyor unless otherwise agreed

Rock

Level and class If rock is to be measured for payment purposes, whether as extra over excavation of material other than rock or for adjustment of provisional measurements, do not remove the rock until the commencing levels and the classes of rock have been determined

3 2 7 Provisional Depths

Contract Depths

General The footing or pier depths shown on the drawings are provisional

3 2 8 Explosives

General

Do not use explosives

3 2 9 Inspection

Notice

Inspection Give sufficient notice (minimum 24 hours) so that inspection may be made of the following

- ▶ Items to be measured as listed in *Records of measurement*
- ▶ Areas to be cleared and/or stripped of topsoil
- ▶ Areas stripped of topsoil
- ▶ Excavation completed to contract levels or founding material
- ▶ Proof roll subgrade prior to placing fill



- ▶ Filling completed to contract levels
- ▶ Stockpiled topsoil before spreading

3 2 10 Tests

Geotechnical Testing Authority

General Use a NATA registered geotechnical testing authority

Compaction Control Tests

Compaction control tests To AS 1289 5 4 1 or AS 1289 5 7 1

Compaction Control Test Frequency

Standard To AS 3798 Table 8 1

Site area > 1500 m² At least (whichever requires the most tests)

- ▶ 1 test per layer or 200 mm thickness per material type per 2500 m²
- ▶ 1 test per 500 m³ distributed evenly throughout full depth and area
- ▶ 3 tests per visit

Site area 500 – 1500 m² At least (whichever requires the most tests)

- ▶ 1 test per layer or 200 mm thickness per 1000 m²
- ▶ 1 test per 200 m³ distributed evenly throughout full depth and area
- ▶ 1 test per allotment per layer

Site area < 500 m² At least (whichever requires the most tests)

- ▶ 1 test per layer or 200 mm thickness per 500 m²
- ▶ 1 test per 100 m³ distributed evenly throughout full depth and area
- ▶ 3 tests per visit

Confined operations 1 test per 2 layers per 50 m²

Imported Fill Tests

Imported fill Standard Indicator and CBR tests

3 2 11 Submissions

Tests

Imported fill Submit certification or test results that establish the compliance of imported fill with the contract

Compaction Submit certification and/or test results in accordance with the specified level of responsibility to AS 3798

Materials

General Submit details of materials proposed, including the following



- ▶ Sources of imported fill

Execution

General Submit the methods and equipment proposed for groundwork including the following

- ▶ Dewatering and groundwater control and disposal of surface water
- ▶ Excavation methods stages clearances batters and temporary supports
- ▶ Stockpiles and borrow pits
- ▶ Placing and compaction methods and stages

3 2 12 Tolerances

Tolerances

Finish Finish the surface to the required level grade and shape within the following tolerances

- ▶ Under building slabs and load bearing elements + 0 -25 mm
- ▶ Pavement subgrades + 0 - 40 mm
- ▶ Batters No steeper than the design slope Flatter slopes shall not impact on boundaries or required clearances to buildings pavements or landscaping
- ▶ Other ground surfaces ± 50 mm, provided the area remains free draining and matches adjacent construction where required Provide smoothness as normally produced by a scraper blade

3 3 Material for Filling

3 3 1 General

Fill shall be defined as material placed at or above the soil surface existing at the beginning of construction operations or after the removal of topsoil where applicable

Material placed in free standing embankments and an embankment constructed around foundations and structures is designated herein as fill

Backfill shall be defined as material placed in excavations below the soil surface existing at the beginning of construction operations or after the removal of topsoil where applicable

Given standard sieve sizes for testing are 75mm and 125mm the maximum size particles in fill materials shall be 75mm rather than the 100mm specified in AUS-SPEC-1\NSW-C213 30

Fill and backfill shall preferably be a granular material and where possible shall comprise sand and broken rock less than 75mm gauge removed from excavations on site unless specified otherwise



Other soils removed from excavations may be used, subject to compliance with the Specification in locations where their properties are compatible with the desired properties of the fill and/or backfill

During earthworks operations various classes of soil shall be handled and stockpiled separately in accordance with the specified classifications

3 3 2 Approved Fill

"Approved fill" shall be defined as sand soil or broken rock obtained from excavations or approved borrow areas. All imported fill material shall be certified as VENM material (as defined in the NSW EPA's Environmental Guidelines Assessment, Classification and Management of Liquid and Non-Liquid Wastes (1999) by a qualified certifier and the written certification is to be presented to the Superintendent prior to placement of fill. Any material placed that is not certified as VENM is to be removed from site at the contractor's cost.

"Approved Fill" material shall

- ▶ Not be used until approved and certified by the Contractor,
- ▶ Be free of material greater than 75mm in size,
- ▶ Contain not more than 2% organic matter
- ▶ Be certified that it is adequate to meet the required strength and geotechnical parameters,
- ▶ Be free of any deleterious materials or chemical contaminants, and
- ▶ Be capable of being brought to a moisture content suitable for compaction as specified elsewhere herein under the weather conditions prevailing on Site
- ▶ Be used up to 300mm below the sub grade level of a pavement structure

3 3 3 Moisture Conditioning of Filling Materials

Fill is to be compacted at a moisture content of +/- 2% of Standard Optimum Moisture Content. Strict adherence to this range is required.

Soils with a moisture content greater than the specified compaction range should be removed and replaced with complying material.

Soils with a moisture content less than the specified compaction range must have water added from a water tanker prior to and during the compaction process.

3 3 4 Selected Fill

"Selected fill" shall be defined as material or mixtures of materials which is

- ▶ Free of rock fragments greater than 75mm in size
- ▶ Free of clay lumps retained on a 75mm sieve
- ▶ Free of organic matter



- ▶ Within the following grading requirements

Sieve Size	% Passing by Weight
75mm	100
26 5mm	50 - 100
4 75mm	25 - 75
0 425mm	10 - 50
0 075mm	0 - 20

- ▶ Non-plastic in that the fraction passing 0 425 mm has a Plasticity Index of not greater than 15

Capable of being brought to a moisture content suitable for compaction as specified elsewhere herein under the weather conditions prevailing on site

Reuse of Material Recovered From Excavation

As far as is practical the Contractor is encouraged to reuse material on the site

3 3 5 Stabilisation

Any works consisting of the supply and incorporation of stabilising binders with a material in a nominates pavement course or subgrade layer including the spreading compaction trimming and curing of such materials shall be carried out in accordance with Pittwater Council Edition AUS-SPEC-1\NSW-C241 Stabilisation

3 4 Execution

3 4 1 Removal of Topsoil

General

Extent Areas to be cut and areas to be filled and areas to be occupied by structures pavements embankments and the like

Reuse of Removed Topsoil

General Re-use of removed topsoil To be in accordance with requirements of the Landscape Specification for topsoil

Topsoil Stockpiles

General Stockpile site topsoil intended for re-use and imported topsoil where necessary The maximum height of stockpiles shall not exceed 2 5m and the maximum batter slope shall not exceed 2h 1v Provide adequate drainage and erosion protection Do not burn off or remove plant growth that may occur during storage Do not allow traffic on stockpiles If a stockpile is to remain for more than four weeks sow with temporary grass Protect the topsoil stockpiles from contamination by other excavated material weeds and building debris



Disposal of Excess Topsoil

General Remove excess topsoil from the site and dispose of legally

3 4 2 Excavation

Extent

Site surface Excavate over the site to give correct levels and profiles as the basis for construction pavements filling and landscaping Make allowance for compaction or settlement

Footings Excavate for footings, pits wells and shafts, to the required sizes and depths Confirm that bearing capacity is adequate

Crawl space Provide clear space under timber floor bearers

- ▶ Minimum clearance 400 mm

Proof Rolling

Extent Proof-roll excavations for pavements filling and non-spanning slabs on ground to determine the extent of any bad ground

Proof rolling method Proof rolling shall be carried out on all prepared fill and non-rock surfaces prior to filling and on placed fill once finished level is reached Proof rolling shall be carried out using a static smooth-drum roller with a mass of not less than 3t per linear metre on the drum and shall comprise a minimum of 2 passes of such a roller

Proof rolling shall be deemed acceptable if no perceptible transient or permanent deformation is observed during the operation

Rock Excavation

General Excavate the ground as found shape to allow free drainage of water off the rock surface (ie preventing perched water) No additional payment will be made for rock excavation

Disposal of Excess Excavated Material

General Remove excess excavated material from the site and dispose of legally

3 4 3 Subgrades Affected by Moisture

Compliance Requirement To AUS-SPEC-1\NSW-C213 36

General

General Where the subgrade is unable to support construction equipment or it is not possible to compact the overlying pavement only because of high moisture content, perform one or more of the following

- ▶ Allow the subgrade to dry until it will support equipment and allow compaction
- ▶ Scarify the subgrade to a depth of 150 mm work as necessary to accelerate drying, and recompact when the moisture content is satisfactory



- ▶ Excavate the wet material and remove to spoil and backfill excavated areas

3 4 4 Bearing Surfaces

General

General Provide even plane bearing surfaces for load bearing elements including footings Step to accommodate level changes Make the steps to the appropriate courses if supporting masonry

Deterioration

General If the bearing surface deteriorates because of water or other cause, excavate further to a sound surface before placing the load-bearing element

3 4 5 Reinstatement of Excavation

General

General Where excavation exceeds the required depth or deteriorates reinstate to the correct depth level and bearing value

Particular

Below slabs or pavements Provide selected filling compacted to the specified density in cut subgrades if the over excavation is less than 100 mm, do not backfill but make good by increasing the thickness of the layer above Backfill rock depressions and over excavation of subsoil drains using coarse subsoil filter

3 4 6 Supporting Excavations

Removal of Supports

General Remove temporary supports progressively as backfilling proceeds

Voids

General Guard against the formation of voids outside sheeting or sheet piling if used Fill and compact voids to a dry density similar to that of the surrounding material

3 4 7 Adjacent Structures

Temporary Supports

General Provide supports to adjacent structures where necessary sufficient to prevent damage arising from the works

Lateral supports Provide lateral support using shoring

Vertical supports Provide vertical support where necessary using piling or underpinning or both



Permanent Supports

General If permanent supports for adjacent structures are necessary and are not described give notice and obtain instructions

Encroachments

General If encroachments from adjacent structures are encountered and are not shown on the drawings, give notice and obtain instructions

3 4 8 Preparation for Filling

General

General Prepare the ground surface before placing fill (including topsoil fill) ground slabs or load bearing elements Shape to assist drainage Remove materials that will inhibit or prevent satisfactory placement of fill layers, loose material debris and organic matter Compact the ground exposed after stripping or excavation in conformance with the Compaction schedule

Benching

General If fill is to be placed on a surface that slopes more than 1V 4H bench the surface to form a key for the fill As each layer of fill is placed, cut the existing ground surface progressively to form a series of horizontal steps in a minimum 3H 1V ratio, with a minimum step width of 1m Recompact the excavated material as part of the filling Shape to provide free drainage

Under Earth Mounds

General Cultivate the ground to a depth of 200 mm before mound formation

Under Slabs, Paving and Embankments

General Compact the ground to achieve the densities specified in the Compaction schedule If necessary loosen the ground to a depth of > 200 mm and adjust the moisture content before compaction to a density consistent with subsequent filling

Rock Ledges

General Remove overhanging rock ledges

3 4 9 Placing Fill

General

Layers Place fill in near-horizontal layers of uniform thickness, deposited systematically across the fill area

Extent Place and compact fill to the designated dimensions levels grades, and cross sections so that the surface is always self-draining

Edges At junctions of fill and existing surfaces do not feather the edges Where placement is to be undertaken adjacent to previously placed fill the previously placed



fill should be cut back a minimum of 300mm and the new placement extended to fill this area

Mix Place fill in a uniform mixture

Previous fill Before placing subsequent fill layers ensure that previously accepted layers still conform to requirements including moisture content

Protection Protect the works from damage due to compaction operations Where necessary limit the size of compaction equipment or compact by hand Commence compacting each layer at the structure and proceed away from it

Protective covering Do not disturb or damage the protective covering of membranes during backfilling

Placing at Structures

General Place and compact fill in layers simultaneously on both sides of structures culverts and pipelines to avoid differential loading Carefully place first layers of fill over the top of structures

Concrete Do not place fill against concrete until the concrete has been in place for 21 days unless struts support the structure or 85% of the design concrete strength is achieved

3 4 10 Compaction Requirements for Fill and Subgrade

Density

General Compact the subgrade and each layer of fill to the required depth and density, as a systematic construction operation and to conform to AUS-SPEC-1\NSW-C213 36

Shape surfaces to provide drainage and prevent ponding

Excavated and stripped ground surface After excavation and/or stripping these surfaces should also be compacted in conformance with the Compaction table to a minimum depth of 150 mm

Maximum rock and lump size in layer after compaction 2/3 compacted layer thickness

Fill batter faces Either compact separately or overfill and cut back Form roughened surfaces to the faces

Moisture Content

General Adjust the moisture content of fill during compaction within the range of $\pm 2\%$ of optimum moisture content determined by AS 1289 5 1 1 or AS 1289 5 2 1 as appropriate in order to achieve the required density

3 4 11 Grading

External Areas

General Grade to give falls away from buildings, minimum 1 100



Particular Pavement grading to be a minimum of 1 100

3 4 12 Completion

Protection and Repair

Protection Protect from damage the trees and shrubs to be retained including those beyond the site area, both above and belowground

Repair Repair trees damaged during the work

Temporary Works

Tree enclosures Remove temporary tree enclosures at completion

Tree marking Remove temporary marks and tags at completion

Temporary supports Remove temporary supports to adjacent structures at completion

Records

Certified records of measurement Submit a certified copy of the agreed records of measurement

Construction Records

General Submit the following

- ▶ Geotechnical site visit record, and
- ▶ Earthworks summary report or daily geotechnical reports

Content At least the following

- ▶ The areas in which fill is placed
- ▶ Levels after stripping
- ▶ Location of any trees or large shrubs that may have been removed
- ▶ Materials exposed after stripping and the criteria upon which the decision to cease stripping was made
- ▶ Levels after completion of the filling
- ▶ Types of fill materials in various zones
- ▶ Location and level of each compliance test together with test results State if a test is a retest of an area that was previously rejected
- ▶ Action taken where testing indicated that the specified criteria had not been met
- ▶ Any areas where fill material or compaction was to be of a greater or lesser standard than elsewhere on site

Format To AS 3798 Appendix B



3 4 13 Site Restoration

Requirement

General Where existing ground surfaces are not required to be varied as part of the works restore them to the condition existing at the commencement of the contract



4 Flexible Pavement

4.1 Scope of Work

The scope of work includes but is not limited to

- ▶ Design and construction of a flexible pavement for the proposed Stage 3 access road and street parking facilities in accordance with this Specification
- ▶ The pavement shall be designed for a design life of 25 years
- ▶ The work consists of the supply spreading, compaction and trimming of required pavement structure to design levels and thicknesses

4.2 General

The Stage 3 pavement design and construction shall conform to Aus-Spec Pittwater Council latest edition available from Pittwater Council

Refer to Pittwater Council Edition AUS-SPEC-1\NSW-C242 Flexible Pavements for comprehensive specification requirements

4.2.1 Aims

Responsibilities

General Provide base and sub base courses that are as follows

- ▶ In conformance with the tolerances specified
- ▶ Tested by a geotechnical testing authority
- ▶ In conformance with the compaction requirements specified

4.2.2 Cross References

General

General Conform to the *General Requirements* worksection

Aus-Spec Pittwater Council Specifications

AUS-SPEC-1\NSW-C241	Stabilisation
AUS-SPEC-1\NSW-C244	Sprayed Bituminous Surfacing
AUS-SPEC-1\NSW-C245	Asphaltic Concrete

4.2.3 Interpretation

Definitions

General For the purposes of this worksection the definitions given below apply



- ▶ Standard To AS 1348
- ▶ Absolute level tolerance Maximum deviation from design levels
- ▶ Relative level tolerance Maximum deviation from a 3 m straight edge laid on the surface

4 2 4 Inspection

Inspection sampling and testing of the pavement shall be undertaken by the Contractor in accordance with the requirements of Council Specification AUS-SPEC-1\NSW-C242 before during and after the construction of the pavement

Notice

Inspection Give sufficient notice so that inspection may be made of the following

- ▶ Prepared subgrade
- ▶ Proof rolling of subbase prior to spreading of base
- ▶ Proof rolling of base prior to sealing

4 2 5 Tests

Testing shall be carried out by a NATA registered laboratory with appropriate accreditation and suitably qualified personnel

Compaction Control Tests

Standard To AS 1289 5 4 1 and AS 1289 5 4 2

4 2 6 Submissions

Proposed Design

At least 15 days before commencing flexible pavement work the Contractor shall submit to the Superintendent for approval details of the proposed flexible pavement design for the work together with a certification that the nominated materials for the work meet the requirements of the Specification

The Contractor shall submit details of all constituents of the proposed base and subbase materials including sources of supply and the proposed type and proportion of any binder These details shall be submitted to the Superintendent supported with test results from a nominated NATA registered laboratory confirming that the constituents comply with the requirements of this Specification If the proposed base or subbase is a bound material the Contractor shall submit a completed Annexure C241A contained in the AUS-SPEC-1\NSW-C241 Stabilisation

Frequency of Compaction Control Tests

General Not less than the following (whichever requires the most tests)

- ▶ 1 test per layer per 25 lineal metres for 2-lane roads
- ▶ 1 test per layer per 1000 m² for carparks



- ▶ 3 tests per layer
- ▶ 3 tests per visit

Standard To AS 3798 Table 8 1

Source of material State the supplier name nature of material (crushed rock natural gravel, recycled etc) and source quarry or recycling site

Compliance of material Provide certification and test results from a NATA registered laboratory confirming that the material complies with the requirements of the specification

Execution

General Submit proposals for the methods and equipment to be used for the roadworks including the following

- ▶ Staging of the work access and traffic control methods
- ▶ Disposal of surface water control of erosion contamination and sedimentation of the site, surrounding areas and drainage systems
- ▶ Methods and equipment for each operation
- ▶ Sources of materials
- ▶ Material stockpiles

Compaction If it is proposed that a layer is to exceed 150 mm in thickness submit evidence demonstrating that the proposed compaction equipment can achieve the required density throughout the layer

4 3 Products

4 3 1 Base and Subbase Material

General

Compliance Base and Subbase materials shall comply with the compliance table below

Table 1 Base and Subbase Compliance

Course	Source	Compliance requirement
Base	Crushed rock or natural gravel	To AUS-SPEC-1\NSW Tables C242 1 C242 2, C242 3
Subbase	Crushed rock or natural gravel	To AUS-SPEC-1\NSW Tables C242 1 C242 2 C242 4



4 4 Execution

4 4 1 Subgrade Preparation

General

General Subgrade preparation to be undertaken in accordance with the *Earthwork* worksection

4 4 2 Tolerances

Width of Pavement

The tolerances table below apply to the width of pavement

Table 2 Width of Pavement

Item	Compliance requirement
Design centre-line to edge of constructed pavement	To AUS-SPEC-1\NSW-C242 22(b)
Average Width	To AUS-SPEC-1\NSW-C242 22(b)

Surface Level

General Provide a finished surface that is free draining and evenly graded between level points

Tolerances The tolerances in the Surface level tolerances table apply to the finished level of each layer unless overridden by the requirements (including tolerances) for the finished level and thickness of the wearing course

Table 3 Surface Level Tolerances

Item	Compliance requirement
Subbase levels	To AUS-SPEC-1\NSW-C242 22(c)
Base levels	To AUS-SPEC-1\NSW-C242 22(c)
Base levels adjacent to Kerb and Gutter	To AUS-SPEC-1\NSW-C242 22(c)
Shape	To AUS-SPEC-1\NSW-C242 22(c)



4 4 3 Subbase and Base Compaction

General

General Compact each layer of fill to the required depth and density as a systematic construction operation and to conform to the minimum relative compaction table

Table 4 Minimum Relative Compaction

Item	Compliance requirement
Minimum value of all calculated relative compaction results	To AUS-SPEC-1\NSW-C242 20

Unstable areas Any unstable areas which develop during rolling or are identified by proof rolling shall be removed for the full depth of the layer and disposed of and replaced with fresh material. Materials used as replacement materials shall comply with the requirements of the specification. The placing and compaction of the replacement materials shall also comply with the requirements of the specification.

Compaction Requirements

General Apply uniform and sufficient compactive effort over the whole area to be compacted. Use rollers appropriate to the materials and compaction requirements.

Moisture Content

General When spread for compaction processes the moisture content of the base or subbase materials shall be in the range of 60-90 per cent of laboratory optimum moisture content in accordance with AS 1289 5 2 1.

Spraying Maintain moisture content. Use water spraying equipment capable of distributing water uniformly in controlled quantities over uniform lane widths.

Rectification

General If a section of pavement material fails to meet the required density or moisture content after compaction remove the non-complying material, replace with fresh material and recompact.

Level Corrections

General Rectify incorrect levels as follows

- ▶ High areas Grade off
- ▶ Low areas Remove layers to a minimum depth of 75 mm, replace with new material and recompact



4 4 4 Placing Base and Subbase

General

Weak surfaces Do not place material on a surface which has been so weakened by moisture that it will not support without damage the constructional plant required to perform the work

Spreading Spread material in uniform layers without segregation

Moisture content Maintain wet mixed materials at the required moisture content before and during spreading Add water to dry mixed materials through fine sprays to the entire surface of the layer after spreading to bring the material to the required moisture content

Layer thickness The thickness of each compacted layer shall be neither less than 100mm nor more than 200mm for all pavement layer types (after compaction) Provide equal layers in multilayer courses

Joints

General Plan spreading and delivery to minimise the number of joints Offset joints in successive layers by at least 300mm

Final Trimming

General Trim and grade the base course to produce a tight even surface without loose stones or a slurry of fines



5 Sprayed Bituminous Surfacing

5.1 Scope of Work

The scope of work includes but is not limited to,

- ▶ Design and construction of sprayed bituminous surfacing for the proposed Stage 3 access road and street parking facilities in accordance with this Specification
- ▶ The work consists of the supply of all materials and the application of any or all of the following types of sprayed bituminous surfacing as required under the Contract
 - Prime
 - Primerseal
 - Seal or Reseal

5.2 General

The Stage 3 sprayed bituminous surfacing design and construction shall conform to Aus-Spec Pittwater edition, available from Pittwater Council

Refer to Pittwater Council Edition AUS-SPEC-1\NSW-C244 Sprayed Bituminous Surfacing for comprehensive specification requirements

5.2.1 Cross References

General

General Conform to the following work sections

- *General Requirements*

Council Specifications

AUS-SPEC-1\NSW-C242	Flexible Pavement
AUS-SPEC-1\NSW-C261	Pavement Markings
AUS-SPEC-1\NSW-C262	Signposting

5.2.2 Interpretation

Definitions

General For the purposes of this work section the definitions given below apply

Standard To AS 1348

Absolute level tolerance Maximum deviation from design levels

Relative level tolerance Maximum deviation from a 3 m straightedge laid on the surface



5 2 3 Inspection

Notice

Inspection Give sufficient notice so that inspection may be made of the following

- ▶ Surfaces prepared for priming sealing or surfacing
- ▶ Commencement of bituminous spraying

5 2 4 Tests

General

Standards Testing of materials shall be in accordance with the relevant materials standards referred to in this specification by a NATA registered laboratory

5 2 5 Samples

General

Standards Sampling of materials shall be in accordance with the relevant materials standards referred to in this specification by a NATA registered laboratory

5 2 6 Submissions

Proposed Design

At least 15 days before commencing sprayed bituminous surfacing work the Contractor shall submit to the Superintendent for approval details of the proposed bituminous surfacing design for the work together with a certification that the nominated materials for the work meet the requirements of the Specification

Tests

Compliance assessment If compliance assessment tests are to be carried out by an independent testing authority,- submit 3 copies of each test result

Certificate of compliance If a certificate of compliance is acceptable as an alternative to testing a manufactured material submit the manufacturer s certificate together with the results of recent tests undertaken by the manufacturer, showing compliance with test criteria

Execution

General Submit proposals for the methods and equipment to be used for the roadworks including the following

- ▶ Staging of the work access and traffic control methods
- ▶ Disposal of surface water control of erosion contamination and sedimentation of the site surrounding areas and drainage systems
- ▶ Methods and equipment for each operation
- ▶ Sources of materials



► **Material stockpiles**

Spraying equipment Submit a current certificate and calibration chart issued by the state road authority

Hand spraying If intended submit proposals

Spraying Submit proposals for start finish and width of each spray run

Records of Measurement

Records Submit certified records of work performed

5 3 Products

5 3 1 Materials

Material Grades

Bitumen To AS 2008 Class 170

Bitumen emulsion To AS 1160

Cut back bitumen To AS 2157

Cover Aggregate

Standard To AS 2758 2

- Precoating agent Precoating agents shall be capable of satisfying plate stripping tests The percentage of stripping shall not exceed 10% in accordance with AS 1141 50 Also refer to RTA 3258

5 3 2 Measuring Materials

Bitumen and Cutter

General Measure by volume at 15°C

Temperatures higher than 15°C Use the *Bitumen volume conversion formula* for primers and binders, where T is the temperature of the material at which the volume has been measured For calculation purposes, assume that the conversion factors are the same for bitumen, bituminous mixes and cutter

Bitumen volume conversion formula

Volume at 15°C = Volume at T°C x (1-(T-15)/1667)

5 4 Execution

5 4 1 Tolerances

Limits and tolerances shall comply with Table C244 29 Pittwater Council Refer to Pittwater Council Edition AUS-SPEC-1\NSW-C244 Sprayed Bituminous Surfacing for comprehensive specification requirements



Finished Levels

General Provide a finished surface that is free draining and evenly graded between level points

Edges abutting gutters Within ± 5 mm of the level of the actual gutter edge

5 4 2 Precoating

Compliance Requirement

To AUS-SPEC1 Section C244 10

General

General Precoat sealing aggregates immediately before the aggregate is loaded into the spreader trucks

7 mm cover aggregate Precoat at least 48 hours in advance of spreading

Preconditions

General Prime and seal in dry and reasonably calm weather on a dry pavement surface at a temperature of at least 15°C

Application

General Apply precoating agent thinly and evenly using a fine pressure spray to a moving stream of aggregate, or by other suitable means so that particles are fully coated but without excess material

Wet aggregate If the aggregate is too wet to precoat or contains enough moisture to cause uneven distribution of the precoating agent dry the aggregate by turning the stockpile over Do not provide precoated aggregate containing moisture until the moisture has evaporated and the precoating agent has adhered efficiently

Application rate In the range 3 – 10 L/m³ of aggregate

5 4 3 Cutting Bitumen

Generally

Temperature Heat sufficient bitumen for immediate needs only Do not keep the material at spraying temperature for longer than 10 hours Do not reheat

Mixing and Heating (on site)

General Heat the bitumen at a rate not exceeding 40°C/h and circulate cutback bitumen for 20 minutes to ensure thorough mixing

Heating Devices

General Use devices capable of uniform heating without damaging bituminous materials



5 4 4 Spraying Equipment

Hand Spraying

Areas not accessible to the mechanical sprayer Spray using hand spray equipment attached to the mechanical sprayer

5 4 5 Preparation for Spraying

Cleaning

General Immediately before spraying remove loose and foreign material on the finished base surface including dust debris and sand spread on primed surfaces, and until a mosaic of well-embedded stone shows on the surface Keep traffic off the cleaned surface

Method Use suitable power blowers or power brooms (or using hand methods where inaccessible to the power equipment)

Potholes

General Trim to a regular shape and a uniform depth of at least 75 mm Tack coat the sides and patch with a suitable bituminous premix, sanded after completion Allow sufficient time for the premix to cure before spraying the surface

5 4 6 Spraying Operations

Protection

General Protect adjacent surfaces during spraying Place drip trays under spray bars when the sprayer is stationary Clean bituminous materials from adjacent surfaces or, if this is not possible replace and make good the surface Protect freshly sprayed surfaces from contamination

Spraying

General Completely and uniformly cover the surface to be treated Prevent the spray overlapping previously treated areas except that where part-width spraying is used, lap the longitudinal joint between adjacent runs by 50 mm

Priming

General Prime the granular pavement to achieve and maintain a strong bond between granular surface and pavement treatment seal

Dry-back

Dry-back granular pavement to at least 70% of Optimum Moisture Content prior to priming

Edges At underbed edges extend the primer 150 mm beyond the edge of the seal



Sealing and Primersealing

Process Allow at least 3 days between priming and sealing and between first and second seals Incorporate the first course of aggregate thoroughly into the binder before a second course is applied Remove loose particles from the sealed area by sweeping lightly, without disturbing embedded aggregate

Spraying temperature ranges

Table 5 Bitumen Temperature Requirements

Material	Compliance requirement
Bitumen	To AUS-SPEC-1\NSW Table C244 1
Cutback Bitumen	To AUS-SPEC-1\NSW Table C244 2

Application Rates

General The Contractor s design rates of application of binder for priming and binder and aggregate for primersealing/sealing shall be in accordance with Austroads design procedures for sprayed seals

5 4 7 Placing Cover Aggregate

Compliance Requirement

To AUS-SPEC-1\NSW-C244 19

Placing Cover Aggregate

Spreading Immediately after the binder or primerbinder has been sprayed cover with a uniform layer of dry aggregate

Rolling Immediately after spreading roll and drag broom the area until it is uniformly covered with aggregate thoroughly embedded in the binder Roll uniformly over the whole area Complete rolling as soon as possible but not later than 3 days after spraying

Loose Aggregate

General When the aggregate has been evenly spread and embedded remove loose particles remaining on the pavement and apply additional aggregate as required

Surface Finish

General Provide an even smooth riding and free draining surface

5 4 8 Defective Surfacing

Primer

Actual rate of application < 90% of that ordered Make up the deficiency with a second spray run

Actual rate of application > 110% of that ordered Cover the surface with sand



Binder and Primerbinder

Actual rate of application < 90% or > 110% of that ordered Reseal the surface

Minimum Criteria for Retention

Actual rate of application 90 – 110% of that ordered

5 4 9 Junctions with Existing Pavements

Junctions with Existing Pavements

Pavement base Protect using a suitable temporary seal or primerseal

Primed surface Keep traffic off the primed surface for at least 3 days after spraying

Commence sanding 4 – 24 hours after spraying

5 4 10 Completion

Traffic on Pavement

Notice Give notice before opening the pavement to traffic before the work is completed Provide adequate means of protection



6 Asphaltic Concrete

6.1 Scope of Work

The scope of work includes but is not limited to

- ▶ Design and construction of asphaltic concrete for the proposed Stage 3 access road and street parking facilities in accordance with this Specification
- ▶ The work consists of the design, production and placing of asphalt including the supply of materials, sampling, testing and any other operations necessary to provide asphaltic concrete in accordance with the provisions of the Contract

General

The Stage 3 pavement design and construction shall conform to Aus-Spec Pittwater Council latest edition, available from Pittwater Council.

Refer to Pittwater Council Edition AUS-SPEC-1\NSW-C245 Asphaltic Concrete for comprehensive specification requirements.

6.1.1 Aims

Responsibilities

General: Provide a finished surface that is as follows:

- ▶ Free draining and evenly graded between level points
- ▶ Even and smooth riding

Standards

Asphalt (hot-mixed): Follow the guidance in AS 2734.

Tolerances

General: Conform to the level tolerances table below.

Table 6 Asphaltic Concrete Level Tolerances

Tolerance	Compliance requirement
Course Thickness	To AUS-SPEC-1\NSW Table C245 10
Course Levels	To AUS-SPEC-1\NSW Table C245 11
Deviation from 3m Straightedge	To AUS-SPEC-1\NSW Table C245 12



6 1 2 Cross References

General

Conform to the following sections

- *General Requirements*

6 1 3 Interpretation

Definitions

General For the purposes of this work section the definitions given below apply

- ▶ Absolute level tolerance Maximum deviation from design levels
- ▶ Relative level tolerance Maximum deviation from a 3 m straightedge laid on the surface
- ▶ Relative compaction The ratio between the field bulk density and the bulk density of the job mix when compacted in the laboratory

6 1 4 Inspection

Notice

Inspection Give sufficient notice so that inspection may be made of the following

- ▶ Surface prepared for priming sealing or asphalt surfacing
- ▶ Commencement of asphalt surfacing
- ▶ Completion of asphalt surfacing

6 1 5 Tests

General

Tests Perform tests of the type and frequency necessary to adequately control the materials and processes used in the construction of the works and in conformance with the tests tables Refer to Section C245 14 to Section C245 18 of the Pittwater Council Edition AUS-SPEC-1\NSW-C245 Asphaltic Concrete for sampling and testing

Process Control Tests

Records Show the results of process control tests on control charts or graphs displayed on site in a readily accessible location and updated daily

Methods Use wet preparation methods where applicable

Sampling Determine timing and location

Compliance Assessment Tests

Timing Obtain materials samples at the time of delivery to the site



Location Sample from selected sample sites within designated uniform test lots consisting of an area placed, or compacted or both in one day Test lots must be uniform in terms of material properties and density

Mix Properties

General Take samples from trucks at the mixing plant and test for mix properties using one of the following methods as applicable

- ▶ Marshall stability of compacted mix
 - Compactive effort 50 blows

Variations in Mix Properties

General Ensure that the maximum variation between the mix property of each sample and the job mix value conforms to AUS-SPEC-1\NSW Table C245 4 and C245 5

Compaction Tests

Density tests Perform a field bulk density test for each test site from either of the following

- ▶ On a core sample taken from the asphalt surfacing layer
- ▶ If the nominal layer thickness is ≥ 50 mm, measured in situ using a nuclear gauge

Sample preparation To AS 2891 2 1 and AS 2891 2 2 as applicable

General Conform to the compaction limits and level tolerances as in table below

Table 7 Compaction Limits/Tolerances

Compaction Activity	Compliance requirement
Dense Graded Asphalt	To AUS-SPEC-1\NSW C245 26
Open Graded Asphalt	To AUS-SPEC-1\NSW C245 27
Acceptance Criteria for Compaction Finished Pavement	To AUS-SPEC-1\NSW C245 28
Thickness	To AUS SPEC-1\NSW C245 30
Shape	To AUS-SPEC-1\NSW C245 32

6 1 6 Submissions

Products – Documentation

Certificate of compliance As an alternative to testing a product submit the manufacturer s certificate together with the results of recent tests undertaken by the manufacturer showing conformance with test criteria



Products – Proposals

General Submit the following details before commencing production

- ▶ Combined aggregate particle size distribution
- ▶ Binder content expressed as a percentage of the total mix
- ▶ The filler content expressed as a percentage by mass of the combined aggregates
- ▶ The asphalt mix properties
- ▶ The proposed mixing temperature

Products – Samples

Samples Submit samples of the following at least one month before use

- ▶ Granular materials One 50 kg sample of each proposed type and size of asphalt aggregate and cover aggregate

Identification Attach a tag to each sample showing relevant information including description source and nominal size of material

Execution – Proposals

General Submit proposals for the methods and equipment to be used including the following

- ▶ Staging of the work access and traffic control methods
- ▶ Disposal of surface water control of erosion, contamination and sedimentation of the site surrounding areas and drainage systems
- ▶ Methods and equipment for each operation
- ▶ Sources of materials
- ▶ Material stockpiles

6 2 Products

Asphalt

Standards

- ▶ Hot mix asphalt To AS 2150
- ▶ Medium cut back bitumen To AS 2157 containing no fluxing oil
- ▶ Tack coat mix 3 2 bitumen emulsion water
- ▶ Bitumen emulsion To AS 1160
 - Designation CRS/170-60

Aggregate

Description To be clean sound hard angular of uniform quality free from deleterious matter in conformance with the Aggregate properties table

Standard To AS 2758 5



Crushed slag To be air-cooled blast furnace slag of uniform quality generally free from vesicular glassy or other brittle pieces

Fine aggregate To be clean sound hard durable particles of natural sand or particles derived from crushed stone gravel or slag, free from injurious coating or particles of clay silt loam or other deleterious matter

Table 8 Aggregate Properties (Course and Fine Aggregate)

Property	Compliance requirement
Wet strength	To AUS-SPEC-1\NSW C245 08(a)
Wet/dry strength variation	To AUS-SPEC-1\NSW C245 08(a)
Particle shape	To AUS-SPEC-1\NSW C245 08(a)
Fractured Faces	To AUS-SPEC-1\NSW C245 08(a)
Polished Aggregate Friction Value	To AUS-SPEC-1\NSW C245 08(a)

Binder

Compliance Requirement To AS2008

Compliance Requirement for Polymer Modified Binder To AUS-SPEC-1\NSW-C245 10(c)

Asphalt Mix

Compliance Requirement To AUS-SPEC-1\NSW-C245 14 Table C245 2 Table C245 3

6 3 Execution

6 3 1 Preparation

Cleaning

General Immediately before priming or tack coating remove loose stones dust and foreign material from the base surface using a power broom or blower Keep traffic off the cleaned surface

Priming

General Prime the base surface as soon as possible after compaction and finishing

Potholes

General Trim to a regular shape and a uniform depth of at least 75 mm tack coat the edges and patch with asphaltic concrete



6 3 2 Surfacing

Protection

General Protect adjacent surfaces during spraying Protect freshly sprayed surfaces from contamination

Tack Coating

General Apply tack coat 30 – 120 minutes before asphalt surfacing is placed

Compliance Requirement To AUS-SPEC-1\NSW- Section C245 22

Spreading

Minimum Asphalt Temperatures for Laying To AUS-SPEC-1\NSW-Table C245 8

Operations Spread the mix in layers covering the full width of the pavement or in the case of carriageways and wide pavements, in lanes of minimum width 3 m Place layers in adjoining lanes to the same compacted thickness

Abutting Structures

General Place asphalt surfacing to match the level of abutting surfaces such as kerbs gutters edge strips manholes, or adjoining pavement in the same manner as for longitudinal and transverse joints Fill spaces left unfilled between the spreader run and abutting edges with sufficient material to the proper height before compaction

Matched Junctions

General If asphalt surfacing is to match an existing pavement bridge deck rail or other fixture place the material to provide a smooth riding surface across the junction Where necessary remove sufficient of the existing pavement for this purpose Where it is necessary to taper the thickness of a layer to provide a smooth riding junction terminate the layer at a chase cut into the existing pavement about 20 mm deep and 400 mm wide Where necessary remove coarse particles from a layer of tapering thickness using hand raking

Tack coat Where the thickness of the layer tapers to less than twice the nominal size of the mix tack coat the area upon which material of such thickness is to be placed uniformly at an application rate 0.50 - 0.75 L/m²

Compaction

General Before commencing compaction, correct any irregularities in line or level Trim lane edges to a straight line Compact asphalt surfacing uniformly as soon as it will support rollers without undue displacement, and complete rolling while the mix temperature is above 80°C

6 3 3 Joints

Joints

General Minimise the number of joints Make joints that are well bonded and sealed and provide a smooth riding surface across the joint



Transverse joints Construct a transverse joint if the operation is stopped for more than 20 minutes or the pavement temperature falls below 90°C Construct to a straight vertical face for the full depth of the layer, and offset in adjoining spreader runs and layer to layer by at least 2 m

Longitudinal joints Offset joints from layer to layer by at least 150 mm Position longitudinal joints in the wearing course to coincide with the lane line

Edges Form exposed edges of each spreader run while hot to a straight line with a dense face inclined between vertical and 45°

Cold joints Tack coat the surface of cold longitudinal and transverse joint before placing the adjoining asphalt

Rejection

Extent Remove areas of rejected asphalt surfacing including defective joints and finish to the full depth of the layer and replace with complying pavement

Joints Treat edges of remedial work as specified for cold joints

Reinstating Adjacent Surfaces

General Reinststate surfaces next to new pavements and associated elements Where an existing flexible road pavement has been disturbed trim it back to a straight and undisturbed edge 250 – 300 mm from and parallel to the new concrete for the full depth of the slab Backfill with asphalt rammed solid using suitable rammers

Traffic on Pavement

General Give notice before opening the pavement to traffic before the work is completed Provide adequate means of protection

Junctions With Existing Pavements

Trimming Where the pavement is to be joined to an existing pavement remove a strip of the existing pavement at least 300 mm wide for its full depth and trim the edge to an angle of approximately 45° in steps of maximum height 150 mm before placing new pavement material

Existing sealed pavement Trim the seal to a neat edge



7 Segmental Paving

7.1 Scope of Work

The scope of work includes but is not limited to,

- ▶ The supply and installation of concrete segmental paving for road pavements medians, traffic islands, driveways, cycleways footpaths and other pedestrian areas including the provision of a sand bedding course and joint filling sand

7.2 General

Paving blocks shall be incorporated into the pavements works in parking and drop-off zones similar to that used in Stage 1 and 2

Paving blocks provide an aesthetic appeal as well as forming part of the storm water quality management works within the final, completed works

The pavements shall be laid in accordance with the manufacturer's specification. If the manufacturer's specification is incomplete works refer to Pittwater Council Edition AUS-SPEC-1\NSW-C254 Segmental Paving for comprehensive specification requirements

7.2.1 Aims

Responsibilities

General Provide segmental paving that are as follows

- ▶ In conformance with the tolerances specified
- ▶ In conformance with the compaction requirements supplied

7.2.2 Cross References

General

General Conform to the *General Requirements* worksection

Council Specifications

AUS-SPEC-1\NSW-C213	Earthworks
AUS-SPEC-1\NSW-C241	Stabilisation

7.2.3 Inspections

Prior to commencement of laying paving units a sample square of paving of a minimum area of 10m² shall be constructed on site for approval by the Principal's Representative. Following approval, the standard of subsequent workmanship shall be at least equal to that of the sample. Any areas that in the opinion of the Superintendent are of a lesser standard than that of the sample shall be immediately removed and re-laid at no additional cost to the Principal. The preparation of the



sample paving area constitutes a HOLD POINT for laying of pavers. The Principal's Representative's approval of the sample area is required prior to release of the hold point.

7.2.4 Submissions

Project Quality Plan

The following information must be included in the Contractor's Project Quality Plan:

- ▶ Methods and equipment for placing and screeding bedding materials
- ▶ Methods and equipment for paying and compacting paving units
- ▶ Survey control methods to ensure final pavement levels and thickness

7.2.5 Tolerances

The following tolerances shall apply:

Table 9 Tolerances

Activity	Compliance requirement
Base – Surface Level	To AUS-SPEC-1\NSW C254 13
Laying Paving Units – Joint Widths	To AUS-SPEC-1\NSW C254 16
Completed Segmental Paving <ul style="list-style-type: none"> - Surface Level - Level Adjacent to drainage inlets - Difference in level of adjacent pavers 	To AUS-SPEC-1\NSW C254 17

7.2.6 Minimum frequency of testing

The minimum frequency of testing shall be as listed in table below:

Table 10 Minimum Frequency Of Testing

Clause	Test Property	Test Method	Minimum Frequency
7.2.1	Concrete block pavers		
	Characteristic breaking load	AS/NZS 4556 5	1 per 5000m ²
	Characteristic flexural strength	AS/NZS 4556 5	1 per 5000m ²
	Dimensional deviations (by individual measurement)	AS/NZS 4556 5	1 per 5000m ²
	Mean abrasion index	AS/NZS	



Clauses	Test Property	Test Method	Minimum Frequency
	Slip resistance	4556 3 AS/NZS 4556 9 AS/NZS 3661 1	1 1
6 2 2	Bedding materials - grading	AS1141 11	1 per 5000m ²
7 3 2	Paving – joint width	measure	1 per day
7 3 3	Geometry		
	Surface level	survey	10m each way
	Deviation of surface of upper layer from 3m straightedge	straightedge	1 per 25m ²
	Total layer thickness at any point	survey	10m each way

7 3 Products

7 3 1 Concrete Block Pavers

Concrete paving units shall be Hydra Pave LT (or similar approved) units complying with the following requirements

- ▶ Thickness 80 mm minimum
- ▶ Characteristic breaking load 7 kN minimum
- ▶ Characteristic flexural strength 3 MPa minimum
- ▶ Dimensional deviation for plan dimensions mean +/- 2.0mm standard deviation 2mm maximum
- ▶ Dimensional deviation for height mean +/- 2mm standard deviation 3mm maximum
- ▶ Mean abrasion index 7 minimum
- ▶ Slip resistance (coefficient of friction) Class W

7 3 2 Bedding Course Materials

Bedding course materials shall

- 1 Be non-plastic with hard angular particles, and
- 2 Be washed free of soluble salts or other contaminants which can contribute to efflorescence

The bedding course shall be 50-mm depth of 6-mm single size clean crushed stone



A 150mm thick base of crushed aggregate utilised for stormwater quality purposes shall have the following particle size distribution

Table 11 Particle Size Distribution

Sieve Size (mm)	% Passing
100	100
63	95 – 100
37.5	60 – 85
20	15 – 30
10	0 – 5

7.4 Execution

7.4.1 Bedding Course

The bedding materials shall be spread in a single uniform layer of sufficient depth over the full area to be screeded to permit screeding to waste. The precise depth required to achieve the nominated compacted thickness shall be determined in the field. The materials shall be screeded by mechanised spreaders or pavers guided by screed rails or string lines to the nominated design profile and levels and shall include the necessary surcharge to achieve a uniformly thick layer following compaction in the range 20mm to 25mm. The thickness of the bedding materials shall nowhere exceed 30mm following compaction.

Any depressions in the screeded bedding exceeding 5mm shall be loosened, raked and re-screeded before laying the paving units. For manual placing of paving units the bedding materials shall be maintained at a uniform density but as loose as screeding operations will permit. For mechanised laying the bedding materials shall be uniformly and firmly but not fully compacted.

Screeded bedding materials left overnight or subject to rain shall be checked for level and re-screeded where necessary before paving units are placed. The bedding materials shall not be screeded more than about 1m in advance of the laying face at the completion of work on any day.

7.4.2 Paving Units

Paving units shall be placed either individually by hand or mechanically in clusters on the screeded bedding in a herringbone bond pattern. Unless otherwise noted on the drawings or directed by the Principal's Representative, the paving units for the herringbone pattern shall be laid at right angles to each other and oriented parallel to the site grid coordinate system. Paving units shall be laid with 2mm to 4mm gaps between adjacent units such that jointing sand will readily penetrate to the full depth of the paving units.



The first row of units shall abut against an edge restraint with the required joint gap and shall be laid at the correct angle to achieve the required orientation of paving units in the completed pavement. In each row, full units shall be laid first. Edge or closer units shall be laid using a power saw or mechanical or hydraulic guillotine and fitted subsequently. Such closer units shall consist of not less than 25% of a full unit and shall be cut to size to suit nominated joint widths. Infill smaller spaces with 35MPa concrete or dry-pack mortar. Structures, manholes, drainage gullies and similar penetrations shall be finished against the paving in accordance with the details shown on the drawings.

The contractor shall set out the work to control the laying pattern, particularly around obstructions, curves and areas of irregular width. The laying operation shall be organised to avoid the meeting of laying faces wherever possible. If this is not possible, the contractor shall submit to the Superintendent for approval the proposed method for meeting of the laying faces.

Unless approved otherwise by the Principal's Representative, construction traffic on paving prior to mechanical compaction shall be limited to foot or barrow traffic using overlay boards to prevent disturbance to underlying units.

After laying the paving units, mechanically compact the area using a suitable heavy duty plate compactor with an energy output sufficient to compact the bedding materials below the paver and having a minimum plate area of 0.5m², a minimum weight of 300kg and a centrifugal force of at least 30kN. Initial compaction shall consist of at least two coverages and shall continue until any level difference between units has been eliminated. The channels formed between abutting chamfered units shall finish with their inverts not less than 5mm proud of drainage inlets.

Any units that are structurally damaged during bedding compaction shall be immediately removed and replaced.

The paving operations shall be arranged so the use of the plate compactor proceeds progressively behind the laying face without undue delay and such that compaction is completed prior to ceasing construction activity on any day. Compaction shall not be carried out within 1m of the laying face except on completion of the pavement against an edge constraint. Sufficient plate compactors shall be maintained at the site for both bedding compaction and joint filling to meet this requirement.



8 Pavement and Road Ancillaries

8.1 Scope of Work

The scope of work includes but is not limited to

- ▶ setting out supply and application of pavement marking paint thermoplastic pavement marking material, pavement marking tape and raised pavement markers as required
- ▶ the supply and erection of the Regulatory, Warning Guide Information and Direction signs as described in AS 1742, AS 1743 and AS 1744
- ▶ the supply and erection of sign support structures to support the signs, and
- ▶ the adjustment of existing signs and sign support structures
- ▶ construction of concrete kerbing and channels

8.2 General

8.2.1 Aims

Responsibilities

General Provide channels, kerbs signage and line marking

Tolerances

Kerbs and channels conform to the following

- ▶ Absolute level tolerance ± 10 mm
- ▶ Maximum deviation from design alignment 25 mm
- ▶ Maximum deviation from a 3 m straightedge placed on horizontal, vertical or sloping surfaces required to be straight 5 mm

Line marking to conform to the following

- ▶ The location of markings shall not vary from the design locations by more than 20mm

8.2.2 Cross References

General

General Conform to the *General Requirements* work section

8.2.3 Interpretation

Definitions

General For the purposes of this work section the definitions given below apply

- ▶ Standard To AS 1348



- ▶ Absolute level tolerance Maximum deviation from design levels
- ▶ Relative level tolerance Maximum deviation from a 3 m straightedge laid on the surface
- ▶ Channels and kerbs Includes all forms of concrete gutters dish drains grated drains and mountable median and barrier kerbing

8 2 4 Submissions

Line marking Materials

General Submit NATA Registered Laboratory Test Reports at least seven days before work is scheduled to commence, on the quality of the materials including paint

8 3 Products

8 3 1 Materials

Concrete

Standard To AS 1379 – Grade N20

Pavement Marking Paint

Standard To AS 4049 1 and AS 4049 3

Signage

Standard To AS 1742

8 4 Execution

8 4 1 Linemarking

Surface Preparation

Clean dry surface Pavement markings shall only be applied to clean dry surfaces Clean the surface to ensure a satisfactory bond between the markings and wearing surface of the pavement

Wet weather Pavement marking shall not be carried out during wet weather or if rain is likely to fall during the process

Scabbling Where raised pavement markers are specified for pavements having a concrete wearing surface, the full area under each raised pavement marker shall be lightly scabbled to removed fine mortar material (laitance)

Provision for traffic Provide for traffic while undertaking the work and protect the pavement markings until the material has hardened sufficiently so that traffic will not cause damage

Mixing of paint All paint shall be thoroughly mixed in its original container before use to produce a smooth uniform product consistent with the freshly manufactured product



Application of Paint

Longitudinal lines All longitudinal lines shall be sprayed by an approved self-propelled machine. The two sets of lines forming a one-way or two-way barrier line pattern shall be sprayed concurrently.

Hand spraying Hand spraying with the use of templates to control the pattern and shape shall be permitted for transverse lines, symbols, legends, arrows and chevrons.

Paint thickness The paint shall be applied uniformly and the wet film thickness shall be neither less than 0.35 mm nor more than 0.40 mm.

Finish, Pavement markings shall be straight or with smooth, even curves where intended. All edges shall have a clean, sharp cut-off. Any marking material applied beyond the defined edge of the marking shall be removed, leaving a neat and smooth marking on the wearing surface of the pavement.

Tolerances

Longitudinal lines The lengths of longitudinal lines shall not vary by more than 20 mm from the lengths shown in AS 1742.2. The widths of longitudinal lines shall not vary by more than 10 mm from the widths shown in AS 1742.2.

Transverse lines The lengths and widths of transverse lines shall not vary by more than 10 mm from the lengths and widths shown in AS 1742.2.

Dimensions The dimensions of arrows, chevrons, painted medians, painted left turn islands and speed markings shall not vary by more than 50 mm from the dimensions shown on the drawings or in AS 1742.2 as appropriate. Arrows and speed markings shall be placed square with the centreline of the traffic lane.

Removal of Pavement Markings

General Remove pavement markings no longer required, from the wearing surface of pavements without significant damage to the surface.

8.4.2 Channels and Kerbs

General

General Before placing any kerb and/or gutter, the foundation material shall be shaped and compacted to form a firm base. Other than for kerb and gutter constructed on pavement courses, the relative compaction shall be in accordance with the requirements of AS 2876. Where placed on pavement courses, the foundation shall be compacted to the requirements of the *Pavement base and subbase* worksection.

Standard Kerb and/or gutters may be constructed in fixed forms by extrusion or by slip forming in accordance with AS 2876. The foundation, concrete quality, curing and testing details shall be in accordance with AS 2876.

Tolerances

General The level at any point on the surface of the gutters shall be within ± 10 mm of design levels. When a straight edge 3m long is laid on top of or along the face of the



kerb or on the surface of gutters, the surface shall not vary more than 5mm from the edge of the straight edge except at kerb laybacks, grade changes or curves or at gully pits requiring gutter depression

Joints

Contraction joints Formed every 3 m of gutter length for a minimum of 50% of cross sectional area. The joint shall be tooled 20 mm in depth to form a neat groove of 5 mm minimum width.

Expansion joints 15 mm in width for the full depth of the kerb and gutter shall be constructed at intervals not exceeding 15 m and where the gutter abuts against pits retaining walls and at both sides of kerb laybacks for vehicular or pedestrian access. Expansion joints shall consist of preformed jointing material of bituminous fibreboard.

Concrete pavement Where kerbs and/or gutters are cast adjacent with a concrete pavement the same type of contraction construction and expansion joints specified in the concrete base shall be continued across the kerb and/or gutter.

Backfill

Timing After the new kerb and gutter has been constructed and not earlier than three days after placing, the spaces on both sides of the kerb and/or gutters shall be backfilled and reinstated in accordance with the drawings.

Material Backfill material behind the kerb shall consist of granular material, free of organic material, clay and rock in excess of 50 mm diameter.

Compaction Backfill material behind the kerb shall be compacted in layers not greater than 150 mm thick to a relative compaction of 95% when tested in accordance with AS 1289 5.4.1, for standard compactive effort.

Pavement Pavement material adjacent to new gutter shall be backfilled in accordance with the drawings and the *Pavement base and sub base* worksection.

8.4.3 Signage

Road signage shall be in accordance with AS 1742 and RTA standards. Directional signage shall be in accordance with ARV Design Standards.



9 Stormwater

9.1 Scope of Work

The scope of work includes but is not limited to,

- ▶ Design and construction of stormwater drainage systems for the Stage 3 site including the provision of water sensitive urban design systems

This section of the Specification covers the supply of materials for laying bedding and jointing of stormwater drainage pipes and excavation backfilling and compaction of drainage trenches headwalls and bioretention swales

9.2 General

The stormwater services on this site are critical to the project both in terms of water quantity and water quality

The overall final site profile is relatively flat falling towards the creek Stormwater from the roof is to be collected in a water reuse tanks located on the hydraulics drawings This harvested water is used for toilet flushing within the buildings as well as landscape irrigation the remainder overflows from the rainwater tanks into the gravity stormwater system

An existing bioretention swale located between the RACF building and the proposed Stage 3 building should remain as far as reasonably possible The bioretention swales discharge into the existing lake before discharging into Narrabeen Creek During dry periods the lake will contains low water levels During rainstorms the lake functions as a detention pond controlling discharge off site into the creek The lake also functions as a water quality treatment device

New water sensitive urban design elements should be incorporated where possible

The Stage 3 stormwater drainage design and construction shall conform to Aus-Spec Pittwater edition available from Pittwater Council

Refer to following Pittwater Council AUS-SPEC Editions for comprehensive specification requirements

- ▶ AUS-SPEC-1\NSW-C220 Stormwater Drainage – General
- ▶ AUS-SPEC-1\NSW-C221 Pipe Drainage
- ▶ AUS-SPEC-1\NSW-C222 Precast Box Culverts
- ▶ AUS-SPEC-1\NSW-C223 Drainage Structures
- ▶ AUS-SPEC-1\NSW-C224 Open Drains (incl kerb and gutter)
- ▶ AUS-SPEC-1\NSW-C230 Subsurface Drainage General
- ▶ AUS-SPEC-1\NSW-C231 Subsoil and Foundation Drains
- ▶ AUS-SPEC-1\NSW-C232 Pavement Drains



► AUS-SPEC-1\NSW-C233 Drainage Mats

9 2 1 Aims

Responsibilities

Provide stormwater design and installation

Provide convenience and safety for pedestrians and traffic in frequent stormwater flows by controlling those flows within prescribed limits

Ensure surface flow routes convey floodwaters below the prescribed velocity/depth limits

9 2 2 Cross References

General

Conform to the *General requirements* worksection

9 2 3 Interpretation

Definitions

General For the purposes of this worksection the definitions given below apply

Pipe surround Includes pipe overlay pipe side support side zone and haunch zone

9 2 4 Standards

Stormwater Drainage

Standard To AS/NZS 3500 3 - Plumbing and drainage - Stormwater drainage

9 2 5 Inspection

Notice

Inspection Give sufficient notice so that inspection may be made of the following

- Excavated surfaces prior to placing pipe bedding material
- Formwork and reinforcement prior to placing cast in situ concrete
- Pipe joints prior to covering
- Placing of cast in situ concrete
- Upon completion



9 3 Products

9 3 1 Materials

Concrete and Mortar

- ▶ Concrete To AS 1379
- ▶ Grade N20
- ▶ Portland cement To AS 3972
- ▶ Type GP

Steel reinforcement To AS/NZS 4671

Joints

- ▶ Solvent cement and priming fluid To AS/NZS 3879

Pipe and Fittings

- ▶ Precast Reinforced Concrete To AS 4058
- ▶ Fibre reinforced cement (FRC) To AS 4139
 - < 450 mm diameter To be pre-socketed at one end with a factory fitted *Adcol* coupling
 - > 450 mm diameter To have a purpose machined internal spigot and socket system within the pipe wall
- ▶ Glass-reinforced polyester (GRP) To AS 3571
- ▶ Buried flexible pipelines structural design To AS/NZS 2566 1
- ▶ Loads on buried concrete pipes To AS 3725
- ▶ Manhole covers and frames To AS 1830 and AS 1831
- ▶ Polyvinyl chloride (PVC) To AS 1254 AS/NZS 1260 AS 1273 and AS 2032
- ▶ Rubber ring joints/elastomeric seals To AS 1646
- ▶ Subsoil To AS 2439 1
- ▶ Vitrified clay or ceramic To AS 1741

Bedding and Filling Material for Unslotted Pipes

General Bedding material for the bed and haunch zones shall consist of a granular material having a grading determined by AS 1141

Conformance Comply with the Bedding material grading table

Bedding Material Grading Schedule for Unslotted Pipes



Sieve size (mm)	Weight passing %	
	Bed and haunch	Side zones
75 0	-	100
19 0	100	-
9 5	-	50-100
2 36	50-100	30-100
0 60	20-90	15-50
0 30	10-60	-
0 15	0-25	-
0 075	0-10	0-25

Bedding and Filling Material for Slotted Pipes

Conformance Comply with the Bedding material grading table

Bedding Material Grading Schedule for Slotted Pipes

Sieve size (mm)	Weight passing %	
	Bed, Haunch and Side Zones	Filter Zones
9 5	100	-
2 36	0-10	-
1 4	0	100
1 0	-	80
0 70	-	44
0 50	-	8 4
0 15	-	0
0 075	-	-



9 4 Execution

9 4 1 Tolerances

General

General Conform to the Pipeline tolerances table These tolerances are conditional on falls to outlets being maintained and no part of a pipeline being at less than the designated gradient

Table 12 Pipeline Tolerances

	Permissible angular deviation from alignment	Permissible displacement from alignment
Horizontal	1 in 300	15 mm
Vertical	1 in 500	5 mm

9 4 2 Stormwater Drains

Location

General Provide stormwater drains to connect downpipes surface drains, subsoil drains and drainage pits to the outlet point or point of connection Make sure that location of piping will not interfere with other services and building elements not yet installed or built Subject to the preceding and documented layouts follow the most direct route with the least number of changes in direction

Downpipe connections Turn up branch pipelines with bends to meet the downpipe finishing 50 mm (nominal) above finished ground or pavement level Seal joints between downpipes and drains

Laying

General Lay in straight lines between changes in direction or grade with socket end placed upstream If other pipes are adjacent set each pipe true to line and complete each joint before laying the next pipe If work is not continuous cap open ends to prevent entry of foreign matter

Bedding

General Grade the underlay evenly to the gradient of the pipeline

Standard In accordance with AS 3725 and AS 3725 Supplement 1

Bedding type Granular

Layers All material shall be compacted in layers not exceeding 150 mm compacted thickness



Lifting Holes

General Lifting holes in all pipes shall be sealed with plastic preformed plugs or 3 1 sand cement mortar before the commencement of backfilling

Trench Backfill

General The remainder of the trench to the underside of the subgrade shall be backfilled with fill material in accordance with the *Earthwork* worksection

Anchor Blocks

General If necessary to restrain lateral and axial movement of the stormwater pipes provide anchor blocks at junctions and changes of grade or direction

Encasement

Concrete Grade N20 to AS 1379

9 4 3 Subsoil Drains

General

General Provide subsoil drains to intercept groundwater seepage and prevent water build-up behind walls and under floors and pavements. Connect subsoil drains to surface drains or to the stormwater drainage system as applicable

Trench width ≥ 450 mm

Pipe depth Provide the following minimum clear depths, measured to the crown of the pipe where the pipe passes below the following elements

- ▶ 100 mm below subgrade level of the pavement kerb or channel
- ▶ 100 mm below the average gradient of the bottom of footings
- ▶ 450 mm below the finished surface of unpaved ground

Jointing

General At junctions of subsoil pipes provide tees couplings or adaptors to AS 2439 1

Pipe Underlay

General Grade the trench floor evenly to the gradient of the pipeline. If the trench floor is rock, correct any irregularities with compacted bedding material. Bed piping on a continuous underlay of bedding material at least 75 mm thick after compaction. Lay the pipe with one line of perforations at the bottom

Chases If necessary form chases to prevent projections such as sockets and flanges from bearing on the trench bottom or underlay

Pipe Surrounds

General Place the material in the pipe surround in layers ≤ 200 mm loose thickness and compact without damaging or displacing the piping



Depth of overlay

- ▶ To the underside of the bases of overlying structures such as pavements, slabs and channels
- ▶ To within 150 mm of the finished surface of unpaved or landscaped areas

Filter Fabric

General Provide polymeric fabric formed from plastic yarn composed of at least 85% by weight propylene ethylene amide or vinylidenechloride and containing stabilisers or inhibitors that provide resistance to deterioration due to ultraviolet light

Marking To AS 3705

Protection Provide heavy duty protective covering Store clear of the ground and out of direct sunlight During installation do not expose the filter fabric to sunlight for more than 14 days

Filter Socks

General Provide polyester permeable socks capable of retaining particles of 0.25 mm size Securely fit or join the sock at each joint

9.4.4 Pits

Finish to Exposed Surfaces

General Provide a smooth, seamless finish using steel trowelled render or concrete cast in steel forms

Corners Cove or splay internal corners

Metal Access Covers and Grates

Standard To AS 3996

Cover levels Top of cover or grate including frame

- ▶ In paved areas Flush with the paving surface
- ▶ In landscaped areas 25 mm above finished surface

Grade Design to suitable loading

9.4.5 Testing

Pre-completion tests

General Before backfilling or concealing carry out the following tests

- ▶ Site stormwater drains and main internal drains Air or water pressure test to AS 3500.3 Section 10

Leaks If leaks are found rectify and re-test



9 4 6 Completion

Cleaning

General Clean and flush the whole installation

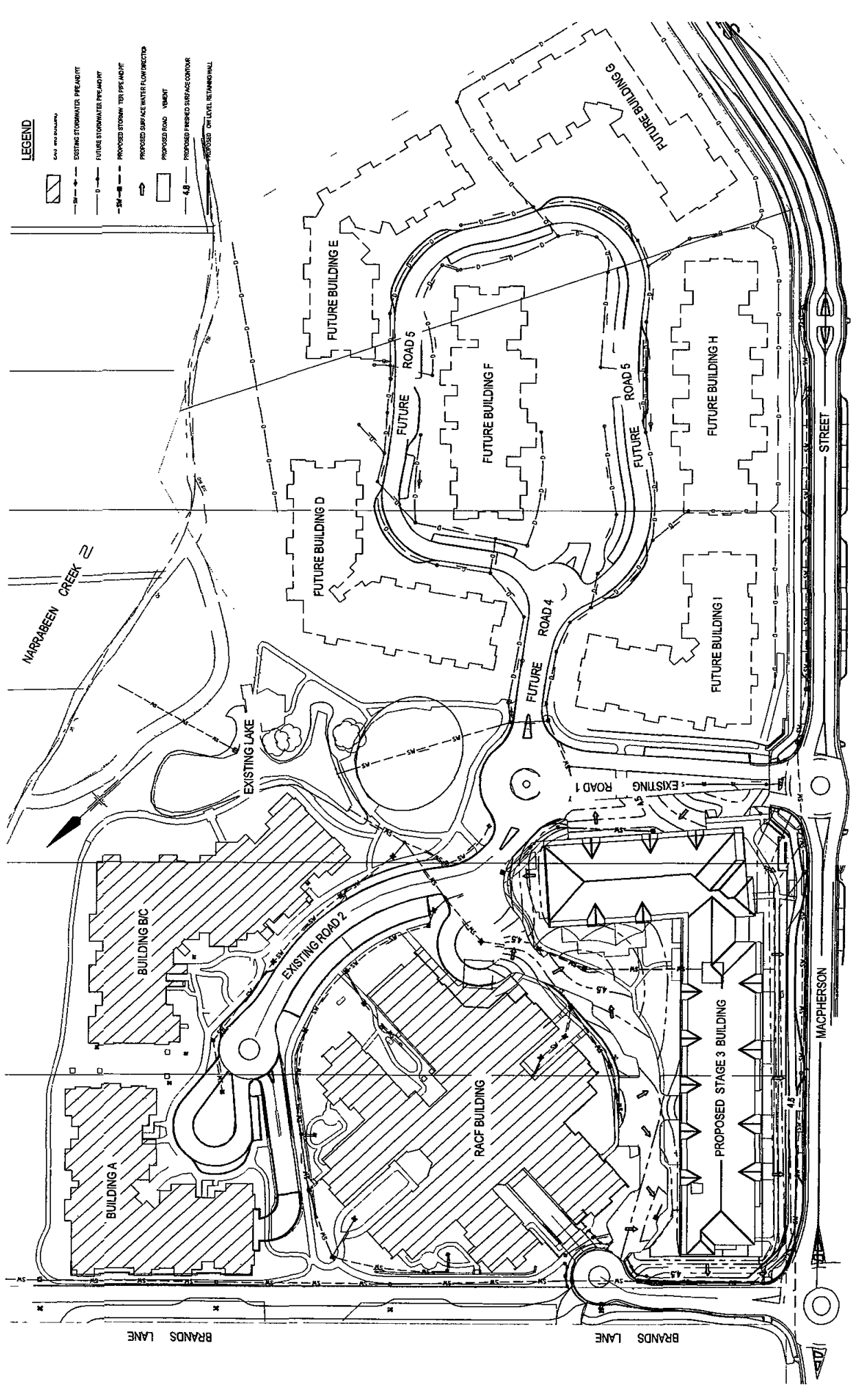


Appendix A
Drawings

Concept Design

LEGEND

[Symbol]	EXISTING STORMWATER PIPE AND FIT
[Symbol]	FUTURE STORMWATER PIPE AND FIT
[Symbol]	PROPOSED STORMWATER PIPE AND FIT
[Symbol]	PROPOSED SURFACE WATER FLOW DIRECTION
[Symbol]	PROPOSED ROAD
[Symbol]	PROPOSED FINISHED SURFACE CONTOUR
[Symbol]	PROPOSED GVI LEVEL RETAINMENT WALL

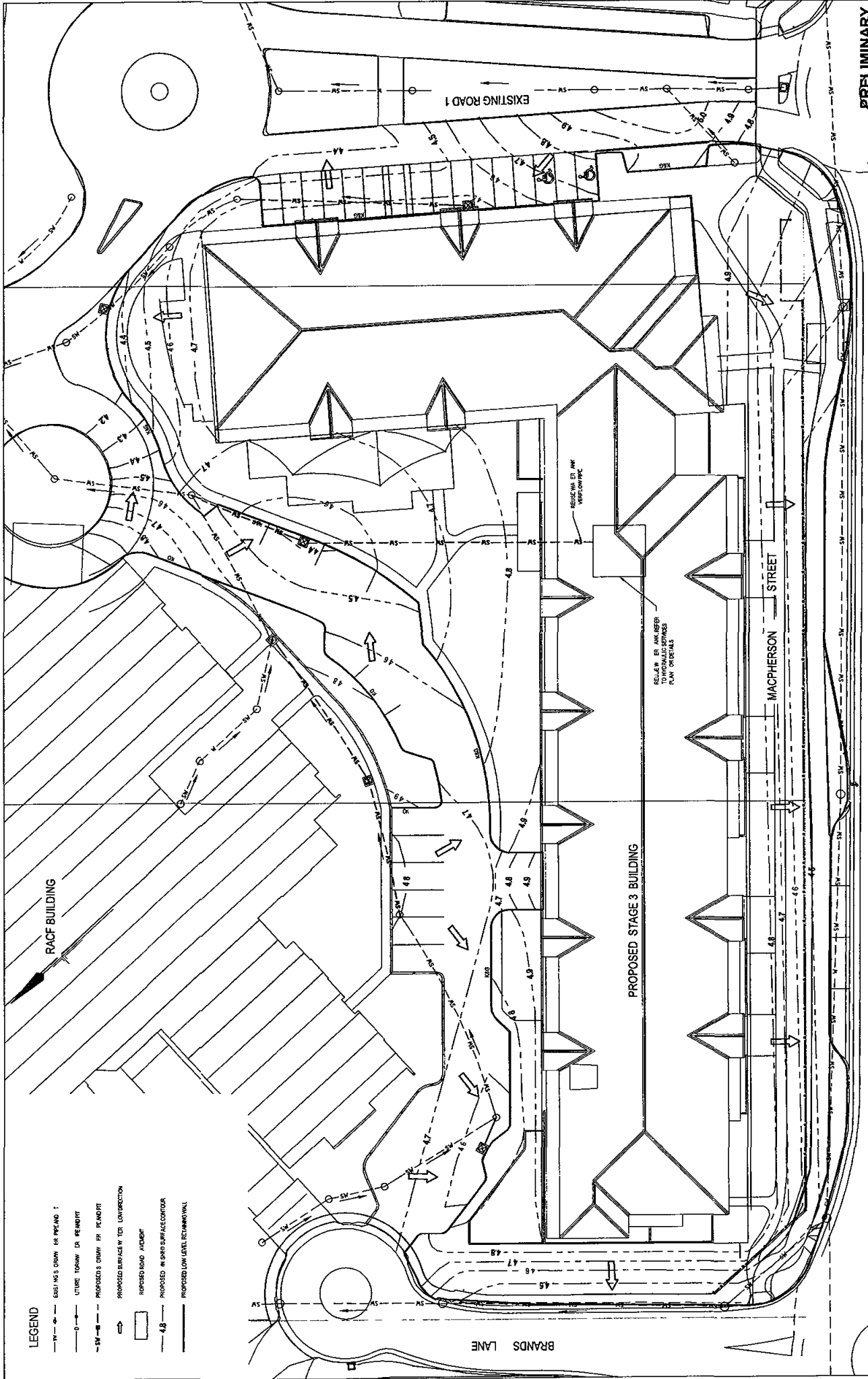


PRELIMINARY

**ANGLICAN RETIREMENT VILLAGES
WARRIEWOOD BROOK STAGE 3
SITE STORMWATER MANAGEMENT PLAN**

<p>ISSUED FOR DEVELOPMENT APPLICATION</p> <p>Project No: 21-19822-C001</p> <p>Date: 08/08/2020 1:48 PM</p> <p>Prepared by: Gabe W. [unreadable]</p>	<p>CLIENT: PROJECT PERFORMANCE</p> <p>11, RUSSELL ROAD WARRIEWOOD NSW 2120</p> <p>Scale: AS SHOWN</p>	<p>DO NOT SCALE</p> <p>This drawing is not to be used for any purpose other than that for which it was prepared and without the written consent of the engineer.</p>
<p>Project No: 21-19822-C001</p> <p>Sheet No: A1</p>	<p>Design Check: []</p> <p>Engineering Check: []</p> <p>Date: []</p>	<p>Scale: AS SHOWN</p> <p>North Arrow: []</p>

Rev A



PRELIMINARY

**ANGELICAN RETIREMENT VILLAGES
WARREWOOD BROOK STAGE 3
CONCEPT STORMWATER DRAINAGE LAYOUT**

Project Title: ANGELICAN RETIREMENT VILLAGES WARREWOOD BROOK STAGE 3
 Drawing No: 21-19822-C002
 Rev: A

Client: ANGELICAN RETIREMENT VILLAGES
 Designer: [Firm Name]
 Date: [Date]

DO NOT SCALE

Scale: AS SHOWN

Comments: This drawing is for conceptual purposes only. It is not to be used for construction. The layout for each site is subject to final site plan.

Scale: 1:500 A ORIGINAL SIZE

Issue Date: 10/20/2021
 Issue By: [Name]
 Issue For: [Purpose]



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Document Status

Rev No	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	F Quigley	A Rahman	A Rahman*	A Rahman	A Rahman*	Oct 10



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sydney@swpartners.com.au
www.swpartners.com.au
ABN 48 02 366 576

NOTICE OF COMMENCEMENT

Notice of Commencement of building or subdivision work and appointment of Principal Certifying Authority under Environmental Planning and Assessment Act 1979 Sections 86 (1)

PART 1 Development Details

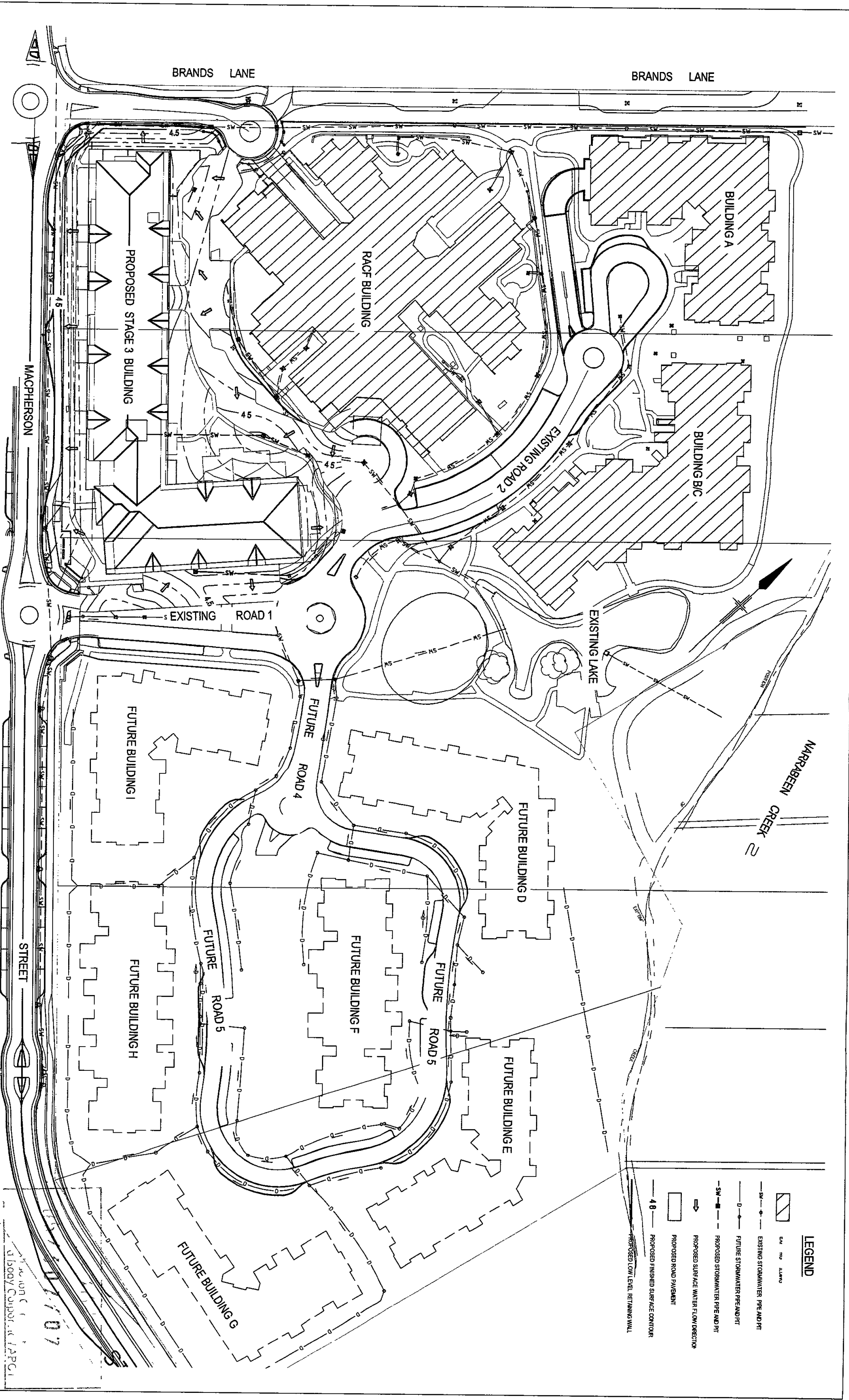
Applicant Details	Applicant's name _____ Address _____ Suburb _____ State _____ Post Code _____ Phone (____) _____ Fax (____) _____ Mobile _____ E-mail _____															
Details of the Land to be Developed	Address _____ Suburb _____ State _____ Post Code _____ Lot no _____ DP No /Section _____															
Description of Work	<table border="1"> <thead> <tr> <th>Type of work</th> <th>Building Work</th> <th>Description</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table>	Type of work	Building Work	Description												
Type of work	Building Work	Description														

PART 2 Details of Development Approval

Complying Development Certificate	Complying Development No _____ Date of Determination ____/____/____
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PART 3 Appointment of Principal Certifying Authority

Details of Principal Certifying Authority Please note in the absence of any prior agreement we reserve the right to nominate the most appropriate member of our staff as the PCA	Certifying Authority Steve Watson & Partners Pty Ltd Accreditation Body Building Professionals Board Accreditation Number ABC 1 Contact number (02) 9283 6555 Address Level 5 432 Kent Street Sydney NSW 2000
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LEGEND

	EXISTING STORMWATER PIPE AND PIT
	FUTURE STORMWATER PIPE AND PIT
	PROPOSED STORMWATER PIPE AND PIT
	PROPOSED SURFACE WATER FLOW DIRECTION
	PROPOSED ROAD PAVEMENT
	PROPOSED FINISHED SURFACE CONTOUR
	PROPOSED LOW LEVEL RETAINING WALL

PRELIMINARY

Client: **ANGLICAN RETIREMENT VILLAGES**
 Project: **WARREWOOD BROOK - STAGE 3**
 Title: **SITE STORMWATER MANAGEMENT PLAN**

Drawing No: **21-19822-C001**
 Rev: **A**

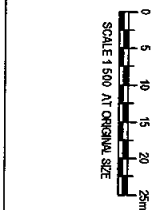
Client	Design	Check	Approved
F. QUIGLEY	F. QUIGLEY		
Design	Check	Approved	
F. QUIGLEY			

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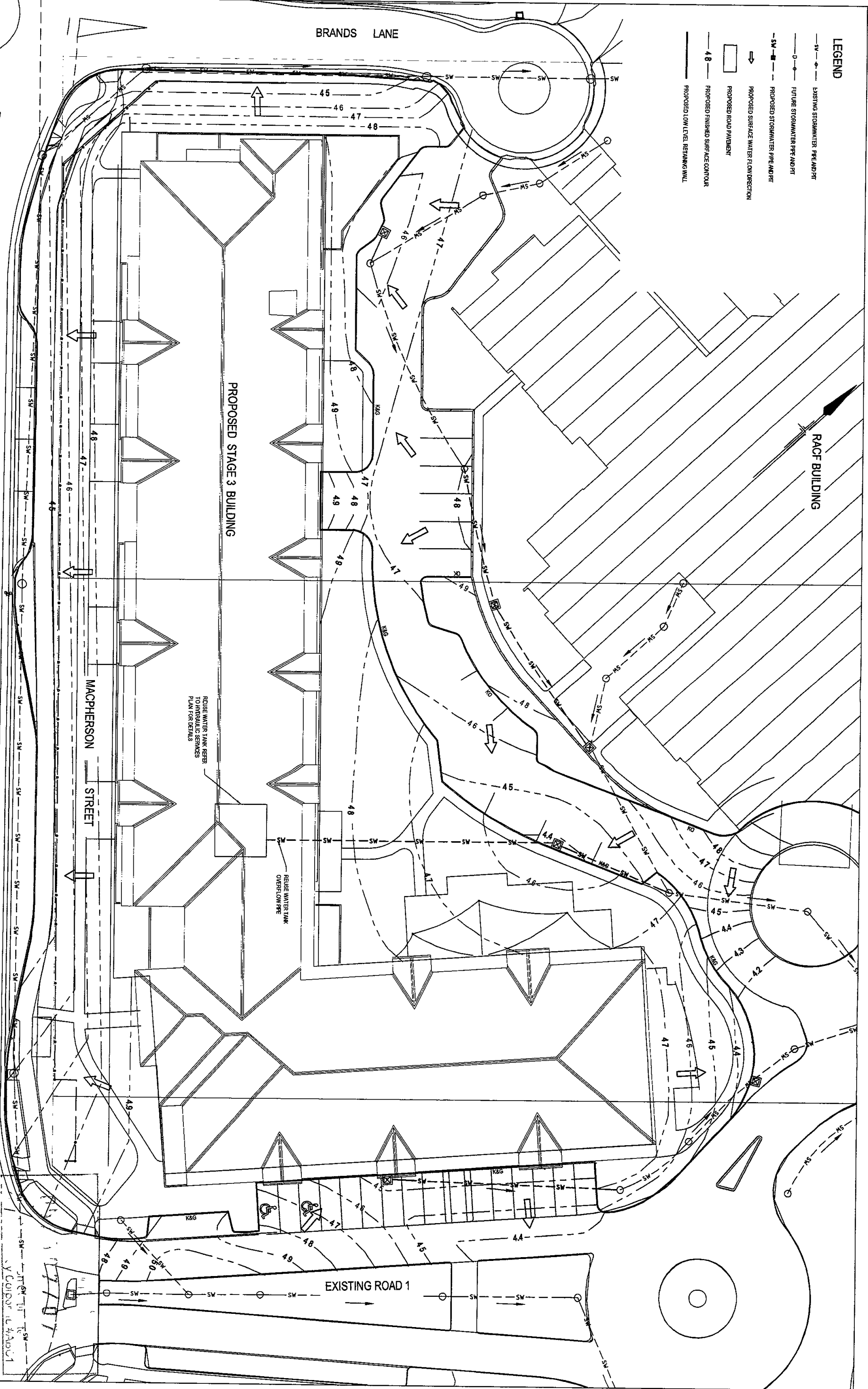
CLIENTS | PEOPLE | PERFORMANCE

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 E yoshida@ghd.com W www.ghd.com



A	ISSUED FOR DEVELOPMENT APPLICATION	QC	GW	8/10/10
Rev	Rev	Rev	Rev	Rev

- LEGEND**
- SW - EXISTING STORMWATER PRE AND PT
 - SW - FUTURE STORMWATER PRE AND PT
 - SW - PROPOSED STORMWATER PRE AND PT
 - SW - PROPOSED SURFACE WATER FLOW DIRECTION
 - PROPOSED ROAD PAVEMENT
 - 4.8 — PROPOSED FINISHED SURFACE CONTOUR
 - 4.8 — PROPOSED LOW LEVEL RETAINING WALL



SCALE 1:200 AT ORIGIN SIZE



ISSUED FOR DEVELOPMENT APPLICATION		FQ	GW	8/0/10
REVISION	DATE	BY	CHKD	APPD

0 2 4 6 8 10m

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Checked	Approved	Design	Checked
Date	Date		
Scale	AS SHOWN		

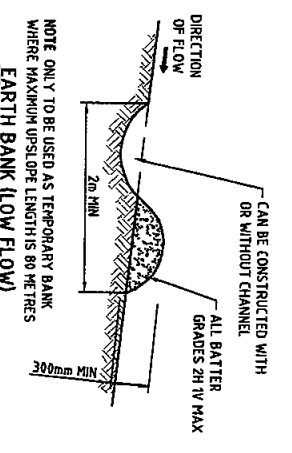
PRELIMINARY

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The: **CONCEPT STORMWATER DRAINAGE LAYOUT**

Drawing No: **21-19822-C002**

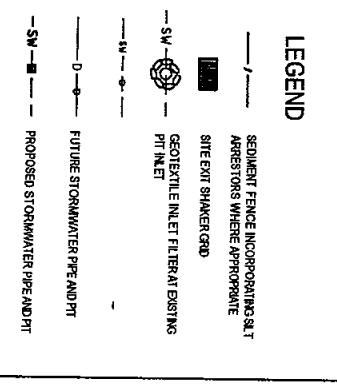
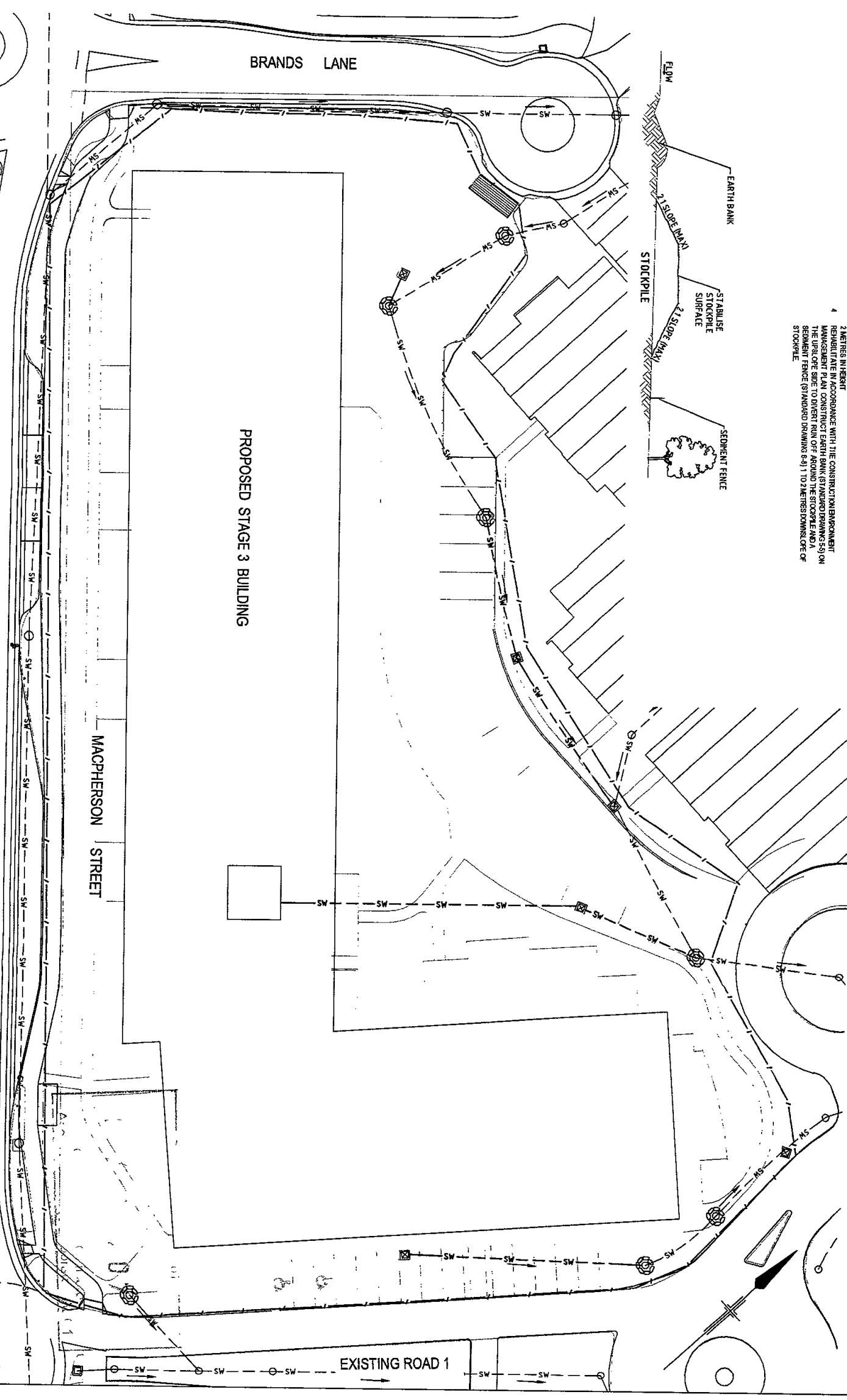
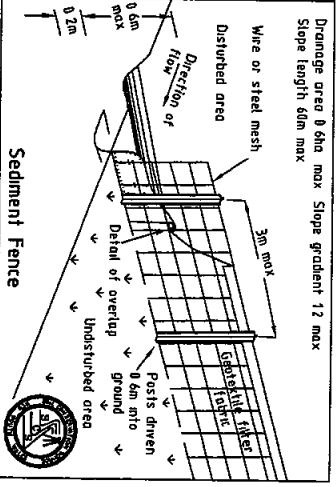
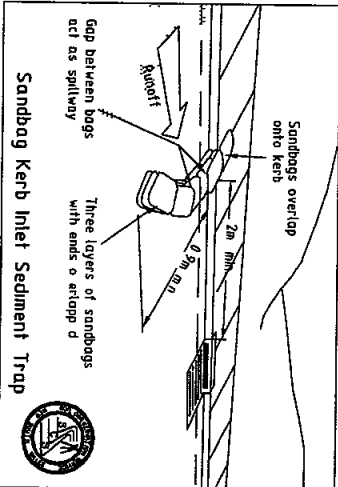
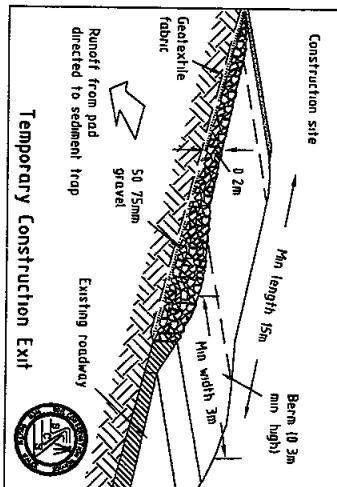
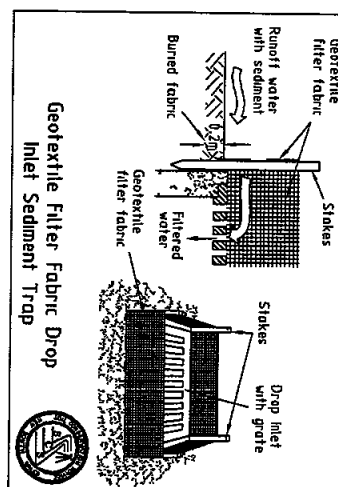
Rev: **A**



- ### GENERAL NOTES
1. ALL EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE INSTALLED PRIOR TO SITE DISTURBANCE.
 2. TOPSOIL FROM ALL AREAS THAT WILL BE DISTURBED TO BE STRIPPED AND STOCKPILED AT THE UNDISTURBED SITE.
 3. CONSTRUCT ALL FENCES ON DOWNSTREAM SIDE OF ALL AREAS OF DISTURBANCE TO PREVENT THE INGRESS OF SEDIMENT.
 4. EARTHWORKS TO BE INSTALLED TO ENTER AND EXIT SITE UNDISTURBED.
 5. CONSTRUCTION ACCESS TO ENTER AND EXIT SITE UNDISTURBED.
 6. CONSTRUCT SHAKER GRID FOR CONSTRUCTION TRAFFIC AT ALL POINTS OF EXIT FROM THE SITE PRIOR TO COMMENCEMENT OF EARTHWORKS OPERATIONS TO CLEAN OUT AND MAINTAIN THE SHAKER DOWNDRAIN.
 7. ALL EROSION AND SEDIMENT CONTROL STRUCTURES MUST BE REGULATED BY EACH RAINFALL EVENT FOR STRUCTURAL DAMAGE.
 8. ALL EROSION AND SEDIMENT CONTROL STRUCTURES MUST BE REGULATED BY EACH RAINFALL EVENT FOR STRUCTURAL DAMAGE.
 9. ALL EROSION AND SEDIMENT CONTROL STRUCTURES MUST BE REGULATED BY EACH RAINFALL EVENT FOR STRUCTURAL DAMAGE.

- ### EARTH BANK (LOW FLOW) CONSTRUCTION
1. CONSTRUCT WITH GRADIENT OF 4:1 TO 5:1.
 2. PINNACLES TO A CIRCULAR PERIMETER ON TRANSVERSE CROSS SECTION NOT ALLOWED.
 3. EARTH BANKS TO BE ADEQUATELY COMPACTED IN ORDER TO PREVENT FAILURE.
 4. PERMANENT OR TEMPORARY STABILISATION OF THE EARTH BANK TO BE COMPLETED WITHIN 90 DAYS OF CONSTRUCTION.
 5. EARTH BANKS TO BE STABILISED WITHIN 90 DAYS OF CONSTRUCTION.
 6. DISCHARGE RUNOFF COLLECTED FROM UNDISTURBED LANDS ONTO EITHER A STABILISED OR AN UNDISTURBED DISCHARGE SITUATION WITHIN THE SAME EARTH BANK TO BE FREE OF PROJECTIONS OR OTHER OBSTACLES THAT WILL IMPERE NORMAL FLOW.

- ### STOCKPILE CONSTRUCTION
1. LOCATE STOCKPILE AT LEAST 5 METRES FROM DRIVING/REGISTRATION CONSTRUCTION WINTER FLOWS ROADS AND HIGHWAYS AREAS.
 2. CONSTRUCT ON THE DOWNHILL AS A LOW FAT ELEVATED MOUND.
 3. 2 METRES MIN HEIGHT.
 4. REHABILITATE IN ACCORDANCE WITH THE CONSTRUCTION MANAGEMENT PLAN CONSTRUCT EARTH BANK (STANDARD DRAWING 50) ON THE UPSLOPE SIDE TO DIVERT RUN OFF AROUND THE STOCKPILE AND A SEDIMENT FENCE (STANDARD DRAWING 4-9) 1 TO 2 METRES DOWNSLOPE OF STOCKPILE.



A ISSUED FOR DEVELOPMENT APPLICATION		FQ		GW		B 10 10	
Rev	By	Date	Check of Appro	Dr	Wn	Scale	AS SHOWN
R 300	M 1	10/11	10/11	10/11	10/11	1:250	AS SHOWN

Client	ANGELICAN RETIREMENT VILLAGES
Project	WARREWOOD BROOK - STAGE 3
Title	SEDIMENT AND EROSION CONTROL PLAN
Contractor	A1
Drawing No.	21-19822-C003
Rev	A

DO NOT SCALE

Drawn	F QUIGLEY	Designed	F QUIGLEY
Checked	F QUIGLEY	Design	F QUIGLEY
Approved	F QUIGLEY	Date	10/11

Scale: 1:250 AT ORIGINAL SIZE

Scale: AS SHOWN

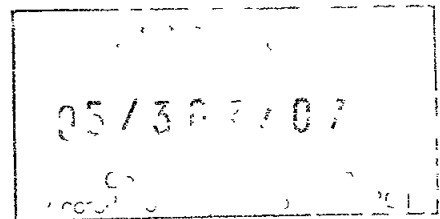
Scale: 1:250 AT ORIGINAL SIZE

C12

LANDSCAPE SPECIFICATION

ARV Warriewood Stage 3
ILU's and Community Centre

LANDSCAPE SPECIFICATION
ISSUE B



OCT 2010

LANDSCAPE ARCHITECT

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Materials and workmanship which are deemed not in accordance with this Section will be rejected and shall be replaced to comply with the instructions issued by the Contractor at the landscape contractors cost. Allow for liaison with other trades and carry out the work so as to cause least inconvenience to others. Set out from the lines and levels provided by the Contractor. Any damage caused to services building structure paving roads and the like shall be made good at the landscape contractors cost.

1 4 STANDARDS AND QUALITY

AS 1289		Methods of testing soils for engineering purposes
AS 3743	(1996)	Potting mixes
AS 4373	(1996)	Pruning of amenity trees
AS 4419	(1998)	Soils for landscaping and garden use
AS 4454	(1997)	Composts soil conditioners and mulches
AS 4454	(1999)	Composts soil conditioners and mulches
AS 1289		Methods of testing soil for engineering purposes
AS 1289 5 2 1	(1993)	Soil compaction and density tests - Determination of the dry density / moisture content relation of a soil using modified compactive effort
AS 1289 5 4 1	(1993)	Soil compaction and density tests - Compaction control test - Dry density ratio
AS 1289 5 6 1	(1998)	Soil compaction and density tests - Compaction control test - Density index method for a cohesionless material
AS 1604	(1997)	Timber - Preservative treated - Sawn and round
AS 1604		Specification for preservative treatment
AS 1604 1	(2000)	Sawn and round timber
AS 3600	(2001)	Concrete structures
AS/NZS 3661		Slip resistance of pedestrian surfaces
AS/NZS 3661 1	(1993)	Requirements
AS/NZS 3661 2	(1994)	Guide to the reduction of slip hazards
AS 3727	(1993)	Guide to residential pavements
AS 3972	(1997)	Portland and blended cement
AS/NZS 4456 6	(1997)	Determining potential to effloresce
AS/NZS 4456 8	(1997)	Determining moisture content and dry density
AS/NZS 4456 9	(1997)	Determining abrasion resistance
AS/NZS 4456 10	(1997)	Determining resistance to salt attack
AS/NZS 4456 11	(1997)	Determining coefficients of expansion
AS/NZS 4456 12	(1997)	Determining coefficients of contraction
AS/NZS 4456 13	(1997)	Determining pitting due to lime particles
AS/NZS 4456 14	(1997)	Determining water absorption properties
AS/NZS 4456 18	(1997)	Determining tensile strength of masonry units and segmental pavers
AS/NZS 4586	(1999)	Slip resistance of new pedestrian surface materials
SAA HB69		Guide to traffic engineering practice
SAA HB69 13	(1995)	Pedestrians
SAA HB197	(1999)	An introductory guide to the slip resistance of pedestrian surface materials
AN14 01 900	(1994)	Slip resistance and pedestrian surfaces

1 5 INTERPRETATION

1 5 1 Definitions

Site rock Rocks approved for salvage

Site topsoil Soil excavated from the site which has the following characteristics

Contains organic matter

Supports plant life

Free from unwanted matter

Unwanted matter (in topsoil)

Sampling As recommended in AS 4419 Appendix A

1 8 SAMPLES

1 8 1 General

General Submit representative samples of each material packed to prevent contamination and labeled to indicate source and content

REQUIREMENT submit representative samples of the plants and other materials and products specified in the SAMPLES SCHEDULE

PLANT SAMPLES Submit each plant sample in the condition that it is proposed to supply it to the site

MATERIAL SAMPLES Submit samples of materials and items for approval as set out in samples schedule

REJECTION Replace at no extra cost plant samples rejected as unsuitable for use including samples rendered unsuitable by the process of examination (eg root condition) Samples not rejected may be included in the plant material for use in the works

1 9 MANUALS

1 9 1 General

General At completion of work submit manuals for all plants and products supplied documenting supplier and contact suppliers warranty and warranty material maintenance requirements/program and as built information

Work on trees

If it is proposed to perform work on trees give notice and obtain instructions

Removal

If a tree is damaged and repair work is considered impractical or is attempted and fails give notice and obtain instructions

1 11 3 Work near Trees

Harmful materials

Keep the area within the dripline free of construction material and debris Do not place bulk materials and harmful materials under or near trees Do not place spoil from excavations against tree trunks Prevent wind-blown materials such as cement from harming trees and plants

Damage

Prevent damage to tree bark Do not attach stays guys and the like to trees

Work under trees

General Do not remove topsoil from, or add topsoil to the area within the dripline of the trees

Excavation If excavation is required near trees to be retained, give notice and obtain instructions and supervision from the arborist Open up excavations under tree canopies for as short a period as possible

Hand methods Use hand methods to locate expose and cleanly remove the roots on the line of excavation If it is necessary to excavate within the drip line use hand methods such that root systems are preserved intact and undamaged

Roots

Do not cut tree roots exceeding 50 mm diameter Where it is necessary to cut tree roots use means such that the cutting does not unduly disturb the remaining root system Immediately after cutting, apply a bituminous fungicidal sealant to the cut surface to prevent the incursion of rot or disease

Backfilling

Backfill to excavations around tree roots with a mixture consisting of three parts by volume of topsoil and one part of well-rotted compost with a neutral pH value free from weed growth and harmful materials Place the backfill layers each of 300 mm maximum depth compacted to a dry density similar to that of the original or surrounding soil Do not backfill around tree trunks to a height greater than 300 mm above the original ground surface Immediately after backfilling thoroughly water the root zone surrounding the tree

Compacted ground

Do not compact the ground under trees If compaction occurs give notice and obtain instructions

Watering

Water trees as necessary including where roots are exposed at ambient temperature > 35°C

1 11 4 Existing Services

Marking

Earthworks within the landscape extent of works consist of the bringing the subgrade levels up to finished levels and the localised mounds that have been documented on the landscape plans The contractor is to be familiar with all services and is to locate and mark existing

Clearing operations

Removal Remove everything on or above the site surface including rubbish scrap grass vegetable matter and organic debris scrub trees timber stumps boulders and rubble

Grubbing Grub out stumps and roots over 75 mm diameter to a minimum depth of 500 mm below subgrade under buildings embankments or paving or 300 mm below finished surface in unpaved areas

Old works Remove old works including slabs foundations paving drains and manholes found on the surface

Existing grass Remove grass to a depth just sufficient to include the root zone

2 3 2 Spoil

Off site disposal

General Remove surplus excavated material and surplus site clearance material from the site

Mulch

Put cleared vegetation through a chipper Reduce to pieces not larger than 75 x 50 x 15 mm and stockpile for re-use as mulch Do not use any material that will contain weed species or seed bearing material that might vegetative regenerate or germinate

On site burial

Do not bury boulders concrete fragments and the like on site

1 13 COMPLETION

1 13 1 Completion

Temporary works

Tree enclosures Remove temporary tree enclosures at completion

Tree marking Remove temporary marks and tags at completion

Ripline planting areas 450mm (determine on site after trial)

Planting beds

Refer to landscape details for details of excavation and cultivation depths

Cultivation

Cultivation depths (mm)

Grassed areas (seeded turf strip turf stolonized) 150mm

Planting areas 300mm

Services and roots Do not disturb services or tree roots if necessary cultivate these areas by hand

Cultivation Thoroughly mix in materials required to be incorporated into the subsoil Cultivate manually within 300 mm of paths or structures Remove stones exceeding 25 mm clods of earth exceeding 50 mm and weeds rubbish or other deleterious material brought to the surface during cultivation Trim the surface to design levels after cultivation

Subsoil preparation schedule

Location	Cultivation method
Existing Trees	By Hand
Mass Planting Beds	Machine / Rotary Hoe
Turf Areas	Machine / Rotary Hoe

Additives

General Apply additives after ripping or cultivation and incorporate into the upper 100 mm layer of the subsoil At the rates specified in the soil testing

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Property	Type	Amount
	Wettability	
	Soil reaction (pH)	6 - 7
	Electrical conductivity (dS/m)	
	Dispersibility	
	Soluble salts (% by mass)	0.1
	Moisture content (% by mass)	
	Toxicity index to AS 3743	
	Permeability	

2.7 PLACING TOPSOIL

General Spread the topsoil on the prepared subsoil and grade evenly making the necessary allowances to permit the following

Required finished levels and contours may be achieved after light compaction

Grassed areas may be finished flush with adjacent hard surfaces such as kerbs paths and mowing strips

Contamination Where diesel oil cement or other phytotoxic material has been spilt on the subsoil or topsoil excavate the contaminated soil dispose of it off the site and replace it with site soil or imported topsoil to restore design levels

Spreading On steep batters if using a chain drag ensure there is no danger of batter disturbance

Finishing Feather edges into adjoining undisturbed ground

2.8 CONSOLIDATION

Compact lightly and uniformly in 150 mm layers Avoid differential subsidence and excess compaction and produce a finished topsoil surface which has the following characteristics

Finished to design levels

Smooth and free from stones or lumps of soil

Graded to drain freely without ponding to catchment points

Graded evenly into adjoining ground surfaces

Ready for planting

2.9 TOPSOIL DETAILS

Spread topsoil to the following typical depths based on subgrade levels being 350mm below finished levels

Excavated planting areas If using organic mulch 275 mm If using gravel mulch 300 mm

Irrigated grassed areas generally 325 mm

Topsoil application schedule

Location	Type	Depth (mm)
To areas of native plantings as nominated	Native Mix Low PH or approved equivalent (As supplied by Australian Native Landscapes)	200mm or as noted
To all other on grade areas and raised vegetable gardens	Organic Garden Mix (As supplied by Australian Native Landscapes)	275mm
On slab planting	Planter Box Mix (As supplied by Australian Native Landscapes)	300mm

3 CONSTRUCTION

3.1 MATERIALS AND COMPONENTS

3.1.1 Proprietary items

Definition A proprietary item is any item identified by naming the manufacturer supplier, installer trade name brand name catalogue or reference number

Implication Identification of a proprietary item does not necessarily imply exclusive preference for the item so identified, but indicates the required properties of the item

Information Submit proposed alternatives for approval. Submit available technical information and any other information required including reasons for the proposed substitution (for example the proprietary item is not reasonably obtainable). State whether the use of the alternative will require alteration to any other part of the works and advise any consequent variation to the contract sum

Manufacturers or suppliers' recommendations

Select where no selection is given and store handle and use materials and components in accordance with the current published recommendations of the manufacturer or supplier

3.2 CONCRETE PAVEMENTS

Standard

General To AS 3600

Coloured concrete footpaths and terraces Refer to landscape plans for colours and architects and engineers details

Subgrade

Preparation to engineers specification

Moisten the subgrade to ensure a firm uniformly moist surface at the time of placing. Remove loose material and debris from the surface. Do not operate construction equipment on the prepared surface

Sub-base

Thickness refer to engineer s drawings

Reinforcement

Slab reinforcement refer to engineer s specification

Concrete grade

Foot and bicycle traffic N20

Slab thickness

Foot and bicycle traffic 120mm

Control/contraction joints

Spacing (maximum) At 4m intervals

Design Tool off arrises to 6 mm radius

Placing

General refer to engineer s specification and drawings

Units Maximum deviation between the surface of adjacent paving units such as bricks, blocks or flags 2mm

3 4 4 Movement Joints

For all unit paving provide movement joints over structural joints in the base (isolation contraction expansion) right through the paving and bed to the substrate

Fill joints with a compressible material

Joint filler Bituminous sealant

Joint Spacing Joint spacing is to be very 5m or as shown on drawings

3 4 5 Abutment with Building

Where paving more than 1 5m wide abuts the wall of a building provide a strip of 10mm thick bitumen impregnated fibreboard between the paving and the wall

3 4 6 Paving Finish Junctions

Where changes of paving finish occur in doorways make the junction directly beneath the closed door or gate

Dividing strip Insert a dividing strip the full width of junctions between different paving finishes with the top edge flush with the finished paving Embed in solid finishes or screw fix to the substrate

Dividing strip material Bituminous sealant

3 4 7 Masonary Units

Minimum compressive strength 25 MPA

3 5 Unit Paving on Grade

3 5 1 Subbase

Prepare the subgrade by regrading as necessary to accommodate the thickness of the base course and paving If necessary loosen the ground to a depth of 200mm and adjust the moisture content before compaction Compact the ground to the required density

3 5 2 Base Course

Use crushed rock consisting of hard dense durable particles free from deleterious material of nominal size 25mm uniformly graded with not more than 10% passing a 0 075mm sieve

Spread and compact the base course to the required thickness and density Adjust the moisture content as needed to facilitate compaction

Required Density

Subgrade

Cohesive soils Minimum dry density ratio (standard compaction) to AS1289 5 4 1 100%

Cohesionless soils Minimum density index to AS1289 5 6 1 80%

Base Minimum dry density ratio (standard compaction) to AS1289 5 4 1 100%

3 5 3 Concrete Foundation

Finish Natural faced blocks
Size 300 500 h x 350 d x 600 – 1000 L
Mortar Sand and Cement 3 1
Rock Sandstone quarry block sound and durable
Minimum density 2200kg/c u m
Foundations By engineer
Bidum lining Behind wall and A 24
Laying Placed in such a manner that they are stable and interlocking laid roughly coursed and bedded on their broadest side

3 8 RAISED PLANT BOXES

General Supply and install to approved sample and approved shop drawings brick planter boxes Brickwork to comply with Architectural specification and general specification for brickwork

Brick Type Colour Smooth faced bricks to match architectural brickwork All exposed brickwork to be faced brick

Location As per landscape plan setout

3 9 FURNITURE TIMBER SEATS

Supply sample for approval Supply as nominated to locations on plan

Seating to ground level to consist of permanent seat unit CMM104 ARV with Armrest 02 as supplied by Street Furniture Australia Pty Ltd ph 1800 027 799

Install pedestal leg to manufacturers instructions ensuring finished height of seat meets Australian Standards for elderly persons Concrete footing dimensions to manufacture s instructions Where seats are indicated within garden beds ensure the concrete pad beneath extends beyond the dimensions of the seat

3 10 ELECTRIC BBQ

Supplier All Park Products Pty Ltd P O Box 587 Dromana VIC 3936
Mobile - 0437 006 564 Phone - 1300 135 227 Fax - 1300 788 832

Modular Electric BBQ – Model MOD-E 02 (for the upper podium level)
1 x electric BBQ 15Amp 240 Volt Single Phase 3 6KW
Push Button operation – 6 second safety delay start
1 x stainless Steel Hotplate – with heat dispersion coating
Stainless steel door and assembly
Stainless steel benchtop – 750mm x 1390mm

3 11 WATER FEATURES

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Sufficient to create a continuous stream of water to trickle down the face of the wall that is evenly spread along the length of the wall

Flow rate to be adjustable onsite

Filter to be fit for purpose and easily cleaned and repairable to be confirmed by contractor

Water conditioner unit size to be confirmed to be determined by supplier

Supplier

Care Free Water Conditioners 02 6925 2304

3/73 Dobney Ave (PO Box 681)

Wagga Wagga, NSW 2650

Power Source

GPO supplied by other trades refer electrical engineers plans for details

Tiles and Pebbles

Glass mosaic tile to ponds Trend Feel 2132 Glass Mosaic Tile with white grout as specified below

Supplier Sareenstone, 61 Mepunga Street, Concord West NSW Australia 2138

P (02) 9736-1833 F (02) 9736-2260

Adhered in place and grouted to suppliers specification

Calaka berry pebbles 300 x 300mm interlocking pebble mat with white grout as specified below

Supplier Sareenstone 61 Mepunga Street Concord West NSW Australia 2138

P (02) 9736-1833 F (02) 9736-2260

Render

Supply the following samples of render for approval Supply and install as per manufacturers specification to water features as per plans

Colour samples

Parchment

Beach

Unitex

14 Artisan Road

Seven Hills NSW 2147

Phone +61 2 9838 0911

Fax +61 2 9838 9555

Glass Cascade Plinths

Supply to approved engineer certified shop drawings honed 19mm formed textured toughened patterned glass to AS/NZS 2208 1996 Colour Clear Float

Supplier Axolotil 02 9666 1207

3 2 3 Water proofing to water feature

Laticrete hydroban waterproof membrane

Install as per manufacturers specifications

3 2 4 Tile adhesive

Laticrete latapoxy 300 adhesive

Install as per manufacturers specifications

have restricted growth due to nursery rows. No substitution shall be made unless approved in writing by the Landscape Architect.

Trees Provide trees which unless required to be multi-stemmed have a single leading shoot.
Replacement Replace damaged or failed plants with plants of the same type and size.
Trees for plant beds in turf areas in courtyard gardens must be clear stem to 1.6m.

At least one plant of each species in a batch shall be clearly labeled.

4.3.1 Advanced Tree

100 to 400 LITRE

Shall be in an appropriate sized container. Contractor to supply photographs of individual specimens that clearly illustrate height, girth, vigour and form for approval by landscape architect.

100 LITRE

Shall be in container sizes minimum 100 litre (635 x 578 pot or equivalent bag) and shall have a well developed straight stem minimum calliper 38mm. Trees shall be well shaped with a densely foliated crown minimum height two (2.5) metres.

25LITRE

Shall be in container sizes minimum 25 litre (343 x 305 or equivalent plastic bag) and shall have a well developed bushy habit of a minimum of 600mm height.

4.3.2 Advanced Shrubs

45 LITRE

Shall be in container sizes minimum 45 litre (203 x 229mm pot or equivalent plastic bag) and shall have a minimum height of 850mm out of the bag.

25LITRE

Shall be in container sizes minimum 25 litre (343 x 305 or equivalent plastic bag) and shall have a well developed bushy habit of a minimum of 600mm height.

5 LITRE

Shall be in container sizes minimum 5 litre (203 x 229mm pot or equivalent plastic bag) and shall have a minimum height of 450mm out of the bag.

4.3.3 Groundcovers

5 LITRE

Noted 5 litre shall be for semi advanced groundcover but a with a strong leading shoot of not less than 450mm in length.

SEMI ADVANCED

Noted 150mm pots. Groundcovers shall have a strong leading primary shoot with developing secondary shoots.

4.3.4 Ordering & Suppling

Plants and plant materials shall be obtained from approved suppliers. Plants shall be ordered early enough to ensure that specified plants are available for planting at the correct times.

Proof of ordering shall be furnished when requested.

Sufficient quantities shall be ordered to allow for plant failures.

Any plants which fail or are damaged at any stage of the work shall be replaced with the equivalent standard of plant.

4.3.5 Warranty

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For plants < 1 m high One 38 x 38 x 1200 mm stake per plant
For Plants in mulched riparian zone above 25yr flood level – 3 x 750 x10 12mm bamboo canes holding 350 x 450mm tree guard in place 250mm of stake to be driven into the ground

General Provide ties fixed securely to the stakes one tie at half the height of the main stem others as necessary to stabilise the plant

Tie types

For plants 2.5 m high Two strands of 2.5 mm galvanized wire neatly twisted together passed through reinforced rubber or plastic hose and installed around stake and stem in a figure of eight pattern

For plants < 2.5 m high 50 mm hessian webbing stapled to the stake

4.6 MULCH AND GRAVEL

4.6.1 Mass planting areas

Supply and install mulch to all mass planting areas the same or similar to Forest Fines supplied Australian Native Landscapes Pty Ltd, Myoora Road Terry Hills Telephone (02) 9450 1444 Install mulch to a depth of 75mm Mulch shall be free from soil weed growth and other green material Spread mulch immediately after planting Mulch shall be tamped down after laying

4.6.2 Gravel Mulch

Supply and install geotextile and gravel mulch to all areas as nominated on the landscape plans Gravel to be the same or similar to Neapean Riverstone 7 – 10mm minus Depth to be 60mm As supplied Australian Native Landscapes Pty Ltd Myoora Road Terry Hills Telephone (02) 9450 1444

4.6.3 Jute Erosion Matting

Supply and install 100% Jute Erosion Control Matting nominally 8.13mm thick laid perpendicular to creek line Overlap by 150mm upstream matt over the top of the downstream matt Bury upstream edge of matt into small channel 150mm deep Pin matt with 3 x 300mm Galvanised U pins per metre square

4.6.4 Commencement

The planting establishment period shall commence from the Date of Practical Completion of the Works and extend for a period of twelve (12) weeks

4.6.5 Recurrent Works

Throughout the establishment period continue to carry out recurrent works of a maintenance nature specified including but not limited to watering weeding fertilising pest and disease control staking and tying replanting cultivating pruning keeping the site neat and tidy and the like

4.6.6 Replacement

Immediately replace plants which die or fail to thrive or are damaged or stolen with plants of same size and quality Notwithstanding anything to the contrary of the contract the Superintendent may instruct the landscape contractor to perform urgent maintenance works Should the landscape contractor fail to carry out works within seven days of such a notice the Superintendent reserves the right to employ others to carry out such specified works and charge it to the contractor

4.6.7 Mulched Surfaces

Maintain in a clean and tidy condition and reinstate the mulch as necessary

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Eradicate weeds by environmentally acceptable methods using a non-residual glyphosate herbicide (eg 'Roundup') in any of its registered formulae at the recommended maximum rate. Regularly remove by hand weed growth that may occur or recur throughout grassed planted and mulched areas. Remove weed growth from an area 750mm diameter around the base of trees in grassed areas. Continue eradication throughout the course of the works and during the maintenance period.

4 7 10 Soil subsidence

Any soil subsidence or erosion which may occur after the soil filling and preparation operations shall be made good by the Landscape Contractor at no cost to the client.

4 7 11 Containers

Collect empty plant containers daily during planting operations and remove or store on site for later removal if permitted but ensure that they are not able to be scattered by wind or other causes.

4 7 12 Weed Growth

Regularly remove by hand rubbish and weed growth that may occur or reoccur throughout grassed planted and mulched areas.

The work contained in this section comprises the establishment maintenance and defects liability of all works executed under this contract.

5 4 WARRANTY

Warrant all work for a period of one year after acceptance. Immediately repair or replace without cost to the client all materials and equipment found to be defective due to faulty material or workmanship during the warranty period.

5 5 STANDARDS AND TESTING

AS1159 Metric High Density Polythene Pipe (Type 50)
AS1460 Mechanical jointing for the high density polyethylene pipe
AS1477 UPVC pipe and fittings
AS2698 Low density polythene pipe Type 30 parts 1 and 2

Testing

The work shall be tested as the project progresses to comply with the authorities codes. Provide all necessary testing and testing equipment.

Include all fittings, brackets, supports and fixing materials necessary to fix pipework to structures whether or not they are shown on the drawings or specified.

5 6 WORK BY OTHERS

These works shall be undertaken by other trades and include:

- Water supply to irrigation main
- Conduits under building as required
- Conduits to irrigation controllers
- 240 v Electrical supply to irrigation controllers
- 100mm conduits under walkways

5 7 PRODUCTS

General

All materials incorporated in the system shall be new, without flaws or defects and of quality and performance specified. All surplus material at the completion of the installation shall be removed from site.

5 8 EXECUTION

Inspection

Inspect and accept the conditions of the site relative to this section before commencing with the work covered in this irrigation section. If not acceptable, notify the Principal in writing. Proceeding with work under this irrigation section indicates acceptance of all previous related work.

5 9 EXCAVATION

Do all necessary excavation for the proper installation of the irrigation system. Trenches to be of adequate width to lay pipe easily, with extra working space provided where necessary to make joints. Cover for UPVC piping shall be 600mm in trafficable areas and 300mm in non trafficable areas. Cover for polyethylene piping shall be a minimum of 150mm in shrub areas.

Over excavation shall be backfilled and carefully tamped to provide a smooth and firm bearing surface for laying the pipe.

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must be left flush with, or slightly above adjacent finished grade after compacting to 90% relative compaction. Be responsible for repairing any damage to services and surfaces surrounding the trench location.

5 13 TESTS

The work shall be tested as the project progresses to comply with all authorities codes and to the satisfaction of the Principal. Provide all necessary testing equipment.
Pressure Test All Submains

5 14 ADJUSTING

Adjusting Systems

Prior to final inspection adjust and balance all drip zones to provide adequate and uniform spray coverage. Spray patterns shall be balanced by adjusting individual Bubblers/drippers with adjustment screws.

The adjusting and balancing of each system shall be at the normal water pressure for each line on the project.

Damage from leaks. Be responsible for damages to the grounds, walks, roads, buildings, piping systems, and their equipment and contents caused by leaks in the piping systems being installed or during the Defects Liability Period. Repair any damage without charge and in a manner satisfactory to the Principal.

Repair of Leaks. All leaking joints, whether discovered at time of installation or at any time during the Defects Liability Period shall be remade with all new materials. Use of caulking to cement to repair leaks is absolutely prohibited.

5 15 INSPECTION AND ACCEPTANCE

Final inspection

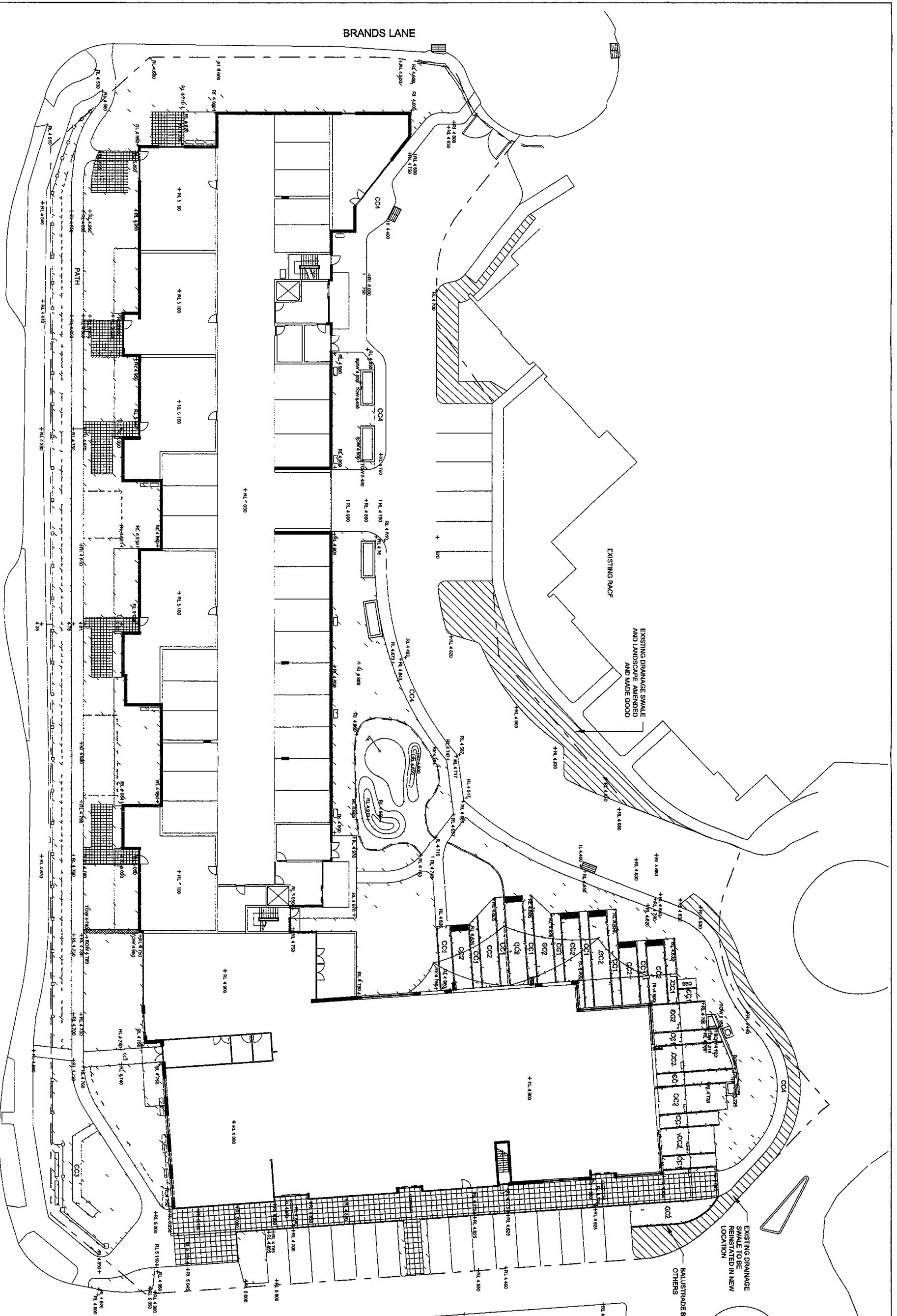
At the completion of all irrigation work request a final inspection. If after the inspection the Principal is of the opinion all work has been performed in accordance with the Drawings/Specification the Principal will give written notice of acceptance. If all or certain portions of the work are not acceptable under the terms and the intent of the Drawings and Specification the defects in the work shall be corrected before work is accepted by the Principal.

6 6 Quality Assurance Requirements Schedule

Schedule 1 – Witness and / or Hold Points

The following Witness Points and Hold Points are nominated Unless otherwise stated in the schedule the Contractor shall provide one working day s notice of the witness points and two working days notice of the Hold Points

Stage of Construction	Witness / Hold Point
Site graded and subsoil prepared ready for topsoil	H
Shop drawings for acceptance	H
Coloured concrete samples	H
On slab planting drainage installed	H
Retaining wall locations setout	H
Imported topsoil delivered on site	W
Graded topsoil	H
Pathway setout	W
Built samples of fencing	H
Built samples of Brick Raised Planters	H
Water Feature pebble rock and render samples	H
Water feature pump filter and water conditioner specification submission	H
Washing line location and setout	H
Imported topsoil delivered on site	W
Ag drains to turf and drainage layer on slab	H
Completion of topsoil placement to on grade and on slab areas Planting bed preparation complete	H
Plant materials delivered to the site	W
Plant material set out before planting	H
Practical Completion	H
Maintenance at 12 Weeks	W
Completion of Defects Liability work	W



LEGEND

	STAGE 3 BOUNDARY
	EXISTING BOUNDARY FENCE
	PREPARED MULCHED AND IRRIGATED MASS PLANT BED
	IRRIGATED TURF AREA
	SYNTHETIC TURF PUTTING GREEN AND MEADOW REFER TO DETAIL
	MOUND CONTOUR
	C01 SAND BLASTED FINISHED COLOURED CONCRETE COLOUR TO BE SELECTED
	C02 SAND BLASTED FINISHED COLOURED CONCRETE COLOUR TO BE SELECTED
	C03 BRUSHED FINISH CONCRETE COLOUR TO BE SELECTED
	C04 CONCRETE REFER TO LD01/07
	UNIT PAVING
	SANDSTONE HIMALAYAN SANDSTONE BANDING SANDBLASTED CUT TO WIDTH
	PROPOSED SPOT LEVEL
	PROPOSED INLET LEVEL OF STORMWATER PIT
	TOP OF WALL
	BOTTOM OF WALL
	STORMWATER PIT
	WATER FEATURE REFER TO DETAIL L003
	WATER FEATURE BALANCING TANK FILTER AND PUMP
	RAISED PLANTER BOXES REFER TO DETAIL LD01/02
	FURNITURE TO MANUFACTURERS DETAILS
	SANDSTONE ROCK RETAINING WALL REFER TO DETAIL LD01/01
	CONCRETE U/S EDGING REFER TO DETAIL LD01/05
	PLASTIC GARDEN EDGING REFER TO DETAIL LD01/08

0 2 4 8 12 16 20 m

05 / 30 7 / 07

Acct dilt 11/07

Cons

taylor graham

LANDSCAPE FINISHES PLAN

PROJECT: ARV WARRIEWOOD STAGE 3

DRAWING NO: LF01

DATE: 18/10/2010

SCALE: AS SHOWN

DESIGNER: J.S.

DRAWN: J.S.

CHECKED: J.S.

PROJECT MANAGER: J.S.

PROJECT LOCATION: 225 Macpherson Street, Warriewood, NSW 1505

PROJECT CONTACT: 02 9444 1111

PROJECT WEBSITE: www.taylorgraham.com.au

PROJECT REFERENCE: ARV WARRIEWOOD STAGE 3

DATE: 18/10/2010

SCALE: AS SHOWN

DESIGNER: J.S.

DRAWN: J.S.

CHECKED: J.S.

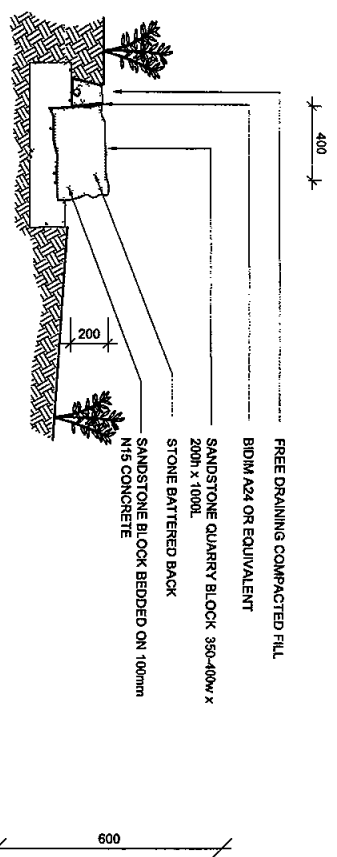
PROJECT MANAGER: J.S.

PROJECT LOCATION: 225 Macpherson Street, Warriewood, NSW 1505

PROJECT CONTACT: 02 9444 1111

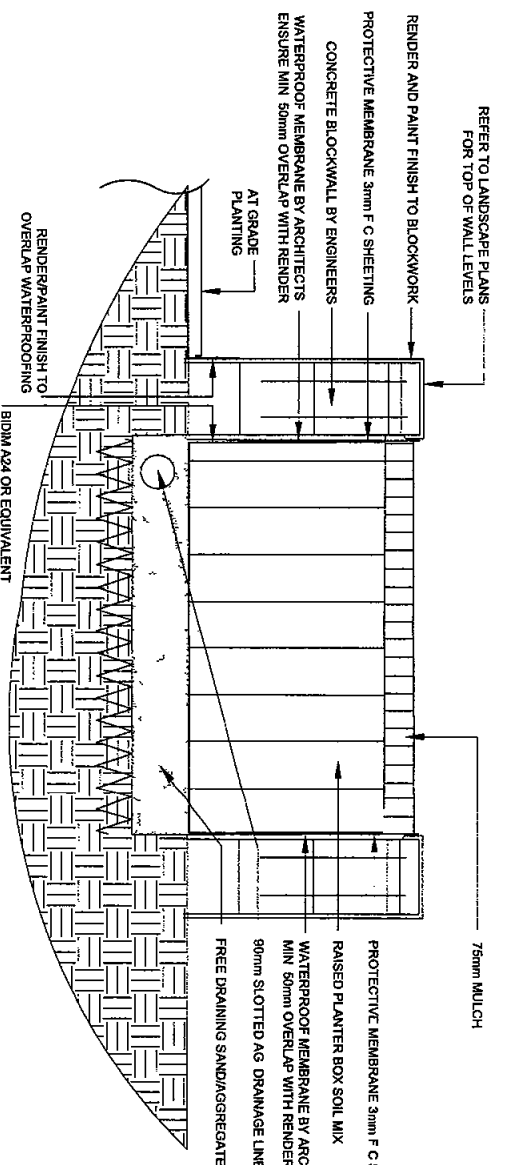
PROJECT WEBSITE: www.taylorgraham.com.au

PROJECT REFERENCE: ARV WARRIEWOOD STAGE 3



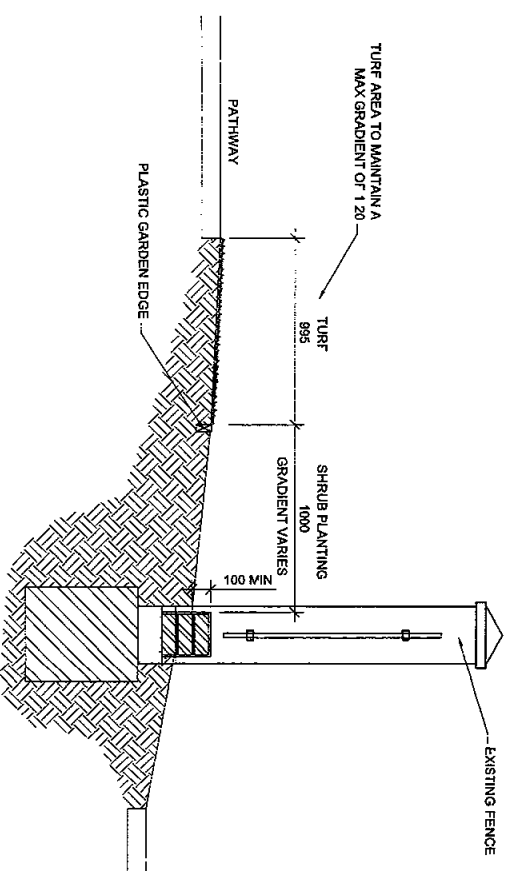
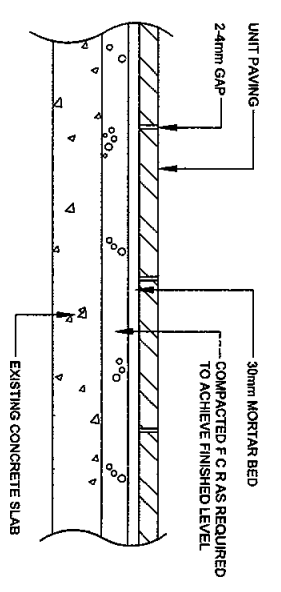
- ROCKWALL NOTES**
- 1 ROCKWALL TO BE GRANULAR FREE DRAINING AND COMPACTED
 - 2 ROCKWALL TO BE FINISHED WITH UNIMPORTED ROCK IS TO BE SOUND DURABLE SANDSTONE MATERIAL WITH MIN DENSITY OF 2200kg/cu.m
 - 3 GEOFABRIC (BIRMUM) SHOULD BE A GRADE A24 OR EQUIVALENT
 - 4 ROCKS SHALL BE PLACED IN SUCH A MANNER THAT THEY ARE STABLE AND INTERLOCKING AND Laid ROUGHLY AND COURSED ON THEIR BROADEST BASE
 - 5 REFER TO LANDSCAPE PLANS FOR TOP OF WALL LEVELS

1 ROCKWALL DETAIL
SCALE 1 20

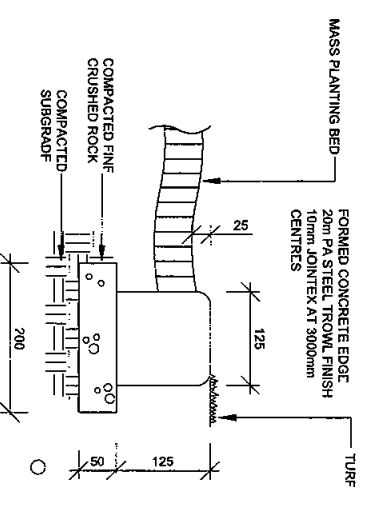


2 RAISED PLANTER BOX-CONCRETE BLOCK
TYPICAL SECTION 1 10

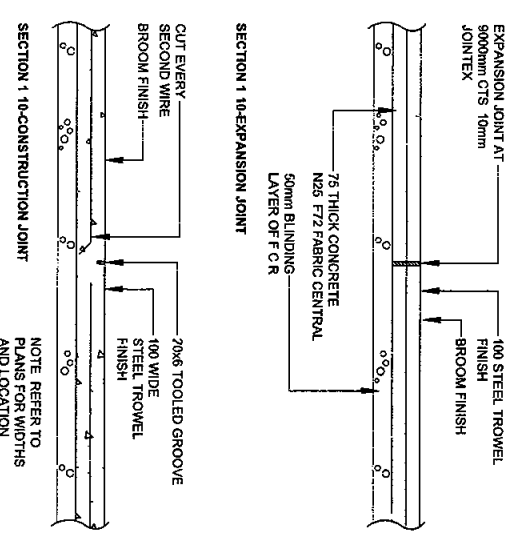
3 UNIT PAVING OVER CONCRETE SLAB
TYPICAL SECTION 1 10



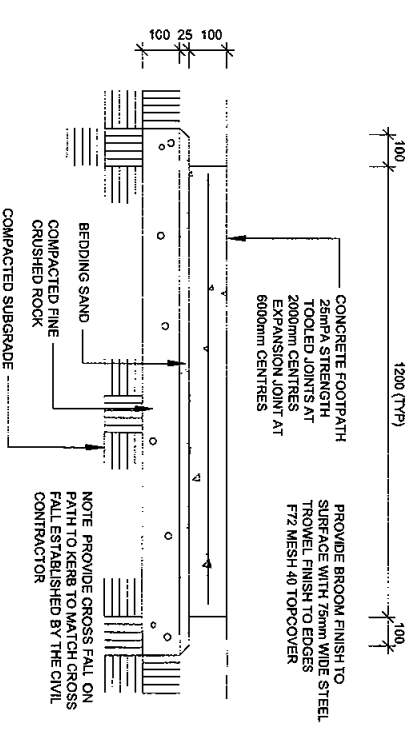
4 GRADIENT TO FENCE
TYPICAL SECTION 1 20



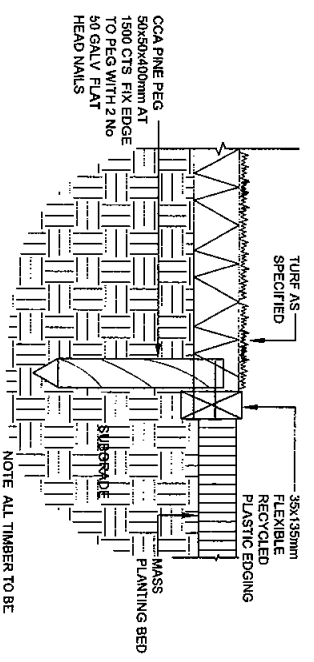
5 EDGE-CONCRETE - CUSTOM
TYPICAL SECTION 1 5



6 CONCRETE PAVING
SECTION 1 10



7 CONCRETE FOOTPATH REINFORCED
SECTION 1 10



8 PLASTIC LAWN EDGE
TYPICAL DETAIL 1 10

01/21/20

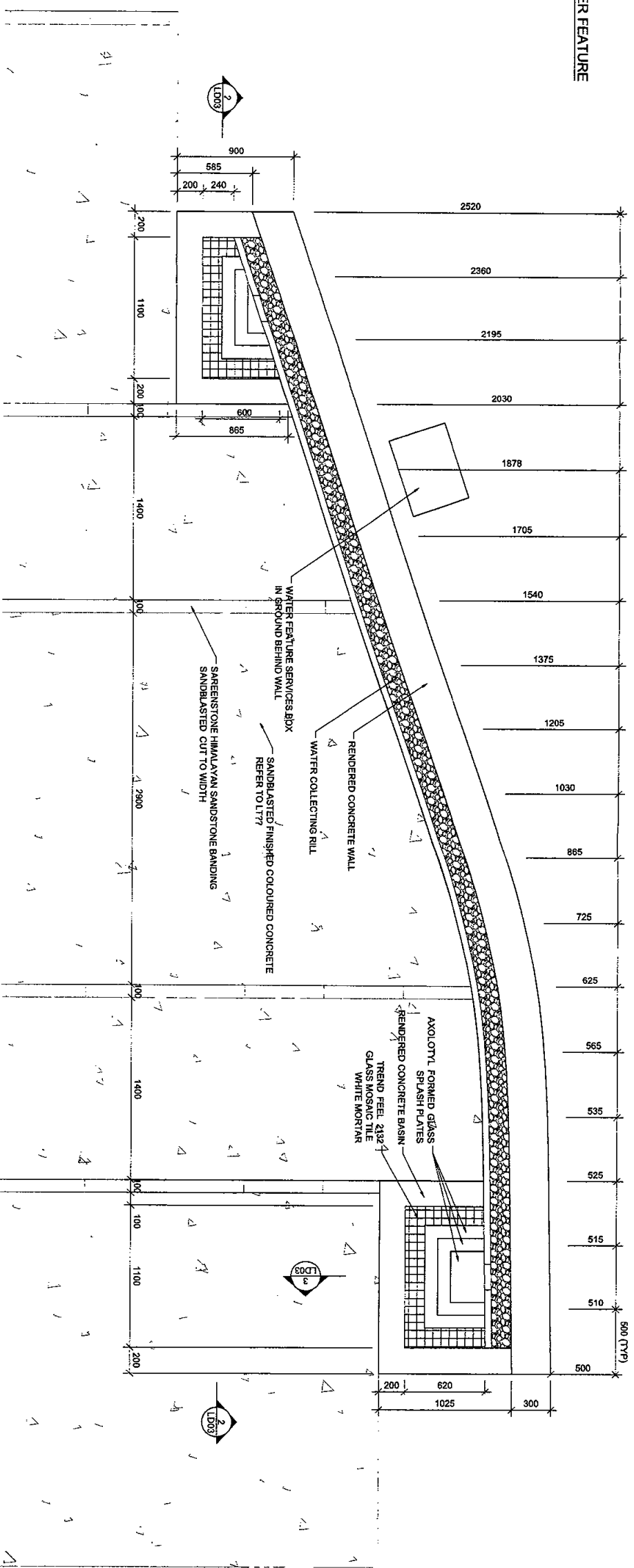
taylor
grammer

LANDSCAPE ARCHITECTS

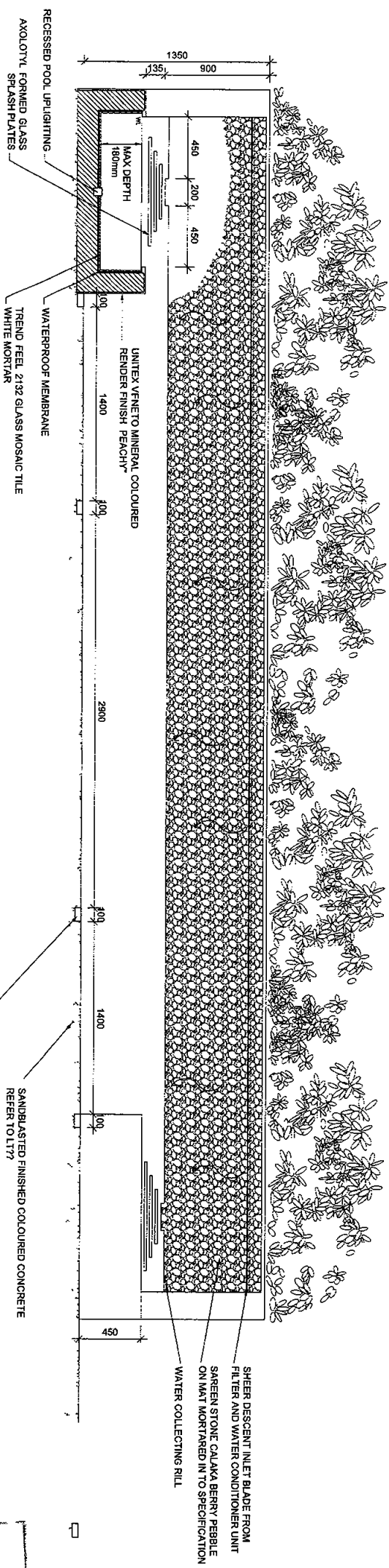
7/18 Oxford Street Wood The NSW State Library
Sydney NSW 2000
t: 02 9239 4112
www.tglandscape.com

drawing no: LD01 A
drawing title: LANDSCAPE DETAILS
client: ARV WARREWOOD STAGE 3
project: ARV WARREWOOD STAGE 3

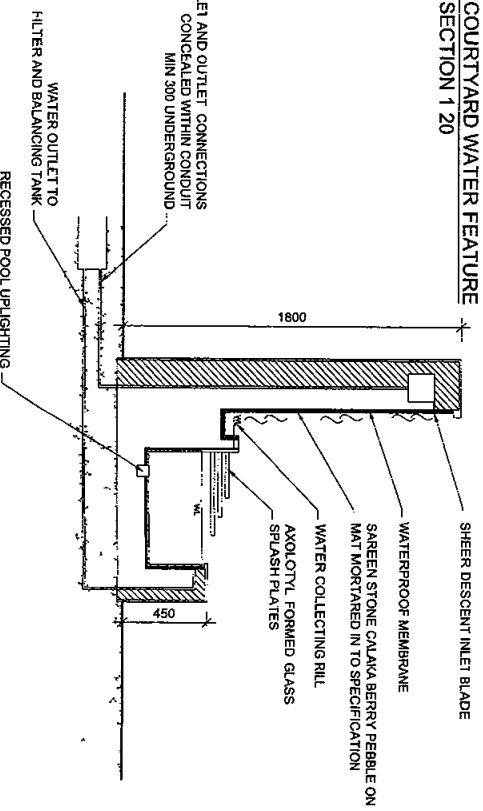
1 COURTYARD WATER FEATURE
PLAN 1 20



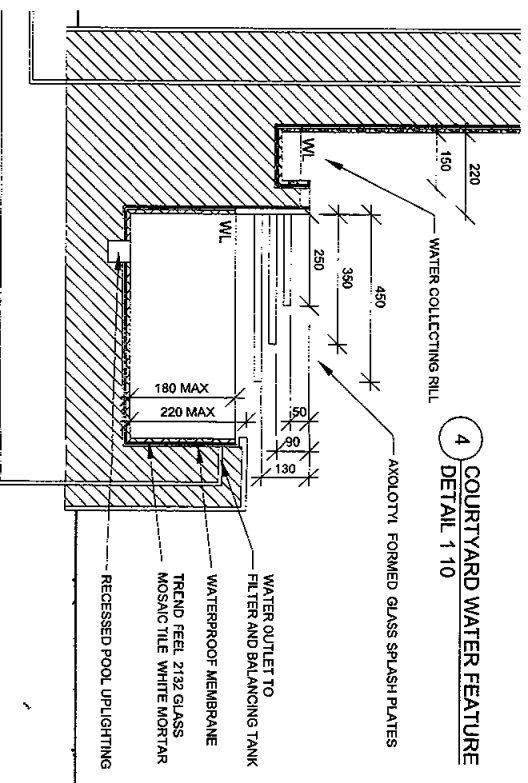
2 COURTYARD WATER FEATURE
SECTIONAL ELEVATION 1 20



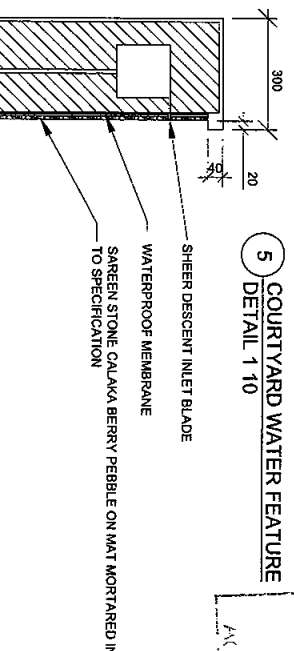
3 COURTYARD WATER FEATURE
SECTION 1 20



4 COURTYARD WATER FEATURE
DETAIL 1 10



5 COURTYARD WATER FEATURE
DETAIL 1 10



15/3/2020

Project	ARV WARREWOOD STAGE 3
Client	Warrewood
Architect	Taylor & Grammer
Scale	AS SHOWN
Date	15/3/2020
Drawn by	LD03
Checked by	A



Case Number 124089

10 May 2011

ANGLICAN RETIREMENT VILLAGES
c/- ROSE ATKINS RIMMER

**NOTICE OF REQUIREMENTS
for
SECTION 73 SUBDIVIDER/DEVELOPER COMPLIANCE CERTIFICATE
(Sydney Water Act 1994, Part 6, Division 9)**

Developer	ANGLICAN RETIREMENT VILLAGES
Your reference	98/22344
Development	Lot B DP400488, 6-14 MacPherson St, Warriewood
Development Description	The Construction of a SEPP Housing for Seniors development including 25 self contained dwellings, associated ground level car parking, ancillary facilities including recreational swimming pool, gym, medical consulting rooms, lounges, multi-purpose room and cafe
Council Consent No	634/10 by Pittwater Council of 24 March 2011
Your application date	27 April 2011

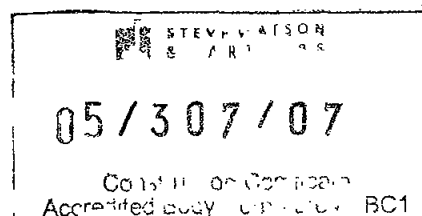
Dear Applicant

Sydney Water has assessed your application for a Section 73 Compliance Certificate (the Certificate) for the development shown above. Before Sydney Water can issue the Certificate, you must meet all the requirements set out in this notice and summarised in the following document *What You Must Do To Get A Section 73 Certificate*

You have until 10 May 2012 to meet those requirements and receive the Certificate. If you have not received the Certificate by then you will have to reapply (and pay another application fee) and Sydney Water will issue you with a new notice. We may have extra requirements and charges may change in the new notice.

The Water Servicing Coordinator (Coordinator) will be your point of contact with Sydney Water. They can answer most questions you might have on our developer process and charges.

You can also find out about this process by visiting www.sydneywater.com.au > Building and Developing > Developing Your Land. (If you want to find out the status of your application, simply select Developer Application Enquiry and enter your case number (shown above) and email address. A response will be sent automatically to you.



What You Must Do To Get A Section 73 Certificate

Summary

There are no servicing requirements raised in this Notice letter At the end of this Notice are some other things that you may need to do They are NOT a requirement to be met before the Certificate can issue but may well be a requirement of Sydney Water in the future because of the impact of your development on our assets You must read them before you go any further Upon acceptance of this Notice letter, a Section 73 Certificate will issue

OTHER THINGS YOU NEED TO DO

Shown below are other things you need to do that are NOT a requirement for the Certificate. They may well be a requirement of Sydney Water in the future because of the impact of your development on our assets. You must read them before you go any further.

Water and Sewer Works Information

This is stage 3 of a multi-staged development. Stages 1 and 2 (Case No 's 115890 and 110589) have been dealt with previously and Section 73 Certificates issued on 7 August 2009.

a) Water

Your development must have a frontage to a water main that is the right size and can be used for connection.

Sydney Water has assessed your application and found that

- The existing 200mm uPVC water main in MacPherson St will serve your stage 3 development (buildings J/K)
- Stages 1 and 2 of this development (Case No s 115890 and 110589 respectively) are already connected to the main (200mm x 200mm) via a large water service and separate meters.

b) Sewer

Your development must have a sewer main that is the right size and can be used for connection. That sewer must also have a connection point within your development's boundaries.

Sydney Water has assessed your application and found that

- The existing 400mm RC sewer carrier main along the eastern boundary will serve your development. Sewerage Service Diagram 700104 indicates connection for this stage 3 can be made to the existing private sewer house service lines set up for the overall development.

Stamping and approval of your building plans

Please note that your building plans must be stamped and approved. This can be done at a Quick Check agency. For an agency list visit www.sydneywater.com.au > Building and Developing > Quick Check or call 13 20 92.

This is not a requirement of the Certificate but the approval is needed because construction/building works may impact on existing Sydney Water assets (e.g. water and sewer mains). In any case, these works **MUST NOT** commence until Sydney Water has granted approval.

Your Coordinator can tell you about the approval process including

- Possible requirements,
- Costs, and

- Timeframes

Note You must obtain our written approval before you do any work on Sydney Water's systems. Sydney Water will take action to have work stopped on the site if you do not have that approval. We will apply Section 44 of the *Sydney Water Act 1994*.

Disused Sewerage Service Sealing

Please do not forget that you must pay to disconnect all disused private sewerage services and seal them at the point of connection to a Sydney Water sewer main. This work must meet Sydney Water's standards in the NSW Code of Practice for Plumbing and Drainage (the Code) and be done by a licensed drainer. The licensed drainer must arrange for an inspection of the work by a NSW Fair Trading Plumbing Inspection Assurance Services (PIAS) officer. After that officer has looked at the work, the drainer can issue the Certificate of Compliance. The Code requires this.

Soffit Requirements

Please be aware that floor levels must be able to meet Sydney Water's soffit requirements for property connection and drainage.

Trade Waste Information

Should this development generate trade wastewater, this notice of requirements does not guarantee the applicant that Sydney Water will accept the trade wastewater to its sewerage system. In the event trade wastewater is generated, the property owner is required to submit an application for permission to discharge trade wastewater to the sewerage system before business activities commence. A boundary trap will be required where arrestors and special units are installed for trade waste pre-treatment.

If this development type is "Industrial" then the property may be part of sewerage catchment subject to a wastewater reuse scheme. This may impact the level of pollutants such as Total Dissolved Solids (TDS) that Sydney Water will accept from the property to the sewerage system. Businesses wishing to discharge wastewater (other than domestic sewage) should first contact a Sydney Water Trade Waste Office. A boundary trap will be required where arrestors and special units are installed for trade waste pre-treatment.

Prospective Purchasers should be made aware of the above situation under the requirements of vendor disclosure.

For further information please visit the Sydney Water website at <http://www.sydneywater.com.au/OurSystemsandOperations/TradeWaste/>

To contact a Trade Waste Customer Service Representative please see below for Local Government Areas and their relevant contact number.

For the following LGA's the contact number for a Trade Waste Customer Representative is 02 9694 6500

Ashfield, Bankstown, Botany Bay, Burwood, Camden, Campbelltown, Canada Bay, Canterbury, Fairfield, Hurstville, Kiama, Kogarah, Leichhardt, Liverpool, Marrickville, Randwick, Rockdale, Shellharbour, Strathfield, Sutherland, Wingecarribee, Wollondilly, Wollongong

For the following LGA's the contact number for a Trade Waste Customer Representative is 02 8805 5588

Auburn, Baulkham Hills, Blacktown, Blue Mountains, Holroyd, Hornsby, Hunters Hill, Kuringgai, Lane Cove, Manly, Mosman, North Sydney, Parramatta, Penrith, Pittwater, Ryde, Sydney, Warringah, Waverley, Willoughby, Woollahra

Backflow Prevention Information

In accordance with Sydney Water's Backflow Prevention Containment Policy, you must install a backflow prevention containment device immediately downstream of each master water meter/s servicing the property. In circumstances where there is no master meter/s the containment device shall be installed on the water supply entering the property boundary.

The device is to be installed on all water supplies entering the property, regardless of the supply type or metering arrangements. It is needed to reduce the risk of contamination by backflow from these supplies.

Separate hydrant and sprinkler fire services on non-residential properties, require the installation of a testable double check detector assembly. The device is to be located at the boundary of the property.

The device must be installed as a condition of continued use of the water supply. Failure to install and maintain the device may result in disconnection of the water service. A licensed plumber with backflow accreditation can advise you of the correct requirements for your property. To view a copy of Sydney Water's Backflow Prevention Policy and a list of backflow accredited plumbers visit <http://www.sydneywater.com.au/Plumbing/BackflowPrevention/>

Fire Fighting

Definition of fire fighting systems is the responsibility of the developer and is not part of the Section 73 process. It is recommended that a consultant should advise the developer regarding the fire fighting flow of the development and the ability of Sydney Water's system to provide that flow in an emergency. Sydney Water's Operating Licence directs that Sydney Water's mains are only required to provide domestic supply at a minimum pressure of 15 m head.

A report supplying modelled pressures called the Statement of Available pressure can be purchased through any Quickcheck agent and may be of some assistance when defining the fire fighting system. The Statement of Available pressure, may advise flow limits that relate to system capacity or diameter of the main and pressure limits according to pressure management initiatives. If mains are required for fire fighting purposes, the mains shall be arranged through the water main extension process and not the Section 73 process.

Large Water Service Connection

A water main is available to provide your development with a domestic supply. The size of your development means that you will need a connection larger than the standard domestic 20 mm size (refer to details under water information relating to existing water connection).

To get approval for your connection, you will need to lodge an application with a Quick Check Agent. You, or your hydraulic consultant, may need to supply the following:

A plan of the hydraulic layout,
A list of all the fixtures/fittings within the property,
A copy of the fireflow pressure inquiry issued by Sydney Water,
A pump application form (if a pump is required),
All pump details (if a pump is required)

You will have to pay an application fee

Sydney Water does not consider whether a water main is adequate for fire fighting purposes for your development. We cannot guarantee that this water supply will meet your Council's fire fighting requirements. The Council and your hydraulic consultant can help.

Disused Water Service Sealing

You must pay to disconnect all disused private water services and seal them at the point of connection to a Sydney Water water main. This work must meet Sydney Water's standards in the NSW Code of Practice for Plumbing and Drainage (the Code) and be done by a licensed plumber. The licensed plumber must arrange for an inspection of the work by a NSW Fair Trading Plumbing Inspection Assurance Services (PIAS) officer. After that officer has looked at the work, the drainer can issue the Certificate of Compliance. The Code requires this.

Other fees and requirements

The requirements in this Notice relate to your Certificate application only. Sydney Water may be involved with other aspects of your development and there may be other fees or requirements. These include:

- plumbing and drainage inspection costs,
- the installation of backflow prevention devices,
- trade waste requirements,
- large water connections and
- council fire fighting requirements (It will help you to know what the fire fighting requirements are for your development as soon as possible. Your hydraulic consultant can help you here.)

END

Our ref 10s199
T 02 9439 2633
E John.williams@mottmac.com.au

Hansen Yuncken
Level 6
15 Bourke Road
Mascot NSW 2020

28th April, 2011

Attention Adam Towner

Dear Sir,

Warriewood Brook Retirement Village – Stage 3

This is to certify that

The structural engineering components of this project will be designed by a practising structural engineer in accordance with the relevant Australian Standards, Building Code of Australia and accepted engineering practice and principles

Where required a practising structural engineer from this office will carry out inspections during construction of the works

In carrying out the design and inspections we will exercise the degree of skill, care and diligence normally exercised by Consulting Engineers in similar circumstances

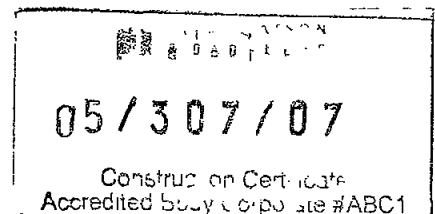
This certificate does not relieve other parties of their responsibilities for the works

Yours sincerely



JOHN WILLIAMS

Mott MacDonald
Hughes Trueman



WARRIEWOOD BROOK ANGLICAN RETIREMENT VILLAGES STRUCTURAL WORKS

GENERAL NOTES

- G1 THESE STRUCTURAL DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL AND OTHER CONSULTANTS DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUMENTS AS MAY BE REFERRED TO HEREIN.
- G2 DO NOT COMMENCE CONSTRUCTION USING THESE STRUCTURAL DRAWINGS UNTIL A CONSTRUCTION CERTIFICATE IS ISSUED BY THE PRINCIPAL CERTIFYING AUTHORITY.
- G3 ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT CURRENT STANDARDS AUSTRALIA CODES AND WITH THE BUILDING CODE OF AUSTRALIA.
- G4 ALL SET OUT DIMENSIONS SHOWN ON THESE STRUCTURAL DRAWINGS SHALL BE VERIFIED BY THE BUILDER ON SITE. DO NOT SCALE THESE STRUCTURAL DRAWINGS FOR DIMENSIONS.
- G5 UNLESS NOTED OTHERWISE ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES.
- G6 THE METHOD OF CONSTRUCTION AND THE MAINTENANCE OF SAFETY DURING CONSTRUCTION ARE THE RESPONSIBILITY OF THE BUILDER. IF ANY STRUCTURAL ELEMENT PRESENTS DIFFICULTY IN RESPECT OF CONSTRUCTIBILITY OR SAFETY THE MATTER SHALL BE REFERRED TO THE STRUCTURAL ENGINEER FOR RESOLUTION BEFORE PROCEEDING WITH THE WORK.
- G7 DURING CONSTRUCTION THE STRUCTURE SHALL BE MAINTAINED IN A STABLE CONDITION AND NO PART SHALL BE OVERLOADED. THE BUILDER SHALL PROVIDE TEMPORARY BRACING SHORING AND EXCAVATIONS STABLE AT ALL TIMES.
- G8 THE BUILDER IS RESPONSIBLE FOR THE ADEQUACY OF ALL TEMPORARY WORKS INCLUDING SHORING BRACING AND BRACING AND WHERE NECESSARY IS TO ENGAGE A STRUCTURAL ENGINEER TO DESIGN AND CERTIFY HIS TEMPORARY WORKS.
- G9 IF THERE IS A DISCREPANCY IN MEMBER SIZES FOR ANY COMPONENT ASSUMED FOR DESIGN THE BUILDER SHALL REFER TO THE ENGINEER FOR DECISION BEFORE DETAILING OR CONSTRUCTION.
- G10 DETAIL AND SECTION IDENTIFICATION:
 ① — DETAIL OR SECTION REFERENCE
 — DRAWING REFERENCE
- G11 THE RLS SHOWN IN THESE DRAWINGS ARE APPROXIMATE AND ARE FOR THE SOLE PURPOSE OF ASSISTING THE STRUCTURAL DOCUMENTATION.
 THEY MUST NOT BE USED FOR CONSTRUCTION.
 REFER TO THE ARCHITECT'S DRAWINGS FOR ALL CONSTRUCTION RLS.
- G12 UNLESS AGREED OR SPECIFIED OTHERWISE, THE BUILDER IS REQUIRED TO NOTIFY AND ALLOW THE FOR THE STRUCTURAL ENGINEER TO INSPECT AT THE FOLLOWING POINTS: COMPLETED EXCAVATION FORMWORK REINFORCEMENT MEMBRANES AND EMBEDMENTS PRIOR TO PLACING CONCRETE COMPLETED STRUCTURAL ELEMENTS PRIOR TO COVERING UNLESS COVERED BY AS/NZS NATIONAL TRAPPA FRAMING CODE).
- G13 48 HOURS NOTICE IS REQUIRED FOR INSPECTION ALL WORK TO BE INSPECTED MUST BE COMPLETED PRIOR TO THE TIME OF INSPECTION FOR THE COMPLETENESS AND CORRECTNESS OF HIS WORK.
- G14 SITE INSPECTIONS DO NOT RELIEVE THE BUILDER OF RESPONSIBILITY FOR THE COMPLETENESS AND CORRECTNESS OF HIS WORK.
- G15 INSPECTIONS WILL BE PERIODIC AND REPRESENTATIVE AND WILL NOT NECESSARILY BE MADE OF ALL WORKS. THE BUILDER IS REQUIRED TO ALLOW THE AND PROVIDE SITE ACCESS FOR THE INSPECTION TO TAKE PLACE AND IS TO HAVE A RESPONSIBLE SITE FOREMAN AVAILABLE TO RECEIVE ANY COMMENT OR DIRECTION FROM THE ENGINEER.
- G16 WHERE STRUCTURAL ELEMENTS ARE DESIGNED AND CERTIFIED BY OTHER PARTIES THE BUILDER SHALL OBTAIN WRITTEN CERTIFICATION PRIOR TO PROCEEDING WITH ANY CONSTRUCTION WHICH MAY PRESENT INSPECTION OR REPELAL WORKS BEING UNDERTAKEN TO THESE ITEMS.

SUBGRADE PREPARATION - FOR BUILDINGS AND NON-VEHICULAR PAVEMENTS

- S11 REMOVE ALL TOPSOIL, VEGETABLE MATTER RUBBLE OR DELETORIOUS MATERIAL.
- S12 PROFILE NATURAL SURFACE WITH A VIBRATING ROLLER OF AT LEAST 10 TONNE STATIC WEIGHT WHERE A VIBRATING ROLLER WOULD PUT AT RISK ADJACENT STRUCTURES USE A NON VIBRATING ROLLER WHERE THERE IS INSUFFICIENT ACCESS FOR A ROLLER. THE CONTRACTOR IS TO AGREE TO AN APPROPRIATE ROLLER TYPE AND SPEED WITH THE CLIENT'S GEOTECHNICAL CONSULTANT PRIOR TO THE WORK.
- S13 GEOTECHNICAL CONSULTANT TO ADVISE ON SUITABILITY OF THE NATURAL SURFACE OR ALTERNATIVE MEANS OF PROOF TESTING SUCH AS ADVISE AND TESTING TO BE AT THE CONTRACTOR'S EXPENSE.
- S14 REMOVE ANY SOFT AREAS OR AREAS UNSUITABLE TO REMAIN UNDER OR TO BEAR THE NEW CONSTRUCTION.
- S15 PLACE STABLE NON ORGANIC FILL SUITABLE TO REMAIN UNDER OR TO BEAR THE NEW CONSTRUCTION WITH A MAXIMUM PARTICLE SIZE OF 75mm AND COMPACT IN 200mm MAXIMUM THICKNESS LAYERS TO ACHIEVE THE REQUIREMENTS OF THE FOLLOWING TABLE.

Location	(Concrete and fill to match density of existing subgrade)	(Concrete and fill to match density of existing subgrade)
Under building 500mm above floor Level: 200Pa or Pad or strip	98P S1d	80P
Under building Supporting floor Level: 200Pa or Pad or strip	100P S1d	80P
Under external Non vehicular Pavements fill to Level: 500mm	95P S1d	70P
Under external Pavements: Top 300mm of fill	98P S1d	80P

CONCRETE

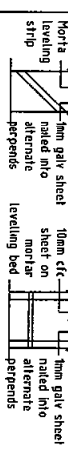
- C1 ALL WORKMANSHIP AND MATERIALS SHALL CONFORM WITH AS3600 EXCEPT WHERE VARYED BY THE CONTRACT DOCUMENTS.
 - C2 ALL CONCRETE SHALL CONFORM WITH AS3799 NO DETAIL TYPE AGRAGGREGATE IS TO BE USED.
 - C2.2 COMPRESSIVE STRENGTH GRADES
- | Element | Strength Grade (MPa) | Slump (mm) | Maximum Aggregate Size (mm) |
|---------------------------|----------------------|------------|-----------------------------|
| Piers and Footings | N32 | 80 | 20 |
| Slabs on Ground and Beams | S40 | 80 | 20 |
| Columns | M40 | 80 | 20 |
| Electrification | N32 | 80 | 20 |
| Mass Concrete | M35 | 80 | 20 |
| Shotcrete | S32 | 80 | 20 |
- C2.4 SHRINKAGE STRAIN SHALL NOT EXCEED 650X10⁻⁶ IN ACCORDANCE WITH AS3799.
 - C2.5 PROJECT ASSESSMENT OF CONCRETE STRENGTH SHALL BE CARRIED OUT IN ACCORDANCE WITH AS1319.
 - C2.6 SAMPLES OF EACH TYPE AND GRADE SHALL BE IN ACCORDANCE WITH THE FOLLOWING TABLE.

NUMBER OF BATCHES PER DAY	NUMBER OF SAMPLES
1	1
2 TO 5	2
6 TO 10	3
11 TO 20	4

1 ADDITIONAL FOR EACH ADDITIONAL 10 APPROVED BY THE ENGINEER IN WRITING

CONCRETE (CON T)

- C4 COMPACT ALL CONCRETE INCLUDING FOOTINGS AND SLABS ON GROUND WITH MECHANICAL VIBRATORS.
- C5 CURING OF CONCRETE
 CURE ALL CONCRETE AS FOLLOWS:
 KEEP SURFACES CONTINUOUSLY WET FOR THREE DAYS THEN PREVENT SURFACE LOSS FOR THE NEXT FOUR DAYS USING WATER SHEETING OR THE APPROVED PROTECTED FROM CURING COMPOUNDS MAY BE USED PROVIDED THAT THEY CONFORM WITH AS3799 AND THEY DO NOT AFFECT FLOOR FINISHES.
 PVA BASED CURING COMPOUNDS ARE NOT ACCEPTABLE.
- C6 SLIP DRIPS TO BE USED ON ALL LOAD BEARING MASONRY WALLS USE TWO LAYERS OF GALVANISED FLAT STEEL WITH BRANIFFE BRACE BETWEEN.



STRUCTURAL DESIGN LOADINGS

FLOOR USAGE	DL (kPa)	TL (kPa)	SUPERIMPOSED DEAD LOAD (kPa)
FLOOR UNDEFINABLE	0.25		0.5
RESIDENTIAL BALCONIES	2		1.5
CONCREGAL WALKWAYS	5		1.5
PLANT ROOM FLOORS	5		1.5
STAIRS/STAIRWELLS	4		0.5
OFFICE FLOORS	4		1
PUBLIC HALLS	4		1.5

TEMPORARY WORKS

DESIGN AND INSTALLATION OF ALL TEMPORARY WORKS AND PROCEDURES MUST BE APPROVED BY THE ARCHITECT PRIOR TO THE WORK BEING COMMENCED. THE BUILDER WILL BE RESPONSIBLE FOR BRACING ANY DAMAGED OR ADDITIONAL WORKS AND ROADWAYS DURING THE INSTALLATION OF THE TEMPORARY WORKS AND THE PERMANENT WORKS. ANY TEMPORARY WORK DETAILS AND PROCEDURES GIVEN IN THESE DRAWINGS ARE FOR THE GUIDANCE OF THE BUILDER ONLY.

WATERPROOF SEALANTS

W1 WATERPROOF SEALANTS ARE INDICATED ON THE DRAWINGS UNLESS SPECIFIED OTHERWISE. THE CONTRACTOR IS TO USE A PROPRIETARY PRODUCT SUPPLIED BY EITHER BUNEST MULTI EPREP SASKA HIT OR PARABURY THAT IS SUITABLE FOR THE PURPOSE. THE CONTRACTOR SHALL CONSULT WITH THE SUPPLIER AND REFER TO THEIR SPECIFICATIONS TO DETERMINE SUITABLE JOINT TYPES AND THE LINE WHERE SPLICING ARE TO BE MADE. THE SEALANT IS TO BE COLOR MATCHED TO THE SUBSTRATE AND THE JOINT SURFACE SHALL BE ELASTOMERIC RESISTANT AND SHALL BE CLEANED FOR THE ENVIRONMENT IN WHICH THEY WILL BE USED. THE SEALANT SHALL BE SUBJECT TO WHICH THEY ARE ATTACHED TO THE SUBSTRATE TO WHICH THEY ARE ATTACHED MINIMUM SHEAR CAPACITY 25% OF JOINT WIDTH.

WATERPROOFING

W1 WATERPROOFING TANKING AND ASSOCIATED JOINT SEALANTS AND/OR HYDRAULIC ENGINEERS DETAILS AND SPECIFICATIONS. WHERE THESE ITEMS ARE NOT COVERED BY THE ARCHITECT OR THE ENGINEER, THE CONTRACTOR IS TO OBTAIN DESIGN AND SPECIFICATION FROM THE ARCHITECT'S APPROVAL.

USE OF PROPRIETARY MATERIALS

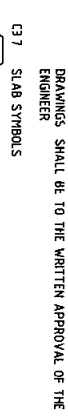
PM1 ALL PROPRIETARY MATERIALS MUST BE USED STRICTLY ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS. BUILDERS TO OBTAIN CERTIFICATE FROM MANUFACTURERS CONFIRMING CORRECT USAGE/INSTALLATION.

EPOXY ADHESIVES AND GROUTS

EM1 WHERE EPOXY ADHESIVES OR GROUTS ARE INDICATED ON THE DRAWINGS UNLESS SPECIFIED OTHERWISE, THE CONTRACTOR IS TO USE A PROPRIETARY PRODUCT SUPPLIED BY EITHER BUNEST MULTI EPREP SASKA HIT OR PARABURY THAT IS SUITABLE FOR THE PURPOSE. THE CONTRACTOR SHALL CONSULT WITH THE SUPPLIER AND REFER TO THEIR SPECIFICATIONS TO DETERMINE SUITABLE JOINT TYPES AND THE LINE WHERE SPLICING ARE TO BE MADE. THE SEALANT IS TO BE COLOR MATCHED TO THE SUBSTRATE AND THE JOINT SURFACE SHALL BE ELASTOMERIC RESISTANT AND SHALL BE CLEANED FOR THE ENVIRONMENT IN WHICH THEY WILL BE USED. THE SEALANT SHALL BE SUBJECT TO WHICH THEY ARE ATTACHED TO THE SUBSTRATE TO WHICH THEY ARE ATTACHED MINIMUM SHEAR CAPACITY 25% OF JOINT WIDTH.

FOUNDATIONS

- F1 FOOTINGS HAVE BEEN DESIGNED FOR AN ALLOWABLE BEARING CAPACITY OF 600 kPa. ALL FOOTINGS SHALL BE IN ACCORDANCE WITH AS2870.
- F2 FOOTINGS SHALL BE PLACED CENTRALLY UNDER WALLS AND COLUMNS UNLESS NOTED OTHERWISE.
- F3 RESIDENTIAL SLABS AND FOOTINGS HAVE BEEN DESIGNED FOR A REACTIVITY CLASS 2 TO AS2870.
- F4 FOR CONTRACT PURPOSES ONLY THE FOOTING LEVEL SHALL BE ACTUAL CONSTRUCTION DEPTH TO BE VERIFIED BY OTHERS BEARING MATERIAL AT BASES OF FOOTINGS AND PERS TO BE CONFIRMED BY AN EXPERIENCED GEOTECHNICAL ENGINEER OR ENGINEERING GEOLOGIST ENGAGED BY THE BUILDER ARCHITECT'S DETAILS.



C37 SLAB SYMBOLS
 — DENOTES SLAB THICKNESS

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NOT FOR CONSTRUCTION

NOTES SHEET 1

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Rev

Rev	Issue For	Date	Completed by	Checked by	Verified by	Issue
A	ISSUE FOR CONSTRUCTION CERTIFICATE	28 Oct 11	HSV	AM	X	Final
B	ISSUE FOR PERCING	05 Nov 10	HSV	AM	X	Final

Scale

Scale	Symbol
300mm	1:300
200mm	1:200
100mm	1:100

WARRIEWOOD BROOK
 8 MACPHERSON STREET
 WARRIEWOOD
 ANGLICAN RETIREMENT VILLAGE
 NRP ARCHITECTURE

10S199 - S01

10S199 - S01

B

BORED PIERS DESIGN INSTALLATION AND CERTIFICATION NOTES

- 1 BORED PIERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH AS 289 AND ANY ADDITIONAL SPECIAL REQUIREMENTS OUTLINED ON THE STRUCTURAL DRAWINGS
2 BORED PIERS SHALL BE DESIGNED BY THE CONTRACTOR IN TERMS OF PILE DIAMETER
3 ALL FOUNDING MATERIAL SHALL BE INSPECTED APPROVED & CERTIFIED AT THE CONTRACTOR'S EXPENSE BY A GEOTECHNICAL ENGINEER ENGAGED BY THE CONTRACTOR AND THE DESIGN LOADS AND COMBINATIONS AS NOTED BELOW
4 ALL BORED PIERS SHALL BE FOUND ON SAME FOUNDATION MATERIAL
5 TOLERANCE ON INSTALLATION OF BORED PIERS SHALL BE IN ACCORDANCE WITH AS 2759
6 PLACING OF CONCRETE IN BORED PIERS SHALL BE IN ACCORDANCE WITH SPECIFICATION
7 THE CONTRACTOR SHALL SUBMIT DETAILED CALCULATIONS SHOWING THE DESIGN CAPACITY OF BORED PIERS & METHODS OF ARRIVING AT THE DESIGN CAPACITY FOR REVIEW BY HUGHES TRUENMAN PRIOR TO COMMENCING ON SITE PER DESIGN TO BE CERTIFIED BY NEER ENGINEER ENGAGED BY THE CONTRACTOR
8 CONCRETE COVER TO ALL REINFORCEMENT IS TO BE 75mm
9 CENTRE LINE OF ALL PIERS TO CONCORD WITH CENTRE LINE OF COLUMNS UNLESS DETAIL OTHERWISE
DESIGN LOADS HAVE BEEN DETERMINED IN ACCORDANCE AS 1110 WORKING LOADS FOR THE LOAD COMBINATION G & ARE SPECIFIED ON THE STRUCTURAL DRAWINGS
LOADS
NOTES
1 TOP OF ALL PIERS TO BE AT BULK EARTHWORKS LEVEL NOMINATED BY CIVIL ENGINEERS UNLESS NOTED OTHERWISE ON PLANS WITH THE EXCEPTION OF
a ALL COLUMNS WHERE SERVICE PIERS RUN DOWN COLUMNS TOP OF PIERS TO BE 300mm BELOW BULK EARTHWORKS LEVEL (LOCATIONS YET TO BE CONFERRED)
b ALL PIERS WHERE STRIP FOOTINGS TYPE DFB1 GFB2 & DFB3 EXIST TOP OF PIERS TO BE 500mm BELOW BULK EARTHWORKS LEVEL
2 AT GREASE ARRESTOR ROOMS & UNDERGROUND PLUMBING FOUNDING LEVEL OF BORED PIER TO BE A MINIMUM OF 300mm BELOW BASE OF EXCAVATION FOR ROOM/PLENUM
3 MINIMUM LENGTH OF BORED PIER UNDER COLUMN 1000mm

STRUCTURAL INSPECTIONS DURING CONSTRUCTION

- SM1 UNLESS AGREED OR SPECIFIED OTHERWISE THE BUILDER IS REQUIRED TO HOLD CONSTRUCTION AND NOTIFY THE STRUCTURAL ENGINEER FOR INSPECTION AT THE FOLLOWING POINTS
COMPLETED EXCAVATION FORMWORK REINFORCEMENT REBAR/ARMS AND EMBLEMENTS PRIOR TO PLACING CONCRETE
COMPLETED ERECTED STRUCTURAL TIMBER FRAMING PRIOR TO COVERING UNLESS COVERED BY ASHRA NATIONAL TIMBER FRAMEWORK CODE
COMPLETED ERECTED STRUCTURAL STEELWORK PRIOR TO COVERING
SM2 48 HOURS NOTICE IS REQUIRED FOR INSPECTION ALL WORK TO BE INSPECTED MUST BE COMPLETED PRIOR TO THE TIME OF INSPECTION
SM3 SITE INSPECTIONS DO NOT RELIEVE THE BUILDER OF RESPONSIBILITY FOR THE COMPLETENESS AND CORRECTNESS OF HIS WORK
SM4 INSPECTIONS WILL BE PERFORMED AND RECORDED AND WILL NOT BE CONSIDERED AS AN INSPECTION OF THE WORK UNLESS THE BUILDER IS TO ALLOW THE AND PROVIDE SITE ACCESS FOR THE INSPECTOR TO TAKE PLACE AND IS TO HAVE A RESPONSIBLE SITE FOREMAN AVAILABLE TO RECEIVE ANY COMMENT OR DIRECTION FROM THE ENGINEER
SM5 WHERE STRUCTURAL ELEMENTS ARE DESIGNED AND CERTIFIED BY OTHER PARTIES THE BUILDER SHALL OBTAIN WRITTEN CERTIFICATION PRIOR TO PROCEEDING WITH ANY CONSTRUCTION WHICH MAY PREVENT INSPECTION OR REBELL WORKS BEING UNDERTAKEN TO THESE ITEMS

REINFORCEMENT FOR CONCRETE

Table with columns: SYMBO, BAR SHAPE, STRENGTH GRADE (MPa), DUCTILITY CLASS, TO COMPLY WITH AUSTR STANDARD. Includes rows for R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12.

REINFORCEMENT FOR CONCRETE (CONT D)

Table: FULL STRENGTH LAP FOR SLAB AND BEAM BARS. Includes columns for BAR DIA, LENGTH L (mm), SEE DIAGRAMS BELOW. Includes diagrams for column and slab reinforcement details.

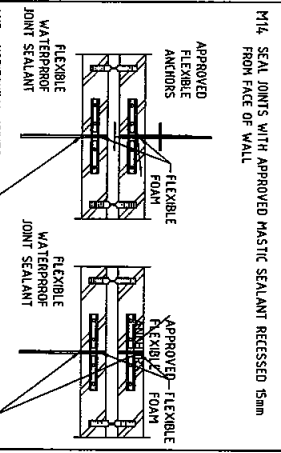
FORMWORK

- FW1 THE DESIGN CONSTRUCTION AND PERFORMANCE OF THE FORMWORK AND FALSE WORK SHALL BE CERTIFIED BY AN REGISTERED CIVIL ENGINEER AND IS THE RESPONSIBILITY OF THE CONTRACTOR. THE DESIGN SHALL BE SUBMITTED TO HUGHES TRUENMAN FOR REVIEW AND APPROVAL PRIOR TO COMMENCING ON SITE.
FW2 FORMWORK DESIGN CONSTRUCTION TOLERANCES AND STRIPPING TIMES SHALL COMPLY WITH AS3600 UNLESS OTHERWISE APPROVED BY THE STRUCTURAL ENGINEER
FW3 CONCRETE FORMED SURFACE FINISHES SHALL COMPLY WITH AS3600 AS SPECIFIED BY THE ARCHITECT
FW4 FORMWORK SHALL BE DESIGNED TO ACCOMMODATE MOVEMENTS AND LOAD REDISTRIBUTION DUE TO POST TENSIONING
FW5 THE FORMWORK SHALL NOT BE DESIGNED TO RELY ON RESTRAINT OR SUPPORT FROM THE PERMANENT STRUCTURE WITHOUT PRIOR APPROVAL FROM THE ENGINEER
FW6 DESIGN INFORMATION CONCERNING THE FOUNDATION FOR FORMWORK SHALL BE OBTAINED FROM THE GEOTECHNICAL ENGINEER ENGAGED BY THE CONTRACTOR AND THE DESIGN REFER ALSO TO THE GEOTECHNICAL REPORT
FW7 DURING CONSTRUCTION PROPER PROPPING WHERE LOADS FROM STACKED MATERIALS, FORMWORK AND OTHER SUPPORTED SLABS ARE APPLIED TO THE FORMWORK SHALL BE PROVIDED TO MAINTAIN THE LOAD FOR STRENGTH OR SERVICEABILITY AS NOTED ON THE DRAWINGS. THE NOMINATED 28 DAY STRENGTH HAS BEEN ATTAINED THESE LOADS SHALL NOT EXCEED THE DESIGN SUPERIMPOSED LOADS SET OUT IN THE GENERAL NOTES
FW8 IN WALL, STRENGTH CONSTRUCTION PROPPING MAY NEED TO EXTEND TO THE FULL HEIGHT OF THE WALL TO MAINTAIN THE STRENGTH OF THE WALL. THE PROPPING SHALL BE REMOVED PRIOR TO CASTING TO AVOID DISTRESS TO THE FORMWORK. THE PROPPING SHALL BE REMOVED PRIOR TO CASTING TO AVOID DISTRESS TO THE FORMWORK. THE PROPPING SHALL BE REMOVED PRIOR TO CASTING TO AVOID DISTRESS TO THE FORMWORK.
FW9 DO NOT PLACE PERMANENT LOADS INCLUDING MASONRY WALLS ON THE LINE OF THE CONCRETE STRUCTURE UNTIL AFTER FORMWORK AND PROPPING IS REMOVED
FW10 SPECIAL REQUIREMENTS FOR SEQUENCE OF CONCRETE PLACEMENT AND STRIPPING ARE AS FOLLOWS
FW11 REFER TO ARCHITECT'S DRAWINGS FOR TEST PANEL DETAILS. REINFORCEMENT FOR TEST PANELS SHALL BE SIMILAR TO THAT IN THE PERMANENT STRUCTURE BEING REPRESENTED
FW12 BEFORE PLACING REINFORCEMENT IN THE FORMWORK APPLY A RELEASE AGENT TO THE FORMWORK COMPATIBLE WITH THE REQUIRED SURFACE FINISH
FW13 CHAMFER RE ENTRANT ANGLES AND FLEET AT CORNERS BY 25MM UNO
FW14 BEFORE PLACING CONCRETE REMOVE ALL WATER DUST AND DEBRIS FROM THE FORMWORK
FW15 FILL ALL HOLES LEFT BY FORM OF THE FINISHED SURFACE MATCHING THE SURFACE COLOUR OF THE FINISHED SURFACE

CLAY BRICK MASONRY

- M1 ALL BRICKWORK SHALL COMPLY WITH AS3700
M2 BRICKS SHALL HAVE 20 MPA UNCOMBINED COMPRESSIVE STRENGTH (IF NOT)
M3 MORTAR SHALL BE 1:1:6 SAND UNLESS NOTED OTHERWISE
M4 MORTAR SHALL BE USED WITHOUT WRITTEN APPROVAL OF THE ENGINEER. DO NOT USE FINE CLAY.
M5 MORTAR SHALL BE USED WITHOUT WRITTEN APPROVAL OF THE ENGINEER. DO NOT USE FINE CLAY.
M6 BRICKWORK SUPPORTS CONCRETE SLABS. SLAB JOINTS ARE TO BE USED REFER TO CONCRETE NOTES
M7 WHERE BRICKWORK SUPPORTS CONCRETE SLABS SLAB JOINTS ARE TO BE USED REFER TO CONCRETE NOTES
M8 JOINTS IN FINISHES ARE TO BE COMPATIBLE WITH JOINTS IN BRICKWORK
M9 NO CHASES OR DEPRESSURES ARE PERMITTED IN LOAD BEARING MASONRY WITHOUT THE APPROVAL OF THE STRUCTURAL ENGINEER

APPROVED FLEXIBLE JOINTS

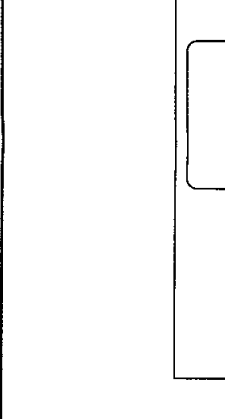


- M14 SEAL JOINTS WITH APPROVED MASTIC SEALANT RECESSED 5mm FROM FACE OF WALL
M15 APPROVED FLEXIBLE JOINTS
M16 WHERE BRICKWORK IS NON-LOAD BEARING PROVIDE 10mm GAP BETWEEN TOP OF WALL AND UNDERSIDE OF SLAB AND FILL WITH FLEXIBLE FOAM (OR SEALANTS AND FILL CALKING TO ARCHITECT'S REQUIREMENTS) PROVIDE M17 & 3 HEAD RESTRAINT TIES BY MASONRY TIES PLY AT EVERY 3RD PERPEND FIBRED TO SLAB AS PER MANUFACTURERS SPECIFICATIONS
M17 WHERE BRICKWORK SUPPORTS CONCRETE SLABS SLAB JOINTS ARE TO BE USED REFER TO CONCRETE NOTES
M18 JOINTS IN FINISHES ARE TO BE COMPATIBLE WITH JOINTS IN BRICKWORK
M19 NO CHASES OR DEPRESSURES ARE PERMITTED IN LOAD BEARING MASONRY WITHOUT THE APPROVAL OF THE STRUCTURAL ENGINEER

NOTES SHEET 2
10S199 - S02
B

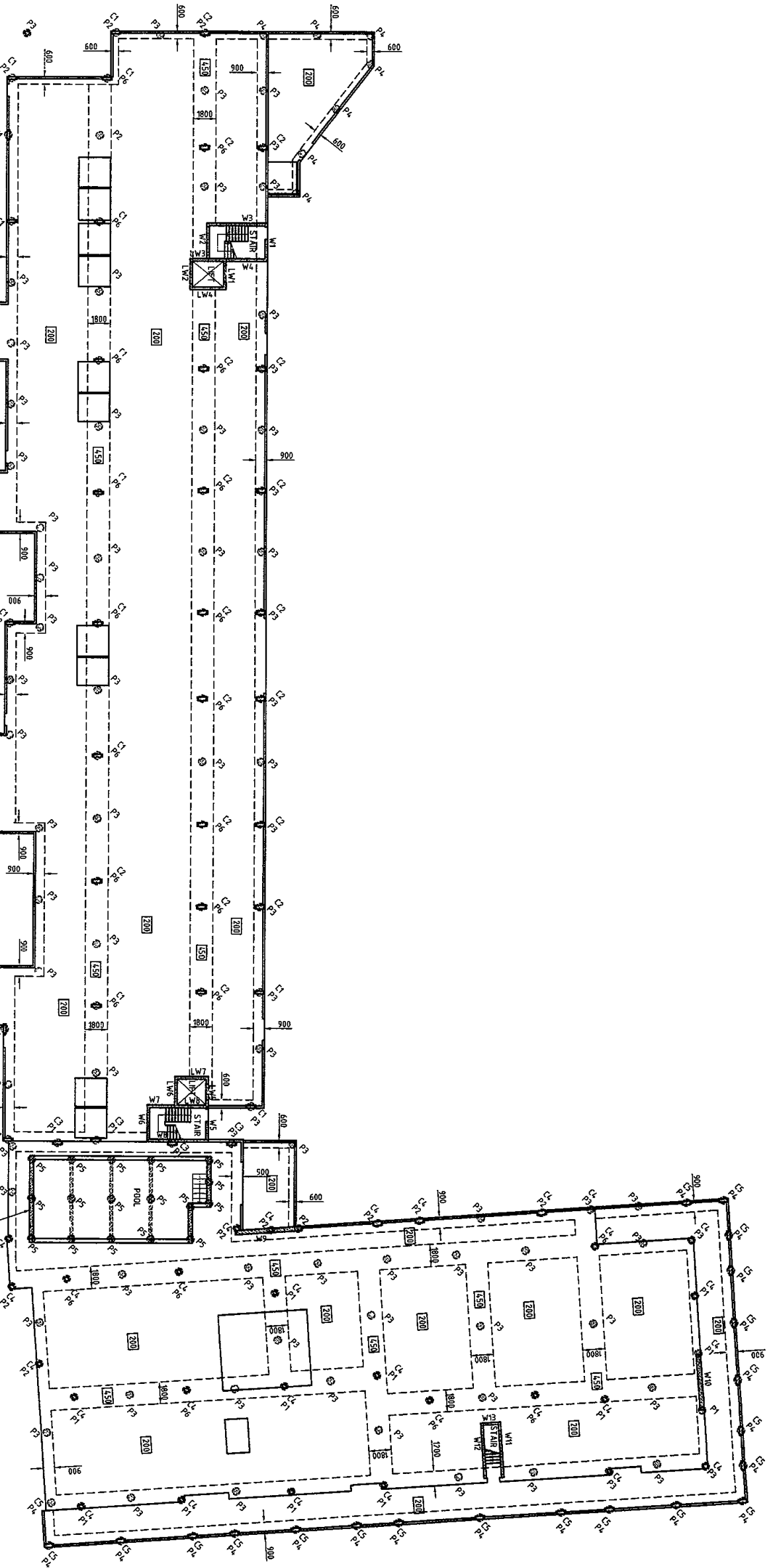
Revision table with columns: Rev, Issue, Date, Completed by, Checked by, Verified by, Authorised by.

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Drawing No: 10S199 - S02



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WARREWOOD BROOK
8 MACPHERSON STREET
WARREWOOD
ANGLOCAN RETIREMENT VILLAGE
NOT FOR CONSTRUCTION



GROUND FLOOR SLAB PLAN

SCALE 1:200

PERIS: P1 TO P5 600# REFER TO DETAIL

COLUMNS: C1 220 x 800
C2 300 x 800
C3 250 x 800
C4 300 x 300
C5 300#

WALLS: W1 TO W13 150 MM THICK RC
LEFT WALLS: LW1 TO LW8 150 MM THICK RC

PERIS TYPE	WORKING LOAD (kN)
P1	1100
P2	150
P3	500
P4	270
P5	270
P6	8000

05/30/10
ACCREDITED
10S199 - S10

NOT FOR CONSTRUCTION

GROUND FLOOR SLAB PLAN

WARRIEWOOD BROOK
8 MACPHERSON STREET
WARRIEWOOD
ANGELICAN RETIREMENT VILLAGE
NRP ARCHITECTURE

HughesTrueman
Consulting Engineers Planners & Managers
40th Fl, 120 St Leonards NSW 2055
1 81 7 242 8533

Scale 1:200 @ A1
North

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Rev	Issue	Checked by	Designed by	Date	Reason for Issue
A	ISSUE FOR INFORMATION	HSW	AV	09/09/10	
B	ISSUE FOR PERICING	HSW	AV	05/10/10	
C	ISSUE FOR PERICING	HSW	AV	18/11/10	
D	ISSUE FOR CONSTRUCTION CERTIFICATE	HSW	AV	28/04/11	



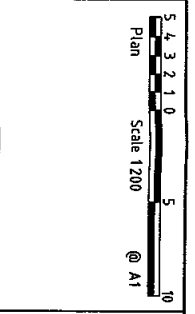
FIRST FLOOR SLAB PLAN

SCALE 1:200
 JOINTS: THJ — TEMPORARY MOVEMENT JOINT
 PHJ — PERMANENT MOVEMENT JOINT

Rev	Issue	Drawn by	Checked by	Issue
A	ISSUE FOR REGISTRATION	HSV	AV	X
B	ISSUE FOR REGISTRATION	HSV	AV	X
C	ISSUE FOR REGISTRATION	HSV	AV	X
D	ISSUE FOR REGISTRATION	HSV	AV	X
E	ISSUE FOR REGISTRATION	HSV	AV	X

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SIL
 P
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 88

Warriewood Brook
 8 Macpherson Street
 Warriewood
 ANGLICAN RETIREMENT VILLAGES
 NRP ARCHITECTURE

NOT FOR CONSTRUCTION

FIRST FLOOR SLAB PLAN

10S199 - S20

S20

E

04/307/07

C17



Our ref 10s199
T 02 9439 2633
E ray.higgins@mottmac.com.au

Hansen Yuncken
Level 6
15 Bourke Road
Mascot NSW 2020

28th April, 2011

Attention Adam Towner

Dear Sir,

Warriewood Brook Retirement Village - Stage 3

This is to certify that

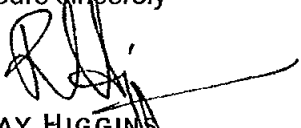
The civil engineering components of this project will be designed by a practising civil engineer in accordance with the relevant Australian Standards, Building Code of Australia and accepted engineering practice and principles. In addition our design will address all relevant conditions in the current development consent dated 28th March 2011 including items B56, C7(1), C10 and C14

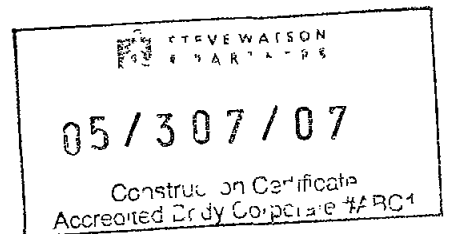
Where required a practising civil engineer from this office will carry out inspections during construction of the works

In carrying out the design and inspections we will exercise the degree of skill, care and diligence normally exercised by Consulting Engineers in similar circumstances

This certificate does not relieve other parties of their responsibilities for the works

Yours sincerely


RAY HIGGINS
Mott MacDonald
Hughes Trueman





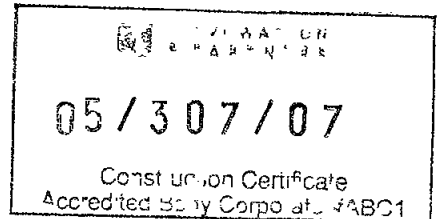
Hansen Yuncken Pty Ltd
Level 6, 15 Bourke Road
MASCOT, NSW, 2020

27 April 2011
Job No A11031

Attention Mr Danny Kataieh

Dear Danny,

**Stage 3 Warriewood Brook Retirement Village,
6-14 Macpherson Street, Warriewood
Review of Access Provisions for people with a disability CC stage**



access associates sydney has been engaged to provide ongoing reviews of the proposed Stage 3 development at the Anglican Retirement Village site Warriewood Brook Retirement Village at Warriewood to ensure access provisions for people with a disability or who are older comply with all relevant access provisions for people with disabilities as outlined below

- The Building Code of Australia 2011 - Parts D3, E3 6 & F2 4
- State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004 (Amendment No 2) 12 October 2007 - standards concerning access and useability, at gazettal date 18 01 08
- AS1428 1 (2009) Design for access and mobility Part 1 (incorporating amendment No 1) General requirements for access – New building work
- AS1428 2 (1992) Design for access and mobility Part 2 Enhanced and Additional requirements-Buildings and facilities
- AS1735 12 (1999) Lifts, escalators and moving walks Part 12 Facilities for persons with disabilities
- AS2890 6 (2009) Parking facilities Parking for people with disabilities
- The Disability Discrimination Act 1992 (DDA) and DDA Advisory Notes on Access to Premises – HREOC, June 1997
- Disability (Access to Premises - Buildings) Standards 2010
- Pittwater Council requirements for accessibility and DA conditions 15 and 17

access associates sydney has conducted a site visit on 09 08 10, reviewed the DA stage drawings, provided an accessibility report of the DA drawings dated 14 09 10, attended a design team meeting for proposed construction design on 21 04 11 and provided ongoing advice on the accessibility provisions for the CC stage

The key issue in the ongoing provision of appropriate access in the Stage 3 development is the provision of continuous accessible paths of travel complying with AS1428 1 to be provided in the paths linking the

- points of arrival including the property boundary and local bus stop
- proposed 25 independent living units
- proposed community centre facilities (swimming pool, gym, consulting rooms, lounges, multi-purpose room and cafe)

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access associates sydney



- Proposed car parking for residents and visitors
- existing Marcus Loane residential aged care facility
- existing two blocks of independent living units
- existing landscaped areas within the retirement village

It is our understanding that Anglican Retirement Villages intend to own and manage the stage 3 of the Warriewood Brook Retirement Village and propose to lease the independent living units. Anglican Retirement Villages has planned management strategies for Aging in Place with ongoing support for residents of the independent living units. While all dwellings are proposed to be designed to be accessible for wheelchair users, some elements of adaptability allow for modification to meet the intent of the SEPP and individual needs if and when required. It is anticipated that the majority of residents will be generally over the age of 75 years.

In summary the design principles for the proposed independent living units and community centre for the Warriewood Brook Retirement Village Stage 3 have potential to satisfy the policy objectives and intent of the State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004 updated 12 October 2007, the requirements of the BCA, AS1428.1 and Pittwater Council DA conditions 15 and 17. Consequently the ILUs and Community Centre facilities for Stage 3 have potential to satisfy the intent of all relevant development controls and the principles of equitable, dignified access of the Disability Discrimination Act.

I certify that I am an appropriately qualified and competent person practising in the relevant area of work. I have recognised relevant experience in the area of work being reviewed. My company is holding appropriate current insurance policy to the satisfaction of the building owner or the principal authorising the installation work being reviewed.

Yours faithfully,

access associates sydney

Jenny Muir

Qualifications Bachelor of Occupational Therapy, University of Queensland 1978
Affiliations Accredited Occupational Therapist by OT Australia (No 201169)
Accredited Member Association of Consultants in Access Australia (No 98)
Affiliate member Australian Institute Building Surveyors (No 4228)
OHS Construction Induction training Certificate CG100925534SEQ1

M^CLAREN TRAFFIC ENGINEERING

Transport Planning, Traffic Impact Assessments, Road Safety Audits, Expert Witness

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 Fax 61-2-9545-1227

12 May 2011

2011/076 L01 CM/sm

Design Manager
 Hansen Yuncken Pty Ltd
 Level 6, 15 Bourke Road
 MASCOT NSW 2020

Attention Mr Danny Kataieh

Dear Danny,

**TRAFFIC MANAGEMENT PLAN DURING CONSTRUCTION
 WARRIEWOOD BROOK RETIREMENT VILLAGE STAGE 3
 DA CONSENT # N0634/10 (Dated 24 March 2011)**

Reference is made to your request to address Condition D13 of the consent dated 24 March 2011 relating to the preparation of a Construction Traffic Management Plan (CTMP) for use during the construction phase of the approved development outlined in Consent # N0634/10 dated 24 March 2011 issued by Pittwater Council for the approved works at 6 MacPherson Street, Warriewood

Condition D13 of the consent is repeated below for ease of reference

A satisfactory construction traffic management plan (CTMP) prepared by a suitably qualified traffic consultant is required to be submitted to the Private Certifying Authority prior to the commencement of any site works. The plan is to detail

- 1) Quantity of material to be transported
- 2) Proposed truck movements per day
- 3) Proposed hours of operation and
- 4) Proposed traffic routes noting that 3 tonne load limits apply to some roads within Pittwater "

The CTMP, which is attached as **Annexure A** in this letter, as prepared by *NRP Architecture* has been reviewed by the undersigned and the undersigned **CERTIFIES** that the attached CTMP satisfies the intent of Condition D13 of the Development Consent # N0634/10 dated 24 March 2011

It is understood that Traffic Control Plans (TCP) will be in operation for the internal management of traffic and pedestrians during the construction period as well as at the gates to the site from Brands Lane and MacPherson Street to effectively control



A DIVISION OF RAMTRANS (AUSTRALIA) PTY LIMITED A B N 45 067 491 678

05/307/07

Construction Certificate
 Accredited

M^CLAREN TRAFFIC ENGINEERING

vehicular and pedestrian traffic and minimise any conflicts that may arise. It is also understood that no kerbside work zone is proposed during the construction phase with all construction traffic managed within the site.

Please contact the undersigned should you require further information or assistance.

Yours faithfully

M^CLAREN TRAFFIC ENGINEERING



Craig M^CLaren

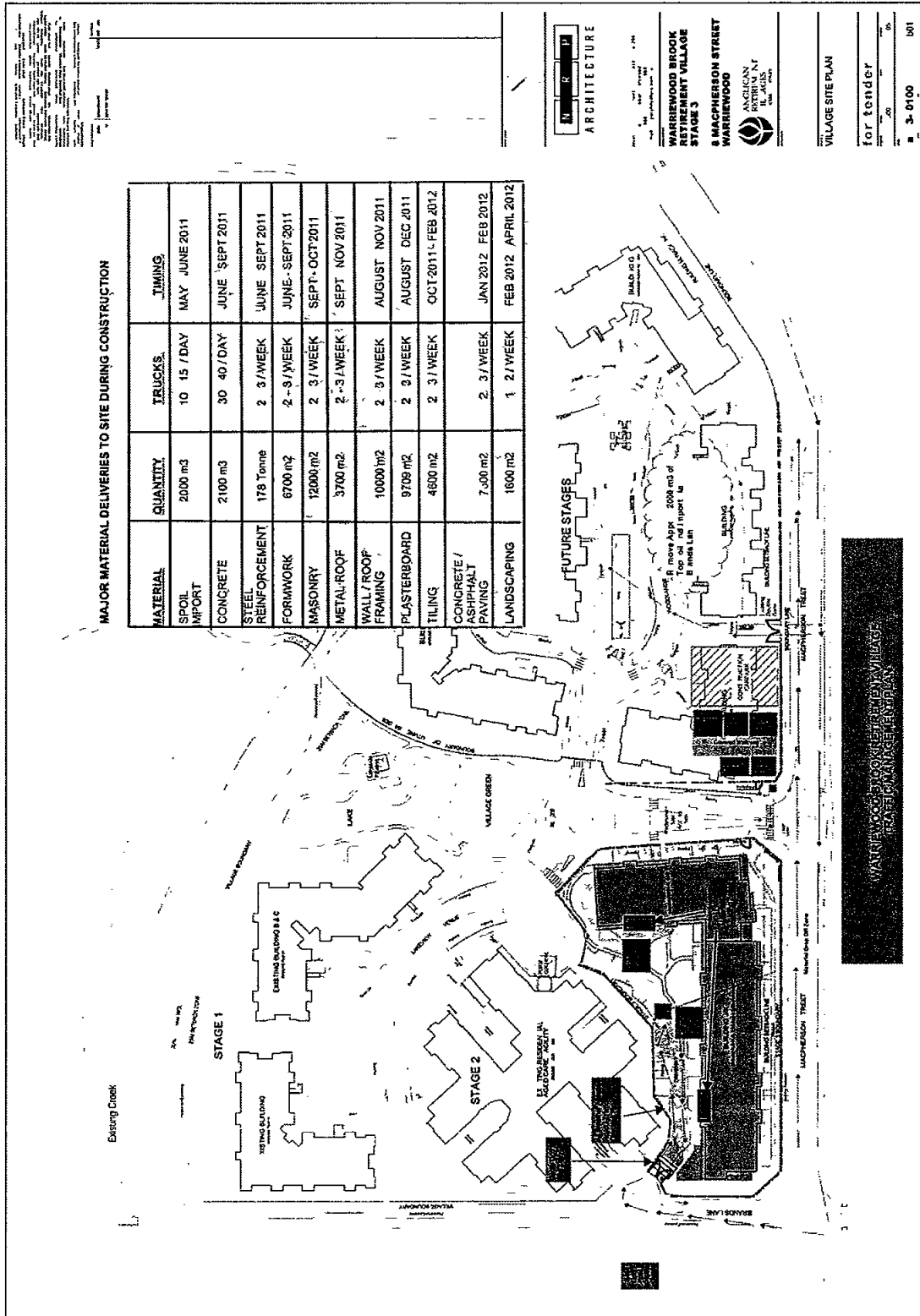
Director

BE Civil Graduate Diploma (Transport Eng) MAITPM MITE

PTA Accredited Level 3 Road Safety Auditor

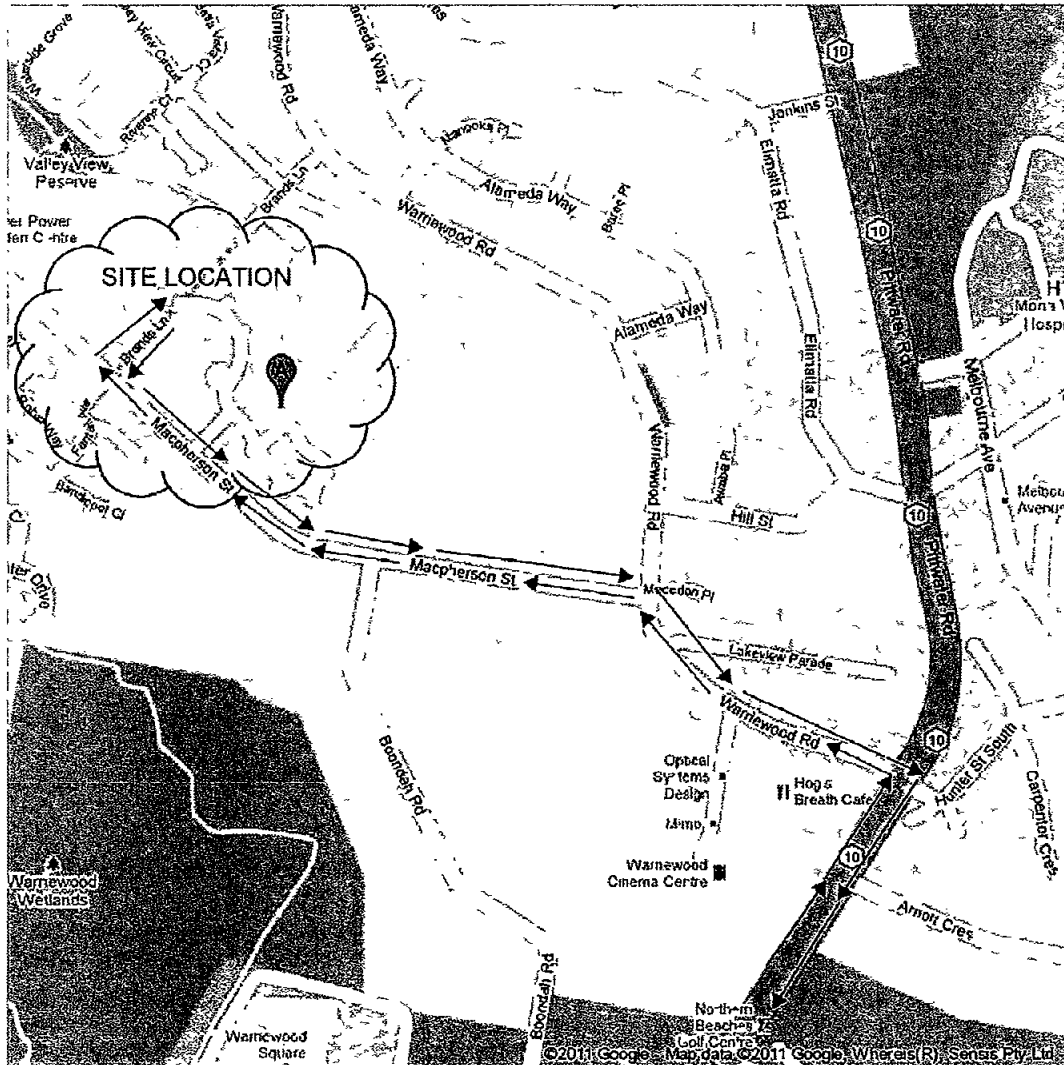
Traffic Control Plan Certifier (Red Card) Certificate No. 2252030272

ANNEXURE A CONSTRUCTION TRAFFIC MANAGEMENT (Sheet 1 of 2)

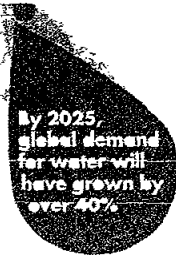


ANNEXURE A CONSTRUCTION TRAFFIC MANAGEMENT (Sheet 2 of 2)

Google maps Address 6 14 Macpherson St
Warriewood New South Wales
2102



TRAFFIC FLOW PATH ENTERING AND
EXITING THE SITE



SUBDIVIDER/DEVELOPER COMPLIANCE CERTIFICATE
 (A certificate under Division 9 Section 73 of the Sydney Water Act 1994)

DESCRIPTION OF SUBDIVISION/DEVELOPMENT			
Council	Pittwater Council		
Street	6-14 Macpherson Street Warriewood		
Lot No(s)	A & B	DP 400488	Lot No(s) A & B DP 358765
Lot No(s)	22 Sec c	DP 5464	
Development	The Construction of a SEPP Housing for Seniors development including 25 self contained dwellings, associated ground level car parking, ancillary facilities including recreational swimming pool, gym, medical consulting rooms, lounges, multi-purpose room and cafe		
NAME OF APPLICANT	Anglican Retirement Villages		
APPLICANT'S ADDRESS	C/o Rose Atkins Rimmer Pty Ltd PO Box 6745, Blacktown NSW 2148		

Sydney Water Corporation certifies that the above named applicant has complied with the requirements relating to the plan of Subdivision/Development described above of Division 9 of the Sydney Water Act 1994

THE FOLLOWING ITEMS 2 AND 5 APPLY TO THE DEVELOPMENT

- 1 ~~Water facilities are to be provided as a result of the subdivider/developer's compliance with Sydney Water's requirements.~~
- 2 **Water facilities are available**
- 3 ~~Water facilities cannot be provided within a reasonable time from the date of this certificate.~~
- 4 ~~Sewerage facilities are to be provided as a result of the subdivider/developer's compliance with Sydney Water's requirements.~~
- 5 **Sewerage facilities are available**
- 6 ~~Sewerage facilities are under the control of the local council.~~
- 7 ~~Sewerage facilities cannot be provided within a reasonable time from the date of this certificate.~~
- 8 ~~Sydney Water's requirements for future subdivision of this dual occupancy development have NOT been met. On subdivision an additional certificate will be required.~~

THE FOLLOWING ITEMS AND APPLY TO LOT/S IN THE DEVELOPMENT

- 9 ~~Water facilities have NOT been provided. They will only be provided after compliance with Sydney Water's requirements placed on a future applicant for subdivision/development or connection.~~
- 10 ~~Sewerage facilities have NOT been provided. They will only be provided after compliance with Sydney Water's requirements placed on a future applicant for subdivision/development or connection.~~
- 11 ~~Sewerage facilities are under the control of the local council.~~

Applicant Reference No **98/22344**

Council Reference No **634/10**

Name **Paul Muller**
 (Approving Officer for and on behalf of Sydney Water)

Signature

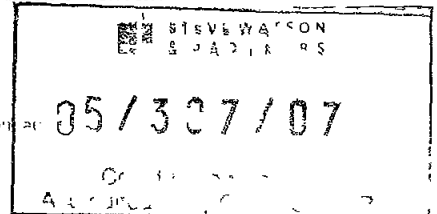
Name **Jack Diplock**
 (Approving Officer for and on behalf of Sydney Water)

Signature

Urban Growth Business **Head Office** Dated **17 May 2011**

THIS CERTIFICATE IS ONLY VALID WHEN SIGNED BY TWO AUTHORISED SYDNEY WATER OFFICERS
 A signed copy is held by Sydney Water

The original of this certificate must be presented to the appropriate consent authority usually Council with which the plan of subdivision/development was lodged so that you can satisfy the relevant condition of consent.





JHA Consulting Engineers
ABN 13 133 090 481

Head Office
Suite 3, Level 9
1 Chandos St
St Leonards NSW 2065

Norwest Office
Suite 3 07 29 31 Lexington
Drive Norwest Business
Park Bella Vista NSW 2153

Ph (02) 9437 1000

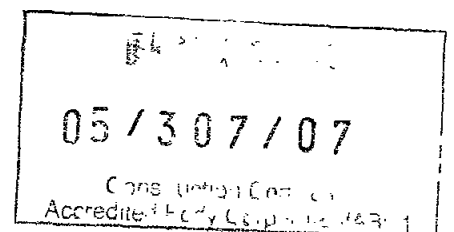
Fax (02) 9437 1020



green building council australia
MEMBER

ELECTRICAL SPECIFICATION

WARRIEWOOD BROOK RETIREMENT VILLAGE STAGE 3



ELECTRICAL SPECIFICATION

JHA Consulting Engineers



DOCUMENT CONTROL

Issue		Date	Job Number
P1	Draft Tender Issue	October 2010	2375
A	Tender Issue	20 TH October 2010	2375

ELECTRICAL SPECIFICATION

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ELECTRICAL SPECIFICATION

A GENERAL REQUIREMENTS

1 GENERAL

1.1 AIM

Design

This specification will describe the general requirements of the project to the Design and construct Contractor

It is the contractor's responsibility to design co-ordinate supply install test and commission the electrical services based on the general design and construct principles detailed on the drawings and this specification

Staging

The project is generally to be staged with the Builders construction programme. Following are the key items for the electrical contractor to consider in avoiding any delays for the commissioning of other services handover and PC

- Procurement of a new Stage 3 main switchboard,
- Energising the new main switchboard,
- Connection of a permanent submain from the existing main switchboard (MSB RACF) to the Stage 3 main switchboard

1.2 HOLD POINTS

- 1 Prior to the commencement of this work, the Contractor shall provide
 - A statement of currency of all electrical workers licences for all electricians working on the contract,
 - Shop drawings of proposed Stage 3 main switchboard & switchboard(s),
 - Design drawings for lighting power fire, communication security and AV services,
 - Samples of light fittings & outlets
- 2 The contractor shall give minimum 14 days written notice to the Principal of the intention to disrupt the power supply
- 3 Hold backfilling of conduit trenches for material & conduit inspection
- 4 Hold fit-off works for electrical comms fire, security & MATV cabling rough in inspection

1.3 GENERAL

Precedence

Requirements of individual technical sections of the specification override conflicting requirements in this section

Co-ordination

The Contractor shall be responsible for continuous and thorough co-ordination with all other services. The contractor shall allow to undertake a comprehensive below ground electrical

ELECTRICAL SPECIFICATION

services search along the cable routes and the new main switchboard location before commencing works on site

Space

The Contractor shall ensure that electrical equipment proposed fits within the spaces provided and is suitable for the conditions. The Contractor shall ensure the availability of acceptable equipment before any electrical work commences.

1.4 REFERENCED DOCUMENTS

Current editions

Use referenced documents which are editions, with amendments, current 3 months before the closing date for tenders, except where other editions or amendments are required by statutory authorities.

Contractual relationships

Responsibilities and duties of the Proprietor, Contractor and Superintendent are not altered by requirements in referenced documents.

General standards

Electrical work To AS 3000 and AS 3008

Switchboards To AS 3439.1

General To supply Authority service and installation rules

Building Code of Australia

Refer to appendix A for applicable standards

Authorities

Ensure all specifications (diagrammatic or textual) all electrical services, all relevant materials and all equipment comply with the requirements of all regulatory authorities having jurisdiction over the site - including but not limited to the following:

- ACA
- Local Council
- Local Supply Authority
- Telstra
- State Government Department of Environment and Heritage
- State Government Division of Workplace Health and Safety
- State Fire and Rescue Authority

If any of the responsible Authorities pursuant to the statutory powers vested in them elect to perform, supply, inspect or test wholly or part of the works, make all necessary arrangements and co-ordinate with the Authorities.

Tests

Except where otherwise defined in referenced documents, the following definitions apply:

Pre-completion tests Tests carried out before completion tests

Type tests Tests carried out on an item identical with a production item before delivery to the site

Production tests Tests carried out on the purchased equipment, before delivery to the site

Site tests Tests carried out on site

ELECTRICAL SPECIFICATION

- **Completion tests** Acceptance tests and final tests

Acceptance tests Tests carried out on completed installations or systems and except for final tests, before the date for practical completion, to demonstrate that the installation or system including components, controls and equipment, operates correctly, safely and efficiently and meets performance and other requirements

Final tests Acceptance tests carried out before completion of the maintenance period

Maintenance period

Co-extensive with the defects liability period

1 5 CONTRACT DOCUMENTS

General

Diagrammatic layouts Layouts of service lines, plant and equipment shown on the drawings are diagrammatic only. It is the responsibility of the contractor to provide full design for all services, co-ordinated with other trades and building structure

Before commencing work, obtain measurements and other necessary information and co-ordinate with the latest issue of drawings on site

It is the contractor's responsibility to provide a design that meets all the relevant standards, the DA, the Basix report and this D&C Specification

1 6 DESIGN

Space requirements

The Contractor shall ensure that plant and equipment selected shall be designed and installed to suit the space allocation shown on the drawings

Check space requirements of equipment and services indicated diagrammatically in the contract documents

Electrical supply system

415 V, 3-phase, 4-wire 50 Hz.

Radio frequency interference

Use equipment which generates interference within limits set by AS/NZS 1044. If necessary, provide suppression devices. If appropriate shield equipment to AS/NZS 1044

Electromagnetic compatibility

Electrical and electronic apparatus To AS/NZS 4251.1 and AS/NZS 4252.1

Fault level protection

To withstand the fault level of the incoming supply at the substation location (minimum of 25KA)

2 QUALITY

2 1 INSPECTION

Notice

General If notice of inspection is to be given in respect of parts of the works, do not conceal those parts without approval

ELECTRICAL SPECIFICATION

Minimum notice for inspections to be made 4 hours for on-site inspectors, otherwise 2 working days

2.2 TESTS

Notice

General Give sufficient notice so that designated tests may be witnessed Do not carry out designated tests without approval

Minimum notice for tests to be witnessed

- 5 working days for site tests and

Testing authorities

General Except for site tests have tests carried out by Authorities accredited by NATA to test in the relevant field, or an organisation outside Australia recognised by NATA through a mutual recognition agreement Co-operate as required with Testing Authorities

Site tests Use instruments calibrated by Authorities accredited by NATA

If tests are to be carried out on parts of the works do not conceal those parts and do not commence further work on those parts until the tests have been satisfactorily completed and compliance verified

2.3 CONTRACTOR 'S SUBMISSIONS

Timing

General Submit the design documents in a timely manner, to suit the construction program Submit the nominated shop drawings for approval and advise if any of the documents are to be returned

Co-ordinate all drawings with other trades

Delays Do not cause delays by making late or inadequate submissions

Quantity

Bound documents 3 copies

Loose documents up to and including A3 One copy

Loose documents larger than A3 One transparency on heavyweight plastic film the same size as the standard contract drawings

Identification

Identify the project, Contractor, Subcontractor or supplier, manufacturer applicable product model number and options as appropriate and include pertinent contract document references Include service connection requirements and product certification Identify non-compliances with project requirements, and characteristics which may be detrimental to successful performance of the completed work

Endorsement

General Do not commence work affected by Contractor's submissions until, the submissions have been endorsed as satisfactory

Errors If a document contains errors submit a new or amended document as appropriate, indicating changes since the previous submission

Shop drawings

General Submit dimensioned drawings showing details of the fabrication and installation of services and equipment including relationship to building structure and other services cable type and size, and marking details

The Contractor shall submit the following shop drawings for approval by the Superintendent

ELECTRICAL SPECIFICATION

- Main switchboard,
- Distribution boards
- Communications systems
- Security Systems,
- MATV / PAY TV systems,
- Photovoltaic system
- Hearing Augmentation Loop

Samples

The Contractor shall submit the following samples for approval by the Superintendent

- all light fittings,
- all outlets and switches,
- smoke / thermal detector,
- speakers
- motion sensors,
- typical unit distribution board,
- Fob readers,
- Intercom door stations,
- Intercom resident stations

Authorities

Correspondence Submit copies of correspondence and notes of meetings with Authorities

Authorities' approvals Submit documents showing approval of the Authorities whose requirements apply to the work

Tests

Tests program Submit a testing and commissioning program which is consistent with the construction program Include particulars of test stages and procedures

Test records For designated tests, including pre-delivery tests, record results and submit reports or certificates in a form suitable for inclusion in operation and maintenance manuals

Materials and components

Product data For proprietary equipment, submit the manufacturer's product data including

- technical specifications and design drawings
- type test reports
- performance and rating tables, and
- *recommendation for installation and maintenance*

Proposed products schedules For major products not specified as proprietary items, within 3 weeks of site possession submit a schedule of those proposed for use

Product certification If products must comply with product certification schemes, submit evidence of compliance

Installation

Fixing of services Submit typical details of locations, types and methods of fixing of services to structure before installation

Embedded services Submit proposals for embedding services in concrete walls or floors, or chasing into concrete or masonry walls

ELECTRICAL SPECIFICATION

Inaccessible services If services will be enclosed and not accessible after completion, submit proposals for location of service runs and fittings

3 MATERIALS AND COMPONENTS

3.1 GENERAL

Proprietary items

Implication Identification of a proprietary item does not necessarily imply exclusive preference for the item so identified but indicates the necessary properties of the item

Alternatives If alternatives are proposed, submit proposed alternatives and include samples available technical information reasons for proposed substitutions and cost If necessary provide an English translation State if use of proposed alternatives will necessitate alteration to other parts of the works and advise consequent costs

Manufacturers' or suppliers' recommendations

General Select if no selection is given and transport, deliver, store, handle, protect, finish, adjust, prepare for use and use manufactured items in accordance with the current written recommendations and instructions of the manufacturer or supplier

Instructions Submit the recommendations and instructions and advise of conflicts with other requirements

Project modifications Advise of activities that supplement or are contrary to manufacturer's or suppliers' written recommendations and instructions

Product certification If products must comply with product certification schemes, use them in accordance with the certification requirements

Consistency

For the whole quantity of each material or product use the same manufacturer or source and provide consistent type size quality and appearance

3.4 FACTORY FINISHES

Joint finishing

Finish visible joints made by welding brazing or soldering using methods appropriate to the class of work (including grinding or buffing) before further treatment such as painting galvanising or electroplating

Preparation for coating

General Before applying coatings to metalwork, complete cutting drilling and other fabrication and prepare surfaces to AS 1627

4 INSTALLATION

4.1 GENERAL

Installation

General Install equipment and services plumb, fix securely and organise reticulated services neatly Provide for movement in both structure and services

Arrangement Arrange services so that services running together are parallel with each other and with adjacent building elements

ELECTRICAL SPECIFICATION

4 2 SYSTEM INTEGRATION

General

Interconnect system elements so that the installations perform their designated functions

4 3 WIRING

General

Concealed wiring Conceal wiring runs, except within plant rooms Install concealed wiring so that it can be rewired easily and without damage to finishes or materials

4 4 BUILDING PENETRATIONS

Piping sleeves

General Provide metal or UPVC sleeves formed from pipe sections for piping penetrations through building elements

Sleeve diameter (for non fire-rated building elements) Sufficient to provide an annular space around the pipe or pipe insulation of at least 12 mm

Cable sleeves

Provide UPVC sleeves formed from pipe sections for penetrations through ground floor slabs and beams and external walls by cables not enclosed in conduit

Fire rated building elements

Seal penetrations using a system to AS 4072 1

Non-fire rated building elements

Seal penetrations around conduits and sleeves Seal around cables within sleeves If the building element is acoustic rated, maintain the rating

Limitations

General Do not penetrate or fix to the following without approval

- Structural building elements including external walls, firewalls floor slabs and beams

4 5 FIXING

General

If equipment and services are not suitable for fixing to non-structural building elements, fix directly to structure and trim around holes or penetrations in non-structural elements

Fasteners

Use proprietary fasteners capable of transmitting the loads imposed and sufficient to ensure the rigidity of the assembly

4 6 MARKING

General

General Mark equipment, electrical wiring, conduits and ducts, to provide a ready means of identification

Labels

Type

- Engraved two-colour laminated plastic

Label edges If labels exceed 1.5 mm thickness use radiused or bevelled edges

Minimum lettering heights

Equipment nameplates 40 mm

ELECTRICAL SPECIFICATION

Warning notices 7 mm

Automatic controls and electrical equipment 5 mm

Isolating switches 5 mm

Inside electrical enclosures 3 5 mm

Other 3 mm

Location

General Locate labels so that they are easily seen and are either attached to, below or next to the item being marked

Fixing

General Use mechanical fixing Do not penetrate vapour barriers

Electrical

Mark operable control devices indicators, isolating switches and outlets to provide a ready means of identification

5 COMPLETION

5 1 GENERAL

Contractor's submissions

Within 2 weeks after practical completion, submit 3 copies of designated documents

Warranties

General Name the Proprietor as warrantee Register with manufacturers as necessary Retain copies delivered with components and equipment

Commencement Commence warranty periods at practical completion or at acceptance of installation if acceptance is not concurrent with practical completion

Approval of installer If installation is not by manufacturer and product warranty is conditional on the manufacturer's approval of the installer, submit the manufacturer's written approval of the installing firm

5 2 RECORD DRAWINGS

General

Submit record drawings Show dimensions, types and location of equipment and cables in relation to permanent site features Show the "as installed" locations of building elements plant and equipment Show off-the-grid dimensions where applicable Include relationship to building structure and other services, and changes made during commissioning and the maintenance period Include diagrammatic drawings of each system showing wiring and Proprietor items of equipment In addition to providing a hard copy of "as-installed" drawings the Contractor shall further provide the drawings electronically on disk

Format

Use the same borders and title block as the contract drawings

5 3 OPERATION AND MAINTENANCE MANUALS

General

General Submit operation and maintenance manuals for installations

Subdivision By installation or system

ELECTRICAL SPECIFICATION

Referenced documents If referenced documents or technical sections require that manuals be submitted, include corresponding material in the operation and maintenance manuals

Format

A4 size loose leaf, in commercial quality, 4 ring binders with hard covers each indexed, divided and titled Include the following features

- **Pagination** Number pages consecutively
- **Cover** Identify each binder with typed or printed title "*OPERATION AND MAINTENANCE MANUAL*" to spine Identify title of project, volume number, volume subject matter, and date of issue
- **Ring size** 50 mm maximum with compressor bars
- **Text** Manufacturers' printed data, including associated diagrams, or typewritten, single-sided on bond paper, in clear concise English
- **Dividers** Durable divider for each separate element, with typed description of system and major equipment components Clearly print short titles under laminated plastic tabs
- **Drawings** Fold drawings to A4 size and accommodate them in the binders so that they may be unfolded without being detached from the rings Provide with reinforced punched binder tabs

Contents

Include the following

- **Drawings and technical data** As necessary for the efficient operation and maintenance of the installation
- **Table of contents** For each volume Title to match cover
- **Directory** Names, addresses, and telephone and facsimile numbers of Proprietor consultant Sub-Consultants, Contractor, Subcontractors and names of responsible parties
- **Installation description** General description of installation
- **Systems descriptions** Technical description of the systems installed, written to ensure that the Proprietor's staff fully understands the scope and facilities provided Identify function, normal operating characteristics and limiting conditions
- **Systems performance** Technical description of the mode of operation of the systems installed
- **Equipment descriptions**

Name address and telephone and facsimile numbers of the manufacturer and supplier of items of equipment installed, together with catalogue list numbers

Schedules (system by system) of equipment, stating locations, duties performance figures and dates of manufacture Provide a unique code number

ELECTRICAL SPECIFICATION

cross-referenced to the record and diagrammatic drawings and schedules, including spare parts schedule, for each item of equipment installed

Manufacturers' technical literature for equipment installed, assembled specifically for the project, excluding irrelevant matter Mark each product data sheet to clearly identify specific products and component parts used in the installation, and data applicable to the installation

Supplements to product data to illustrate relations of component parts Include typed text as necessary

- **Operation procedures**

Manufacturer's technical literature as appropriate

Safe starting up running-in operating and shutting down procedures for systems installed Include logical step-by-step sequence of instructions for each procedure

Control sequences and flow diagrams for systems installed
Legend for colour-coded services

Schedules of fixed and variable equipment settings established during commissioning and maintenance

Procedures for seasonal changeovers

- **Maintenance procedures**

Manufacturer's technical literature as appropriate Register with manufacturer as necessary Retain copies delivered with equipment

Detailed recommendations for preventative maintenance frequency and procedures which should be adopted by the Proprietor to ensure the most efficient operation of the systems installed

Safe trouble-shooting, disassembly, repair and reassembly cleaning alignment and adjustment, balancing and checking procedures Provide logical step-by-step sequence of instructions for each procedure

Schedule of spares recommended to be held on site, being those items subject to wear or deterioration and which may involve the Proprietor in extended deliveries when replacements are required Include complete nomenclature and model numbers, and local sources of supply

Schedule of normal consumable items, local sources of supply and expected replacement intervals up to a running time of 40,000 hours

Instructions for use of tools and testing equipment

Emergency procedures, including telephone numbers for emergency services and procedures for fault finding

- **Certificates**

ELECTRICAL SPECIFICATION

Copies of manufacturers' warranties

Certificates from Authorities

Product certification

Copies of test certificates for the mechanical installation and equipment used in the installation

Test and balancing reports

- Drawings

Record drawings, full size

Switchgear and control gear assembly circuit schedules including electrical service characteristics, controls and communications

Timing and quantity

Draft manuals Submit 2 draft manuals 4 weeks before the date for practical completion to enable the Proprietor's staff to familiarise themselves with the installation. Include provisional record drawings and preliminary performance data

Final copies Submit 3 sets of final volumes as set out in Clause 9.09A of the General Conditions. Incorporate feedback from review and from training of Proprietor's staff, including preparation and insertion of additional data

5.4 COMMISSIONING

Reports

Submit reports indicating observations and results of tests and compliance or non-compliance with requirements

Notice

Give sufficient notice for inspection to be made of the commissioning of the installation

5.5 COMPLETION TESTS

General

Carry out acceptance tests and final tests

Functional checks

Carry out functional and operational checks on energised equipment and circuits and make adjustments for the correct operation of safety devices

5.6 CLEANING

General

At practical completion clean the following

- Luminaires Relamp luminaires used during construction
- Insides of switchgear and control gear assemblies
- Switchgear and contactors, and other electrical contacts Adjust as necessary
- All pits and switchboard cupboards

5.7 MAINTENANCE

General

ELECTRICAL SPECIFICATION

General During the maintenance period, carry out periodic inspections and maintenance work as recommended by manufacturers of supplied equipment, and promptly rectify faults

Emergencies Attend emergency calls promptly

Maintenance program

Submit details of maintenance procedures and program relating to installed plant and equipment 4 weeks before the date for practical completion. Indicate dates of service visits. State contact telephone numbers of service operators and describe arrangements for emergency calls

Site control

Report to the Proprietor's designated representative on arriving at and before leaving the site

Maintenance records

General Submit, in binders which match the manuals, loose leaf log book pages designed for recording completion activities including operational and maintenance procedures, materials used, test results, comments for future maintenance actions and notes covering the condition of the installation. Include completed logbook pages recording the operational and maintenance activities performed up to the time of practical completion

Service visits Record comments on the functioning of the systems, work carried out, items requiring corrective action, adjustments made and name of service operator. Obtain the signature of the Proprietor's designated representative

Certification On satisfactory completion of the installation, submit certificates stating that each installation is operating correctly

6 SCOPE OF WORKS AND DRAWINGS

6.1 SCOPE OF WORKS

The work to be carried out under or in relation to this Contract is as set out below and as may be further described elsewhere in this Specification and Architectural drawings

All work and materials not specifically mentioned in this Specification but obviously necessary for the proper and complete installation and operation of the services as envisaged in this Contract shall be deemed to have been included in the tender

Tenderers are referred to site for all local information required in the preparation of their tenders. They must satisfy themselves as to any work involved and the nature and extent of all work to be done. No extras shall be allowed for necessary work unforeseen by the Contractor through not having taken this precaution

Unless specified otherwise all equipment and materials installed under this Contract shall be new

The work covered by this specification comprises the design, preparation of drawings, supply, installation, commissioning, testing, placing into service, warranty on design and installation, and maintenance of the electrical services and shall include but not be restricted to the following

- new main switchboard for Stage 3 (here after MDB S3),

ELECTRICAL SPECIFICATION

- underground submains from the existing RACF MSB to MDB S3 including associated conduits trenches & pits
- distribution boards and submains,
- metering CT's panels, etc,
- submains to the other services control panels & control centres
- trenching and backfilling
- lighting, power and communication services to lifts,
- light fittings and associated sub circuiting throughout the building,
- Design supply & installation of external lighting and associated PE & timer control & cabling,
- emergency and exit lighting and test switches to AS 2293
- power outlets and permanent electrical connections along with associated sub circuiting
- Voice & data services including 100 pair external grade copper cable & 6 core single mode fibre optical cables in underground conduits from existing Stage 2 RACF building to Stage 3 development including trenches pits etc,
- AS 1670 Fire Detection system components, including an addressable Sub Indicator panel (SIP), smoke/thermal detectors manual call points audible and visual alarms and interface with the existing Stage 2 RACF fire detection system
- electromagnetic door hold open devices including manual door release buttons & associated cabling & connected to the fire detection system,
- MATV system and Pay TV system and interfaced with the Stage 2 RACF MATV, Pay TV systems
- access control security and intercom systems including security expander panels electric strikes reed switches PIR detectors FOB readers key pads, intercom door stations, intercom resident stations etc associated cabling and wiring and interfaced with Stage 2 RACF systems ,
- 10KW photo-voltaic grid connected generation system including negotiation with supply authority solar panels mounting brackets controllers, inverters cabling, etc ,
- mobile generator support on the RACF while modification is being carried out on the main switchboard
- services as shown on Architectural Room Data Sheets
- Audio visual system for community centre including PA speakers & amplifiers,
- Hearing augmentation loops in community centre multipurpose room & cafe areas inclusive of amplifiers,
- all other miscellaneous minor works as described elsewhere in this specification and/or indicated on the drawings,

ELECTRICAL SPECIFICATION

- testing and commissioning of all systems,
- 24 months defects liability period and maintenance
- shop and as-installed drawings
- preparation of submission of operating and maintenance manuals,
- provision of 'As Installed' drawings in Auto CAD format 2009

Note The Contractor shall forward any ambiguities in the document at the time of tender for the works specified. Claims for extra costs based on the lack of knowledge of the documents or services will not be accepted after submission of the tender.

The Contractor is to reference the Architectural room data sheets for the precise power, communication, security & fire services requirements throughout the Community Centre section of the project

6.2 DRAWINGS

Drawings associated with this electrical installation and to supplement this specification are as follows:

E01	Cover Sheet Legend of Symbols & Drawing Schedule
E02	Site Reticulation Layout & Typical Apartment Layout
E03	Ground & First Floor – Typical Lighting, Power & Communications Layout
E04	Typical Apartment Layouts
E05	Single Line Diagram & Schematics

This performance specification shall be read in conjunction with all architectural, structural and other services drawings and shall be considered to convey the minimum scope requirements and design intent.

Any electrical services details shown on these drawings are provided for general information purposes only. The contractor shall be required to check all necessary calculations and compliance with relevant Authorities and Australian Standards. The existence of these drawings in no way diminishes the Contractor's design and construction responsibility.

6.3 WORKS BY OTHER TRADES

6.3.1 GENERAL

The work listed below will be carried out by Contractors or other Sub-Contractors other than the electrical contractor.

The Electrical Contractor shall provide all details necessary for the carrying out of the work in sufficient time to enable the other Contractors and other subcontractors to carry out the work and shall complete the respective portions in sufficient time to permit making good within the construction programme.

6.3.2 BY THE BUILDER

ELECTRICAL SPECIFICATION

In addition to the facilities and other items set out in the preamble of this specification the Contractor will provide the following in association with the Electrical Services

- 1 Building-in of the Subcontractors sleeves, conduits, pipes and brackets, where necessary
- 2 Trimmed openings in ceilings for recessed lighting fittings
- 3 Fire rated cupboards and rooms for MDB S3 & distribution boards
- 4 Normal making good after the Subcontractors installation of his services
- 5 Sign writing of 'danger' 'switchboards "Do not turn off', etc and other notices required by regulation
- 6 Openings in the building structure to detailed set outs supplied by the Electrical Sub-Contractor Builder to install all as required
- 7 Painting of exposed conduit, metal ducting and other metalwork

6 3 3 BY THE HYDRAULIC SERVICES SUB-CONTRACTOR

The Hydraulic Services Sub-Contractor will carry out the following work associated with the electrical services

- 1 Provision of all control panels, which will be complete with allowance to accommodate the incoming sub-mains The Electrical Sub-Contractor shall provide sub-mains and make the final connection
- 2 Wiring from the control panels to the plant and equipment
- 3 Provision of water heaters, rain water tanks control panels, etc Ready for termination of final sub-circuits

6 3 4 BY THE MECHANICAL SUB-CONTRACTOR

The mechanical services Sub-Contractor will carryout the following work associated with their electrical services

- 1 Final connection to condensers and other mechanical plant from Isolator switches
- 2 Termination of cabling installed by the Electrical Sub-Contractor to terminal strips in mechanical switchboard/controls for fire trips and by-pass control of mechanical equipment during fire alarm conditions
- 3 All wiring from mechanical services switchboards to motors and equipment for power and control purposes
- 4 Connection of and looping of fire trip cabling to all mechanical plant from one single point provide by the electrical contractor

ELECTRICAL SPECIFICATION

B ELECTRICAL SUPPLY

1 GENERAL

The site of Stage 3 development shall obtain supply from the existing Stage 2 RACF MSB

Design, supply and install new submains to the new Stage 3 Main Switchboard (MDB S3) location. The permanent submain cables shall be installed in HD-UPVC orange underground conduit. Allow to install 1x100mm spare conduit with draw wire between the RACF MSB and the new MDB S3. Cable routes shown on the drawings are indicative only. It is the Contractor's responsibility to trace and check for exact location and co-ordinate with other services and building works. Depth and layout of the conduits should comply with required relevant standards and, in particular AS3000 and AS3008.

Cables shall be run so that no derating applies. If derating is unavoidable representation should be made to the Electrical Consultant for the works.

Prior to commencement of any work obtain specific information from Supply Authority regarding termination details and prepare detailed drawings for approval by the Supply Authority and the Superintendent.

2 SUBMAINS

Design, supply and install submains of the size and type as shown on the drawings. When installing submain cabling ensure the following minimum requirements:

- submain cabling shall generally be reticulated in underground HD UPVC orange conduit where external to the building and on appropriately sized cable ladder tray within buildings as shown on the drawings and where necessary.

submain cabling shall be reticulated in such a manner so as to ensure that no derating of the cabling takes place.

that the reticulation of all such cabling shall be co-ordinated with all other services in the region. Cabling should not be located in such a position as to restrict vehicular or pedestrian headroom. It should avoid disabled car spaces and wet areas where possible.

- submain size and type is to be identified at each end in the form of engraved labelling on the distribution boards.
- verify all final proposed loads and advise the Superintendent prior to installation of the submains.

All 3 phases shall be evenly balanced for both submains and consumer mains.

- All submains shall utilise stranded copper conductors.
- All terminators shall be fitted with compression lugs.

3 TRENCHING

ELECTRICAL SPECIFICATION

Submit details of proposed trenching routes to the Superintendent

All trenching is to be kept as narrow and shallow as possible to meet regulatory requirements (in particular depth to AS3000 and width to AS3008 for derating etc) Back filling on trenches must be with stabilized sand

The Contractor must liaise with other services to share trenches where possible (within the provisions for separation as outlined in AS3000 and relevant Austel documents) to reduce costs and disruption to the site Routes for trenching shown on the electrical documents are indicative only

4 EARTHING

Where applicable, supply and install an MEN earthing system to earth effectively the main switchboard, all distribution boards, fixed and general purpose outlets, luminaires and all other equipment as required by the SAA Wiring Rules and Energy Australia

The main Earthing conductor shall be connected to a commercial Earthing electrode, which shall be installed to the requirements of the Supply Authority The Earthing electrode shall be in one piece and consist of a solid steel core rod bonded to an outer casing of electrolytic copper The rod shall be of minimum length 2.4m and minimum diameter 25mm

Should the electrode be installed in rock and electrode shall be installed in a hole of minimum dimensions 50mm diameter and 25mm deep drilled into the rock The vacant space around the electrode shall be packed with a mixture of Bentonite clay and gypsum

The main Earthing conductor shall be connected to the Earthing electrode by means of an approved Earthing clamp The connection shall be carried out in a pit or core hole

The Contractor shall also install bonding conductors to connect the earth bar from the main switchboard to the incoming cold water supply pipe where it enters the building The connection shall be made at a suitable bolted flange connection in the pipe work To this end, the Contractor shall liaise with the Hydraulics Contractor to ensure that provision is made for the connection and that the connection is made in a manner suitable to the Supply Authority

The main Earthing and bonding conductors shall be sized as required by the SAA Wiring Rules and shall comprise PVC insulated copper cables in conduit

All metallic cable support systems including cable trays, skirting ducts wall studs roof trusses, steel covers, removable escutcheon panels housing electrical and communication cabling shall be earthed in accordance with AS3000

Where the cable support systems are not electrically connected a suitably sized earth cable with crimped lug ends is to be installed between the 2 support systems to form a continuous electrical bond The earth cables with crimped lug ends are to be secure to the cable support system with bolts and nuts Spot welds and compression type applications will not be acceptable

All stud walls where GPO's are mounted on shall be earthed to avoid the risk of electrocution

ELECTRICAL SPECIFICATION

C MAIN SWITCHBOARD & DISTRIBUTION BOARDS

1 GENERAL

1.1 STANDARD

General

To AS 3439 1

The electrical contractor shall design, supply and install a Form 2B1 Main Switchboard as specified herein. The main switchboard shall be provided with a service protection device to comply with the NSW Service and Installation rules and local energy authority requirements.

The new Stage 3 Main Switchboard shall be constructed to fit within the space allocated. It shall be built and populated with components to accommodate the Fault Current Level, confirmation from local energy authority is to be sought. The Contractor shall ensure that the system complies in particular with AS3000 section 1.7.4.3.2 for touch-voltages and 1.7.4.3.4 for disconnection times.

The Main Switchboard should be located inside the Switch room as such to comply with the requirements of access around the main switchboard in accordance with AS3000. The CT's and metering equipment shall be installed in accordance with NSW Service and Installation rules and the local energy authority requirements.

1.2 INTERPRETATIONS

Definitions

Proprietary assemblies Low voltage switchgear and control gear assemblies available as a catalogue item, consisting of manufacturer's standard layouts and equipment.

Rated currents Rated currents are continuous uninterrupted current ratings within the assembly environment under in-service operating conditions.

Abbreviations

TTA Type tested assemblies

NTTA Non-type tested assemblies

PTTA Partially type tested assemblies

1.3 DESIGN

Layout

Position equipment to provide safe and easy access for operation and maintenance. The Contractor shall design and build distribution board/meters/etc to fit within the cupboard spaces allocated. Refer Architects drawings.

Fault levels

Rated short-circuit currents Maximum prospective symmetrical r.m.s. current values shall be as advised by the Supply Authority.

Moulded case or miniature over current circuit breakers rated up to 100 A, connected to circuits for lighting, general purpose outlets and small single or multi-phase electrical accessories. Mount any number of circuit breakers within a Form 1 separated subsection, provided the circuit

ELECTRICAL SPECIFICATION

breakers are mounted on an approved multi-pole busbar chassis assembly, concealed with an escutcheon panel and removable door

Proper grading of fault current levels should be ensured either via the use of fault current limiting fuses or via cascading of circuit breakers. If the latter is chosen, proper cascading operation (while maintaining selectivity) should be verified by the circuit breaker manufacturer with account taken of cable sizes and lengths and also of incoming fault level. In this case the fact that cascading is being used should be made clearly, unambiguously and permanently evident by an obvious notice on the relevant switchboard(s)

Degree of protection

In plant rooms IP42

Assemblies for outdoor use IP54W for exterior surfaces and IP41 for interior operating face

Elsewhere \geq IP41

Spare facilities

Provide at least 20% spare pole capacity or as shown on the drawings. Whichever is the greater

Switchboard assemblies if wall mounted should be front access assemblies with frontal areas not exceeding 2 sqm²

Connection

Indoor cable entries Top and bottom

Outdoor cable entries Bottom only

Single core cables rated > 300 A Pass separately through non-ferrous gland plates. Do not provide metal saddles

Cable supports

Cable supports Support or tie mains and submains cables within 200 mm of terminations

Provide cable supports suitable for stresses resulting from short circuit conditions

Cable enclosures

Cable enclosures Continue cable enclosures to or into assemblies and fit cable entry plates so that the IP rating of the assembly and the fire rating of the cable are maintained

Ventilation

The Contractor shall ensure that the distribution boards and all auxiliary boards and equipment are adequately ventilated without compromising fire safety and smoke propagation regulations. In general, ambient temperatures should remain below the lower of either 45°C or the operational temperature of the component with greatest susceptibility to temperature

1.4 AUTHORITIES

Requirement

Submit shop drawings of the distribution board to the Superintendent and Supply Authorities for comment/approval prior to proceeding with the manufacture of such. Documented evidence of such approval shall be submitted

Supply Authority Equipment

Install meters, current transformers, potential fuses, test links and the like equipment supplied by the Supply Authority, and provide the wiring necessary to complete the installation

As approved by the supply authority, all independent living unit metering will be located in an enclosed metal box on each dwelling at the nominated locations as shown on the drawings. The contractor shall 'cheese cut' brick wall to conceal all conduits & wiring entering and leaving the meter box

ELECTRICAL SPECIFICATION

All ILU metering will be protected by a device that limits the fault current level to less than 6kA where the incoming fault level is greater than this amount

1 5 INDEPENDENT LIVING UNITS

The Contractor shall provide ILU distribution boards within cupboards above the fridge locations as indicated by the architect

Typical ILU Board

- 18 pole (or greater), single phase
- 63A main switch for general lighting & power
- DIN rail with dust cover
- 10KA fault level circuit breakers

ILU DB s shall be fitted with 30mA ELCBs on all individual lighting & power sockets accessible to the residence

2 QUALITY

2 1 INSPECTION

Notice

Give notice so that inspection may be made at the following stages

- Assembly installed and connected
- Acceptance

2 2 PRE-COMPLETION TESTS

Site Tests

Visual and functional inspection

2 3 CONTRACTOR'S SUBMISSIONS

Product data for proprietary assemblies

Submit design drawings showing the following

- General assembly,
- Types and model numbers of items of equipment,
- Overall dimensions
- Fault level,
- IP rating,
- Rated current of components
- Number of poles and spare capacity,
- Mounting details
- Paint colours and finishes
- Access details,
- Schedule of labels
- Shop drawings of custom-built assemblies

3 PROPRIETARY ASSEMBLIES

3 1 REQUIREMENT

Provide removable escutcheon plates with neat cut-outs for circuit breakers. Each escutcheon shall be secured by a minimum of 4 fixings each consisting of an M8 plated stud fixed to the

ELECTRICAL SPECIFICATION

cubicle and fitted with a serrated star washer and a chromium plated acorn nut Lockable distribution boards shall be fitted with chromium plated lever-type handle

4 BUSBARS

4.1 BUSBARS

General

Provide main circuit supply busbars within assemblies, extending from incoming supply terminals to the line side of protective equipment for outgoing functional units and for future functional units

Standards

To AS 3768 AS 3865 and AS 4388

Definitions

Incoming busbars Busbars connecting incoming terminals to line side terminals of main switches

Main circuit supply busbars Busbars connecting incoming functional unit terminals, or incoming busbars where no main switches are included to outgoing functional unit terminals or outgoing functional unit tee-offs

Tee-off busbars Busbars connecting main busbars to incoming terminals of outgoing functional units

Material

Hard-drawn high-conductivity electrolytic tough pitched copper alloy bars, designation 110

Temperature rise limits - active and neutral conductors

Maximum rated current temperature rise limits $65 \pm 1.5^{\circ}\text{C}$ by type test or calculation to AS 3768 or AS 4388

Maximum short-circuit withstand current temperature rise limits 160°C by calculation to AS 3865

Cross section

Rectangular with radiused edges

Supports

General Sufficient to withstand thermal and magnetic stresses due to maximum prospective fault currents

Material Non-hygroscopic insulation capable of holding busbars at 105°C

Phase sequence

For main busbars and connections to switching devices set-out phase sequence for phases A, B and C from left-to-right top-to-bottom and back-to-front when viewed from the front of the assembly

Colour coding

General Provide 25 mm minimum width colour bands permanently applied to busbars at 500 mm maximum intervals with at least one colour band for each busbar section within each compartment

Active busbars Red white and blue respectively for the A, B and C phase

Neutral busbar Black

ELECTRICAL SPECIFICATION

MEN link Green-yellow and black
Protective earth busbar Green-yellow
Restrictions Do not use adhesive type colour bands

Busbar systems

Use multi-pole proprietary busbar assemblies or busbar systems which have been verified for short circuit capacity and temperature rise-limits by type tests

Current carrying capacity

Active conductors Take into account thermal stresses due to short circuit current assuming magnetic material enclosures located indoors in well-ventilated rooms and 90°C final temperature

Neutral conductors Size to match incoming conductor current carrying capacity

Protective earth conductors Size for at least 50% of the rated short circuit withstand current for 100% of the time duration

Tee-off busbars current rating

For individual outgoing functional units Equal to maximum frame size rating of the functional unit

For multiple functional units Equal to the diversity factors of AS 3439 1 based on frame size rating

MEN links

MEN links > 10 mm² in section Bolted removable busbar links stamped "MEN LINK" located in the incoming compartment between neutral and earth busbars

Fault current limiters

Rate busbars connected to fault current limiters to 100% of the indicated fault current limiter circuit breaker frame size or fuse base rating

Busbar links

For current transformers, provide removable busbar links ≥ 450 mm long

Cable connection flags

General Provide and support busbar flags for equipment with main terminals too small for cable lugs Use flags sized to suit cable lug termination with current rating of at least the maximum equipment frame size

Phase isolation Provide phase isolation between flags where the minimum clearance distances phase-to-phase and phase-to-earth are below the component terminal spacing

Jointing

Use high tensile steel bolts washers and nuts, with lock nuts or locking tabs Do not use tapped holes and studs or the like for jointing current carrying sections

Busbar insulation

Active and neutral busbars and joints Select from the following

Polyethylene At least 0.4 mm thick with dielectric strength of 2.5 kV r m s for 1 min applied by a fluidised bed process in which the material is phase coloured and directly cured onto the bars

- Close fitting busbar insulation mouldings at least 1 mm thick
- Heat shrink material Use only on rounded edge busbars

ELECTRICAL SPECIFICATION

Damaged insulation Repair damaged insulation before energising

5 MAIN SWITCHES

5 1 SWITCH-ISOLATOR

Standard

To AS 3947 3

Type

Poles 3

Rated current To suit unit installed in enclosure

Rated fault capacity

Short circuit making capacity At least the fault level at assembly incoming terminals

Breaking capacity At least the rated full load current

Utilisation category

Circuits consisting of motors or other highly inductive loads At least AC-23

Other circuits At least AC-22

Rated duty

Uninterrupted in non-ventilated enclosure

Operation

Independent manual operation including positive "ON/OFF" indicator

Construction

General Either

- totally enclosed, or
- with full and direct shrouding to fixed live parts of switches and fuses, so that insertion of a screwdriver does not cause faults between phases

Shrouding Effective over range of air break switch positions

Incorporate the following

- Earthing terminal
- Neutral link mounted within unit
- Contact position clearly indicated whether cover is in place or not For fuses mounted in withdrawable carriage ensuring isolation from supply before access to fuses is possible secondary indication may be omitted

6 CIRCUIT BREAKERS

6 1 MOULDED CASE AND MINIATURE CIRCUIT BREAKERS

Standard

Fault capacity ≥ 10 kA. To AS 3858

To be of Terasaki or Cutler-Hammer manufacture and suitable for the fault level present

Miniature circuit breakers

Fault capacity < 10 kA, current rating < 100 A. Use miniature over current circuit breakers

Mounting

ELECTRICAL SPECIFICATION

Mount circuit breakers so that the "ON/OFF" and current rating indications are clearly visible with covers or escutcheons in position. Align operating toggles of each circuit breaker in the same plane.

Utilisation category

Non-discrimination Type A

7 LINKS

7.1 NEUTRAL AND EARTH LINKS

Terminals

Provide terminals for future circuits.

Links

Assembly capacity ≥ 36 poles. Provide links at the point of entry of incoming supply cables.

Mounting. Mount neutral links on an insulated base.

Control circuits. Provide separate neutral and earth links.

Labels. Provide labels for neutral and earth terminals.

8 EARTHING

8.1 EARTHING SYSTEM

System design

Provide an MEN earthing system complying with AS/NZS 3000 Part 5.

Provide earthing systems for communications applications complying with AS/ACIF S009.

Electrodes

Measure electrode resistivity in accordance with ESAA EG 1 and ensure that the measured value complies with standards.

Earth & bonding clamps

Provide proprietary earthing and bonding clamps to AS 1882.

9 WIRING

9.1 SWITCHBOARD INTERNAL WIRING

Cable type

Provide 0.6/1 kV copper cables. Use V-90HT insulation where directly connected to active and neutral busbars.

Cables $> 6 \text{ mm}^2$

Terminations

- Tunnel terminals. Single cables.
- Other connection points or terminals. ≥ 2 cables.

Cables $> 10 \text{ mm}^2$

Provide bolts or studs.

Supports

- Spacing at enclosure. ≥ 200 mm from a termination.
- Spacing generally. ≥ 400 mm.

ELECTRICAL SPECIFICATION

- Strength Capable of withstanding forces exerted during fault conditions

Marking Terminate marked cables for connection to external controls in correspondingly marked terminals within the assembly

9 2 GENERAL INTERNAL WIRING

Control and indication circuits

General Provide conductors sized to suit the current carrying capacity of the particular circuit
Minimum size 1 mm² with 32/0 2 stranding

Cable colours

Colour code wiring as follows

- A phase Red
- B phase White
- C phase Blue
- Neutral Black
- Earthing Green-yellow

Cable size

Use multi-stranded copper cable generally except for mineral insulated metal sheathed (MIMS)

Minimum size

Lighting sub-circuits 2.5 mm²

Power sub-circuits 2.5 mm²

Sub-mains 6 mm²

Voltage drop Install final subcircuit cables within the voltage drop parameters dictated by the route length and load

Fault loop impedance Select final subcircuit cables to satisfy the requirements for automatic disconnection under short circuit and earth fault/touch voltage conditions

Underground residential distribution systems Select cables according to AS/NZS 4026

Distribution cables To AS/NZS 4961

9 3 TERMINATIONS

Submains, light and power circuits

Connect direct to the circuit breaker terminals

Other circuits

Connection to circuits $\leq 16 \text{ mm}^2$ Provide DIN-type tunnel terminal blocks

Tunnel terminals Provide insulated sleeve ferrules to flexible cables terminated in tunnel terminals

Identification Identify cables at both ends using neat ring-type ferrules

Type Screw-tightened clip-on, 35 mm DIN-type, flexible non-flammable and, as a minimum suitable for the insertion of a screwdriver blade

Location Locate terminals to provide ready access to outgoing terminations

Mounting rails Screw or rivet mounting rails to assembly at $\geq 500 \text{ mm}$ centres Provide sufficient length to accept a further 20% terminals or 3 terminals whichever is the greater

ELECTRICAL SPECIFICATION

- Arrangement Terminate internal wiring to one side of the terminal block, leaving the other side for outgoing circuits
- Grouping Provide separate terminal groups for final subcircuit and control wiring Provide oversized barriers between each group of terminals having different voltages and terminal size
- Terminals for power wiring 3 phases or single phase and neutral
- Control terminals In alphabetical or numerical order of wire identification with the lowest number or letter next to the power terminals
- Shipping breaks Provide terminal blocks for interconnecting wiring on each side of shipping breaks

10 SWITCHGEAR ACCESSORIES

10.1 RESIDUAL CURRENT DEVICES

Integral type

General Incorporate earth leakage in circuit breaker protection operation

Mounting Comply with Moulded case and miniature circuit breakers in the Circuit breakers subsection

Tripping

Residual current classification Type II

Maximum tripping current 30 mA

Requirement

All apartment distribution boards shall incorporate individual earth leakage circuit breakers on all power and lighting circuits excepting those for the oven and air conditioning units

10.2 SURGE PROTECTION

Install Surge Diverters in each of the major distribution boards The Surge Diverters shall be connected between the switchboard active and neutral busbars and the MEN earth link

The unit shall utilise Metal Oxide Varistors individually fused and shall incorporate an external clean contact to provide an individual phase segment failure

Unit specification

Operating voltage	250 VAC
Surge withstand	ANSI C62.41 Cat A, B, C AS1768 Cat A, B, C
Surge rating	8/20 us pulse response 200KA
Performance	< 750V clamp voltage for 3KA Cat C < 950V clamp voltage for 20KA Cat C
Alarms	Local digital display External clean contact C/O on one segment failure

ELECTRICAL SPECIFICATION

Max Conductor 16mm²

The surge diverters shall be factory fitted to each switchboard and shall be Procel or an approved equal

11 CONTROLGEAR

11 1 CONTACTORS

Standard

A C contactors To AS 1029 1 or AS 3947 4 1

Type

Block type, air break, electro-magnetic

Poles

3

Minimum rated values

Rated operational current Full load current of the circuit protective device

Rating 16 A

Mechanical endurance 10

Contacts life 1 million operations at AC-3

Auxiliary contacts

General Provide auxiliary contacts with at least one normally-open and one normally-closed separate contacts with rating of 6 A at 240 V a c

Utilisation category AC-1

Slave relay If the number of auxiliary contacts exceeds the number which can be accommodated, provide a separate slave relay

Mounting

Mount with sufficient clearance to allow full access for maintenance, removal and replacement of coils and contacts, without the need to disconnect wiring or remove other equipment

Interconnection

Do not connect contactors in series or parallel to achieve ratings

12 INSTALLATION

12 1 ASSEMBLY INSTALLATION

Fixing

Before making inter-panel connections, fix assemblies and metering equipment enclosures into position, level and plumb

12 2 ASSEMBLY ENTRIES

Cable entries

General Neatly adapt one or more cable entry plates if fitted to accept incoming cable enclosure Use the minimum number of entry plates to leave spare capacity for future cable entries Do not run cables into the top of weatherproof assemblies

ELECTRICAL SPECIFICATION

Cable enclosures

Continue cable enclosures to or into assemblies and fit cable entry plates so that the IP rating of the assembly and the fire rating of the cable are maintained

Cable supports

Support or tie mains and submains cables within 200 mm of terminations. Provide cable supports suitable for stresses resulting from short circuit conditions

13 MARKING

13.1 MARKING

General

Provide labels including control and circuit equipment ratings, functional units, notices for operational and maintenance personnel, incoming and outgoing circuit rating, sizes and origin of supply

Use either

- Traffolyte labels
- Or photo-anodised rigid aluminium labels

Identifying labels

Provide labels fixed to access panels, doors, covers and escutcheon panels and internal equipment, indicating the relevant section and component

Minimum lettering heights

Main assembly designation 25 mm

Distribution assembly designations 15 mm

Small proprietary distribution boards 10 mm

Main switches 10 mm

Outgoing functional units 8 mm

Identifying labels (on outside of cabinet rear covers) 4 mm

Danger, warning and caution notices 10 mm for main heading, 5 mm for remainder

Other labels including equipment labels within cabinets 3 mm

Label colours

Generally Black lettering on white background

Main switch and caution labels Red lettering on white background

Danger, warning labels White lettering on red background

Fixing

General Fix labels securely

Method Select from the following

- Screws and double-sided adhesive
- Fixed in extruded aluminium sections fixed to panels using rivets or countersunk screws

Aluminium labels Use aluminium or monel rivets

Restrictions Do not use self-tapping or thread-cutting screws

Set-out

Align horizontally and vertically with adjacent labels

ELECTRICAL SPECIFICATION

Labels on assembly exteriors

Display the Manufacturer's name fault current level and substation or Distribution Board from which its supply originates

Display warning notices for operational and maintenance personnel

Assemblies Label with essential markings

Designation labels For other than main assemblies provide designation label stating source of electrical supply Identify separate sections of enclosures

Assembly controls Label all installed components protruding through the board's front surface, including the following

- Circuit designation for main switches, main controls and submains controls
- Fuse link size

Also include labels showing details of consumer's mains and submains (destination DBs and cable sizes) and incoming busbar rating or cable rating to first tee-off

Labels on assembly interiors

General Provide labels for equipment within assemblies Locate so that it is clear which equipment is referred to, and lettering is not obscured by equipment or wiring

Moulded case circuit breakers If circuit breaker manufacturer's markings are obscured by operating handle mechanisms or motor operators, provide additional markings open to view on or next to the circuit breaker

Danger, warning and caution notices

Busbars If polymer membrane coating is used without further insulation provide warning notices on the front cover near the main switch or local main switch and on rear covers, indicating that busbars are not insulated

Fault current limiters In assembly sections containing fault current limiter fuses provide caution notices fixed next to the fault current limiters, stating that replacement fuse links are to match as-installed fuse link ratings make and characteristics Provide separate label stating fault current limiting fuse ratings

Circuit breakers If multi-breaker cascading is used to effectively increase the fault current handling ability of a circuit breaker provide caution notices fixed next to all breakers in the chain to ensure an equivalent replacement is used

Externally controlled equipment To prevent accidental contact with live parts provide warning notices for equipment on assemblies not isolated by main switch or local main switch

Positioning Locate notices so that they can be readily seen next to or, if impracticable, on busbar chamber covers of functional units and behind the front cover of functional units Provide circuit identification labels in the cabling chamber of each functional unit, located next to external terminations

13.2 CIRCUIT SCHEDULE

Schedule cards

General For the general distribution boards, provide schedule cards of minimum size 200 x 150 mm with machine-written text showing the following as-installed information

ELECTRICAL SPECIFICATION

- Submain designation, rating and short-circuit protective device
- Light and power circuit numbers and current ratings, cable sizes and type and areas supplied
- whether cascading has been used for circuit breaker sizes and the details of the cascading

Mounting Mount schedule cards in a holder fixed to the inside of the assembly or cupboard door next to the distribution circuit switches Protect with hard plastic transparent covers

Care must be taken to ensure that the schedules are on non-yellowing cards and that the inks used are low aging and suitable for use at elevated temperatures

14 COMPLETION

14 1 COMPLETION TESTS

General

Carry out the following tests

- All electrical and control operation
- All fault detection operation where a fuse will not be sacrificed

14 2 MAINTENANCE

General

General Carry out the following

- Monthly inspections and maintenance work to maintain the assembly
 - Rectify faults, make adjustments, and replace consumable and faulty materials and equipment within 24 hours of notification

At 12 months from practical completion provide (to the Electrical Consultant) a thermoscan taken during peak usage Provide (to the Electrical Consultant) a two-day (one weekday one weekend day) chart recording of voltage, current and power factor for each phase

Standard To AS 2467

15 ELECTRICAL METERING

The Contractor shall supply and install all metering panels to Supply Authority requirements and shall include in his tender price for all fees, levies and charges for the provision of metering including the supply and installation of meters, meter bases cabling, service fuses CTs, links etc The Contractor shall observe the space set aside for metering and shall be responsible for selecting components to fit this space In general, a meter should be located in the electrical switchroom that minimises the cable run to the unit The switchroom shall be provided with a Supply Authority approved lock or a key exchange box shall be located in a location acceptable to Supply Authority

The meters shall be protected by a fuse which limits fault currents to 6kA

ELECTRICAL SPECIFICATION

D LUMINAIRES

1 GENERAL

1.1 STANDARDS

Standards

Luminaires To AS 3137

Radio interference limits To AS/NZS 4051

1.2 INTERPRETATIONS

Definitions

Proprietary luminaires Luminaires available as a catalogue item

2 QUALITY

2.1 SAMPLES

Where nominated light fittings are not supplied by the Superintendent submit samples of each proposed luminaire for approval by the Superintendent

Where deviations to the design intent or alternative equipment proposed it shall be the subcontractors responsibility to confirm all design objectives and criteria as described here-in parameters to install systems with adequate capacity co-ordination on site with detailed design resolution between other trades and building elements, achieve a performance to meet the requirements in accordance with all Regulatory Authority requirements and satisfy the architectural style and client requirements to the true intent and meaning of this specification and the accompanying drawings

Refer to Appendix B for Luminaire Schedule

3 COMPLETE

Lamps

Provide luminaires complete with lamps and accessories Luminaires shall be provided with long-life lamps

4 ACCESSORIES AND CONTROL EQUIPMENT

4.1 BALLASTS

Current total harmonic distortion < 15%

Number of ballasts Provide separate ballasts for each lamp

All fluorescent lights shall be fitted with low loss ballasts Refer following table

Maximum ballast losses at operating temperature table

Lamp size (W)	Ballast grade - switch start type	
	Low loss (W)	
18	5	
36	5.5	
58	7.5	

ELECTRICAL SPECIFICATION

4.2 CAPACITORS AND FILTERS

Power factor correction

General Correct each luminaire to a minimum power factor of 0.9 lagging
Capacitors To AS 2644

Blocking Inductors

If required by the Supply Authority, provide blocking inductors to Authority approval

4.3 FLUORESCENT LAMP STARTERS

All fluorescent luminaires shall be of the switch start variety Provide a starter for each lamp

5 LAMPS

5.1 GENERAL

Standards

Fluorescent To AS 1201 All fluorescent lamps shall be of the tri-phosphor TLD84 variety

Incandescent To AS 2325

5.2 FLUORESCENT

General

Cathodes Low resistance

Bi-pin caps Standard

Lamps

26 mm diameter – colour corrected temperature 4100K

Low energy 16mm diameter – colour corrected temperature 4100K

Colour rendering index at least Ra85

5.3 COMPACT FLUORESCENT LAMPS

Standard

To AS 1201

Type

Tri-phosphor type, 4100K colour temperature, colour 84

Compact fluorescent lamps (CFLs) shall be from a recognised manufacturer Use standard wattage compact fluorescent lamps only

Compact fluorescent lamps (and associated ballasts) used in bathrooms, toilets, cupboards shall be of a fast run-up variety, reaching at least 80% of final output within one minute

Compact fluorescent lamps shall be chosen to suit location The Contractor shall consult the lamp manufacturer's recommendations to determine the correct lamp For example external CFLs shall be selected to have a wide starting and running temperature range

CFL specified lifetime to be 10 000 hours under recommended installation conditions

ELECTRICAL SPECIFICATION

5 4 METAL HALIDE LAMPS

Type

Use vertical high output lamps of the required wattage

Manufacturer

Metal-halide lamps shall be of standard type

5 5 HIGH PRESSURE MERCURY VAPOUR LAMPS

Should not be used

5 6 HIGH PRESSURE SODIUM LAMPS

Should not be used

5 7 LOW PRESSURE SODIUM LAMPS

Should not be used

5 8 LOW VOLTAGE DICHROIC

Type

Use high quality, quartz-iodide, sealed reflector type

Use only long-life lamps rated a greater than 4000hours

Ratings

Minimum Wattage 20W

Maximum Wattage 75W

Nominated Manufacturer

GE or VENTURE

5 9 QUARTZ IODIDE

Discharge Luminaires

Provide quartz (QI) auxiliary lamp for each HID luminaire where nominated, which switches off when the luminaire reaches maximum illumination

5 10 LED lamps

LED system efficiency (ie driver and lamp) will exceed 75 lumens per Watt

CRI will exceed 85

Provide a driver specifically suited to the LED The driver must be installed in an accessible location Install to ensure heat dissipation from heat sinks

LED lighting will have a minimum 40,000hr tested mean-time-to-failure This includes all driver components as well as LEDs themselves LEDs will have no discernable colour drift over the life of the fitting

6 INSTALLATION

6 1 GENERAL

General

Mount luminaires on proprietary supports using battens, trims noggings roses and packing material as necessary

ELECTRICAL SPECIFICATION

Surface mounted luminaires

General Fit packing pieces to level luminaires and prevent distortion of luminaire bodies Use packing strips to align end to end luminaires

Fixing Use 2 fixings at each end of fluorescent luminaires A single fixing at each end in conjunction with 16 mm backing plates may be used for narrow luminaires

Recessed luminaires

Connect recessed fluorescent luminaires to a plug socket outlet

Where recessed luminaires have been specified the Contractor must ensure that there is adequate ventilation in the ceiling void to allow unimpaired operation for the expected lamp and fixture lifetime This relates particularly to the installation of insulation around the fittings

The Contractor shall check that clearances have not been compromised by inaccurate formwork or installation of other services before light fittings are purchased

6.2 POSITIONING OF LUMINAIRES

Final positioning of luminaires both internal and external luminaires shall be carried out on site in consultation with the Architectural drawings and the Superintendent The Contractor shall not carry out any installation work without first undertaking such co-ordination and gaining approval

7 SPECIFIC LIGHTING REQUIREMENTS

7.1 GENERAL

All light fittings shall be set-out as per the Architectural documentation

All light fittings in car park, common areas, hallways lobby, lift lobby and plant rooms shall be controlled by time clock and motion sensors

7.2 EXTERNAL LANDSCAPE AREAS

All external lighting shall be set-out as per the Architectural documentation

Cables for external lighting should be installed with no joins beneath the ground If this is unavoidable the Contractor must seek the approval of the Superintendent

- An override switch located at DB cupboard shall operate all external lights in case of an emergency
- Generally the lights shall be controlled by a programmable timer and PE Cell,
- After 10 pm 50% of external lights will be switched off to provide security lighting remaining lights will remain on until the daylight activates PE Cell

7.3 APARTMENT LIGHTING CONTROL

All light switches are to be set-out as per the Architectural documentation, but generally as follows

- To be located at 1100mm AFFL,
- To be of large format (Clipsal Prestige P2000 series)

Exhaust fans up to 400W may be connected into the local lighting circuit

ELECTRICAL SPECIFICATION

E EMERGENCY EVACUATION LIGHTING

1 GENERAL

1 1 CROSS REFERENCES

General

Comply with the General services requirements section

Related sections

Refer to the following sections

- *Wiring and accessories* for cabling requirements
- *Luminaires* for general information

1 2 STANDARDS

General

Design and installation AS 2293 1

Inspection, tests and maintenance AS 2293 2

2 QUALITY

2 1 CONTRACTOR'S SUBMISSIONS

Product data

Submit manufacturer's data for each type of luminaire and exit sign including tables indicating the maximum luminaire spacing for a given mounting height

Type test data

Submit the following

- Photometric data and temperature test reports for each type of luminaire and exit sign
- Data on battery life, charging and discharge rates

Shop drawings

Submit details of the testing facility, with locations of all emergency luminaires

3 COMPONENTS

3 1 SINGLE-POINT SYSTEM LUMINAIRES

General

Design, document, supply and install new emergency and exit lighting throughout to comply with AS2293

Visual indicator lights Provide a red indicator, readily visible when the luminaire is in its operating condition, which indicates that the battery is being charged

Inverter system Provide protection of the inverter system against damage in the event of failure, removal or replacement of the lamp while in normal operation

ELECTRICAL SPECIFICATION

Local test switches Provide a momentary action test switch, accessible from below the ceiling, on each luminaire to temporarily disconnect the mains supply and connect the battery to the lamp

Emergency Lights

Carpark areas

2x28W surface mounted fluorescent luminaire with wire guard and one tube provided with NiCd battery pack complying with AS2293 1

Fire stairs

2x28W surface mounted fluorescent luminaire with acrylic diffuser and one tube provided with NiCd battery pack complying with AS2293 1

Internal corridors

Provide emergency luminaires Stanilite Spitfire type within the internal corridors of each level of development where a false ceiling permits. At other locations (AS2293 1 compliant) surface mounted luminaires with battery backed compact fluorescent tubes are to be used

The following applies to all battery backed luminaires

Visual indicator lights Provide a red indicator readily visible when the luminaire is in its operating location, which indicates that the battery is being charged

Inverter system Provide protection of the inverter system against damage in the event of failure removal or replacement of the lamp, while in normal operation

Local test switches Provide a momentary action test switch accessible from below the ceiling, on each luminaire to temporarily disconnect the mains supply and connect the battery to the lamp

Batteries

General Use nickel-cadmium batteries capable of operating each lamp at its rated output continuously at least 2 hours during acceptance tests and during subsequent tests

Battery life At least 3 years when operating under normal conditions at an ambient temperature of 25 °C and subjected to charging and discharging at 6 monthly intervals

Marking Indelibly mark each battery with its date of manufacture

4 INSTALLATION

4.1 GENERAL

Power supply to single-point systems

Provide a 240 V active supply to each luminaire and exit sign to monitor the nearest common area lighting final sub-circuit

All exit and emergency luminaires shall monitor a local lighting circuit which shall be fitted with automatically switched and variable timed circuitry capable of simulating a power failure on the monitored circuit without affecting general lighting in the area. Test switches shall be installed adjacent local distribution board and labelled Emergency Lighting Test Switch. Design of test circuit to AS 2293 1

Luminaire mounting heights

ELECTRICAL SPECIFICATION

For all emergency exit luminaires, the mounting height should be chosen to give optimum visibility with due regard to clearances and AS2293 1 1998 Section 5 6 5. In some situations, luminaires may need to be suspended to provide effective functionality. For instance, where an emergency exit sign is obscured by other services, pole suspension should be considered as a mechanism to extend visibility. In general, however, the Contractor should avoid situations such as this by co-ordinating with other services at an early stage.

5 COMPLETION

5.1 COMMISSIONING

Mains supply

Before commissioning, ensure mains supply has been continuously connected for at least 24 hours.

Single-point systems

Simulate mains supply failure to each general lighting final sub-circuit and verify the correct operation of luminaires and exit signs for a continuous period of 2 hours. Then restore normal supply and verify the operation of the indicator lights on each luminaire.

5.2 COMPLETION TESTS

Single-point systems

Carry out the 6-monthly procedures before practical completion and again before the end of the maintenance period.

5.3 MAINTENANCE

General

Carry out the 6-monthly procedures.

Provide all relevant warranty cards for all LED type EXITS.

Provide an appropriate log book for entering test performance of Emergency and Exit lights.

ELECTRICAL SPECIFICATION

F TELECOMMUNICATIONS, SECURITY, MATV & PAY TV SYSTEMS

1 GENERAL

The existing Stage 2 telecommunications security, access control, MATV & Pay TV systems shall be expanded to cater for the new Stage 3 development. The stage 3 telephone distribution frame (IDF) security expander panels, MATV & PAYTV head-ends servicing all apartments & community centre shall be located within a dedicated comms room located on the first floor.

1.1 CROSS REFERENCES

Related sections

Refer to the *Wiring and accessories* section for electrical cabling requirements.

1.2 STANDARDS

General

Cabling products To AUSTEL TS 008 and AS3260

Installation of cabling To AUSTEL TS 009

2 QUALITY

2.1 CONTRACTOR'S SUBMISSIONS

Product data

Submit product data for components.

Shop drawings

Submit shop drawings showing layouts and configuration of each system.

2.2 CONTRACTOR'S QUALIFICATIONS

All works shall be performed by the holder of an appropriate AUSTEL licence.

3 TELECOMMUNICATIONS

3.1 GENERAL

The telecommunications system shall consist of new communications cables from the existing site MDF located in Stage 2 RACF comms room and terminate at the Stage 3 IDF and distributed throughout the facility via the structured cabling system.

The electrical contractor is required to provide all a comms rack unit patch panels telephone distribution frames and all necessary equipment required to enable the service to be provided to the individual apartments.

3.2 SCOPE OF WORKS

The scope of the contract telecommunications works as detailed within this specification and associated drawings, room data sheets shall include, but not be limited to the following:

- Supply & install 100 pair external grade copper cable & 6 core single mode fibre optical cable in underground conduits from the existing Stage 2 main comms room to the new comms room.

ELECTRICAL SPECIFICATION

- Supply and install building distributor (hereafter called IDF) within the communications room,
- Supply and installation of 1-off 45RU communications cabinet in the comms room
- Supply and installation of Cat 6 horizontal cabling and RJ45 outlets,
- Supply and installation of 1kVA rack mounted UPS in the main communications rack unit with 5 minutes standby at full rated load
- Supply of fly and patch leads
- Supply and installation of all copper tie cables to enable a fully functional system,
- Supply and installation of cable trays and cable management
- All other works deemed necessary to implement a fully functioning system
- Allow to fully commission the lift phone line as required Principal to sign all necessary account forms
- Testing, commissioning and training

The system shall be provided with the manufacturer s minimum 15 year certification

The Contractor shall provide at least one two pair phone line to each of the following,

- Lifts (the Contractor shall liaise with the lift provider to determine the location where connection is to be provided Phone line cable to be two hour fire-rated)
- Meter Data Loggers (MDL) Coordinate with Hydraulics services for final location

The Contractor shall allow for all liaising, co-ordination and payment of fees to Telstra to ensure that incoming lines are installed prior to project completion All line rentals shall be paid by the Superintendent

All installation shall be carried out to the detailed requirements of the contract documents and AUSTEL All cabling shall be carried out by an AUSTEL approved Contractor

3 2 TELEPHONE DISTRIBUTION FRAME

The Contractor shall supply and install a telephone distribution frame within the Communications room and shall further allow for the reticulation of an appropriately sized telecommunications earth conductor The frame shall be of the enclosed Krone manufacture The Contractor shall allow for all terminations and jumpering as necessary to have a fully functional telephone system to each apartment The system must have capacity to provide at least one voice and one separate ADSL line to each apartment plus a further 20% spare capacity

3 3 TELEPHONE OUTLETS

Requirements

Supply and install Cat 6 UTP 4 pair cable from the Telephone IDF to each apartment as indicated on the schematics Outlets should be connected in a star configuration to a distribution point (FDP) near the electrical distribution board (above the fridge) Cable should be terminated at each end to Cat 6 standard

ELECTRICAL SPECIFICATION

The telephone outlet in the main bedroom should be located beside the bed, on the side closest to the door

All telephone faceplates shall be colour finished to Architect's selection

Segregation

Segregate communications cables from other services to AS3000, AS3080 and TS009. On parallel runs longer than 3000mm, Telecommunication cabling shall be separate from power cabling by 600mm min. For shorter runs, 300mm separation is permissible.

Sockets

Supply and fit AUSTEL/TS009 approved telephone sockets (RJ45) where shown on Architectural plans.

Sockets are to be wired such that the activation of any particular socket as a new phone line requires at most rewiring at that one socket only.

3.4 TESTING

Pair tests

Test each pair in every cable for correct operation. In particular check for

- Continuity,
- correct sequence

Resistance

Test the insulation resistance of each pair in the outer layer of every cable and of one pair to earth. Ensure the measurements are greater than the TS009 minimum limits.

Cat 6 performance

10% of all connected pairs shall be randomly selected and tested to ensure Cat 6 performance (eg cross talk, attenuation etc). Performance criteria are outlined in the Cat 6 standard EIA/TIA 568.

IDF

Test the resistance from the IDF to ground. Ensure the measurements are less than the TS009 maximum limits.

4 HEARING AUGMENTATION

The Contractor shall provide fully functional hearing augmentation loop system in multipurpose hall & cafe areas. The electrical contractor is to engage a specialist contractor to design and undertake the associated works.

The hearing augmentation loop cabling is to be installed inside the floor slab. The contractor shall provide adequate loop cables and arrange in order to provide full coverage of the broadcasted media.

A hearing augmentation loop will be provided to supply magnetic fields sufficient for hearing augmentation to the Australian Standard. Hearing augmentation shall be available to 100% of seated audience members in multipurpose room & Cafe areas. The Contractor shall engage a loop designer to ensure that the area will be fully covered and to ensure minimal leakage to the adjoining areas (including corridors). The design will be completed before pouring of slab to ensure that the loop can be seamlessly incorporated into the slab.

ELECTRICAL SPECIFICATION

The system shall be able to generate a PA announcement over the PA speakers in multipurpose room & cafe areas

The system (PA speakers and hearing augmentation loops) will be connected to the building occupant Warning System so that BOW messages over-ride all other inputs

The following items are to be provided as part of the hearing augmentation loop package,

- Wireless microphones corresponding to relevant areas,
- Separate amplifiers which are to be located in community centre communications rack unit,
- Comprehensive end user training arranged by builder

5 SECURITY, ACCESS CONTROL & INTERCOM SYSTEM

5.1 GENERAL

The Contractor shall integrate the security and intercom systems such that the opening of doors can be operated from either

While the functionality outlined herein is required the methods outlined are indicative only. It is the Contractor's responsibility to ensure that all components, sensors, actuators, ancillary equipment and software are in place, all design is completed and all interfaces with other systems are realised to create a fully functional system without additional costs. It is the Contractor's responsibility to ensure all works are in accord with all relevant Australian Standards, BCA and Authority requirements.

5.2 INTERCOM

The Contractor shall supply and install a colour video and audio Intercom System throughout the development. It shall consist of, but not be limited to, the following minimum features:

- 1-off video intercom entry station at each main pedestrian entry of the building. The stations should be located as directed by the Architect. However, this does not diminish the Contractor's responsibility to alert the Superintendent if the chosen location may create operational difficulties. In general, the stations should be in a well lit location, protected from weather, and should be vandal-resistant and anchored to the wall in such a way that a screw-driver cannot be inserted between the face-plate and the wall.
- Each resident station shall consist of a wall mounted handset unit with an integral push button. The button will allow remote release of the main entry gate/doors electric strike while the button is depressed. Within each apartment, the intercom will be wired via a distribution point located within the comms room.
- The entry intercom stations shall include at least the following features:
 - LED or backlit LCD display
 - IP44 rated (station and wiring thereto)
 - UV resistant (external station components and external wiring)
 - A method to search for resident names and numbers as approved by the Superintendent
 - Call button
 - Numeric keypad

ELECTRICAL SPECIFICATION

- The intercom system shall incorporate a programmable electric strike time-out function, which will ensure that if entry door is not opened within the preset time period the electric strike will relock the door
- **Door Electric Strike**
The Contractor shall install a PADDI ES2000 electric door strike complete with lock tongue sensor at the entry gate. The strikes should still operate with a 1.0 kN force in the direction that the door opens and should not be impaired by the accumulation of dust
- The intercom system shall allow clear 2 way audio communication between each unit and each of the entry locations, equivalent to standard telephone reception at the handset and good PA system quality at the entry locations. Audio volume at entry points sufficient to overcome prevailing traffic noise
- The resident units should have a ring tone with volume control up to 80dBA
- The video system should be colour so that good visibility in low or difficult lighting levels can be accommodated
- The external cameras shall be positioned to allow a face to be easily recognised despite changing light levels. In particular bright sunshine should not render a face unrecognisable because of shadow. Neither camera nor display should suffer from hole burning due to stationary light sources. The video system (including cameras and display) should be provided with a two year warranty against malfunction
- The system should contain anti-Larsen circuitry
- One defective or accidentally off-hook handset should not disturb system operation
- The unit shall be **Comelit Vandalcom** for compatibility between stages. The unit must be supplied by an installer with at least 5 years experience
- Any wiring topology would be acceptable so long as performance criteria are met and the extent of cabling does not interfere with the installation of all other services in restricted risers, ceiling spaces and cable trays
- Each entry point will provide a directory that includes names of residents, their floor and door number. The directory will be electronic and will be able to be updated remotely
- Full shop/technical drawings and literature shall be submitted for approval by the Superintendent prior to proceeding with the installation

5.3 SECURITY

Key fob readers are to provide access to all external opening doors. The readers are to be located in a well-lit location immediately adjacent the respective doors. They should be IP56 rated and vandal resistant. They should provide an LED to indicate that a fob has been detected.

The fob readers should not be damaged by electric or magnetic fields expected to be endured in practice (eg from mobile phones, electrostatic discharge, magnets etc).

The access system shall incorporate a programmable electric strike time-out function which will ensure that if entry door is not opened within the preset time period the electric strike will relock the door.

ELECTRICAL SPECIFICATION

All single leaf doors opening to the outside shall be complete with as part of the door hardware, an electric strike and integral reed switch. Double leaf doors shall be complete with as part of the door hardware, an electric strike with integral reed switch for one door panel and a separate reed switch for the other door panel. The Contractor shall co-ordinate with the Builder to ensure that

- o double leaf doors are strong enough to be pinned at an upper point, and
- o all hardware is compatible with the respective doors

All reed switches shall be recessed into doors and frames. All reed switch cabling shall be hidden from view or installed on cable tray unless otherwise approved. Surface mounted reed switches shall only be permitted if approved by the Superintendent.

All door locks are to be integrated with the sub-FIP to ensure that they open in the case of a fire alarm. All door locks are to fail open (eg during a power outage or electrical equipment failure).

The fobs are to be of **Sielox** manufacture to match those supplied for Stage 1 & 2. They will allow entry to all other areas of common access within the complex.

The Contractor shall provide two fobs per apartment, plus a further twenty for community centre. The Village Security Office will have the capability of programming the system to accept new fobs. The fob supplier must guarantee availability of supply of the fobs for at least ten years with a maximum price increase of 8% per annum (excepting currency movement).

An e-tag operated system is to be used for the remote operation of vehicular entry doors.

The e-tags will allow operation from a distance of four meters in front of the entrance door.

The Contractor shall provide one e-tag plus hardware for mounting on a vehicle windscreen to each apartment, plus twenty tags for community centre. The Contractor shall disclose to the Superintendent (before installation) the cost of extra e-tag units for his approval. The security office will have the capability of programming new e-tags, re-programming old tags and replacing the e-tag batteries. The e-tag supplier must guarantee availability of supply of the e-tags, batteries and mounting hardware for at least ten years with a maximum price increase of 8% per annum (excepting currency movement).

The Contractor shall ensure that the addition of more security devices to the existing system does not compromise its ability to operate during a power outage. If this ability has been significantly reduced, the Contractor shall allow to augment the existing back-up UPS.

The Contractor shall provide any automatic vehicle door opening components not already supplied by the builder. The door opening motors must be protected from burn-out due to stalling in either direction. The motors must be specified for a mean-time-to-failure of 500 000 operations (excepting brushes).

Directly inside each door must be provided a key switch allowing the selection of either automatic or manual operation of the doors. In automatic mode the door will be operated by e-tag. In manual mode, an adjacent, secondary switch will allow the door to be manually opened or closed. In addition a timed switch will be provided such that a single, momentary push will open the door and close it again after one minute.

A magnetic loop buried within the road surface will allow automatic opening of the door by a car approaching from the inside.

The loop will be designed and located so as to prevent accidental triggering by manoeuvring vehicles or sundry metallic objects. The loop will be re-triggerable such that the door will remain open for a second vehicle following the first out.

ELECTRICAL SPECIFICATION

A magnetic sensor on the base of the door and a photo-electric beam will stop the door from closing in the event of interruption by a solid object

Provision must be made for the simple connection of future stages at a later date

6 MATV SYSTEM

6.1 GENERAL

The Contractor shall supply and install a fully functional MATV system to service all outlets as nominated on the Architectural services layouts and complying with at least the current versions of

System design and performance To AS/NZS 1367

Receiving Antennae AS/NZS 1417

Cabling and component installation Comply with the recommendations of AS 3815 and Foxtel installation guidelines

Earthing and segregation To AS/NZS 3000

Safety requirements To AS/NZS 1367 Section 2

Electromagnetic compatibility To AS/NZS 1367 Section 3 AS 1367 and AS 1417

The system shall be interfaced with the Stage 2 system and shall consist of but not be limited to, the following components

- MATV outlets in each unit
 - 1 outlet in the lounge area
 - 1 outlet in each bedroom & study
- outlets in Community centre,
- amplifiers, filters and splitters,
- cabling,
- provision (cabling, accessories etc) for reticulation of Pay TV satellite TV services
- testing and commissioning

As a minimum requirement the system shall be capable of receiving all digital & analogue free-to-air channels available in the area

6.2 SYSTEM DESIGN

Prior to the commencement of any on site works the Contractor shall engage a specialist Sub-Contractor to undertake on-site measurements of the signal output of the current aerial located on Stage 2 building

The aerial should provide high quality signal over all free-to-air analog and digital channels Sufficient performance overhead should be available to give the system resilience to adverse weather conditions and to the expected extent of signal manipulation within the system

Prior to the commencement of the installation the Contractor shall submit for the Superintendents approval full design figures of the system and proposed location of equipment

6.3 PERFORMANCE

ELECTRICAL SPECIFICATION

At each outlet, the picture received on a domestic TV receiver shall not be noticeably different from the picture received when the receiver is connected directly to the aerial and shall be free from discernible cross-modulation, saturation, inter-modulation, ringing, noise or other distortion

Input to headend and amplifiers	Channel signal level <input type="checkbox"/> 60 dB μ V
Mutual isolation between system outlets	<input type="checkbox"/> 36 dB within the band 5 MHz to 862 MHz, within or between premises
System outlet range of levels	<input type="checkbox"/> 60 dB μ V and \leq 80 dB μ V, at all times
System outlet levels	<input type="checkbox"/> 65 dB μ V for all channels
Carrier to noise ratio	<input type="checkbox"/> 45dB for all channels

6 4 CABLING

Cables shall be run continuously from splitters/amplifiers to the terminating point without intermediate joints or connections unless otherwise approved

All MATV vertical trunk cabling shall be reticulated throughout the site in low loss quad-shield trunk cable suitable for the transmission of PAY TV / cable TV services Cabling between buildings will be reticulated in conduit at a distance of at least 1m from electrical cables The bending radius of all cabling shall not be less than the cable manufacturer s recommendations

Cable entries to buildings should be adequately waterproofed and strain relieved

Coaxial connectors

Crimp type Series 6 and 11 Do not use Twist-on or type employing a separate Crimp ring to secure the outer braid of the cable

Sealant Provide a moisture ingress prevention sealant at the crimp end of connectors and a moisture ingress prevention washer at the securing nut

6 5 FILTERS

The Contractor shall supply and install such filters as required to reduce out-of-band signal interference and saturation effects to below the visibly noticeable level Filters shall allow reception of digital and analog services

6 6 AMPLIFIERS

The Contractor shall supply and install individual channel amplifiers for each broadcast channel All amplifiers shall be sized to ensure adequate picture quality and signal strength at each unit All amplifiers shall be housed within the communications cupboard

Amplifier gain shall be sufficient such as to provide a minimum of 2mV across 75 Ohm at each outlet

The filter/amplifier combination should not distort the received waveform for each channel

Amplifiers must provide for reception and reticulation of digital and analog services

6 7 SPLITTERS AND T-OFFS

Taps, splitters, and the like shall be of the transformer or directionally coupled type Connections for splitters and T-offs must be via 75Ohm F-type connectors

The devices used for reticulation must provide isolation between outlets to reduce interference

ELECTRICAL SPECIFICATION

6 8 OUTLETS

All TV outlets in positions as nominated on the Electrical/ Architectural drawings shall have 75 Ohm coaxial type cable sockets flush mounted on faceplates which match GPOs. Fix components on a printed board assembly fitted with a clamp and screw for the co-axial cable termination.

Install attenuators to provide the specified isolation between outlets.

Provide 2-meter long co-axial cable fly leads fitted with a suitable plug at each end for each unit.

All MATV cabling shall be installed uninterrupted between TV socket and MATV splitter located within each apartment at a distribution point near the electrical distribution board (above the fridge).

6 9 TESTING AND COMMISSIONING

Carry out tests required by regulatory authorities and tests necessary to demonstrate compliance with the performance and other requirements of the specification.

The Contractor shall provide all equipment, apparatus and materials necessary to perform the tests, including field strength meter and portable TV receiver.

General

Setup Use locally generated test signals to provide static conditions for level measurements.

Verify system performance. Verify that the whole system meets the performance criteria before practical completion. Include tabulated results for all or key system points.

Carrier-to-noise measurements Required

Headend

Measure and record the following signals at the headend:

- Off air as received channels
- Input to channel converters and channelled amplifiers
- Final grouped output of channel converters and channelised amplifiers
- Final grouped output of modulators
- Input and output of amplifiers for all channels (output is main output not 'test output')
- Input and output of filters for channels passed
- Main nodes of passive separating or combining networks for channel of lowest level and of highest level
- Final output of the headend for all channels

Measure and record the following carrier to noise ratios:

- Off air as received channels
- Input to channel converters and channelled amplifiers
- Final grouped output of channel converters and channelled amplifiers
- Final grouped output of modulators
- Input and output of amplifiers for all channels
- Final output of the headend for all channels

Amplifiers

Measure and record:

- Input and output amplifier signal levels for all channels (output is main output not the test output)
- Input and output carrier to noise ratios of all channels

ELECTRICAL SPECIFICATION

Commissioning

- Adjust to ≤ -6 dB of maximum available gain
- Operate at ≤ -6 dB relative to the published maximum output level
- Derate amplifiers relative to the number of channels to be carried with allowance for future expansion
- Apply derating for second and subsequent amplifiers, where amplifiers are to be cascaded

Distribution components

At splitters and taps measure and record the input outputs and all tap ports at minimum and maximum signal frequencies

Outlets

At each outlet

- Measure and record
 - All channel signal levels
 - Carrier to noise ratios of all channels
- Evaluate subjective picture and sound quality on five-grade impairment scale

Flyleads

Following approval of installed system, provide appropriate flyleads to all outlets

7 PAY TV SYSTEM

7.1 PAY TV SYSTEM

The Contractor shall install all cabling and equipment necessary to provide the development with a fully functioning Foxtel Satellite TV reception system

The pay TV system is to be independent of the MATV system

Each apartment will be provided with a Pay TV faceplate adjacent to the MATV outlet in the lounge room & bedroom 1. Each Pay TV faceplate shall accommodate two Pay TV outlets (F-type connectors) on the same faceplate. An RJ45 phone outlet will also be provided for each Pay TV faceplate – either on the faceplate itself or immediately adjacent. This is in accordance with Foxtel's directives regarding pay TV delivery. Preferably one multi-switch will be located within the communications space within each unit.

Each system shall consist of but not be limited to the following Foxtel approved components

- outlets at specified locations within apartments. Where possible outlets should share a faceplate with the MATV outlet. The outlets should be appropriately labelled
- outlets in community centres,
- amplifiers, filters and splitters,
- cabling,
- provision for future reticulation of Pay TV cable TV services
- testing and commissioning

Cable lengths and types should be co-ordinated so that the maximum signal variation between outlets in a grouping should be less than 12dB at the highest proposed frequency of use

ELECTRICAL SPECIFICATION

G FIRE DETECTION & ALARMS

1 GENERAL

1 1 CROSS REFERENCES

Related sections
Refer to the following sections
Wiring and accessories, for cabling requirements

1 2 STANDARD

General
To AS 1670

2 SCOPE

2 1 GENERAL

The fire detection & alarm system in Stage 3 shall be interfaced with the existing fire detection system in Stage 2 RACF building

The scope of works associated with the fire detection system to be undertaken by the Contractor shall include but not be limited to the following

- Design, document, supply and install addressable sub-fire indicator panels to cater for the detection and Building Occupant Warning (BOWS) zones fire trip signals and fan controls, etc and to comply with BCA and AS 1670 BOWS amplifiers should be located within the SFIP housing The panel power supply should be locally surge protected
- supply and install thermal and/or smoke detectors in locations and quantities to satisfy the BCA and AS1670 Within apartments supply and install 240V domestic smoke detectors These detectors are not required to be linked to the building occupant warning system In common areas provide a linked thermal and/or smoke detector system compliant with AS1670
- supply and install concealed space smoke detectors (with adjustable & removable mounting bracket) to comply with AS 1670
- supply and install audible alarm devices throughout the buildings to satisfy the BCA and AS1670
- supply and install a Sub-Fire Indicator Panel immediately within the entrance to the building It should accommodate the Occupant Warning System drivers and the Fire Fan Control Panel for the basement carpark exhaust fans of the building
- supply and install all ancillary equipment as necessary to allow the Main FIP located within the Stage 2 RACF to communicate with the sub indicator panel, detectors and occupant warning systems in the stage 3 Building
- integrate the sub-fire indicator panels with all sensors alarms remote warning devices booster pumps, fans, sprinkler valves gate/door locking systems Fire Fan Control Panels etc and links back to the Stage 2 RACF Main site Fire Indicator Panel (installed by others)

ELECTRICAL SPECIFICATION

- Supply and install all equipment to enable remote fire detection system monitoring for 24 months
- All miscellaneous works as necessary to ensure a fully functional system
- Shop drawing as-installed drawings and manuals
- Training of the staff
- Testing and commissioning

3 QUALITY

3 1 CONTRACTOR'S SUBMISSIONS

Product data

Submit product data for components

- Sub-Fire indicator panels
- thermal and smoke detectors
- audible alarms
- Manual call points
- Fire bell and flashing light,
- Fire annunciator panels

Shop drawings

Submit shop drawings showing the following

- Fire detector layout
- Fire indicator panels
- Location
- Circuit identification
- Labelling details

4 DETECTION AND ALARM SYSTEMS

4 1 AUTHORISED PRODUCTS

General

Use equipment listed in the SSL Register of Accredited Products - Fire Protection Equipment

4 2 POWER SUPPLY

Surge Protection

Ensure that normal operation is maintained and that damage is not caused to control and indicating equipment by voltage surges in the power source

Sealed batteries

Precycle the batteries, ensuring that at least 100% of nominal capacity is available at practical completion. A minimum of 8 hours battery back-up in normal operating mode shall be provided

4 3 APPROVALS

All equipment shall have a certificate of compliance to AS 1603.4 or AS 1668.2 as applicable and be listed by SSL (Scientific Services Laboratory)

ELECTRICAL SPECIFICATION

Federal, State and Local building codes as adopted by the Authority having jurisdiction. All detectors shall comply with AS 1603 parts 1 & 2 and shall be listed in the Scientific Services Laboratories (SSL) listing dated February 1993 or later. Copies of Certificates shall be provided by the Contractor with the tender submission for the works specified therein.

4.4 AUTHORITIES APPROVALS

Requirement Documents evidencing approval of regulatory authorities to be provided before practical completion, include the following:

Telecom Australian Certificate approving the fire indicator panel for connection to Telecom lines
Fire Brigade approval of the installation. Only SSL approved and listed equipment shall be used for all fire alarm, A/C controls and evacuation systems on this project.

4.5 INSTALLATION WIRING

Wiring and connections

Conductor size: minimum 1.5 mm² TPI 250 V rated, with red and white insulation

Sheathing: Red

4.6 CONTROL AND INDICATING EQUIPMENT

General

CIE Facilities: Minimum facilities to AS 1603 4 and other facilities as specified herein, suitable for connection to the specified power source.

Sub-Fire Indicator Panel

The Contractor must provide and install sub-fire indicator panel and associated diagrams in the building at the entrance lobby. The panel should be located immediately within the entrance doors, observing Australian Standards requirements for clearance. Care must be taken to ensure stability of the system in the event of thunderstorms. Signal/ground isolation should be installed in all lines running between buildings. The panel must accommodate any motor/equipment controls as required by the other services to be controlled by the FIP and must interface with all devices (such as doors and door locks) that require fire control signals.

A break-glass alarm will be installed in each entrance lobby – preferably on the sub-fire indicator panel.

The Fire Fan Control Panel shall be integral to the Sub-Fire panel enclosure.

The LCD and keypad arrangements shall comply with AS 4050 – Fire Fighters Control and Indicating facility.

Construction: Generally as specified in SWITCHBOARDS.

Enclosure: Provide a metal cubicle-type enclosure for the sub-fire indicator panel to AS 1603 4 clause 3.3.4. Provide an engraved stainless steel layout drawing showing the detector zone layout and concealed detectors in mechanical ventilation ducts.

Isolation: Provide isolate facilities on the Sub-fire indicator panel to enable tests to be carried out without the transmission of the alarm signal to AFASP.

The sub-fire indicator panel shall be on an addressable type **Pertronic addressable F100A** series and shall be fully compatible with the existing Main Fire Indicator Panel (installed by others) in Stage 2 RACF. The unit should accommodate all required building occupant warning.

ELECTRICAL SPECIFICATION

amplifiers The amplifiers should also be capable of accepting an audio input to serve double duty as a public address system Precautions should be taken to ensure that the warning system function cannot be overridden by a malfunction in the audio input system

The contractor shall supply and install a 2 hour fire rated signalling cable (number of pairs to suit the relevant code requirements) between the fire indicator panel and the following equipment,

- Mechanical panel MCC's in order to activate or deactivate fans or other equipment as specified by the drawings and Mechanical Contractor,
- Distribution boards
- Access control system including all doors with electric locks and as nominated on the architectural door schedule,
- Lift control panels

Isolation

Provide isolating facilities on sub-fire indicator panels to enable tests to be carried out without the transmission of alarm signals to fire brigade

4 7 DETECTORS

Standards

Heat detectors To AS 1603 1

Thermal detectors shall be of the Type A variety with normal temperature duty, incorporating both fixed temperature and rate-of-rise temperature

Point type smoke detectors To AS 1603 2

Smoke detectors shall be of the ionisation or optical type complete with integral sounder Optical detectors shall ring an alarm when the smoke entering the detector scatters the light beam between the light emitting diode and the light photo sensing diode

Self-indicating detectors

General Provide a light emitting diode mounted in a clearly visible position which illuminates whenever detector operation causes an alarm condition to register on the sub-fire indicator panel Provide self-indicating devices which, if faulty will not render the detector inoperative under fire conditions

Mounting positions of light emitting diodes

- Visible detectors On the outside of the detector or its base
 - Detectors concealed above ceilings On the underside of the ceiling immediately below the detector
 - Detectors in other concealed spaces On a visible panel close to the try to the concealed space housing the detector
 - remote indicators To AS 1603 15

4 8 MANUAL CALL POINTS

Standard To AS 1670

Standard To AS 1603 5

Additional call points IN addition to the manual call point required by AS 1670 to be provided at the main entrance provide and connect manual call points in other locations as is good practice

ELECTRICAL SPECIFICATION

Ensure that Break Glass Alarms (BGA's)/manual call points are installed in evacuation routes so that no point on a floor is no more than 30m from the BGA/manual call point
Individual RED BGA s shall be installed to facilitate all the relevant code requirements of the BOWS and Fire Detection System

4 9 ANNUNCIATOR PANELS

Standard To AS 1670 BCA spec E2 2a

LCD low profile annunciator panels are to be supplied and installed at the locations in each fire zone The annunciator panels will be functionally equivalent to a Brooks Australia Liquid Crystal Display RLCM/B Panel There will be provision for muting of local alarm and sounders

4 10 RESIDENTIAL UNITS

The Contractor shall supply and install smoke detectors within all residential apartments Each smoke detector shall incorporate an integral siren alert per level and be connected to 240V AC supply and have integral battery backup

Detectors to be utilised shall be Australian Standards approved and registered The contractor shall submit samples of the proposed detectors for approval by the Superintendent prior to proceeding with the installation

In apartments with more than one smoke detector detectors will be interconnected so that all detectors will sound in an alarm event

Installation

Install detectors so they can be easily inspected and tested in situ and readily withdrawn from service Consideration should be given to minimising false alarms (eg by steam or kitchen events) by thoughtful placement of the sensors

4 11 ALARM BELLS AND AUDIBLE ALARMS

Requirement To AS 1670

Fire Alarm Bells	To AS 1603 6
Bell Circuits	To AS 1603 4 clause 2 4
Bell Sizes	Internal (if any) 75mm
	External 150mm
Strobe Lights	To AS 1603 11

Power Supply

To the main bell and not more than two others From the Sub-FIP battery supply

To any additional bells From mains supply Provide appropriate interface relays, operated by the sub-fire indicator panel Install cables to all bell circuits

Provide fire alarm bell outside the building Ground Floor main entry and audible alarm sounders on every level of the residential block within common corridor areas Alarm sound pressure levels shall meet the requirements of BCA & AS1670

Surface mounted sounders are permitted where there is no ceiling void Otherwise recessed versions should be used

Recessed mounted audible speakers are to be provided with a 100mm round recessed plastic covers complete with 2mm minimum perforated holes All mounting screws are to be provided with caps to conceal the screw heads

In basement areas where ceiling do not exist, surface mounted audible horn type speakers are to be mounted on manufactured brackets with the lead cables neatly connected to the fire detection circuitry adjacent in a junction box Colour of horns to be confirmed by architect Horn speakers

ELECTRICAL SPECIFICATION

are to be rated at IP44 at a minimum if mounted indoors and IP56 if mounted externally Wire cages are to be provided if the horns are located in a public car park area or if is mounted below 2400mm

5 INSTALLATION

5 1 ELECTRICAL ISOLATION

Requirement

Provide isolating devices where necessary to avoid feedback between FIP panel equipment and other electrical equipment, eg Building occupant warning system

5 2 INSTALLATION WIRING

Wiring and connections To AS3000, AS 1670 and AS 3013

Installation As specified in Electrical Services section

Double-insulated Cables Use only those with red coloured sheathing

Fire rated MIMS cable shall be installed between the main switchboard and FIP

5 3 MAGNETIC DOOR HOLD OPEN DEVICE

The contractor shall supply, install and connect the sub-fire indicator panel to all electric and magnetic locks, power operated hold open door devices so that in the event of a Fire Alarm the appropriate doors receive a signal causing them to release/open immediately Co-ordinate with the Security and Door Hardware trades

5 4 ELECTRIC/MAGNETIC LOCKS AND POWER OPERATED DOORS

The contractor shall supply install and connect sub-fire indicator panels to all electric and magnetic locks power operated hold open door devices including sliding doors so that in the event of a Fire Alarm the appropriate doors receive a signal causing them to release/open immediately Co-ordinate with the Security and Door Hardware trades Provide appropriate signals to the nurse call system to allow indication of any fire event on fixed and mobile nurse call equipment

5 5 INTERFACE TO FIRE SPRINKLER SERVICES

Install and connect all wiring (associated with fire detection system) between the FIP and fire sprinkler flow switches

5 6 INTERFACE TO MECHANICAL SERVICES

Install and connect all wiring (associated with fire detection system) between the sub-fire indicator panel and all mechanical services panels as required

5 7 INTERFACE TO ELECTRICAL SERVICES

Install and connect all wiring (associated with fire detection system) between the sub-fire indicator panel electrical power supply systems to operate as required and nominated

5 8 INTERFACES TO LIFT SERVICES

Install and connect all wiring (associated with fire detection system) between the sub-fire indicator panel and electrical lift panel to operate as required and nominated

ELECTRICAL SPECIFICATION

5.9 TESTING AND COMMISSIONING

It is important that the Fire Alarm Contractor shall ensure that operator's manual for the CIE, as installed drawings and documentation commissioning test report forms and the system logbook are available to facilitate commissioning and testing

Give sufficient notice so that tests may be witnessed by the superintendent

Minimum notice required 7 days

On completion of the installation and before practical completion, satisfactorily carry out the following

- To AS 1670 Section 6
- CIE Tests The Performance Testing specified in AS 1603.4 Section 4
- Authorities Test Additional tests which may be required by the relevant Authority
- Trial Period A twenty one day trial period with the building occupied or ready for occupation, during which non fault or instability occurs

6 COMPLETION

6.1 MAINTENANCE

Standard

Maintenance and records To AS 1851.8

ELECTRICAL SPECIFICATION

H PHOTOVOLTAIC GRID-CONNECTED GENERATION

1 GENERAL

The installation must comply with current versions of
AS5033 Installation of Photovoltaic Arrays
AS4777 Grid connection of energy systems via inverters
AS1170 2 Wind Loading
AS3000 Electrical Wiring Rules
AS1768 Surge arrestors

In addition the installation must comply with local supply authority guidelines for grid-connected generators

Shop drawings of the system must be presented to and accepted by the Superintendent before work is started or equipment purchased

The Contractor will liaise with the relevant Energy Authority in order to bring the system fully on-line This will involve (at a minimum) completing all application forms providing any required certificates of suitability and equipment information, arranging inspections ordering and arranging for the installation of import-export metering

The Contractor shall ensure that the power meter PV system main switch, circuit breaker and PV system connections are installed appropriately

2 MODULE SUPPORTS

- 1 The photovoltaic (PV) modules must be located directly on the roof, forming the ceiling over the area shown on the architectural drawings
- 2 The supports or brackets should be designed to withstand winds to AS1170 2 The supports must connect to the building framework so as to transfer all wind loads directly to the framework and not to sheeting materials
- 3 The supports must not increase the risk of water penetration through the canopy roof
- 4 Contact of dissimilar metals must be avoided The supports must be protected against corrosion Wood or untreated metal will not be accepted
- 5 All electrical connections and cables to the modules must be protected from access and exposure to the weather
- 6 Access routes must be maintained to all panels
- 7 All accessible conductive components are to be earthed All earthing conductors to have a cross-sectional area capable of sustaining the module short-circuit current of at least 6 sqmm Resistance to earth from any point must be less than 25Ω
- 8 The Contractor is responsible for providing all brackets, fixtures and conduits for fixing the inverter, switches protective devices and any other equipment associated with the PV system The Contractor will be bound by the requirements of the general Electrical Specification This covers issues such as neatness of wiring etc In particular cables

ELECTRICAL SPECIFICATION

should be installed out of sight where possible This may involve reticulating cables through the centre of structural elements

3 PHOTOVOLTAIC MODULES

- 1 The PV modules should be UL-listed (meet Underwriter Laboratories Standard 1703 for safety of flat-plate photovoltaic modules) and meet or exceed IEEE Std 1262
- 2 The modules must be guaranteed for continuous undisturbed operation over 10 years
- 3 The modules nominal combined output shall be 10kW (continuous) under rated conditions (1000W/m² at 25 C)
- 4 There is no preference for single crystalline multi-crystalline or amorphous save that the required rated power be obtainable from the allotted roof area
- 5 There is no preference for either a floating or earthed solution, provided that the protective measures of AS5033 are complied with The DC section of the system should be entirely double insulated (Class II)
- 6 There is no requirement placed on the number of strings of modules, save that the DC voltage cannot exceed 600V and that the voltage levels are compatible with the inverter or any other equipment
- 7 Strings will be protected against fault current as per AS5033 section 2 Current protection devices will be located as per AS5033 table 2 2
- 8 The modules must be protected with high transmission toughened glass capable of withstanding hail damage Because the panels are forming the ceiling over the canopy glass used therein must comply with AS1288 2006 for the use of glass in buildings
- 9 Where the underside of a module is exposed it should be protected against vandalism with a vandal-proof mesh This will be provided by others The mesh should be either sufficiently open-space or placed far enough below the array so as not to interfere with air flow The module temperature should not exceed 75°C with a 35°C ambient Liaise with the mesh installer to ensure that this is the case

4 CABLING

- 1 Cabling losses between the modules and the inverter/s must be kept to 2% or less by selecting appropriate cables and maintaining low join resistances
- 2 Current carrying capacity of the cables must be greater than that of any protective device that protects the cable and at least 125% of the PV short-circuit currents
- 3 All cables must be copper, preferably stranded
- 4 All DC cables and connections should be Class II (double insulated)
- 5 All above-roof DC connections must be IP54 or better
- 6 Derate current carrying capacity of conductors (and allowable temperature rise of insulation) based on expected ambient temperatures Cables connected to the solar

ELECTRICAL SPECIFICATION

modules should be selected for continuous operation at 60°C All insulation should be rated for operation at 90°C or higher

- 7 All cables should be reticulated through conduit where practicable Where cables are exposed to direct sunlight they must be UV resistant Where conduits are exposed to direct sunlight they must be UV resistant
- 8 All cables must be strain-relieved when connected to a fixed point
- 9 For DC cables, use only heavy-duty crimping tools to crimp terminals/lugs Do not use crimping tools intended for electronic purposes
- 10 An appropriately-sized MOV-based surge arrestor should be located on each DC circuit within 15m of the PV modules Long DC cables should have additional surge arrestors as per AS5033 section F 2 3 3 The recommended specifications for surge arrestors (AS5033 F2 3 4) should be observed

5 INVERTER

- 1 Either three single phase inverters or a single three phase inverter may be used More than one set of inverters may be used if this is advantageous (for instance, to reduce cabling losses in co-ordination with the cabling section above - keeping cable losses to 2% or less)
- 2 The inverter must be capable of handling the full range of voltages output by the PV cells under all realistic conditions Assume maximum insolation of 1500W/m² module surface temperature range of -10°C to 80°C with 10% margin
- 3 The inverter must be sized to provide the maximum energy over a year at the expected insolation rates This may mean that the inverter rating be less than the total rating of the PV modules The solar Contractor must provide calculations to show his determination of this optimal point The solar Contractor must also provide grounding details of the inverter unit
- 4 The inverter/s must track the maximum power point of the PV cells and must switch off when supplied energy is less than the inverter s losses
- 5 The Contractor should program any shutdown/start up sequences to suit the installation
- 6 The inverter should have a Certificate of Suitability from the Department of Fair Trading
- 7 The inverter will be located in a suitable location in a weatherproof enclosure if located external to the building The solar Contractor will ensure that ventilation is adequate and will liaise with the Electrical Contractor for exact positioning
- 8 Preferably the inverter should power-down when photovoltaic module output is below the inverter s own running current

The inverter/s must,

- synchronise to the mains phases as per AS4777
- incorporate anti-islanding protection in the case of mains failure
- provide safe shutdown in the event of mechanical damage to PV modules
- provide three phase 415V +/-4% over full load range
- provide 50Hz +/- 0.01% over full load range

ELECTRICAL SPECIFICATION

- provide a sine wave with distortion less than 4%
- be immune to mains disturbances Its immunity should meet or exceed the requirements of the "Voltage Tolerance Envelope published by Technical Committee 3 of the Information Technology Industry Council of America
- Peak inverter efficiency must be greater than 90% overall efficiency greater than 85%
- must comply with AS 1044 for Electromagnetic compatibility,
- be reverse polarity protected,
- operate throughout the temperature range -5 C to 50 C

6 SUNDRY

- 1 AC and/or DC disconnect switches may be incorporated into the inverter if desired
- 2 Solar array warning signs (AS5033 figures G1, G2 and G3) are to be affixed to appropriate locations In addition the main switchboard board will be provided with a sign noting that it is supplied from two sources – mains and solar panels – and that both main switches should be disconnected before any work is conducted on the switchboard
- 3 Lettering should be 8mm high
- 4 The Contractor must provide any combiner boxes fuses junction boxes etc as necessitated by the choice of module connection and earthing methodology
- 5 The Contractor must provide waterproof enclosures where necessary All waterproofed cable entries must be from below
- 6 All junction boxes and connection points for DC wiring must be accessible
- 7 There must be no more than one grounded connection to the DC grounded conductor of the PV system
- 8 All system components must be clearly identified as to type, manufacturer and model number to allow simple replacement in the event of failure
- 9 The main switch on the main distribution boards will be interlocked with the solar main switch on the boards as shown in the drawings Opening the mains switch will also open the solar main switch Opening the solar main switch will not affect the main switch

ELECTRICAL SPECIFICATION

I METER DATA LOGGERS

1 GENERAL

The Contractor shall supply power to a main meter data logger (MDL) & auxiliary MDLs in the Building. The Contractor shall arrange for the power socket (a double GPO) supplying the MDLs to be lockable in accordance with gas and water utility requirements (eg a Clipsal 255 series enclosure).

The Contractor shall supply and install

- all wiring between main and auxiliary MDLs,
- all wiring between water and gas meters and the local MDL. This includes meters for gas Barbecues, hot water heating etc. Each meter will be connected by its own cable.
- a two-pair phone cable to the main MDL,
- any equipment not supplied by the utilities to allow dial-out capability of the main MDL as per gas and water utility requirements.

The Contractor shall observe the instructions as set out on the following page for the MDL installation. The Contractor shall liaise with the MDL Manufacturer or Distributor to determine the best method for linking MDLs to reduce the occurrence of errors. This may require the installation of surge protection/dissipation.

The Contractor shall arrange to acquire all necessary equipment from the respective utilities and make all arrangements and payments necessary to utilities in order to have a fully functioning automatic MDL system.

The following 13 points are to assist the contractor installing cabling and data logger boxes for MDL installations:

- 1 MDL board to be mounted by electrician by means of dyna bolts or equivalent rigid fixing.
- 2 Builder to arrange for a dedicated phone line and phone number with Telstra A S AP. Phone line to be installed at master MDL. This can be the first or last MDL in the network.
- 3 Each MDL must have a **DOUBLE** power point mounted in an enclosure similar to clipsal 255 series adjacent to the MDL.
- 4 MDLs to be installed in areas not accessible to unauthorised personnel (ie switch rooms, communications rooms).
- 5 If original design is altered MDL location to be such that cable length to meters is minimal (100 metres is an accepted maximum level).
- 6 Telephone line for MDL modem to be installed at one box only (this applies for each independent building block).
- 7 All MDL boxes within one building to be connected with a network cable. This cable will be identical to the type used for metres.
- 8 Cable to be used is a two pair twisted communication type with a drain wire and overall shielding (7/020). Preferred colours are blue, blue/white, orange and orange/white. Cable type must be electra cables type No. EAS 7205P.

ELECTRICAL SPECIFICATION

- 9 Cabling to be installed in accordance with AUSTEL guidelines
- 10 Cables to be installed in an approved manner to the bottom of the MDL with approximately two metres overlap
- 11 Cable ends at an MDL must be identified with unit number and meter type (ie 14G or 16 HW etc)
- 12 Every effort should be made to utilise all 32 channels of an MDL
(the maximum number of meters an MDL can accommodate is 32)
- 13 Each meter including master water master gas bbq pool garbage room etc, must be connected to the MDL with its own two pair cable

Supplied by Paul McNamara
Mobile 0418 236035

ELECTRICAL SPECIFICATION

J WIRING & ACCESSORIES

1 GENERAL

1 1 CROSS REFERENCES

General

Comply with *General services requirements* section

1 2 INTERPRETATIONS

Abbreviation

MIMS Mineral-insulated metal-sheathed

2 QUALITY

2 1 PRE-COMPLETION TESTS

Cable systems Test the insulation resistance before the final connection of equipment and before energisation

2 2 SUBMISSIONS

If not shown on the drawings in detail submit details of the following

- Sub-main cable routes
- Switchboard cupboard layouts

Power cable ratings calculations

General If cable sizes are not given submit calculations of current ratings and voltage drop

Standard To AS 3008 1

3 WIRING SYSTEMS

3 1 SELECTION

General

Use the following systems

- Accessible spaces Thermoplastic insulated and sheathed cables
- Concealed spaces Unsheathed cable in UPVC conduit
- Plastered or rendered surfaces Cable in UPVC conduit
- Stud walls without bulk insulation Thermoplastic insulated and sheathed cables

3 2 INSTALLATION

Standard

Fire or mechanical damage Classifications to AS/NZS 3013

Installation methods table Installation and concealed cabling facilities

Wall construction

Rendered masonry	Flush wall box – conduit chased into wall partition
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Stud partition	Rewirable
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ELECTRICAL SPECIFICATION

Handling cables

Report damage to cable insulation, serving or sheathing

Straight through joints

Unless unavoidable due to difficult installation conditions, run cables without intermediate straight-through joints

Cable joints

Locate in accessible positions in junction boxes

Conductor colours

General For fixed wiring, use coloured conductor insulation. If this is not practicable, slide at least 150 mm of close fitting coloured sleeving on to each conductor at the termination points

Active conductors in single phase circuits Red

Active conductors in polyphase circuits

- A phase Red
- B phase White
- C phase Blue

Tagging

Identify multicore cables and trefoil groups at each end using stamped non-ferrous tags clipped around each cable or trefoil group

Marking

Identify the origin of all wiring using legible indelible marking

4 UNDERGROUND SERVICES

4.1 SERVICES TRENCHES

Existing surfaces

The preference is that the Contractor implements underground boring where possible to avoid the breaking/ damaging of existing surfaces. The Contractor shall advise the Superintendent of any proposed disturbance of existing surfaces before proceeding.

Before excavating trenches, saw-cut existing concrete and bituminous surfaces on each side of the trench to provide a straight even joint. Lift and store unit paving for later reinstatement.

Note: The Contractor shall employ a 'services finder' to locate all underground services prior to commencing any excavation on site. Services damaged by works carried out under this contract shall be replaced at the Contractor's expense.

Excavation

If practicable, make trenches straight between pits, junctions and changes in cable route, with vertical sides and uniform grades.

Spoil: If excavated material cannot be used for filling or backfilling, remove it from the site.

Trench widths

Keep trench widths to the minimum consistent with the laying and bedding of services and the construction of pits.

ELECTRICAL SPECIFICATION

Trench depths

If excavation is necessary below the level of adjacent footings seek approval, and provide necessary support for the footings

Obstructions

Clear trenches of sharp projections Cut back roots to at least 600 mm clear of services Remove other obstructions including stumps and boulders, which interfere with services or bedding If rock is encountered give notice

Dewatering

Keep trenches free of water Place bedding material, services and backfilling on firm ground free of surface water

Excess excavation

If trench excavation exceeds the correct depth, reinstate to the correct depth and bearing value using compacted bedding material or grade N20 concrete

Backfilling

Backfill trenches as soon as possible after approval of laid and bedded service Place the backfill in layers 150 mm thick and compact to the density which applies to the location of the trenches to minimise settlement, and so that pipes are buttressed by the trench walls

Backfill material

Back filling on trenches must be with stabilized sand

Under roads and paved areas Stabilized sand controlled low strength material or fine crushed rock

In topsoil areas Stabilized sand backfill to a level 150 mm above the top of conduits Complete the backfilling with topsoil for at least the top 50 mm

In reactive clay Stabilized sand backfill to a level 150mm above the top of conduits In sites classified M, H or E to AS 2870 1 use an impervious material if trenches fall towards footings

Elsewhere Well graded, inorganic non-perishable material maximum size 75 mm plasticity index < 55% Do not place stones greater than 25 mm within 150 mm of services

4.2 REINSTATEMENT

Lawn areas

Provide 150 mm of loam and return the lawn over the trench and other disturbed areas

Paving and roads

Reinstate to match adjacent work paved surfaces and assets disturbed or removed during excavation of trenching

Concrete surfaces

Reinstate concrete surfaces to the original level If necessary, provide steel reinforcement keyed to the adjacent concrete and laid to prevent the reinstalled concrete from subsiding and cracking

Bituminous surfaces

General Provide crushed rock base and sub-base to match the pavement Prime coat the edges of the surfacing with bitumen Lay and compact hot-mix asphalt so that the edges are flush and

ELECTRICAL SPECIFICATION

the centre is cambered 10 mm above the pavement. If hot pre-mix is not available, cold pre-mix may be accepted.

Minimum asphalt thickness 50 mm or the adjacent pavement thickness, whichever is thicker.

Landscaped areas

The Contractor shall avoid landscaped areas where possible. In all areas where landscaping trees, ground cover, retaining walls etc are disturbed, the Contractor shall reinstate the disturbed area to its original condition to the satisfaction of the Superintendent.

4.3 CABLE PITS

General

Draw-in pits. Pit sizes are to be determined by the Contractor with due regard to recommended cable bending radii.

All pits shall be heavy duty rated suitable for heavy vehicle loading with chequer plate galvanised steel covers.

Proprietary cable pits

For pits 1.2 x 1.2 m provide proprietary concrete moulded pits.

In site construction

For pits > 1.2 x 1.2 m select from the following:

- Proprietary cable pits
- Construct walls and bottoms using rendered brickwork or 75 mm thick reinforced concrete. Incorporate a waterproofing agent in the render or concrete.

Pit covers

General. Provide lockable pit covers to suit heavy traffic loads. Fit flush with the top of the pit. Standard To AS 3996.

Maximum weight 40 kg for any section of the cover.

Lifting handles. Provide a lifting handle for each size of cover section.

Drainage

General. Provide drainage from the bottom of cable pits either to absorption trenches filled with rubble or to the storm water drainage system.

Absorption trenches. Minimum size 300 x 300 x 2000 mm.

4.4 UNDERGROUND CABLE ROUTES

Survey

Accurately record the routes of underground cables before backfilling.

Location marking

General. Accurately mark the location of underground cables using route markers consisting of a marker plate set flush in a concrete base.

Location. Place markers at each joint, route junction, change of direction, termination and building entry point and in straight runs at intervals of not more than 100 m.

Concrete bases. 200 mm diameter x 200 mm deep, minimum.

ELECTRICAL SPECIFICATION

Direction marking Show the direction of the cable run using direction arrows on the marker plate
Indicate distance to the next marker

Plates Brass minimum size 75 x 75 x 1 mm thick
Plate fixing Waterproof adhesive and 4 brass or stainless steel countersunk screws

Marker height Set the marker plate flush with paved surfaces, and 25 mm above other surfaces

Marker tape

Where electric bricks or covers are not provided over underground wiring, provide a 150 mm wide yellow or orange marker tape bearing the words "*WARNING - electric cable buried below*", laid in the trench 150 mm below ground level

5 POWER CABLES

5.1 SELECTION

Cable

General Use multi-stranded copper cable generally, except for MIMS

Minimum size

- Lighting sub-circuits 2.5 mm²
- Power sub-circuits 2.5 mm²
- Sub-mains 6 mm²

5.2 UNSHEATHED - INSTALLATION

General

Use permanently fixed conduit enclosures assembled before installing wiring. Use draw wires to pull in conductor groups from outlet to outlet, or use ducts with removable covers.

5.3 MIMS - INSTALLATION

General

Maintain manufacturer's seals until joint or termination is made. Remove moisture by heating cable ends.

Seals

Temporary seals Fit temporary seals to the open ends of cables cut and not immediately used.

Terminations Fit termination seals at ends of cable runs as soon as the cable has been cut to length, stripped back, and the moisture driven out.

Through joints Use joints with the same fire-rating as the cable.

Sheath earthing

If MIMS cables enter metal enclosures, earth sheaths to non-ferrous plates secured to the enclosures. Where sheaths terminate at plates, fully insulate, colour code and fix the conductors to the enclosures.

Bonding

Bond metal sheaths of single core cables in multi-phase circuits using proprietary earth bonding clips or clamps.

Separation

ELECTRICAL SPECIFICATION

Separate MIMS cables from tough plastic sheathed (TPS) cables and UPVC conduits by at least 25 mm

Eddy currents

Arrange single core cable entries into non-ferrous metal gland plates to minimise eddy currents

Vibration

Connections with vibrating equipment Loop cables in a complete circle next to the point of connection

Alternative cabling

Where MIMS is specified alternative two-hour fire-rated cable may be used (such as Pyrotenax, Firestop or Radox) The manufacturer s guidelines for joining terminating and reticulating these cables should be followed scrupulously so as not to diminish the fire rating of the power connection

6 TERMINATIONS

6 1 COPPER CONDUCTORS

General

Other than for small accessory and luminaire terminals, terminate copper conductors to equipment using compression-type lugs of the correct size for the conductor Compress using the correct tool or use soldering

Within assemblies and equipment

General Loom and tie together conductors from within the same cable or conduit from the terminal block to the point of cable sheath or conduit termination Neatly bend each conductor to enter directly into the terminal tunnel or terminal stud section, allowing sufficient slack for easy disconnection and reconnection

- Alternative run cables in UPVC cable duct with fitted cover

Identification ferrules Provide durable numbered ferrules fitted to each core, and permanently marked with numbers letters or both to suit the connection diagrams

Spare cores Identify spare cores and terminate into spare terminals if available Otherwise neatly insulate and neatly bind the spare cores to the terminated cores

7 WIRING ENCLOSURES AND CABLE SUPPORTS

7 1 CONDUITS

Minimum sizes

Metallic and non-metallic conduits 20 mm

Galvanised water pipe Medium or heavy to AS 1074

Rigid conduits

Provide straight long runs smooth and free from rags burrs and sharp edges Set conduits to minimise the number of fittings

Galvanising

If installed in damp locations galvanise mild steel wiring enclosures and support systems

Set out

ELECTRICAL SPECIFICATION

If exposed to view, install conduits in parallel runs with right angle changes of direction

Inspection fittings

Locate in accessible positions

Draw cords

General Provide draw cords in conduits not in use. Leave 1 m of cord coiled at each end of the run

Material Polypropylene cord, or insulated stranded earth wire 2.5 mm² minimum size

Draw-in boxes

General Provide draw-in boxes at intervals not exceeding 30 m in straight runs, and at changes of level or direction

Underground draw-in boxes Provide gasketed covers and seal against moisture

7.2 CONCEALED CONDUITS

Routes

Conduits concealed in wall chases embedded in floor slabs or installed in inaccessible locations. Run directly between points of termination minimising the number of sets. Do not use inspection fittings

Conduits in concrete slabs

Route Do not run in concrete toppings. Do not run within pretensioning cable zones cross pretensioning cable zones at right angles. Route to avoid crossovers and minimise the number of conduits in any location. Space parallel conduits at least 50 mm apart

Minimum cover Conduit diameter or 20 mm

Conduit size 40 mm maximum diameter

Fixing Fix directly to top of the bottom layer of reinforcing where the conduits pass above a single layer of reinforcing

Columns

General Do not place more than four 25 mm (maximum) diameter conduits centrally in each column

Bends Enter columns via bends with minimum radius of 150 mm

Chasing Do not chase columns

7.3 METALLIC CONDUITS AND FITTINGS

Standard

Metallic conduits and fittings AS/NZS 2053.7 or AS/NZS 2053.8

Type

Screwed steel

Corrosion protection

For steel conduits paint ends and joint threads with zinc rich organic binder to GPC-C-29/16

Expansion joints

General Provide flexible couplings consisting of flexible conduit and fittings at

- structural expansion joints and

ELECTRICAL SPECIFICATION

- in long straight runs if the ambient temperature varies by more than 40°C

Conductivity Maintain electrical conductivity between the two ends of rigid metallic conduit

Movement Provide conduit support saddles close to flexible couplings to permit free movement for expansion and contraction

7.4 NON METALLIC CONDUITS AND FITTINGS

Standard

Non-metallic conduits and fittings AS/NZS 2053 Parts 2, 3, 4, 5 or 6

Conduits in roof spaces

Locate below roof insulation and sarking. In accessible roof spaces provide mechanical protection for light-duty conduits

Conduit in slabs

Use high compression corrugated conduit and restrain at regular intervals to achieve a nominally straight run

Category A conduit

For direct buried installations requiring the use of Category A conduit, use protective cover strips and corrugated conduit

Flexible conduit

Use for equipment and plant subjected to vibration. If necessary, use for adjustment or ease of maintenance. Provide the minimum possible length

Associated fittings

General Use fittings of the same type and material as the conduit

Wall boxes on UPVC conduits For special size wall boxes not available in UPVC use prefabricated earthed metal boxes

Inspection fittings

Use inspection-type fittings only in accessible locations and where exposed to view

Joints

General Use cemented or snap on joints

Expansion couplings If encased in concrete do not use bellows type

7.5 CABLE SUPPORTS

System

Provide a complete cable support system consisting of trays or ladders and including brackets, fixings and accessories. Fabricate brackets, racks and hangers using structural steel sections or other materials in sections of equivalent strength. As a minimum the Contractor shall provide ladder/tray throughout the carpark levels and within cupboard risers to support cabling

Manufacture

Use proprietary trays, ladders and accessories from a single manufacturer in the same application

Cable trays

ELECTRICAL SPECIFICATION

Materials

- Interior Zinc-coated steel, or steel with two-pack liquid coating air-drying enamel or stoving enamel finish
- Exterior Hot dip galvanised steel

Minimum steel thickness

- Trays < 150 mm wide 1 mm
- Trays ≥ 150 mm, < 300 mm wide 1.2 mm
- Trays ≥ 300 mm wide 1.6 mm

Perforations To Admiralty pattern reverse stamping

Cable ladders

General Use 2 folded steel or extruded structural grade aluminium side rails with cable support rungs between the rails

Steel ladders Galvanised

Rung spacing 300 mm maximum

Small cables Run cables less than 13 mm diameter in cable trays or ducts

Structural sections

- Angles and bars 6.5 mm minimum thickness
- Rods 10 mm minimum diameter

Fixing to building structure

General Fix supports to the building structure or fabric using direct fixing hangers or brackets

Spacing Space supports at maximum intervals of 1.5 m for trays and 3 m for ladders

Access

Provide a minimum of 150 mm free space above and 600 mm free space on one side of trays and ladders

Cable fixing

Provide slats or rails suitable for fixing cable ties, strapping or saddles

Bend radius

Provide bends with a minimum inside radius of 12 times the outside diameter of the largest diameter cable carried

Cable protection

Provide rounded support surfaces under cables where they leave trays or ladders

Cable strapping

Use steel straps on MIMS cables

Minimum clearances

Hot water pipes 200 mm

Boilers or furnaces 500 mm

Earthing

All metal cable trays/ladder sections are to be electrically bonded together and earthed at intervals (to NEMA VE-2-2001)

ELECTRICAL SPECIFICATION

8 ACCESSORIES

8.1 LIGHTING AND SOCKET OUTLET SWITCHES

Minimum rating

15 A 240 V a c

8.2 GENERAL PURPOSE OUTLETS

Pin arrangement

Mount outlets with the earth pins at the 6 o'clock position

8.3 LIGHTING OUTLETS

Pin arrangement

Standard 3 flat pin with looping terminal

Emergency lighting 4 flat pin if self-contained emergency lighting is to be connected

8.4 INSTALLATION

General

Provide flush mounted accessories except in plant rooms

Surface mounting

Use proprietary mounting blocks

Restricted location

Do not install wall boxes across junctions of wall finishes

Marking

Label isolating switches and outlets to identify circuit origin

8.5 OUTLETS AND SWITCHES

All outlets & light switches in apartments shall be large format Clipsal Prestise 2000 Series

8.6 WET AREA CLEARANCES

The Contractor shall note that notional locations have been shown on the Architectural drawings for the installation of services within bathroom and laundry areas. The Contractor shall allow for the co-ordination and positioning of all such services within all wet areas to ensure full compliance with AS3000 is maintained.

ELECTRICAL SPECIFICATION

APPENDICES

APPENDIX A – APPLICABLE STANDARDS

Reference	Name
AS1024	Direct recording electrical measuring instruments and their accessories
AS1029	Low voltage contactors
	Part 1 - Electromechanical - Up to and including 1000 V AC and 1200 V DC
AS1042	Direct-acting indicating electrical measuring instruments and their accessories
AS1044	Limits of electromagnetic interference for electrical appliances and equipment
AS1052	Electromagnetic interference measuring equipment
	Part 2 - Equipment for the frequency range of 0.15 MHz to 1000 MHz.
AS1074	Steel tubes
AS1100	Technical Drawing
AS1102	Graphical symbols
AS1103	Diagrams, charts and tables for electro-technology
AS1125	Conductors in insulated electric cables and flexible cords
AS1136	Low voltage switchgear and control gear assemblies
	Part 1 - General requirements
AS1201	Tubular fluorescent lamps for general lighting service
AS1284	Electricity meters
	Part 1 - General purpose watt-hour meters
AS1384	Transducers for electrical measurements
AS1431	Low voltage switchgear and control gear - Control circuit devices and switching elements
	Part 1 - General requirements
	Part 2 - Additional requirements for pushbuttons and indicator lights
	Part 7 - Additional requirements for Control switches with positive-opening operation
AS1449	Wrought alloy steels - Stainless and heat-resisting steel plate, sheet and strip
AS1468	Ballasts for high pressure mercury vapour and low pressure sodium vapour discharge lamps
AS1627	Metal finishing - Preparation and pre-treatment of surface
	Part 1 - Cleaning using liquid solvents and alkaline solutions
	Part 2 - Power tool cleaning
	Part 4 - Abrasive blast cleaning
	Part 7 - Hand tool cleaning of metal surfaces
	Part 9 - Pictorial surface preparation for painting steel surfaces
AS1650	Galvanised coatings
AS1670	Fire detection
AS1675	Current transformers for measurement and protection
AS1680	Code of practice of interior lighting and the visual environment

ELECTRICAL SPECIFICATION

AS1734	Aluminium and aluminium alloys - flat sheet coiled sheet and plate
AS1775	Low voltage switchgear and control gear, air-break switches isolators and fuse connection units (up to and including 1000 V AC and 1200 V DC)
AS1795	Sheets and boards for electrical purposes
AS1882	Earth and bonding clamps
AS1866	Aluminium and aluminium alloys - Extruded rod, bar, solid and hollow shapes
AS1930	Circuit-breakers for distribution circuits (up to and including 1000 V AC and 1200 V DC)
AS1939	Classification of degrees of protection provided by enclosures for electrical equipment
AS1955	Semi-Conductor Converters
	Part 1 - General
AS2005	Low voltage fuses - Fuses with enclosed fuses-links
	Part 2 - Fuses for industrial application
	Part 10 - General requirements
AS2052	Metallic conduits and fittings
AS2053	Non-metallic conduits and fittings
AS2184	Low voltage switchgear and control gear - Moulded-case circuit breakers for rated voltages up to and including 600 V AC and 250 V DC
AS2293	Emergency evacuation lighting in buildings
	Part 1 - Design and installation
	Part 2 - Inspection and maintenance
AS2325	Tungsten filament lamps for general service
AS2480	Electrical equipment for explosive atmospheres - Flameproof enclosure
	Type of protection
AS2481	All-or-nothing electrical relays (instantaneous and timing relays)
AS2551	Steel sheet and strip - Cold-rolled, electrolytic zinc-coated
AS2643	Fluorescent lamp ballasts - Performance requirements
AS2644	Capacitors for use in discharge lamp circuits
AS2700	Colour standards for general purposes
AS2946	Suspended ceilings, recessed luminaires and air diffusers - Interface requirements for physical compatibility
AS2948 1	Solder less connectors
AS3000	SAA Wiring Rules
AS3008	Electrical installations - Selection of cables
	Part 1 - Cables for alternating voltages up to and including 0.6/1 kV
AS3080	Telecommunication Installations Integrated telecommunications cabling systems for commercial premises
AS3084	Telecommunication Installations Telecommunication pathways and spaces for commercial buildings
AS3085	Telecommunication Installations Administration of communication cabling systems
AS3087	Telecommunication Installations Generic cabling systems Specification for the testing of balanced communication cabling

ELECTRICAL SPECIFICATION

AS3100	Approval and test specification - Definitions and general requirements for electrical materials and equipment
AS3108	Approval and test specification - Isolating transformers and safety isolating transformers
	Part 1 - General requirements
	Part 2 - Supplementary requirements - Isolating transformers
	Part 3 - Supplementary requirements - Safety isolating transformers
AS3111	Approval and test specification for miniature overcurrent circuit breakers
AS3112	Plugs and plug sockets
AS3115	Approval and test specification for motor-operated appliances
AS3116	Elastomer insulated electric cables and flexible cables for working voltages of 0.6/1 kV
AS3117	Approval and test specification - Bayonet lamp holders
AS3126	Approval and test specification for extra-low voltage transformers
AS3133	Approval and test specification for air break switches
AS3135	Approval and test specification for semi-enclosed fuses for AC circuits
AS3137	Approval and test specification - Luminaires (lighting fittings)
AS3140	Approval and test specification for Edison-type screw lamp holders
AS3145	Approval and test specification for radio interference suppression devices
AS3147	Approval and test specification - Electric cables - Thermoplastic insulated for working voltages up to and including 0.6/1 kV
AS3159	Electronic sound and vision equipment
AS3168	Approval and test specification for fluorescent lamp ballasts
AS3178	Silicone rubber insulated electric cables and flexible cables for working voltages of 0.6/1 kV
AS3187	Approval and test specification - Mineral-insulated metal-sheathed cables
AS3188	Terminations and glands for mineral-insulated metal-sheathed cables
AS3190	Approval and test specification for current-operated (core balance) earth-leakage devices
AS3191	Electric flexible cords
AS3198	XLPE insulated electric cables for working voltages of 0.6/1kV
AS3250	Approval and test specification for mains operated electronic and related equipment for household and similar general use
AS3300	Approval and test specification - General requirements for household and similar electrical appliances
AS3302	Approval and test specification - Particular requirements for electric
AS3439	Low voltage switchgear and control gear
AS3650	Low voltage switchgear and control gear - Common requirements
AS3702	Diagrams charts and tables for electrotechnology
AS3832	Neon Installation
AS3858	Low voltage switchgear and control gear - Circuit breaking
AS4117	Surge protective devices for telecommunication applications
AS4783	Performance of electrical lighting equipment – ballasts for fluorescent lamps
AS60598 2 1	Luminaires Part 2 1 Particular requirements Fixed general purpose luminaires

ELECTRICAL SPECIFICATION

AS60598 2 18	Luminaires Part 2 18 Particular requirements Luminaires for swimming pools and other similar applications
AS60598 2 6	Luminaires Part 2 6 Particular requirements Luminaires with built-in transformers or converters for filament lamps
AS60598 1	Luminaires Part 1 General requirements and tests
AS60998	Connecting devices for household & similar purposes
AS61000 3	Disturbances in Mains supply networks EMC
DR04122	Circuit breakers
IEC 155	Starters for tubular fluorescent lamps
IEC 188	High-pressure mercury vapour lamps
IEC 192	Low-pressure sodium vapour lamps
IEC 662	High-pressure sodium vapour lamps
ISO11801 Ed 2	Information technology – Generic cabling for customer premises
TIA/EIA 568 B 1, 2 and 3	Commercial building telecommunication standard Parts 1 2 and 3
TIA/EIA 568 B 2-1	Transmission performance specification for 4 pair 100 ohm category 6 cabling
NEMA-VE	Cable Tray Systems
ACA TS008	Requirements for authorised cabling products
ACA TS009	Installation requirements for customer cabling (wiring rules)
HB 243	Australian regulatory arrangements
HB29	Communication cabling handbook
AS/ACIF S009 2001	Telephone installation requirements for customer cabling

ELECTRICAL SPECIFICATION

APPENDIX B – LUMINAIRE SCHEDULE

AREA DESCRIPTION	LIGHTING TYPE	DISTRIBUTOR	CATALOGUE REFERENCE	LAMP / ACCESSORIES
CARPARK	SURFACE MOUNTED FLUORESCENT BATTEN	PIERLITE	PIERLITE RY228 RY128 RY228M	WIRE GUARD PHWG228
CARPARK ENTRY	SURFACE MOUNTED HIGH BAY FLUORESCENT LUMINAIRE	PIERLITE	PIERLITE H5S454DW4/E	WIRE GUARD
STORE, WORKSHOP, CLEANERS	SURFACE MOUNTED FLUORESCENT BATTEN	PIERLITE	PIERLITE RYD228	
FIRE STAIRS	SURFACE MOUNTED FLUORESCENT BATTEN	PIERLITE	PIERLITE RYD128	
WC	SURFACE MOUNTED FLUORESCENT BATTEN	PIERLITE	PIERLITE RYD128M	
LOBBY, CORRIDOR	RECESSED COMPACT FLUORESCENT DOWNLIGHT	EAGLE	PLEAID G2 205 77360	
LOBBY	COMPACT FLUORESCENT WALL LIGHT	EAGLE	PLANET VIC 237 P-237	
GARBAGE, PLANT ROOM	SURFACE MOUNTED FLUORESCENT BATTEN	PIERLITE	PIERLITE PWP236QS	
ADJACENT APARMENT ENTRY DOOR	COMPACT FLUORESCENT WALL LIGHT	LIGHT UP WILLOUGHBY	CAT NO 537NS881	
COMMS ROOM, SWITCHROOM	SURFACE MOUNTED FLUORESCENT BATTEN	PIERLITE	PIERLITE RYD228M	
APARTMENT BEDROOMS	SURFACE MOUNTED	ELS	SLIMLITE SL430/55T5/O/	

ELECTRICAL SPECIFICATION

LOUNGE STUDY	OYSTER		W	
APARTMENT DINING, LAUNDRY	SURFACE MOUNTED OYSTER	ELS	SLIMLITE SL330/22T5/O/ W	
APARTMENT KITCHEN	RECESSED DOWNLIGHT	EAGLE	LIGHTCRAFT GM95-SC	PHILIPS 7W MASTER LED MR16 LAMP
APARTMENT ENSUITE / BATHROOM	RECESSED DOWNLIGHT IP65 RATED	EAGLE	LIGHTCRAFT LC-IP115	PHILIPS 4W MASTER LED MR16 LAMP
APARTMENT KITCHEN UNDER SHELF	RECESSED DOWNLIGHT	EAGLE	LIGHTCRAFT LC-ES83	PHILIPS 4W MASTER LED MR16 LAMP
EXTERIOR	WALL MOUNTED EYELID	ZUMTOBEL	BEGA 2523	
EXTERIOR CARPAK	POLE TOP FLUORESCENT LUMINAIRE ON 4M POLE	ZUMTOBEL	STAFF 9050	4M GALVANISED POWER COATED POLE
EXTERIOR PATHWAYS	POLE TOP FLUORESCENT LUMINAIRE ON 4M POLE	ZUMTOBEL	BEGA 8189	4M GALVANISED POWER COATED POLE
EXTERIOR SIGN LIGHTING	SURFACE WASHER	ZUMTOBEL	BEGA 8405	IP 65 42W TC TEL

ELECTRICAL SPECIFICATION

WARRIWOOD BROOK RETIREMENT VILLAGE

STAGE 3

ELECTRICAL SERVICES

SCHEDULE OF RATES

(Note The accompanying submitted tender rates shall be utilised for additions and deletions as ordered by the Superintendent)

1	Supply and install double GPO within 10 meters of existing	\$
2	Supply and install 20 amp single phase permanent connection/GPO complete with circuit breaker and within 40 metres of distribution board	\$
3	Supply and install a new type 2 x 28W recessed mounted luminaire with K12 diffuser within 10 metres of existing luminaire	\$
4	Supply and install a new type 2 x 28W surface mounted luminaire with prismatic diffuser and within 10 metres of existing luminaire	\$
5	Supply and install new telephone outlet within 90m of telephone frame	\$
6	Supply and install a light switch complete with switch wire	\$
7	Supply and install a new MATV outlet within 20m of splitter	\$
8	Supply & install a new smoke detector with integral sounder & cabling	\$

TENDER

SIGNATURE

DATE

ELECTRICAL SPECIFICATION

**WARRIWOOD BROOK RETIREMENT VILLAGE
STAGE 3**

ELECTRICAL SERVICES

SCHEDULE OF PRICE BREAK-UP

1	Stage 3 Main switchboard & distribution boards	\$
2	Modification to existing RACF MSB	\$
3	Consumer's mains and submains	\$
4	Excavation pits & conduits	\$
5	Supply & install External Luminaires & associated circuiting	\$
6	Supply & install Internal Luminaires & associated circuiting	\$
7	Supply & install internal / external Luminaires & associated circuiting to Community Centre – PC Sum	\$ 50,000 00
8	Supply & install Power outlets, connections & associated circuiting	\$
9	Supply & install Telephone / voice & data services	\$
10	Supply & install Security, access control & Intercom services	\$
11	Supply & install MATV / Pay TV services	\$
12	Supply and install AV system – PC sum	\$50,000 00
13	Hearing augmentation loop	\$
14	Supply & install photovoltaic generation system	\$
15	Design drawings, project management shop-drawings	\$
16	Testing and commissioning of all systems	\$
17	24 months defects liability period and maintenance	\$
18	As-installed drawings and Operation and maintenance manuals,	\$
TOTAL LUMP SUM TENDER PRICE		\$

TENDERER _____

SIGNATURE _____

DATE _____

ELECTRICAL SPECIFICATION

TENDERER

SIGNATURE

DATE

ELECTRICAL SPECIFICATION

WARRIEWOOD BROOK RETIREMENT VILLAGE

STAGE 3

ELECTRICAL SERVICES

SCHEDULE OF TECHNICAL DATA

The Schedule of Technical Data shall be completed and returned with the tender. The Schedule shall include manufacturers, installer's and supplier's names of all equipment, together with figure and model numbers as specified and offered included in the tender. For alternative offers of equipment, refer to 'Instructions to Tenderers'.

Item of Equipment	Manufacturer or Supplier	Model or Figure No	Contractor
Main Switchboard			
Distribution Boards			
Communication System			
Smoke Alarm System			
MATV / PayTV System			
Security, Access Control System			
Intercom System			
Luminaries			
1			
2			
3			
4			
5			
A			
B			
F			
G			
K			
N			
S1			
W			
EMERGENCY			
EXIT			



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Mechanical Services
Design & Construct Specification

Prepared for

Anglican Retirement Villages

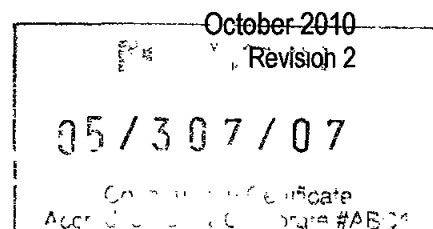


**ANGLICAN
RETIREMENT
VILLAGES**

Diocese of Sydney

Warriewood Brook Retirement Village Stage 3

KAE Reference 10 136



DOCUMENT ISSUE AUTHORISATION

PROJECT ARV Warriewood Brook Retirement Village Stage 3
MECHANICAL SERVICES

Prepared by Bill LIU Signed Date
Verified by Jorgen Knox Signed Date 27/9/10
Approved by TYPE IN NAME Signed Date

Revision Status

Revision No	Description of Revision	Date	Author	Approved
01	ARV Review	27/9/10	BL	JK
02	ARV Review	28/9/10	BL	JK
P1	Tender	08/10/2010	BL	JK

Recipients are responsible for eliminating all superseded documents in their possession



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1. General

1.1 Contractual

Refer to clients documents

Design layouts, sizing information and the like are for guidance only and represent minimum requirements

1.2 Mechanical Tender Documents

The following documents form part of this tender

- Client Documents
- Architectural Drawings
- Structural Drawings
- Mechanical Drawings

Drawing No	Description	Notes
10 136 M01	Mechanical services legend, notes and drawing schedule	
10 136 M02	Mechanical services single line layout 1 of 2	
10 136 M03	Mechanical services single line layout 2 of 2	
10 136 M04	Mechanical services air & water schematic	

- BASIX Certificate
- This Specification
- BCA 2010
- All referenced standards and guides

1.3 Requirements

This section of the specification gives a general description of the various air conditioning and mechanical ventilation systems that are to be installed under this contract and the specific duties of the contractor

The air conditioning and ventilation systems are to be designed to provide the indoor comfort conditions stated while complying with the requirements of the Statutory Authorities and Codes

The mechanical services design is the responsibility of the contractor. It includes but is not limited to the investigation, cost analysis, design, documents, installation, commissioning, 12 months warranty and 12 months operational maintenance of the mechanical services

Design Installation and certification (Design & Installation) of HVAC services for the project all in accordance with the BCA 2010 and referenced Australian/New Zealand Standards

Design to be undertaken by qualified personnel with a minimum of 10 years experience

Designer to hold PI insurance with a minimum \$5M cover works designed

Design drawings to be undertaken in CAD format



Heat loads to be undertaken using ACADS C A M E L software

1 4 Submissions

The contractor is required to provide the following submissions

Item		
Name, qualifications, experience of designer		
PI insurance details of designer		
NEBB commissioning practitioner details		
Design Certification		
C A M E L files (soft copy)		
Work Shop Drawings (Hard Copy and Soft Copy)		
Equipment Schedules and Test Certificates		
As Installed Drawings (Hard Copy and Soft Copy)		
Commissioning Data		
Certification of Fire Dampers		
Mechanical Installation Certificate		
Acoustic Certification		
Water Treatment Certification		
Operation & Maintenance Manuals		
Electrical Certification		
BCA Section J Compliance Statement (list all clauses)		

Note Practical completion will not occur until all the above is provided

1 5 KAE Witnessing

The contractor is required to prove the following to KAE

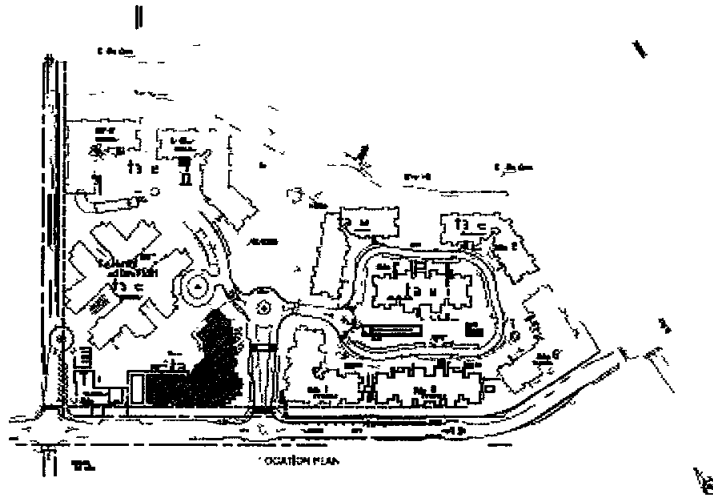
Item	Method	
Air Flow to each room	Test hood	
Capacity of cooling units	Schedules and air flow/temperature calculations	
Cooling coil velocities	Air Flow device	
Ductwork Velocities	Air Flow Device	
Operation of Chillers	Controls specialist	
Operation of AHU plant	Controls specialist	
Operation of Misc Ventilation	Controls specialist	
Installation of all fire dampers	Visual	
Review of all commissioning data	Visual	
Fire Test	Controls specialist	
Training of client	Letter from client stating they have been trained on the operation of the HVAC systems	



Note Practical completion will not occur until all the above is provided

1 6 Description of Project

The project is a new 2 levels building in the Warneewood brook retirement village. The project will include car parks, residential apartments, cafe, and multi purpose room, meeting rooms, swimming pool, Gym, offices and entertainment areas. Support spaces such as kitchens, stores and change rooms are also included.



1 7 Standards

General

Notwithstanding that stated herein, the entire mechanical services installation shall fully comply with the regulation of the following Authorities having jurisdiction over such works

- Local Building Regulations
- Building Code of Australia (latest edition)
- NSW Fire Brigade
- Sydney Water
- Local gas supply company
- Electricity Local Network Provider
- Workcover NSW

Together with all relevant Australian Standards and all Amendments to those Standards listed below but not limited

Units of measurement To AS ISO 1000, *The international system of units (SI) and its application*

Electrical work

AS 3000, *SAA Wiring Rules*

AS 3013, *Electrical installations – classification of the fire and mechanical performance of wiring systems*

On completion submit a Certificate of Electrical Safety

Fixed access ways

To AS 1657, *Fixed platforms walkways, stairways and ladders*

Mechanical ventilation and air conditioning



Specification for **ARV Warnewood Brook Retirement Village Stage 3 – Collaroy Mechanical Services**

To AS/NZS1668 1, *Fire and smoke control in multi compartment buildings* and AS/NZS1668 2, *Mechanical ventilation for acceptable indoor air quality* as required by the Building Code of Australia

Microbial control

To AS/NZS 3666, *Air handling and water systems of buildings microbial control*

Water supply

To AS/NZS 3500 1 1, *Water supply performance requirements* and AS/NZS 3500 1 2 *Water supply Acceptable solutions*

Gas installation To AS5601, *Gas installation code*

Plumbing and drainage To AS/NZS 3500 2, *Sanitary plumbing and drainage*

Electromagnetic compatibility

Comply with Australian Communications Authority requirements for electrical and electronics products to limit electromagnetic interference (EMI)

Emissions

Provide products with C tick or Regulatory Compliance Mark (RCM) to AS 4417 3, *Marking of electrical products to indicate compliance with regulations – specific requirements for electromagnetic compatibility regulatory applications*

Immunity

Electrical and electronic apparatus To AS/NZS 4252 1, *Electromagnetic compatibility Generic immunity standard residential commercial and light industry (EN 50082 1) or*

EN 50082 2, *Electromagnetic compatibility – generic immunity standard – industrial environment*

Harmonics and Voltage Surges

Level of emissions to be acceptable to the electricity suppliers

1 8 Description of Mechanical Services

The car park is to be naturally ventilated The contractor is to provide all necessary calculations to enable certification of a natural ventilated car park

Residential apartments are served by individual split or multi head split reverse cycle air conditioning systems

A centralised air conditioning system is provided to the common spaces

Thermal plant consists of 2 off air cooled chillers and one off hot water unit Poolpak unit, air to air heat exchanger, exhaust air fan and remote condenser also are in the Plantroom

Offices are served by some four pipes constant volume fan coil units

The swimming pool has a dedicated system to provide heating/cooling services Which include poolpak unit, remote condenser, air to air heat exchanger and an exhaust fan

There are two four pipes constant volume fan coil units provide a preconditioning for the apartments corridor areas

Mechanical ventilation systems, such as kitchen exhaust, toilet exhaust are also provide according to the regulation

The main MSSB is located in the thermal plant room



19 Extent of Mechanical Services Works – Detailed

191 General

- Provision of design drawings for client approval
- Provision of work shop drawings for client approval
- Provision of As Installed Drawings
- Commissioning & Testing and setting to work all systems
- Provision of 12 months warranty
- Provision of 12 Months maintenance
- Undertaking & completion of all defects noted by the client
- Design Certification
- Installation Certification

192 Central thermal Plant

- Provision of two high efficient air cooled chillers with built in pumps
- Provision of one high efficient hot water boiler with two of circulating pumps
- Provision of one mechanical switchboard
- Provision of full height acoustic weather louvre on the North-eastern external wall
- Chilled water/hot water pipe work and associated fittings and valves

193 Air Conditioning to Lounge and Cafe

- Provision of heating and cooling air conditioning system to serve the main hall
- The system is to comprise an air cooled chiller and a hot water boiler located at level 1 plant room
- Chilled water/hot water pipe work and associated fittings and valves
- Ceiling void located fan coil units to be located in a builders work plenum
- Provision of 50mm panel filters to each fan coil unit
- Provision of 25mm insulated discharge plenums to each supply air and return air device
- Provision of filter fixing/housing
- Provision of fine line registers complete with vertical operable deflection blades
- Provision of fine line registers for return air to each FCU Each return air grille c/w balancing damper
- Provision of ducted outside air to the plenum c/w balancing dampers
- Provision of room sensors and controller located in the hall to stop/start the AC units

194 Air Conditioning to offices and meeting rooms

- Provision of heating and cooling air conditioning system to serve the space
- The system is to comprise an air cooled chiller and a hot water boiler located at level 1 plant room
- Chilled water/hot water pipe work and associated fittings and valves
- Ceiling void located fan coil units to be located in a builders work plenum
- Provision of 50mm panel filets to each fan coil unit
- Provision of 25mm insulated discharge plenum
- Provision of filter fixing/housing
- Provision of fine line registers complete with vertical operable deflection blades
- Provision of fine line registers for return air to each FCU Each return air grille c/w balancing damper
- Provision of ducted outside air to the plenum c/w balancing dampers
- Provision of room sensors and controller located in the hall to stop/start the AC units

195 Air Conditioning to Gymnasium

- Provision of heating and cooling air conditioning system to sever the gymnasium on ground floor
- The system is to comprise an air cooled chiller and a hot water boiler located at level 1 plant room
- Chilled water/hot water pipe work and associated fittings and valves
- The fan coil unit is located in one of the pool change room in the ceiling



196 Air Conditioning to Apartments

Type 1 – Premium (apartment No 20 & 21 only)

There two options the mechanical contractor can chose, subject to the client approval The first one is VRF reverse cycle air conditioning system (multi indoor units and 1 outdoor unit) Another one is a ducted reverse cycle split air conditioning system (1 off indoor unit, 1 off outdoor unit)

- A centralised A/C controller controls the A/C operation The controller and zone control panel to be the same as the stage 1 For option 1, the central controller modulates a room temperature by controlling the corespondent room air conditioning, for option 2, the central controller can only control zone dampers There are two zones in each apartment, day zone, which includes living area and kitchen night zone, which includes all bed rooms
- Locate each outdoor unit as noted on mechanical tender drawings(if it is shown)

or

outdoor unit to be close to the served apartments with no visual affection to the whole building

or

Condenser units are not to be located on balcony/patio areas or under operable windows
Locate condensers ensuring that internal noise levels in apartment being served or adjacent apartments comply with Acoustic requirements of this specification

- The outdoor unit shall sit on the pours concrete base with anti vibration pad
- Provide drainage pipe to each indoor unit on the first floor, the drainage pipe needs to penetrate the floor and connect to the tundish at level below The tundish shall be provided by the hydraulic contractor
- Provide drainage pipe to each indoor unit on the ground floor, the drainage pipe needs to connect to the tundish near by The tundish shall be provided by the hydraulic contractor
- Provide insulation to all pipes between indoor and outdoor units
- Provide colorbond box to host any refrigerant pipes exposed to atmosphere
- Provide commissioning by manufacturer
- Provide a make up air transfer duct from corridor to living room
- Provide a fire damper in the transfer duct at the penetration point
- Provide an access panel for the fire damper,

Type 2 Standard

- Provide air conditioning via wall located, inverter multi head air conditioning system
- Living room and master bed room to be provided with individual indoor unit c/w wall mounted controller
- Locate the outdoor unit as noted on mechanical tender drawings, on poured concrete base

or

Condenser units are not to be located on balcony/patio areas or under operable windows
Locate condensers ensuring that internal noise levels in apartment being served or adjacent apartments comply with Acoustic requirements of this specification

- Provide drainage pipe to each indoor unit on the first floor, the drainage pipe needs to penetrate the floor and connect to the tundish at level below The tundish shall be provided by the hydraulic contractor
- Provide drainage pipe to each indoor unit on the ground floor, the drainage pipe needs to connect to the tundish near by The tundish shall be provided by the hydraulic contractor
- Provide condensate drainage to each outdoor unit
- Provide insulated suction and liquid lines between indoor and outdoor units



- Provide commissioning by manufacturer
- Provide a make up air transfer duct from corridor to living room
- Provide a fire damper in the transfer duct at the penetration point
- Provide an access panel for the fire damper,
-

1 9 7 Air Conditioning to Residential Corridors & Lobbies

- Provide Residential Corridor and Lobby air conditioning system (100% outside air) systems including ductwork, outside air fan, dampers, filters and controls Size units for full air flow to satisfy the following
 - Make up air for each apartment plus plus 1 l/s per sq m floor area for pressurisation

1 9 8 Air Conditioning to Pool Hall

- Provide heating and cooling and active humidity control air conditioning to the pool hall via air cooled packaged air conditioning unit with remote condenser in the level 1 plant room
- Unit to be full fresh air
- Unit c/w air to air plate heat recuperator to allow for intake air to be pre heated or pre cooled by the pool return air
- Unit c/w return air fan and outdoor air fan
- Unit complete with all sensors for control and operation of the system
- Outside air dry bulb sensor
- Outside air humidity sensor
- Indoor air humidity sensor
- Indoor temperature sensor
- Indoor glass interstitial condensation sensor
- Off coil dry bulb temperature and humidity sensor

Provision of UPVC circular ductwork with UPVC side blow registers to deliver air to the hall

Provision of UPVC circular ductwork with UPVC return air register to deliver return air to the AC unit

1 9 9 Air Conditioning to Commercial Kitchen Area

Provide ducted air conditioning to the kitchen prep area The AC unit will be located in the prep store ceiling The AC unit will be provided with chilled water and hot water heating coil Supply air will be via solid ductwork and diffusers

1 9 10 Air Conditioning to comms room

Provide dedicated split cooling only air conditioning to the comms prep area The fault alarm and high temperature alarm shall be installed outside of the room

1 9 11 Ventilation – Residential Areas

- Mechanical ventilation system including exhaust air fan, ductwork, grilles, fire dampers (between any two fire compartments), control and all associated wiring,
- **Premium Apartments – Kitchen Hoods**
Apartment kitchen exhaust systems including exhaust fans (if not installed in hoods), ductwork, control and associated wiring The exhaust is to comply with AS1668 2 (2002) and be discharged horizontally This will require an Alternative Solution to be proffered by the contractor
- **Standard Apartments – Kitchen Hoods**
Recirculating kitchen hoods will be provided by the builder



- **Toilet Exhaust**
Apartment toilet exhaust systems including exhaust fans, ductwork, controls and associated wiring. The exhaust is to comply with AS1668 2 and be discharged horizontally. This may require an Alternative Solution to be proffered by the contractor, utilising AS1668 2 (2002). Exhaust fans are to light switch operated, complete with 5 minute run on timer.
- **Laundry exhaust**
Same as toilet exhaust. These systems may be combined.
- **Apartment Make Up Air**

Design & Provide make up air to each apartment sized for the exhaust quantity from each apartment.

Make up air is to be from corridor/lobby areas.

Provide

- Corridor located inlet grille and acoustic plenum box
- Flexible Acoustic ductwork & solid ductwork
- Wall located Fire damper
- Access panel in ductwork
- Solid and acoustic flexible ductwork
- Apartment located grille and acoustic plenum box

Maximum air velocity to be 1.8 m/s

Employ Acoustic Consultant to ensure noise from corridor/lobby areas to apartments does not occur.

1.9.12 Ventilation – NON Residential Areas

- **Hot Water Boiler Room**
Provision of boiler room ventilation system as per AS5601 complete with supply and exhaust fans, filters, ductwork, air diffusers and exhaust equipment and all associated controls. Ventilation system shall be interlocked to cause the gas supply to the hot water unit to shut off on failure of the ventilation system.

Alternatively

Provide natural ventilation in accordance with AS5601.

- **Garbage room ventilation**
Provide mechanical ventilation to garbage room to roof. Comply with AS1668 2.
- **Pool Plant room**
Provide mechanical ventilation for the pool plant room in accordance with AS1668 2 and the requirements of the pool consultants documentation for this project.

Provide mechanical ventilation for the pool water heating boiler in accordance with AG601 **OR** provide natural ventilation in accordance with AG601.

- **Commercial Kitchen Hood**
The catering consultant is to provide the exhaust hood for this project.

The mechanical contractor is to provide exhaust from the hood and ducted make up air to the hood (direct hood connection).



Provide hood located on/off switch complete with run and off neon indicating lamps

- **Car Park**

Design and certify natural ventilation to the car park, in accordance with AS1668 2 (1991)

1 9 13 General Exhaust in common area

Mechanical exhaust ventilation will be provided for the following areas

- WC's, where it is not feasible to provide natural ventilation by means of operable windows Client to confirm if naturally ventilated toilets are not desirable
- Laundry's
- Change room
- Main switch board room
- Kitchen hoods
- Diesel pump room (if there is any)

1 9 14 Fire Protection

- Provision of terminal strip within the mechanical services switchboard to allow for the connection of all fire trip signals from the FIP/FFCP Co ordinate with the fire contractor to determine terminal strip requirements
- Final connection of fire trip signal(s) into terminal strip with the mechanical services switchboard
- Provision of controls including relays, switches, contactors etc within the mechanical services board to operate all plant in fire mode including, supply air fans, dampers, exhaust air fans etc
- Provision of matrix table to the fire engineer detailing all fire mode plant operations
- Wiring of all fire mode plant and equipment (power and controls) in MIMS cable

1 9 15 Gas Supply System

Gas piping to the hot water unit with valves and fittings from a valved 7kPa supply point of 13m³/hr capacity provided by others adjacent to the central plant room

1 9 16 Electrical Systems

Electrical power supply and control installation for the above systems including

- Mechanical services switchboards
- Cabling from mechanical services switchboards to individual items of plant
- Cabling from electrical switchboards to mechanical services switchboards
- Uninterruptible power supply for the mechanical services control system
- Wiring to key tag switches for control of air conditioning of residential rooms

1 9 17 Thermal and Acoustic Insulation

- Thermal insulation of chilled water, heating water and refrigeration pipework and equipment
- Thermal or acoustic insulation of air conditioning supply and return ductwork and plenums
- Internal insulation of concrete supply air shafts
- Internal insulation of masonry returns air shafts

1 9 18 Plant Mountings

- Anti-vibration mountings for plant and pipework
- Plinth surrounds for floor mounted plant



- Inertia base frames and mountings

1 9 19 Steelwork

- Secondary steelwork supports for equipment, excluding primary support structure
- Mounting stands for air conditioning units installed on access floors
- Mounting stands for roof mounted air cooled condensers, air handling units and packaged air conditioning units
- Steel platforms, access ways, ladders and stairs as shown
- Grid mesh flooring, handrails and hoist beams at the top of each supply air shaft and at alternate floor levels of pipe shafts
- Supply of lifting and pulling eyes, excluding installation over all plant and equipment exceeding 150kg and over all main shafts for bosons chair/access
- Monorails and trolleys for maintenance of equipment

1 9 20 Miscellaneous Items

- Fire resisting ductwork as shown
- Over flashing of ducts, pipes and the like penetrating the roof and external walls
- Bird screens over ducts penetrating the exterior of the building
- Supply and fixing in form work prior to concreting of circular sleeves for penetrations, holding bolts, cast in fixings, conduits, puddle flanges and other items required to be set in concrete

Or

- Supply of circular sleeves for penetrations, holding bolts, cast in fixings, conduits, puddle flanges and similar items required to be built in during construction and provision of drawings showing their location
- Shop drawings of locations and sizes of rectangular penetrations through beams, floors and walls for ducts, piping and cabling
- Provision of fire dampers and sub ducts including fire packing of penetrations
- Trim angles around ductwork penetrations exposed to view
- Sealing of ductwork penetrations of air tight shafts
- Support of piping and ductwork from structural floor where shown on the drawings where structure above is not capable of carrying the load
- Support of piping and ductwork from structural roof by providing secondary structural members at locations approved by the structural engineer
- Fire resisting sealing of fire resisting floors and shaft walls at penetrations for ducts, pipes and conduits
- Seal mechanical services pipe and cable penetrations in floors to provide a fire resisting seal
- Final duct connections to weather louvres, and blanking off all inactive sections of weather louvres
- Linear diffusers with pattern control supply air plenums and blanking of inactive sections
- Supply only of door wall and ceiling relief grilles, together with shop drawings showing locations
- Co ordinate sizes and locations of kitchen exhaust canopies to suit layout of kitchen equipment
- Shop drawings showing locations
- Lighting within air handling units
- Provision of services installed in trenches, including bedding and initial cover, but excluding trenching backfilling and making good of surface
- Hoisting of all equipment
- Scaffolding for all equipment
- Over flashing of ducts, pipes and the like penetrating external walls and roof (underflashing will be by Builder)
- Escutcheon plates at pipework penetrations exposed to view
- Provision of 1 chain block and 1 trolley for the chiller plantroom
- Painting and labelling of the completed installation as specified



Specification for **ARV Warrewood Brook Retirement Village Stage 3 – Collaroy Mechanical Services**

- Setting to work, testing and commissioning of total system Air balance of air conditioning units above plasterboard ceiling shall be done with remote damper operations provided by Adjustaire or approved equal
- The making good around all openings in the building structure for the penetration of pipes, ducts, grilles and conduits and all cutting, patching framing up, furring in and making good associated with the building structure The provision and making good of core holes for the pipework risers
- Warranty against defects for 12 months
- Working drawings and "as installed" drawings, including permanent reduced scale diagrams as specified
- Provision of detailed drawings showing locations and sizes of penetrations, plinths, drain points, and any other item required to be provided by other trades Payment for rectification work which becomes necessary due to failure to submit accurate details in time to permit the work to be performed
- Preparation and submission of Operating and Maintenance manuals
- Provision of 12months operational maintenance
- Training/Instruction of the Principal's maintenance personnel in the operation and maintenance of all building services
- Training/Instruction of the Principles representative in the operation and control of the BMS system
- Testing and demonstrating the performance of all systems supplied
- Provision of authorities certificate such as required by Fire Bngades
- Provision of documentary evidence for horizontal fire dampers where utilised to prove the operation compared to vertically mounted dampers

1 9 21 Acoustics

- Employ a qualified approved Acoustic consultant to verify the noise levels in all rooms and project boundaries of the project meet project design noise criteria Provide detailed report
- Allow for local boundary noise measurements suitable for Council approval
- Modification/deviation from contract signing documents will require acoustic consultant verification at the mechanical contractors cost This will form part of the work shop drawing approval process
- Select all plant and equipment to meet as a minimum project noise criteria Do not exceed values within this specification
- Provision of attenuators as required
- Provision of internally lined ductwork and bends as required
- Provision of internally independent open type steel springs with minimum 20mm static deflection for all fans on all AHU's and PAC's
- Installation of all AHU's, PAC's and all other fans on rubber/neoprene pads providing a minimum 2mm static deflection
- Provision of ant-vibration spring pipe work hangers and supports providing minimum 6mm deflection for a length of a least six pipe work diameters
- Provision of inertia bases for all pumps at minimum 1.5 times the pump weight Base to be supported on open type A/V spring mounts including a noise stop pad
- Isolation of all plant and systems from the structure

1 9 22 Water Treatment

- Water treatment for chilled water and Heating water systems

1 9 23 Electrical

- All electrical equipment and services required for the operation of the conditioning and ventilation systems including
 - Mechanical service switchboards where shown on the drawings, or schedule



- All circuit breakers, fuses, starters, relays, switches, timers, pilot lights and isolating switches required for the satisfactory operation and maintenance of the systems
- Final connection of 415/3/50Hz-4 wire incoming power submains to the mechanical service switchboards including supply and connection of terminating lugs
- All power wiring between the MSSB and motors, starters, heaters, fan coil units and ancillary equipment including terminating lugs and final connections
- All control and interlocking wiring required to form a complete and operating control system
- Separate compartment in the mechanical switchboards for incoming fire rated cable and associated equipment for the essential services
- Final connection of incoming control wiring from the fire indicator panel to terminals in the mechanical mechanical service switchboards and each control panel, including relays, PLC's etc
- Provision of fire cable (MIMS) connected to the essential services fan motors, mechanical switchboards FCCP and the FIP

1 9 24 Co ordination

The mechanical services contractor shall provide services co ordination drawings at 1 50 scale for all building services for the project Liaise with other services contractors and co-ordinate the physical location of all services to avoid clashes and to facilitate installation and maintenance

Prepare 1 50 shop drawings of services to be installed under this contract, and liaise with contractors to co-ordinate the physical location of all services to avoid clashes and to facilitate installation and maintenance



2. Design Criteria

2.1 General

The following details are given as a guide to the contractor in understanding the systems designed for this building

2.2 Building Construction

The following table is extracted from BCA report, items not shown here , please refer to separate documents and standards

	Administration		Cafe		Community Centre		SOU (first floor, western wing ground)	
	R value	Density	R value	Density	R value	Density	R value	Density
External Walls	1.8	>=220	1.8	>=220	1.8	>=220	1.4	>=220
Windows	Refer to separate glazing calculations							
Floors	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Roof	3.2	Nil	3.2	Nil	3.2	Nil	2.7	Nil
Doors	Refer to separate glazing calculations							

2.3 System Parameters

2.3.1 External Design Conditions

General areas

Outside air

Ambient temperatures

To AS 1668.2

Summer

34.0°C db and 24.0°C wb

Winter

7.0°C db

2.3.2 Internal Design Conditions

Apartments

Summer

23°C db ± 1°C

Winter

21°C db ± 1°C

Main Hall

Summer

23°C db ± 1°C

Winter

21°C db ± 1°C

Pool Hall

Summer

23°C db ± 1°C

Winter

21°C db ± 1°C

Offices

Summer

23°C db ± 1°C

Winter

21°C db ± 1°C

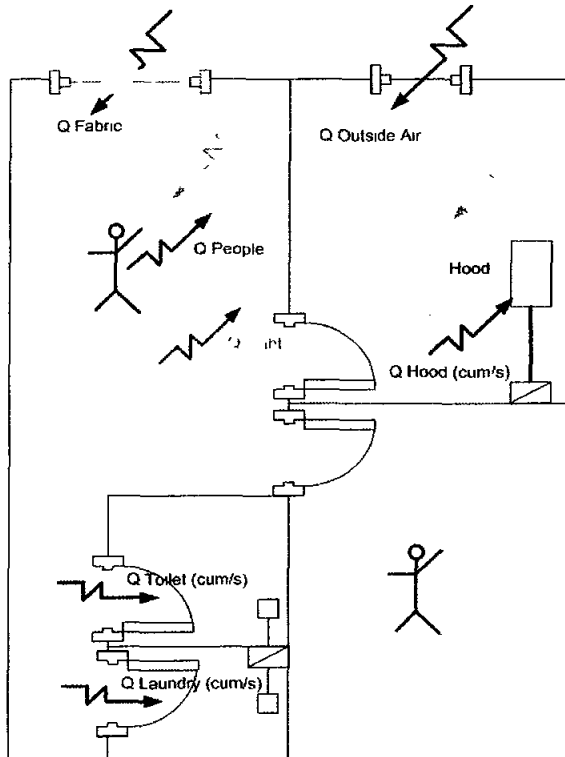


2.4 Internal Loads

The following loads will be allowed for in our heat load calculations

The following diagram summarises the incident loads onto a typical air conditioning system

Diagram 1 - Typical Apartment Cooling Loads



2.4.1 Misc Equipment

- TV & Audio Equipment 200W
- Fridge 150W
- Cooker 150W
- Lights Allow for lighting Incorporate upward and downward components and light ballasts and transformers
- Air conditioning fan gain 1K

2.4.2 People

Allow for the following people in a zoned apartment

- Master bedroom – 2 people
- All other bedrooms – 1 person
- Living areas – Sum of people in master bedroom and other bedrooms plus 1

Each person will emit 150W (75 sensible and 75 latent approximately) This is typical for a seated/standing activity



2.4.3 Toilet Exhaust

- Allow Outside air make up to full exhaust quantity for 24 hour toilet exhaust systems
- Allow outside air make up to 50% full exhaust quantity if intermittent toilet exhaust quantity

Minimum air flow rates

- 25 l/s recommended

2.4.4 Laundry Exhaust

- Allow Outside air make up to full exhaust quantity for 24 hour laundry exhaust systems
- Allow outside air make up to 50% full exhaust quantity if intermittent laundry exhaust quantity

Minimum air flow rates

- 25 l/s – 50 l/s recommended, (dependant on dryer requirements)

2.4.5 Apartment Kitchen Exhaust

- Allow Outside air make up to full exhaust quantity for 24 hour kitchen exhaust systems
- Allow outside air make up to 50% full exhaust quantity if intermittent kitchen exhaust quantity
- Air flow rate depends on hood selected

[Note If the building is designed to be airtight, it may be necessary to provide a purpose designed, acoustically treated air intake for controlled infiltration for make-up to kitchen, laundry and toilet exhaust systems]

2.4.6 Safety Factors

Safety factors to be incorporated within the design

- | | |
|-----------------------------------|------|
| • Supply Fan Heat Gain | 1K |
| • Supply Duct Leakage & Heat gain | 7.5% |
| • Return Air Heat Gain | 7.5% |
| • Overall Safety Factor | 10% |

Ceiling/Roof Consider heat gain to ceiling space from fabric and lights

Consider infiltration of outside air to ceiling void if negatively pressurised as a return air plenum. Where practical utilise ducted return air to unit/cupboard. If impractical, ensure that return air path is over sized to avoid excessive negative pressure which will promote infiltration through the building facade. Ensure that an additional allowance is made in the cooling load to offset infiltration to the ceiling void.

2.5 Mechanical Ventilation General

Mechanical exhaust ventilation will be provided for the following areas

- WC's, where it is not feasible to provide natural ventilation by means of operable windows. Client to confirm if naturally ventilated toilets are not desirable
- Laundry s
- Main switch board room
- Kitchen hoods
- Gas fired Hot water plant rooms

AS 1668.2 (1991) Requirements

Residential Outdoor Air	via operable windows, (refer to BCA for opening size) Subject to acoustic review
Lift/Stair Lobbies Outdoor Air	1L/s/m ²
En-suite Exhaust	25 L/s,
Common WC's Exhaust	10 L/s/ m ² or 25 l/s per room



Laundry Exhaust	30 L/s
Kitchen Exhaust	50 l/s
Grease Room Exhaust	5 l/s/sq m

2.6 Plant capacity

Client has assessed the approximate loads (a table in section 13.1) using “C A M E L ” These loads are not to be used by the Contractor as the basis of their tender

The subcontractor is to perform its own heat load calculations using C A M E L software and shall advise client in its tender submission of its calculated results. Should these results vary by more than +/- 5% of the client calculated results a conforming estimate as well as an estimate based upon the subcontractors results shall be provided



2.6.1 Ductwork and Fittings

The following velocities are to be utilized for ductwork design and fabrication

SYSTEM	MAXIMUM VELOCITY (m/s)
Supply Air	
- Flexible ducts to outlets (actual friction at 4.0m/s is approximately double the Ductulator reading – refer to manufacturers data if actual losses are required)	4.0
- Branch duct with diffuser or register directly connected	6.0
- Main duct in ceiling space	7.5
- Main duct in occupied space	6.0
- Brickwork Risers and Plant room ducts, subject to acoustic approval	9.0
Car parks, loading docks, unoccupied services rooms, etc	
- Metal ducts with grilles	7.5
- Brick or block ducts and plenums	7.5
Return Air	
- Through slots to ceiling plenum (based on free area)	4.0
- Free flow through ceiling plenum	3.0
- Transfer ducts	4.0
- Free flow along corridor	0.4
- Ducts with R/A grilles direct connected	6.0
- Main ducts in ceiling spaces	7.5
- Opening from ceiling plenum to riser shaft, (damper and subduct)	6.0
- Riser shafts	
- With R/A grilles direct connected to occupied space	6.0
- With R/A opening to ceiling space	7.5
- Transfer ducts	4.0

Door Grilles and Relief Air Grilles	MAXIMUM VELOCITY (m/s)
Based on a grille having a net free area not less than 60% of the gross area	1.25
The number of grille sizes used should be minimised eg 0.1m ² minimum with size increments of 0.05m ²	2.5
Door grilles should have a pressure loss not exceeding 15Pa to ensure that the room is not excessively pressurised, which would make the door hard to open and cause variation in supply air quantity when the door is opened and closed	
Toilet Exhaust Grilles	



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Based on a net free area of not less than 90% of the gross area (egg crate or similar)	2.5
Preferably use only one size of grille throughout the job and, at a maximum, use 2 sizes. 150x150 is a good size to standardise on, (up to 55 L/s). Provide a grille over each toilet bowl and urinal.	
Car Park Exhaust Grilles	
Car Park Exhaust Grilles should be sized such that the pressure drop through the grille and opposed blade damper does not exceed 25Pa.	
Based on a low pressure drop grille, the recommended maximum velocity is	3.5
They should be constructed to resist damage by vehicles.	
They should be constructed to resist damage by vehicles.	
Low level grilles should be located where they are least susceptible to damage by reversing vehicles (especially those with tow bar). This can usually be achieved by centering them on marked dividing lines between parking bays, or preferably in line with columns. In some cases, guard rails or bollards may be advisable.	
Ventilation Supply Grilles (Unoccupied)	
Ventilation Supply Grilles serving "unoccupied" areas such as car parks, plantrooms, and switchrooms (based on a low loss grille such as egg crate or register)	3.5
Ventilation Supply Grilles (Occupied)	
Ventilation supply grilles serving occupied areas such as kitchens, laundries, locker rooms, workshops. Use diffusers or registers.	
Stair Pressurisation Supply Grilles	
Based on egg crate, register or similar	5.0
Relief air grilles (for on floor plant with outside air cycles)	1.4



2.6.2 Noise and Vibration

Air conditioning and ventilation systems shall be designed and constructed such that noise levels will not exceed, with all systems operating. Refer to AS2107 for detailed noise requirements,

Internal office areas	Max 40 dB (A)
Cafe	Max 45 dB (A)
Cafe Toilets	Max 45 dB (A)
Office Toilets	Max 50 dB (A)
Apartments living	Max 35 dB (A)
Apartments Sleeping	Max 30 dB (A)

External and other areas including any point on the property boundary, As required by the relevant Local Authority, AS2107, or relevant environmental noise codes, whichever is more stringent

Vibration of the plant shall not cause annoyance to occupants in the normally occupied areas of the building

The contractor is to allow for the employment of an acoustic consultant to undertake an acoustic report on the mechanical services for review by client during the detailed design phase of this project. In addition the Acoustic Consultant will be required to review the work shop drawings undertaken by the contractor and certify the final acoustic solutions will achieve design noise levels internally and externally. The contractor will undertake all remedial works to achieve the design noise levels



3. Air Conditioning Equipment Details

3 1 Refrigeration Machines

3 1 1 General

Two air cooled chillers should be installed in the project to provide the community hall and other common areas
The chillers have to be Climaveneta NECS 0452

3 1 2 Cross References

General

Comply with General Services Requirements

3 1 3 Quality

3 1 3 1 Type Tests

Submit test data certificates for identical model configurations for the following

AS1210	Unfired Pressure Vessels
ANSI/ARI 590	Performance rating, efficiency
ARI 575	Noise
ASHRAE 30	Testing
AS1677 and SAA HB40	Refrigeration system
ASHRAE 15	Safety Code for Mechanical Refrigeration

3 1 3 2 Factory Testing

All chillers shall be factory test run to ANSI/ARI 590 at full load a minimum period of 10 minutes to demonstrate satisfactory operation and capacity

Factory controls tests for factory assembled chillers, demonstrate that chiller controls meet performance requirements Verify the marked set points of instruments, gauges and switches, by measurement of the controlled medium Record and rectify deviations

Safety alarm circuits tests Simulate each unsafe condition alarm

3 1 3 3 Performance

The heat transfer components shall be selected for a fouling factor of 0 088m²/kW on the chilled water side
The maximum water pressure drop shall be 90kPa on the evaporator at specified conditions The fouling factor on the condenser water side shall be 0 176m²/kW, with a maximum water pressure drop of 50kPa

3 1 3 4 Power Consumption

The supplier shall guarantee the specified power consumption in kW per kW of refrigeration of each chiller at design conditions at full load The power factor under all operating conditions shall not fall below 0 85 (reciprocating machines) or 0 9 (centrifugal machines)

The supplier shall warrant the performance of the chiller when operating under conditions as specified in the latest editions of the ARI Standard 590



3 1 4 Construction Scroll Chillers

3 1 4 1 Supporting frame

Frame comprising a base in polyester-painted hot-galvanised sheet steel and supporting panels in Peraluman. The self supporting structure containing the main components is designed to ensure maximum ease of access during servicing and maintenance operations.

3 1 4 2 Evaporators

Evaporator shall be of the shell and-tube, flooded type.

Shell Fabricated from rolled carbon steel plate with fusion welded seams.

Tube sheets carbon steel drilled and reamed to accommodate the tubes. Intermediate tube supports provided on 1000mm centres. Tubes shall be high-efficiency, externally and internally enhanced type. Each tube shall be roller expanded into the tube sheets providing a leak proof seal, and be individually replaceable. Water velocity through the tubes shall not exceed 2m/s. Two liquid level sight glasses shall be located on the side of the shell to aid in determining proper refrigerant charge. A suction baffle or aluminium mesh eliminators shall be located above the tube bundle to prevent liquid refrigerant carryover to the compressor. The evaporator shall have a refrigerant relief device sized to meet the requirements of the ASHRAE 15 safety Code for Mechanical Refrigeration.

Flanges water boxes shall be removable to permit tube cleaning and replacement. Stubout water connections having Victaulic grooves shall not be used. Pipe connections shall be via Table E flanges. Water boxes shall be designed for 1000kPa design working pressure and be tested at 1500kPa. Vent and drain connections with plugs shall be provided on each water box.

Condenser

Condenser shall be of the shell and-tube type, designed for 750kPa working pressure on the refrigerant side, and be tested at 1250kPa. Shell shall be fabricated from rolled carbon steel plate with fusion welded seams, have steel tube sheets, drilled and reamed to accommodate the tubes, and intermediate tube supports spaced no more than four feet apart. A refrigerant sub-cooler shall be provided. Tubes shall be high-efficiency, externally and internally enhanced type. Each tube shall be roller expanded into the tube sheets providing a leak-proof seal, and be individually replaceable. Water velocity through the tubes shall not exceed 2m/s. Sacrificial anodes shall be supplied and installed in each water box in order to achieve cathodic protection. The sacrificial anodes shall be magnesium discs of 150mm diameter and 50mm thickness to be bolted to the water box, one on the water inlet and one at the water outlet. These sacrificial anodes shall be installed after the initial water treatment process has been carried out. The sub-Contractor shall inspect the sacrificial anodes six monthly to ensure that they are functioning effectively and that the evaporator shells and tubes are protected from galvanic corrosion.

3 1 4 3 Water side filter

"Y" type filter designed and built to retain impurities in the hydraulic circuit. It features a stainless steel mesh cartridge with 0.9mm holes which can be replaced easily without removing the valve from the piping.

3 1 4 4 Refrigeration Systems

Main components of the refrigerant circuit

- dryer filter,
- refrigerant line sight glass with humidity indicator,
- externally equalised thermostatic valve,
- high pressure safety valve,
- high and low pressure switches,



Provide liquid receivers and refrigeration valves to enable the full refrigeration charge to be pumped down during maintenance Refrigerant to be R410A

3 1 4 5 Refrigerant air heat exchanger

Finned coil exchanger made from copper tubes and aluminium fins The aluminium fins are correctly spaced to guarantee optimum heat exchange efficiency

3 1 4 6 Fans

Axial electric fans protected to IP 44, with external rotor and pressed sheet metal blades Housed in aerodynamic hoods complete with safety grille, 6 pole electric motor with built in thermal protection The fan chamber is divided into two sections This improves efficiency with partial loads as the fans of the idle circuit can be stopped

3 1 4 7 Compressors

Hermetic scroll compressors All the compressors are fitted with an oil sump heater, electronic overheating protection with centralised manual reset and a two pole electric motor

3 1 4 8 Capacity Control

Capacity control shall be provided utilising pre-rotation vanes of bronze construction These shall be electrically actuated via solid linkages Vanes shall be designed to provide stable operation at 20% of the specified capacity

3 1 4 9 Motor Starters

Motor starters shall be solid state

Comply with the electrical installation section of this specification

Starters shall be accommodated in the motor starter control panel integral to the chiller unit and shall be rated such that the chiller motors can be started under all load conditions

At normal operating level, current and voltage waveforms to the chiller motor shall not be distorted by the motor starter

The motor starter control panel shall be vibration isolated from the chiller unit The supplier shall provide adequate facility and connecting lugs to enable supply cables to be connected to the motor starter control panel by the mechanical services sub contractor

The electric supply for controls of the chiller in the chiller control panel shall be available from the motor starter control panel

3 1 4 10 Motor and Starter Protection

The following protection shall be provided

- (a) Current transformer overload sensors on the three phases with electronic analyser of thermal overload protection, incorporating I²t protective features and disconnecting supply to motor should motor starter exceed normal operating temperature A local manual reset button shall also be provided
- (b) Phase sequence protection, disconnecting supply to the motor if an incorrect phase sequence occurs A local manual reset button shall be provided
- (c) Earth fault protection disconnecting supply to the motor in the event of a single phase to earth fault on the output A local manual reset button shall be provided

Fuse/Circuit breakers for incoming mains to the motor starter panel located within or immediately adjacent to the chiller control centre and sized to provide protection of starter and motor under fault conditions, having a fault level to match



Loss of phase protection, disconnecting supply to motor on a loss of phase of the supply mains

Thermistor protection, disconnecting supply to the motor should the resistance of PTC thermistors embedded in the motor windings change and thereby protect the motor from overheating. Thermistors shall be wired in series to a thermistor protection unit complying with AS1023 Part 1. A local manual reset button shall be provided.

On disconnection of supply to the chiller motor, the motor starter shall send an indicating signal to the chiller control centre and hence the control system to initiate shutdown of the affected refrigeration circuit.

3 1 4 11 Fans

Axial electric fans, protected to IP 44, with external rotor and pressed sheet metal blades. Housed in aerodynamic hoods complete with safety grille, 6 pole electric motor with built-in thermal protection. The fan chamber is divided into two sections. This improves efficiency with partial loads as the fans of the idle circuit can be stopped.

3 1 4 12 Control and Instrumentation

Electric power and control panel, built to relevant standards, complete with

- control circuit transformer,
 - general door lock isolator,
 - automatic circuit breakers for compressors and fans,
 - terminals for cumulative alarm block (BCA),
 - remote ON/OFF terminals,
 - spring-type control circuit terminal board,
 - electric panel with double door and seals for outdoor installation,
 - electronic controller
- Control circuit numbered wires
- Pump control consent relay
 - Fan speed continuous regulation

User Interface

Provide a menu driven, microprocessor based control module, providing control, status and fault indication with memory of 5 previous faults and time of occurrence.

Indication

Provide indication of the following

- System on
- CHWF&R temperature
- CCWF temperature
- Fault requiring manual reset
- High and low pressure cutout on each circuit
- Oil pressure failure
- Compressor contactor overload on each compressor
- Total running hours

Safety Controls

Provide electrical interlocks to protect chiller against the following

- Chilled water low flow (flow switch)
- Condenser water low flow (flow switch)
- Compressor motor overload or high winding temperature
- Oil pressure failure
- High and low pressure
- Short cycling of compressor
- Low leaving chilled water temperature



HP, LP and low oil pressure safety contacts shall require manual reset

Remote Monitoring Interface

Provide the following interfaces to the Mechanical Control System

- Machine common fault
- Machine run status
- Remote setpoint adjustment
- CHWF temperature

3 1 5 Installation

General

Install chillers to allow manufacturers recommended service clearances Provide flanged pipe connections to allow ease of access, inspection and cleaning of vessels

Marking

Each chiller shall be permanently marked with the following

- Unit Number
- Date of delivery
- Capacity (kWR)
- Motor (kWE) and FLA
- Flow (L/s)
- Leaving water temperature (°C)

3 1 6 Completion

3 1 6 1 Evacuation and Dehydration of Refrigeration Systems

General

The chiller manufacturer's factory trained field representative shall supervise the final evacuation, leak testing, charging, and initial start up This representative shall attend all acceptance tests

All refrigeration systems shall be evacuated and dehydrated to the satisfaction of the Main Contractor prior to charging the systems with refrigerant

Triple deep vacuum evacuation and evaporative dehydration method shall be employed as described later

All equipment and instrumentation for the evacuation and dehydration process shall be provided by the mechanical sub contractor, including the electronic gauge

The vacuum pump to be used shall be designed for vacuum duty capable of pulling the system vacuum down to 50 micron and shall be tested for efficiency prior to connecting to the system The oil in the pump must be to the manufacturers recommendation and shall be clear and free of contaminants

Both the high and low pressure sides of the refrigerant circuit shall be effectively evacuated and dehydrated



Procedures

A triple evacuation and dehydration schedule shall be used as described below

- (a) Attach the vacuum pump to both the high and low sides of the system using as large a diameter line as possible to reduce any restriction between the vacuum pump and the system. Flexible hoses shall not be used for evacuation.
- (b) With the vacuum pump in operation, pull the system vacuum down to 1000 microns. Valve off the vacuum pump and admit dry nitrogen to the system and pressurise to 700kPa. Leave the system standing for one hour.
- (c) Bleed off dry nitrogen. Reconnect the vacuum pump and pull the system down to 500 microns. Valve off the vacuum pump, admit dry nitrogen to the system and pressurise to 10kPa.
- (d) Fit dry cores, admit dry nitrogen and pressurise the system to 1000kPa. Check dryer casing for leaks.
- (e) Leave the dry nitrogen in the system for one hour. Bleed off the dry nitrogen and recommence the dehydration, pulling the system down to 200 microns.
- (f) Valve off the vacuum pump and vacuum gauges and leave the system standing for 12 hours. Recheck the system pressure. The system pressure shall not have risen above 250 microns except where a temperature rise would have been responsible for the increase.

If the vacuum cannot be achieved, the causes shall be rectified and the evacuation process shall be repeated until the system complies to the satisfaction of the Main Contractor, when the evacuation system shall then be completely isolated and the refrigeration system vacuum shall be broken with dry refrigerant and the normal charging process can proceed.

3 1 6 2 Testing of Refrigeration Equipment

Test the refrigeration equipment for performance and compliance with Specification

The test shall consist of operating the equipment at prevailing conditions and recording chilled water temperature in and out of water cooler, air temperature in and out of condenser, chilled water flow in l/s and power input. These tests shall be carried out in the field.

Calculated refrigeration capacity shall be compared with predicted full and part load curves supplied by the manufacturer. These curves shall indicate power input plotted against refrigeration output capacity at condenser entering temperatures ranging from 25 deg C to 29 deg C in 0.5 deg K intervals.

Chilled water quantities shall be assessed from annubar reading checked against pressure drop readings taken across chiller and condenser.

Test shall consist of a minimum continuous run of 6 hours with 24 readings made for each item above, unless continuously recording instruments are used.

Supply calibrated instruments and probes for testing. Instruments shall be calibrated immediately prior to tests and after completion of tests.

Tests shall also include but shall not be limited to

- (a) sensor calibration tests,
- (b) control algorithms for staging up and staging down chillers
- (c) refrigerant and oil quality tests before and after commissioning





3 2 Air Handling Units, Fan Coil Units and Plenums

3 2 1 General

Apartment Air conditioning units are to be by Fujitsu or approved equal

3 2 1 1 Cross References

General

Comply with the *General Services Requirements* section

Related sections

Refer to the following sections for details relevant to air handling units, fan coil units and plenums

Air coils
Air filters
Ductwork
Electric heaters
Fans
Instruments
Insulation thermal and acoustic
Mechanical control system
Mechanical electrical installation
Mechanical services switchboards
Motors
Noise and vibration
Painting and identification
Testing and commissioning

3 2 2 Quality

3 2 2 1 Standards

Construction

To AS1668 1, *Fire and smoke control in multi compartment buildings* and AS4254, *Ductwork for air handling systems in buildings*

3 2 2 2 Pre-Completion Tests

Type Tests

Submit certificates from an independent NATA registered laboratory or international equivalent to demonstrate compliance with the following type tests

Air handling units To ANSI/ARI 430, *Central station air handling units*

Fan coil units Testing to ANSI/ASHRAE 79 *Methods of testing for rating room fan coil air conditioners*

Rating to ARI 440, *Room fan coil and unit ventilators*

Air handling unit casing sweat test For units to be installed in tropical locations (design wet bulb temperature $\geq 25^{\circ}\text{C}$) submit type test reports of casing sweat tests

Test conditions casing exterior in still air at $28^{\circ}\text{C} \pm 0.5^{\circ}\text{C}$ dewpoint, casing interior air $13^{\circ}\text{C DB} \pm 0.5^{\circ}\text{C}$

Acceptance conditions No visible deposition of moisture on the casing panels, framing or fasteners



Fan coil unit acoustic tests Sound power level test of bare units with open inlet and discharge in a reverberant test chamber Determine sound power levels in octave bands and one third octave bands from 63 Hz to 8 kHz to AS1217 *Acoustics determination of sound power levels of noise sources*

Tonal noise emission to be determined from one third octave band sound power level tests No band to exceed 5dB above adjacent bands

Samples

Fan coil units Submit typical unit

3 2 3 Fan Coil Units (up to 600 L/s)

3 2 3 1 General

Provide packaged fan coil units with components as scheduled including fans, cooling coils and drain pans, heating coils or electric heaters, panel filters, air mixing plenums with outside air and return air dampers all mounted with a thermally and acoustically insulated casing Components to comply with related sections of this specification

Casings

Fabricate single skin casings from 1.0mm thick zincanneal sheet with 25mm internal acoustic insulation Enclose exposed units within powder coated decorative enclosures with adjustable supply air grilles and removable panels for access Filter panels to be readily removable

3 2 3 2 Fans

Select for quiet operation with long life bearings and resilient mounts

Direct driven forward curved centrifugal with three speed windings or variable speed control as specified under automatic control Mount on detachable mounting plate with extended cables to facilitate maintenance

3 2 3 3 Capacity

Select air flow and cooling capacity at medium fan speed unless otherwise scheduled

3 2 3 4 Drain Pans

Insulated corrosion resistant drain pan graded to screwed outlet and extending beyond cooling coil and chilled water or refrigeration connections

3 2 3 5 Filter and Damper Section

Provide filter section with access panels Provide damper section with separate butterfly or opposed blade dampers for outside air and return air

For VAV units provide separate minimum outside air dampers, independent of economy cycle outside air dampers

3 2 4 Air Handling Units (above 600L/s) and Plenums

3 2 4 1 General

Provide factory assembled or built up air handling units as scheduled Provide components as scheduled including supply fans, cooling and heating coils, electric heaters, air filters, air mixing plenums with outside air and return air dampers all mounted within thermally and acoustically insulated casings

Components to comply with related sections of this specification



3 2 4 2 Layout

All plant to be accessible for inspection, adjustment, maintenance and removal from one side of each air handling unit. Hand the units to suit their locations.

Provide 300mm separation between heating and cooling coils in series. All coils to be removable.

For blow through units fit perforated plates downstream of fans to equalise air flow across coils.

Provide insulated drain pans graded to outlet and extending beyond cooling coils and chilled water connections.

A structural steel channel base shall support the complete unit.

Units over 1.0m high shall be "walk in" and have trafficable insulated solid sheet metal floors.

3 2 4 3 Casings and Plenums

Standard

Construct casings and plenums to *SMACNA HVAC Duct Construction Standards Metal and Flexible* Chapter 6.

Pressure Classification

Select pressure class greater than the maximum operating pressure in each section of air handling unit (AHU) or plenum.

Pressure classes for casings and plenums on discharge side of supply fans shall exceed close off (stall) pressure of associated supply fan.

Pressure Classes

- Discharge side of constant volume supply fans. Pressure class 750 Pa minimum seal Class A.
- Discharge side of variable volume supply fans. Pressure class 1000Pa minimum, seal Class A.
- Exhaust plenums and suction side of supply fans. Pressure class 500 Pa, seal Class B.

Construction

Provide single skin casings or plenums of folded zincanneal sheets, braced by galvanised steel sections. Provide 50mm minimum thermal and acoustic internal insulation with perforated foil laminate facing as for internally insulated ductwork. Refer to Insulation, Thermal and Acoustic section.

ALTERNATIVELY

Provide double skin casings or plenums comprising folded zincanneal steel braced by galvanised steel sections, incorporating a solid outer casing, 50mm minimum thermal and acoustic insulation, and perforated sheetmetal inner casing. Refer to Insulation Thermal and Acoustic Section. Provide thermal barriers between framing and fasteners and exterior panels to prevent thermal bridging and condensation.

ALTERNATIVELY

Fabricate casings or plenums from sandwich panels consisting of 50mm thick cellular polystyrene sheet to AS 1366.3 Class M between two 0.6mm thick factory prepainted zincanneal sheets with an insulated supporting framework of galvanised steel or extruded aluminium members.

Penetrations through cellular polystyrene panels



Pipes, conduits Provide flanged sleeves Fill the void between the sleeve and the panel using a one part polyurethane sealant

Ducts Frame penetrations using aluminium channels

3 2 4 4 Access Doors and Panels

Locations Provide access to all internal equipment including fans, motors, filters, coils, heaters and valves

Requirements Refer Ductwork section

3 2 4 5 Fans

Units less than 5000L/s capacity to have forward curved belt driven centrifugal fans Bearings to be removable from the sides of units without removing the fan shaft Twin fan units to have central bearings of split construction, removable without disturbing the shaft

Units greater than 5000L/s capacity to have belt driven singled backward inclined DIDW centrifugal fans and motors mounted on common base within the units with anti vibration spring mounts and flexible discharge connections between fans and casings

3 2 4 6 Coil Installation

Coil Support Provide structural supports for coils and condensate pans

3 2 4 7 Condensate Drainage

Standard To AS 3666, *Air handling and water systems of buildings microbial control*

Condensate trays Provide graded trays beneath cooling coils, extending beyond headers and valves and 300mm downstream to collect water carryover

Provide a separate tray beneath each coil of multiple coil banks

Material Stainless steel, 1.6mm copper, or epoxy coated galvanised steel

Insulation Insulate underside of trays and internal drain piping with 25mm of rigid, non hygroscopic cellular foam insulation to prevent condensation Insulation to have a spread of flame index zero and smoke developed index three when tested to AS 1530.3, *Simultaneous determination of ignitability, flame propagation heat release and smoke release* Maximum water vapour transmittance to be 580mg/m²s to AS 2498.5 *Methods of testing rigid cellular plastics determination of water vapour transmission rate*

Drain Piping In multiple coils units, inter connect drain pans Terminate down pipes a minimum of 25mm below the rim of the lower pan Down pipes shall be a minimum DN 38

Extend drain piping outside the air handling unit and seal the pipe penetration in the casing

Drain pipe sizes

Single coils DN 25 minimum

Multiple coils DN 38 minimum

3 2 4 8 Multizone and Coil Bypass Dampers

Provide coupled motorised multizone and cooling coil bypass dampers as required

Requirements Refer to Ductwork Section

Select cooling coil bypass dampers for 10m/s air velocity



3 2 4 9 Filter and Damper Section

Provide accessible filter plenum of adequate size with filter holding frames and blanking panels. Fit opposed blade outside and return air dampers to mixing plenums, controlled manually or automatically as required.

Damper requirements Refer to Ductwork Section

3 2 4 10 Installation

Location

Elevate units to allow for installation of drain traps and adequate fall of condensate drains

Unit supports

Suspended units Provide unit supports to AS 4254, *Ductwork for air handling system in buildings*

Provide secondary steelwork supports as necessary

Flexible duct connections Fix to inlets and outlet ducts of air handling units and ducted fan coil units irrespective of whether fans are fitted with flexible connections within the unit

Condensate drains

Connect drains from units to building sanitary waste system. Provide a water seal trap adjacent to each unit, of sufficient depth to maintain the seal under all conditions of operation

Trap dimensions

Unit type	Draw through	Blow through
Trap depth below inlet	150mm	100mm
Outlet below inlet	100mm	Level

Fit air vents to drains downstream of traps

Condensate discharge shall be visible from outside of air handling units, fan coils units and packaged air conditioning units, via air gap at tundish or transparent piping

Air Handling Unit Lighting

Provide maintenance lighting within each air handling unit exceeding 1.0m height, comprising robust fluorescent fittings with non-metallic IP54 enclosures. Light each filter plenum, fan chamber and between coil space to an average level of 100 lux. Provide a common control switch on the outside of the unit with indicating light. Provide supply from mechanical service switchboard



3 3 Air Conditioning Units – Packaged

3 3 1 General

3 3 1 1 Cross References

General

Comply with the General Services Requirements section

Related sections

Refer to the following sections relevant to air conditioning unit – packaged

Mechanical control system

- Mechanical electrical installation
- Mechanical services switchboards
- Noise and vibration
- Piping
- Refrigeration
- Testing commissioning

3 3 2 Quality

3 3 2 1 Standards

Construction

To AS 1668 1 Fire and smoke control in multi compartment buildings

3 3 2 2 Pre Completion Tests

Type Tests

Submit type test reports demonstrating compliance with the following

All units To ASHRAE 15 - Safety Code for Mechanical Refrigeration

- Safety requirements for electrical heat pumps, and air conditioners AS 3350 2 40, Approval and test specification - safety of household and similar electrical appliances

Maximum cooling test conditions

For design ambients not exceeding 35°C DB Standard test condition T1(35°C DB entering outdoor air)

For design ambients exceeding 35°C DB Standard test condition T3 (46°C DB entering outdoor air)

Heating Capacity test conditions

Air entering outdoor side 7 °C DB, 6 °C WB per AS/NZS 3823 1 1 Table 6 line two

- For tests to AS/NZS 3823 1 1, ANSI/ASHRAE 16 or AS 1861 2 include cooling, freeze up and enclosure sweat tests for all units
- Condensing units To ASHRAE 23 Methods of testing for rating positive displacement refrigerant compressors and condensing units
- Electrical equipment To AS 3100, Approval and test specification - general requirements for electrical equipment



3 3 2 3 Samples

General

Submit samples of the following

- Each type of thermostat/control module exposed to view within conditioned spaces
- Finish and colour of equipment cabinets

3 3 3 Equipment

3 3 3 1 General

Assemblies

Provide factory packaged air conditioning units complete with all necessary equipment, piping, insulation, wiring, starters, controls, vibration isolation and casings

Provide integral cleanable air filters for room air conditioning units accessible via return air grille

Provide filter plenum and filters for ducted packaged air conditioning units Refer *air filter* section

Operating conditions

Provide equipment which operates reliably within an ambient temperature range of 0°C to 45°C

External Noise Level

Comply with local noise control guidelines

Selection of Split Systems

Make allowance for effects on capacity, refrigerant charge and oil return due to difference in elevation between sections and pressure losses in refrigeration lines

Cooling and Heating Cycles

Provide cooling with electric heating as scheduled

Equipment casings

Outdoor location Provide casing, materials and finishes which are corrosion resistant, and weatherproof

Construction Assembled and reinforced to prevent flexing and drumming Provide for removal of major components

Access Provide access for inspection and maintenance

Access panels Readily removable with positive re-useable fasteners and soft gaskets which provide an airtight seal

Insulation Insulate casings to prevent external surface condensation under operational conditions Fit internal acoustic insulation to casings

Insulation fire tests Spread of flame index zero and smoke developed index three to AS 1530 3 Simultaneous determination of ignitability, flame propagation, heat and smoke release

Condensate trays

General Provide trays with screwed outlets under cooling coil sections, under outdoor coils of heat pump units, and under components on which condensation can occur extending downstream to collect water carry over

Standard To AS 3666 Air handling and water systems of buildings - microbial control



Specification for **ARV Warriewood Brook Retirement Village Stage 3 – Collaroy Mechanical Services**

Insulation Insulate trays and internal drain piping with cellular foam insulation to prevent condensation on external surfaces Insulation to have AS 1530 3 spread of flame index zero and smoke developed index three Maximum water vapour transmittance to be 580mg/m²s to AS 2498 5 - Methods of testing rigid cellular plastics - determination of water vapour transmission rate

Construction

Air Filters

- Standards AS 1324, Air filters for use in general ventilation and air conditioning, AS 1668 1, Fire and smoke control and AS 1668 2, Mechanical ventilation for acceptable indoor air quality
- Flame spread index Zero to AS 1530 3, Simultaneous determination of ignitability, flame propagation, heat release and smoke release
- Type Washable flat panel filter
- Average arrestance to AS 1324 2, Air filters for use in general ventilation and air conditioning - methods of test for test dust no 4 70%

Electric heaters

- Standards AS 3100, Approval and test specification - general requirements for electrical equipment, AS 1668 1, Fire and smoke control

Fans Balance assembled impellers and shafts to AS 3709, Vibration and shock - balance quality of rotating rigid bodies (ISO 1940/1) grade G6 3

Electrical system Comply with Mechanical Services Switchboards section

Motors Fit inherent overheat protectors to AS 1023 3, Inherent overheat protectors

Motor protection Provide short circuit protection using miniature circuit breakers of adequate fault rating and a contactor (with manual reset thermal overload) for each compressor and each 3 phase motor Provide high motor winding temperature protection

Materials

Standard units

- Casing - Powder coated galvanised steel or aluminium
- Condenser coil - Copper tube and aluminium fins 0 12mm minimum thickness
- Fan blades - Aluminium or resin
- Fixings - Galvanised steel

Coastal Units

For units installed within 1km of the sea

Casing - galvanised steel or aluminium with 80 micron Polyester resin paint

- Condenser Coil Copper tube and aluminium fins 0 12mm minimum thickness with anticorrosive coating



- Fan Blades - Aluminium with 30 microns anti corrosion treatment or resin
- Fixings - stainless steel

Installation of condensers

Provide clearance around units for condenser air flow and maintenance access

3 3 3 2 Ducted Packaged Air Conditioning Units

General

Provide complete packaged units consisting of cooling coil, supply air fan, compressor, condenser, filter and prewired electrical panel with starters and controls and if required a separate labelled terminal strip for remote control and alarm Refer to Mechanical Control System section for controls description

Arrangement

Provide single unit package system as scheduled
Horizontal or vertical as scheduled

Fans

Provide supply fans which are forward curved, double inlet, centrifugal type with adjustable speed drive Fit vibration isolation mountings and fan guards

Compressors

Fit multiple compressors to units over 18kW total cooling capacity Fit suction unloading or four compressors to units over 100kW total cooling capacity Fit vibration isolating spring mountings

Electric Heaters To AS 1668 1, Fire and smoke control

Controls

Control panel mounted on unit with terminal strip for connection to remote on/off control, temperature control, fault indication and alarm

Provide compressor and condenser capacity controls and high head pressure, low suction pressure and compressor motor over temperature safety controls

Controls to self-reset following restoration after power failure

3 3 4 Installation

Provide supports for air conditioning units, flash wall penetrations and make electrical and controls connections

Condensate drains Connect condensate trays to nearest drain points using trapped minimum DN 20 drain lines



3 4 Boiler Plant

3 4 1 General

One of condensing boiler should be installed in the project to provide the heating for the community hall and other common areas

The boiler has to be Fegasus F3 119

3 4 2 Cross References

General

Comply with the General Services Requirements section

Related sections

Refer to the following sections relevant to boilers

- Gas Supply and Reticulation
- Instruments
- Insulation thermal and acoustic
- Mechanical control system
- Mechanical services switchboards
- Motors
- Noise and vibration
- Painting and identification
- Piping
- Tanks and vessels
- Testing and commissioning
- Water treatment

3 4 3 Standards

Boiler Construction

Hot water boilers below 100°C To AS 1228, Pressure equipment boilers, BS 779 Specification for Cast Iron Boilers for Central Heating and Indirect Hot Water Supply (rated output 44kW and above) or BS 855, Specification for Welded Steel Boilers for Central Heating and Indirect Hot Water Supply (rated output 44kW to 2MW)

Electrical Equipment To AS 3100, Approval and test specification - General requirements for electrical equipment

Comply with Mechanical services switchboards

Comply with the Health and Safety in Employment Hazardous Equipment Regulations

Boiler Installation

Gas fired boilers to Code, AG 5601, Australian gas installation code

3 4 4 Design

Performance

Heating water boilers

Suitable for operation with leaving water temperature of 85°C and returning water temperature of approximately 60°C

Efficiency

At least 80% for standard continuous rating, to BS 845 1 Methods for assessing thermal performance of boilers for steam hot water and high temperature heat transfer fluids using results based on gross calorific value of the fuel with flue gas exit temperature not exceeding 230°C and CO₂ content not less than 11.5% Flue gas exit temperature on low fire at design operating temperature to exceed both the dew point and 150°C, excepting for condensing boilers



3 4 5 Quality

3 4 5 1 Quality Assurance

- Comply with authority requirements regarding design and manufacture of pressure equipment
- Comply with AS 3920 1, Assurance of product quality - Part 1 pressure equipment manufacture

3 4 5 2 Pre Completion Tests

Type Tests

Performance To BS 845 1 Methods for assessing thermal performance of boilers for steam, hot water and high temperature heat transfer fluids- concise procedure or BS 7190, Method of assessing thermal performance of low temperature hot water boilers using a test rig

Production tests

Steam boilers Hydrostatic pressure testing to AS 1228

Hot water boilers Hydrostatic pressure testing to not less than 414 kPa and at least 1.5 times operating pressure, for at least 5 minutes

3 4 5 3 Contractor's Submissions

Test records

Submit copies of certificate of hydrostatic tests and report of performance type tests

3 4 6 Boilers

3 4 6 1 General

General

Boilers with supports, burners, controls, wiring, instrumentation, insulation and flues

Boilers and burners to be matched

3 4 6 2 Hot Water Boilers

Connections Water flow and return, drain, relief valve, vent, control and limit thermostats, thermometer, altitude gauge, flue, condensate drain, front and rear combustion chamber doors. Fit spring loaded combustion chamber vents and fit glass combustion chamber observation port with handle and closing clamp

3 4 6 3 Marking

General

Provide the following details

- Model number
- Serial number
- Output
- Design and test pressures
- Burner details

3 4 7 Installation

3 4 7 1 Boilers

General

Standard To AS 3892, Pressure equipment - installation



Mount boilers on concrete plinths

Install gas boilers and appurtenances to AG 601, Gas installation code

Feed water tanks, expansion tanks and pressurisation vessels

General Provide feed water and expansion tanks with working capacity to accommodate the expansion of water contained within the boilers and the associated piping system

Location To flood boilers, pumps and piping system

Pumps Provide feed water pumps or pressurising pumps as required

Piping Do not fit valves between tanks and boilers

Ventilation air supply

Provide facilities for adequate burner and ventilation air supply

Gas Boosters

Install a gas quiet gas booster fan if necessary to increase gas pressure for required gas train inlet pressure

3 4 7 2 Boilers Flues

General

Flues for gas appliances to AG 601 Gas installation code and oil fired appliances to AS 1375, SAA Industrial fuel fired appliances code Fit draught diverters or barometric dampers as required

Flue location and terminal to meet authority requirements for discharge to the environment

Provide a separate flue to each forced or induced draught boiler

Flues to be designed to be self supporting

Flue sizes

Ensure that boilers and flues are compatible For boilers with pressurised combustion chambers, size flues to overcome flue design pressure loss plus additional pressure drop associated with exit velocity cone, or cowl

Construction

Oil fired

Use either

- purpose-built 1 6mm thick stainless steel or 4 8mm thick steel
- a proprietary modular pre-insulated stainless steel system

Gas fired

Stainless steel minimum 0 7mm thick or stainless steel twin wall

Flue Exit Velocity

General Ensure that the turn down ratio of burner does not result in a flue velocity below 4 m/s

Minimum velocity at full load 15 m/s upward

Flue Terminations

Pressurised burners Do not fit flues with caps or obstructions that will prevent free exit of flue gases Cone down to produce the designated discharge velocity



Smoke Density Indicator

Install Eclad series 100 or similar to industrial oil fired boiler flues

Boiler Flue Thermometers

Provide a 50mm dia dial type stack thermometer of suitable range in each boiler stack, to be clearly visible from the floor

Insulation

For oil burners, insulate and clad to within 300mm of the top of the flue Provide a waterproof seal at the top and at exposed joints

Installation

Provide sleeves and packing for flue penetrations through fire resisting walls and roof

Provide weatherproof sleeves and caps at roof penetrations

Fit 150mm long capped nipples in boiler breechings for flue gas sampling

Drain flues via rigid PVC piping and acid resisting valves

Fit flue condensate drain and trap to protect boiler

Provide for thermal expansion of flue, casing and differential expansion

3 4 8 Completion

3 4 8 1 Pre commissioning inspection

To AS 3892, *Pressure equipment installation*

3 4 8 2 Completion Tests

Acceptance tests

On completion, start up and test run boilers at rated load under the supervision of the boiler manufacturer's representative as follows

- Carry out boiler flue gas analysis tests noting percentage of CO₂ and O₂ in the flue gas Take the flue gas temperature in the boiler smoke outlet Determine the fire draft and flue draft using a calibrated draft gauge
- Test operation of automatic combustion controls by separately operating all safety and operating devices on the boiler
- Test flame failure relays
 - Shut off gas or oil supply to simulate loss of fuel supply
 - Remove scanner eye to simulate flame or pilot failure
 - Check that operating and safety devices function correctly and in the correct sequence
- Check the setting and operation of operating thermostats and safety thermostats Set safety thermostats 30C above normal operating temperature

Report Submit a detailed report on each of the acceptance tests



3 5 Air Filters

3 5 1 Quality

3 5 1 1 Pre Completion Tests

Type tests

To AS 1324 2, *Air filters for use in general ventilation and air conditioning methods of test*

Test filter face dimensions 610 x 610

Provide type test certificates by independent NATA laboratory for each type of filter, comprising a complete assembly of media, filter frame and holding frame, demonstrating average arrestance or efficiency and dust holding capacity at maximum final resistance, for the specified test dust

3 5 2 Air Filters for General Ventilation and Air Conditioning

3 5 2 1 General

Standards

Construction To AS 1324 1, *Air filters for use in general ventilation and air conditioning application performance and construction*

Testing To AS 1324 2, *Methods of test*

Fire and smoke control To AS 1668 1, *Fire and smoke control in multi compartment buildings*

Function To AS 1668 2, *Mechanical ventilation for acceptable indoor air quality*

Flame spread index Zero to AS 1530 3 *Simultaneous determination of ignitability flame propagation heat release and smoke release*

Medium Provide medium free of glass fibres

Filter cells 600 x 600 maximum dimension Provide standard sizes throughout project

Filter cell frames and filter holding frames Provide steel or aluminium frames for filters, with airtight seal to prevent air bypassing the filters

Filter removal provide filter retaining clips or slide channels Filters shall be replaceable without tools

Steel filter frames, holding frames and wires to have zincanneal or epoxy coated surface treatment

3 5 2 2 Panel Filters

COMMENT

Panel filters are low efficiency filters with limited dust holding capacity applied to small air handling units, packaged air conditioning units and fan coil units less than say 1 5m³/s capacity

Typical Selections

Flat Panel

Email DY



Specification for **ARV Warneewood Brook Retirement Village Stage 3 – Collaroy Mechanical Services**

	Rainbow TAF/THF
Veeform Panel	Email or Rainbow V form

Flat Panel Filters 25mm deep frames

Performance

Requirement	Performance
Maximum Face Velocity (Panel)	1.75 m/s
Max Initial Resistance @ 2.5m/s	32Pa
Min Efficiency to AS1132 Test Dust No 1 at 125Pa	20%
Min Dust Holding Capacity to No 4 Dust at 125Pa	130g
Min average Efficiency to AS 1132 Test Dust No 4 at 125Pa	87%

Classification Type 1, Class C

Effective face velocity 1.75 m/s maximum

Performance rating G2 to AS 1324 1, *Application performance and construction*

Average arrestance to AS 1324 2 *Methods of test* for test dust no 4 at 1.75 m/s effective face velocity 70%

Dust holding capacity per 600 x 600 cell at 125 Pa final resistance 490 g/m² of no 4 dust

Vee form panel filters 50 mm deep frames

Performance

Requirement	Performance
Maximum Face Velocity (Vee Form)	2.5 m/s
Max Initial Resistance @ 2.5m/s	32Pa
Min Efficiency to AS1132 Test Dust No 1 at 125Pa	20%
Min Dust Holding Capacity to No 4 Dust at 125Pa	130g
Min average Efficiency to AS 1132 Test Dust No 4 at 125Pa	87%

Classification Type 1, Class C

Effective face velocity 2.5 m/s maximum

Performance rating G2 to AS 1324 1, *Application, performance and construction*

Average arrestance to AS 1324 2 *Methods of test* for test dust No 4 at 2.5m/s effective face velocity 73% minimum

Dust holding capacity per unit of effective face area at 125 Pa final resistance 365 g/m² of No 4 dust minimum

3.5.3 Marking

Filter

General Permanently and legibly mark, on a suitable section of the filter, the following

- Filter type and class



- Direction of airflow
- Proprietary type, model and serial number
- Type of media
- Statement of compliance with AS 1324.1
- Filter performance rating

3.5.4 Installation

3.5.4.1 Installation of filters

Attachment

General Rigidly attach filter frames to the air handling plant casing

Sealing Ensure that there are no leaks between the filter holding frame and the casing. Seal individual filter units to each other. Seal filter connections to adjoining equipment, paneling or supporting framing. Do not use adhesive tapes for sealing.

Cell frames

Install filters so that they are accessible for maintenance and do not accumulate moisture.

Blanking plates

General Close gaps where the dimensions of the filter plenum do not match those of the framing.

Plates material 0.8mm (minimum) galvanised steel or grade 304 stainless steel sheet

Bracing

General Provide stiffeners to filter holding frames to limit the deflection of filter bank under operating conditions.

3.5.4.2 Filter Access

Filter platforms Provide access platforms for filters extending >2.4m above floor. Platform standard: To AS 1657 *Fixed platforms, walkways, stairways and ladders*. Ensure that platforms and ladders do not obstruct filter access.

Access Facilitate replacement and maintenance in accordance with AS 3666, *Air handling and water systems for buildings – microbial control*. Provide ductwork and conditioner access doors.

3.5.4.3 Instruments

Filter Differential Pressure Gauges

Function Indicate differential pressure across each filter bank.

Differential pressure gauge unit Include pipework, termination and fittings necessary for correct operation and maintenance.

Indicator scale 0 to 250 Pa in 5 Pa divisions

Type Dwyer Magnehelic series 2000 or similar

Location Outside unit casing in a readily readable location. Extend pressure tubes to upstream and downstream plenums.

Commissioning Mark gauge to indicate air resistance of clean and dirty filters. Mark dirty pressure drop with the words "replace media".

3.5.5 Testing and Commissioning

3.5.5.1 Protection

Cover and protect all filter media against dirt during construction. Clean air systems before removing protective covers.



3 5 5 2 Temporary Media

Prior to commissioning install temporary filter media across all filters except panel filters to protect the filter and maintain in place throughout commissioning Temporary medium to have an average arrestance of No 4 dust of 70%



3 6 Fans

3 6 1 Fan Static Pressures

Fan static pressures scheduled are approximate

Calculate system resistances including pressure drops across dirty filters, wet cooling coils heating coils, sound attenuators, dampers, plenums, ductwork, terminals, registers, door grilles and the like as installed

Amend fans, drives, motors and electrical power supplies to accord with the calculated system resistances

Where fan sound power levels exceed scheduled values, increase acoustic attenuation to achieve required sound levels Submit acoustic calculations for review

3 6 2 Fan Selection

Variable speed fans for variable volume systems

Operation from full design air flow to 10% without surge, for partial occupancy

Stability Select and install to avoid beating and surge down to 10% less than scheduled minimum flow rate

Fans in parallel Fit backdraft dampers or motorised discharge dampers to all fans running in parallel to prevent backwheeling when only one fan is running

Noise characteristics Select fans which do not have high levels of noise at discrete frequencies under normal operating conditions

3 6 3 Quality

3 6 3 1 Pre Completion Tests

Type tests

Type tests in NATA accredited laboratory or equivalent Type tests to be for complete fan and casing assembly of similar geometric proportions

Fan performance To BS 848 1 *Fans for general purposes methods of testing performance*

AS 2936, SAA fan test code

ANSI/ASHRAE 51 or ANSI/ASHRAE 210, *Laboratory methods of testing fans for rating*

Fan sound power levels To BS 848 2 1985, *Methods of noise testing* or AS 1217 3, *Acoustics - determination of sound power levels of noise sources precision methods for discrete - frequency and narrow band sources in reverberation rooms*

Roof mounted smoke spill fans

To BS 7346 2, *Specification for powered smoke and heat exhaust ventilators*

Must be Type Tested to AS 4429 1999

Production tests

Balance assembled impellers shafts and pulleys to AS 3709, *Vibration and shock - balance quality of rotating rigid bodies (ISO 1940/1) grade G6 3*

Test run each fan in factory and record amps drawn and freedom from vibration



3 6 3 2 Contractors Submissions

Submit fan type test certificates of performance and sound power levels of each series of fans

Submit performance curves for all fans showing duty point and shaft power and demonstrating stability of operation

3 6 4 Fans

3 6 4 1 Centrifugal (roof mounted fans)

Selection Ensure stable operation, so that system curve intersects with fan curve where a decrease in fan volume causes an increase in pressure

Select for high efficiency and quiet operation, not more than one fan size smaller than peak efficiency selection

Arrangement AMCA standard 99 2404 arrangement 1, 3 or 9

Casings Welded steel scroll and side plates, reinforced to prevent flexing and drumming Provide split casings where necessary for installation Fans with motors 4 kW and less may have seamed zinc coated sheet steel casings

Inlet bells Removable, shaped for aerodynamically efficient air entry and close fit to impeller

Bases

General Form from fully welded steel sections or for fans 4kW motor power or less, pressed zinc coated steel

Mounting brackets Provide mounting brackets for spring mounts

Impellers

Blade type

- Duty shaft power below 4kW select forward curved or backward inclined laminar type
- Duty shaft power 4 to 8kW select backward inclined curved laminar type
- Duty shaft power greater than 8kW select for greater efficiency either backward inclined aerofoil or laminar type

Characteristics

- Keyed to drive shafts using taper-lock fixing devices or taper keys
- For overhung driven fans, retain onto drive shafts using positive devices such as washers and set screws into tapped holes in shaft ends

Shafts

Characteristics Provide the following

- Designed so that the first critical resonant speed of the shaft is 30% greater than maximum operating speed For double width fans with shaft diameter >60mm provide filleted, stepped type to permit easy impeller removal
- Keyed with taper lock pulley hubs
- Countersunk ends for tachometer application



Material Mild steel or high tensile steel, as appropriate for the duty Provide corrosion protection

Fan Bearings

For single width fans with impellers <1200mm outside diameter and for double width fans with impellers <1050mm outside diameter Provide pillow block mounted, self aligning ball bearings, to AS 2729, *Rolling bearings dynamic load ratings and rating life* sealed for life with a basic rating life with 10% failure, L10 of 35,000 hours

For larger fans Provide plummer-block mounted self aligning roller bearings to AS 2729, with basic rating life with 10% failure, L10 of 35000 hours with seals and grease relief Extend grease nipples for ready access

Allow for thermal expansion of the shaft, and clamp bearings to shaft and housing by taperlock

Replace fan bearings with wooden blocks where shipment to site is over unsealed roads and refit bearings prior to commissioning

Motor Selection

Power rating For backward inclined impellers with non overloading characteristic select for at least 15% above limit load fan shaft power at design speed (to enable fan speed to be increased by 5%) plus 10% drive losses For forward curved impellers as for backward inclined plus additional 20% for overloading characteristic

Belt drives

Standard To AS 2784, Endless wedge belt and V-belt drives

Drive sizing Service factor 1.3

Pulleys For motors 5.5 kW and above, fit taper lock on fan and motor shafts Balance all pulleys to AS 2784

Belts Wedge belts to AS 2784 Multiple belts to be matched sets

Drive adjustment Provide for adjustment of belt drive tension and alignment by either movement of motors on slide rails or by pivoting support Adjustment by jack bolts with lock nuts Clamp motors in place Adjust belt tension initially and after run-in to AS 2784 Appendix B, using spring scale

Couplings

Fit flexible couplings to all direct driven fans where fan and motor have separate bearings

Variable Inlet Vanes

Where scheduled provide balanced low friction variable inlet vanes and linkages to reduce fan capacity to 25% of full open flow Link both sets of vanes of double inlet double width (DIDW) fans

Guards

Provide belt guards complying with safety standards and

- Rigid, removable and totally enclosing the drive and exposed shafts
- Provide tachometer openings at fan and motor shafts Belts to be clearly visible and belt tensioning to be with guard in place
- Weatherproof, ventilated and drained where exposed to weather

Provide inlet and outlet guards where fans are not connected to ducting Provide shaft and coupling guards for exposed shafts



Finishes

External surfaces Equipment paint system, using GPC P-162 primer

Internal surfaces Prime with zinc phosphate primer to GPC-P-162

3 6 4 2 Centrifugal - In – Line (Poolpak exhaust)

General

Provide fans with non overloading power characteristics

Selection

As for centrifugal fans

Construction

Casings

- Steel or aluminium Rectangular or circular with spigot or flanges for duct mounting, of zinc-coated steel sheet, spot welded Paint spot welds Provide access panels in rectangular casings for fan and motor removal
- Fibreglass or plastic Fire retardant moulded fibreglass or impact resistant plastic with integral support foot applicable to fans up to 300 diameter

Motors Direct mounted to impellers

Electrical connection Provide terminal boxes external to fan casings and wired to fan motors

3 6 4 3 Axial Flow Aerofoil (residential kitchen fans)

Selection

Select fans with high efficiency and low noise level, in the stable region, clear of blade stall and maximum speed 24r/s and between 50% and 80% of peak pressure Blade pitch angle to be close to mid range and not less than 5° from the maximum pitch angle for which performance data is published

Select adjustable pitch fans and motors to allow for 5% increase in airflow and 10% increase in pressure above design

Casings

Tubular, long type, constructed from mild steel, fully welded, hot dip galvanised to AS 1650 *Hot dipped galvanised coatings on ferrous articles* after fabrication Provide 50 mm sight hole with closure, for impeller inspection

Fans 450 diameter and above to have flanged casings and mounting brackets

Impellers

General Provide aerofoil section blades All fans exceeding 500W shaft power to have taper lock hubs and adjustable pitch blades with facility for pitch angle measurement Blade angles to be factory preset

Material UV stabilised glass reinforced polypropylene (excepting smoke exhaust fans), or cast aluminium Impellers 1250mm diameter and above to be cast aluminium

Balancing Balance all impellers Fans up to 500 diameter may be statically balanced by selective assembly All other fans to be statically and dynamically balanced

Motors

General Direct mount to impellers Adjustable pitch fans, allow power rating 15% greater than limit load shaft power at design duty to enable air flow to be increased by 5%



Control Provide speed controllable motors for variable volume systems

Electrical connection

Provide terminal boxes external to fan casings and wired to fan motors excepting flame proof motors with motor mounted terminals

Open inlets/outlets

Inlet cones Provide aerodynamically shaped cones to inlets of fans

Guards Provide galvanised steel or bronze mesh guards

3 6 4 4 Roof Mounted (common toilet exhaust)

Impellers

Types Centrifugal, mixed flow, aerofoil axial or propeller as scheduled

Selection Stable with high efficiency and low noise

Vibration Balance statically Mount motor resiliently

Housings

General Provide compact housings enclosing fans and motors and fitted with square weathering skirts

Material UV stabilised ABS, polypropylene, polyethylene, glass-fibre reinforced polyester or zinc-coated steel of neutral colour

Corrosion protection Zinc plated or hot dip galvanised steel components

For vertical discharge type, provide weatherproof backdraft dampers to prevent rain entry when idle
Dampers to close against wind pressures

Birdmesh Where backdraft dampers are not fitted, provide birdmesh guards

Motors

Control Provide speed controllable motors for variable volume systems

Mountings Resilient neoprene antivibration

Electrical connection

Provide terminal boxes external to fan casings and wired to fan motors

3 6 4 5 Window and Wall Mounted Propeller Fans (car park cleaner room)

Standard

To AS 2681

Fans

Impellers Laminar bladed propeller type direct driven GRP or aluminium blades Statically balanced

Motors Drip proof 240V single phase 24 r/s maximum, with sealed bearings to AS 2729, and with a basic rating life with 10% failure, L10, of 35,000 hours Motors to be speed controllable

Resilient neoprene antivibration mountings

Housing

- Pressed zinc coated steel mounting ring or diaphragm plate with fan isolating mountings



- Discharge cowls with concealed birdmesh guards
- Interior grille with backdraft shutters constructed from lightweight nylon or aluminium blades, arranged to close electrically or by gravity when fans are not operating
- Steel components cadmium plated

3 6 4 6 Special Applications

Kitchen exhaust fans Provide clean out doors and plugged drain holes

Fans for hazardous locations Where scheduled, provide appropriate fans for flammable or explosive atmospheres

3 6 4 7 Marking

Labels

Show the following

- Manufacturer's name
- Model
- Serial number
- Size
- Direction of rotation, marked on casing

3 6 5 Installation

3 6 5 1 Installation

On Site Storage

Ensure impellers are free to rotate to prevent Brunelling of bearings, and protect motors and bearings from weather

Access

Arrange fans and accessories to allow service access for maintenance and removal and for replacement of assemblies and component parts, without disturbance of other items of plant

Duct connections

Arrange ductwork to ensure smooth air flow entering and leaving fans

Provide flexible connections to prevent transmission of vibration to ductwork. Locate flexible connections at ducted inlets one diameter upstream to minimise turbulence in the entering air. Provide duct transitions between fans and flexible connections, rigidly connected to the fans

3 6 6 Commissioning

Change pulleys of constant speed belt driven fans to adjust total air flow rate

3 7 Pumps

3 7 1 General

3 7 2 Cross References

General

Comply with the *General Services Requirements* section

Related sections

Refer to the following sections related to pumps



- Motors
- *Noise and Vibration*
- *Painting and Identification*
- *Testing and Commissioning*

3 7 3 Quality

3 7 3 1 Pre Completion Tests

Type tests

Australia To AS 2417 2, *Pumps international acceptance test codes ISO 2548 Class C tests* in NATA accredited laboratory

New Zealand To ISO 2548 Class C

Safety Pumps for residential applications to AS/NZS 3350 2 41, *Pumps for liquids having a temperature not exceeding 35°C*, or to AS/NZS 3350 2 51, *Stationary circulation pumps for heating and service water installations*

Production Tests

Balance assembled impellers and shafts grade 6 3 to AS 3709 *Vibration and shock balance quality of rotating rigid bodies* (ISO 1940 1)

Capacity and efficiency To AS 2417 2 in NATA accredited laboratory for each pump with 150 dia or greater discharge

3 7 3 2 Contractors Submissions

Submit system pressure drop calculations

Submit pump performance curves showing head flow and power, marked to show duty points

Submit pump type test certificates for each series of pumps

Submit production test reports for pumps 150 dia or greater

3 7 3 3 Static Pressures

- Static pressures scheduled are approximate
- Calculate system head as it will be installed including static lift and pressure drops across hot water unit, chillers, heat exchangers coils, control valves, piping and the like
- Adjust pump and motor selections and power supply capacity as necessary to suit the installed system Follow specified pump and motor selection criteria maintaining specified reserve capacity Submit revised selections for review

3 7 4 Pump Selection

Arrangement

Capacity above 150 L/s Direct coupled axially split casing

Capacities below 150 L/s and motor power exceeding 1 5 kW Direct coupled end suction back pullout type with spacer coupling



Specification for **ARV Warriewood Brook Retirement Village Stage 3 – Collaroy Mechanical Services**

Motor power 300 W to 1.5 kW Close coupled end suction or in-line back pullout motor pumps with supporting feet on volute casings and air cooled flange mounted motors

Motor powers less than 300W In line canned motor circulators, pipeline mounted, with liquid cooled motors

Operating Conditions

Running hours Continuous

Temperatures

Condenser Water	10°C to 40°C
Heating Hot Water	10°C to 90°C

Speed 24 r/s maximum unless scheduled otherwise

Casing pressure Maximum working pressure 1.6 MPa unless scheduled otherwise Test pressure 2.4 MPa

Suction pressure Maximum 1.0 MPa unless scheduled otherwise

Pump efficiency

Shaft Power (kW)	Minimum Efficiency
Up to 1	35%
1 to 2	50%
2 to 5	60%
5 to 20	70%
20 and over	75%

Stability

Single operation

Provide pumps with constant falling head v flow curves for stable operation with duty nearest to the best efficiency point for the impeller

Parallel operation

General Provide pumps with stable and constant falling head versus flow curves, with no instability when operating either singly or in parallel at the same shaft speed Maximum difference between the individual shut off heads 10% of that of the pump with the lowest shut-off head

Variable flow systems Operation from full design flow to 10% without surge

Capacity

Impellers for the design duty shall not exceed 95% of the maximum impeller diameter that can be fitted in the casing Select each motor with sufficient power for any point of the head/flow curve of the impeller 5% larger than the impeller size for the design duty

Suction Head

Select and install each pump so that the available net positive suction head is greater than that required for that pump Provide flow inducer if necessary

Noise Levels

Sound power levels of each pump to be less than that of its driving motor, both overall and in each octave band

3.7.5 Materials

Category 1 Water below 90°C



- Applies to cold water supply, closed circuit chilled water, heating water and condenser water , ethylene glycol solution, chemically treated open condenser water and evaporative cooler pumps
- Casings, casing wear rings, covers Cast iron grade T 220 minimum to AS 1830, *Iron castings grey cast iron* or spheroidal graphite iron grade 500-320-7 to AS 1831, *Iron castings spheroidal or nodular graphite cast iron*
- Impellers Zinc free bronze grade C90250 to AS 1565 *Copper and copper alloys ingots and castings*
- Shafts Stainless steel grade 431 to AS 2837, *Wrought alloy steels stainless steel bars and semi finished products*

3 7 6 Centrifugal Pumps

3 7 6 1 Close Coupled End Suction or In line Back Pullout Motor Pumps

Standard

End suction pumps to ISO 2858

Type

Provide base mounted single stage radially split, close coupled back pullout motor pumps, of end suction or in line arrangement

Rating

Operating Pressures Bronze casing 1 0 MPa max
Cast Iron casing - 0 6 MPa max

Operating Temperatures 120°C max

Rotating Assemblies

Impellers Shrouded type

Shafts Solid, directly coupled to motor shafts

Thrower rings Fit to shafts

Shaft seals Unbalanced mechanical

Casings

Drainage Provide tapped drainage holes in seal drip wells and at low points of casings

Jointing Provide gaskets or O rings compatible with the fluid being pumped

Piping Connections

Flanged connections minimum Table E to AS 2129, *Flanges for pipes valves and fittings*

Pressure Gauge Tappings

Provide drilled and plugged openings at suction and discharge flanges

Motors

General Provide electric motors compatible with pump requirements, giving efficient, non overloading pumping units

Mounting Suitable for mounting with the shaft vertical or horizontal



3 7 6 2 Marking

Direction of rotation

Provide permanent indication on the principal component of the casing, indicating the direction of rotation

Name plates

Attach to the casing permanent labels indicating the following

- Make
- Model
- Serial number
- Casing material
- Impeller material
- Shaft material
- Impeller diameter
- Seal type

3 7 7 Installation

Location

Install pumps so that available net positive suction head (NPSH) is greater than the NPSH required by the pump under all operating conditions

Piping

Pump loads Install piping so that no load is imposed on the pump casing Provide separate supports for all piping Anchor piping to isolate pumps from effects of thermal expansion

Fit base supports to suction elbows of end suction pumps and to suction and discharge elbows of axially split casing pumps Extend floating or inertia bases to include base supports

Fittings Reducing fittings in suction lines to be eccentric type, installed flat on top Valves, strainers and fittings installed close to pumps to be sized to match the larger of the pipe size and the pump connection size

Bends installed close to pump connections to be long radius type or fit straight spacer with a length equal to three pipe diameters between pumps and bends

Install check valves on discharge lines from all pumps in parallel

Install discharge valves and suction check valves or foot valves to all pumps in open systems

Drains Connect drains from seal drip wells to drainage system using 25 dia copper pipe

Commissioning

During commissioning, after all circuits have been proportionally balanced and with valves on the index circuit open the total flow rate may exceed the design flow rate by more than 10% If so, machine down the pump impeller to achieve a maximum flow rate of 110% of the design flow rate



4 Ductwork

4.1 General Requirements

The design drawings may not show all transitions etc to all items of plant. The contractor is to allow for the following in their tender price:

30 degree transitions from/to all exits/entries to all plant
Minimum of 3 equivalent diameters in length of straight ductwork from

- Any Equipment
- Between Bends
- Fan discharges

Ductwork layouts to provide the most economical solution in terms of static resistance

4.1.1 Standards

General

Comply with the following standards and documents:

- BCA latest edition or as nominated by project BCA consultant
- BCA section J BCA, latest edition or as nominated by project BCA consultant
- AS 4254, Ductwork for air-handling systems in buildings
- AS 1668 1, Fire and smoke control in multi compartment buildings
- AS 1668 2, Mechanical ventilation for acceptable indoor air quality
- AS 3666, Air handling and water systems of buildings - microbial control
- AS 1677, Refrigerating systems

4.1.2 Design

Ductwork Pressure Classification

Select ductwork pressure class greater than the maximum operating pressure in each portion of the system

Duct Pressure Classes

- Variable Air Volume (VAV) ducts upstream of VAV terminals Pressure class 750, seal Class B
- Low velocity supply from air handling units Pressure Class 500, seal Class C
- Low velocity supply from fan coil units, exhaust, return and outside air ducting Pressure class 250, seal Class C

4.1.3 Performance

Construct ductwork to minimise noise generation. Ensure that ductwork interiors are smooth and free from projections

Minimise resistance to airflow

4.2 Quality

4.2.1 Pre Completion Tests

Duct Leakage Tests Prior to concealment, enclosure or insulation test each completed section of VAV supply ductwork between supply fans and VAV terminals to SMACNA, HVAC, Air Duct Leakage Test Manual, leakage Class 12 Maximum leakage rate 1.25 L/s m² surface area at 750 Pa. Rectify excessive leakage and retest



4.2.2 Contractor's Submissions

Certification

Fire and smoke dampers Submit type test certificates from independent NATA approved laboratory showing compliance to AS 1682.1 Fire dampers - specification for air leakage and fire resistance

Motorised dampers Submit type test certificates from independent NATA approved facility laboratory showing compliance with air leakage and actuator torque requirements

Shop Drawings

Submit shop drawings of ductwork showing extent of acoustic lining, turning valves, access doors and walkways

4.3 Ductwork

4.3.1 Sheetmetal Ductwork

Construction

To AS 4254 Ductwork for air handling systems in buildings or SMACNA HVAC Duct Construction Standards, Metal and Flexible

Material

Fasteners

Rivets Expanding solid end type, aluminium base alloy

Self tapping screws Bright zinc plated

Self drilling and tapping screws Bright zinc-plated Use only if base material into which they screw is thicker than 1.5mm, and they are unlikely to be removed or replaced

Bolts, nuts, washers, drop rods and tie rods Zinc-plated steel, service condition number 2 Provide washers under nuts

Joints

Rectangular ducts

Longitudinal

- Do not use snaplock seams

Transverse

- Drive slip or standing drive slip joints
Use only on ductwork under positive pressure up to 500 Pa maximum
Do not use drive slip type joints for vertical risers

Transverse joints on vertical ducts Select from integrated standing flanges, companion angle flanges, integrated machine rolled flanges or slip on proprietary flanges

Circular or oval ducts

Longitudinal Helical 4 ply locked seams or helical or longitudinal butt welds

Transverse Internal beaded sleeves to 600 dia maximum, or companion angle flanges or slip on proprietary flanges with bolted closure ring

Fittings

General Provide duct fittings for gradual transition of duct sizes and directions, with minimum air flow resistance



Duct bends Provide long radius or vaned elbows, or five piece lobster backs

- Inside radius of any air channel >width of channel
- Vanes up to 750 long to be small type with 25mm tangential tails per AS 4254 figure 2 3 (L) item (a)
- Do not use unvaned or mitred elbows for supply or exhaust

Branch connections Use 45° or conical branches for branch air velocities $\geq 3\text{m/s}$ Refer AS 4254 figure 2 3(P), (c) and (d)

- Use 90° taps or flanged spigots only for air velocities $< 3\text{ m/s}$

Acoustic turning Vanes

- Install in all vaned elbows in acoustically lined ductwork and in bends within 4m of fans
- Double thickness perforated vanes acoustically lined with 96 kg/m^3 mineral wool with scrim encapsulation

Heavy Gauge Ductwork

Extent Provide heavy gauge rectangular ductwork where shown to limit noise breakout

Include discharge ducting from VAV supply fans for 10m from the fans and all supply ducts within plantrooms

Construction 1.2mm zinc coated steel Provide acoustic lining Support heavy gauge ductwork from resilient spring and neoprene hangers

Provide circular high pressure ducts of standard gauge in lieu of rectangular heavy gauge where space permits

Ductwork Exposed to View

Provide exposed ductwork well finished, straight and true, and free of visible defects

Transverse Joints

Rectangular duct - use drive slip or slip on proprietary flanges

Circular or oval duct - use internal beaded sleeves

Match spacing of transverse joints on adjacent exposed ducts

Hangers

Top connected rod hangers with local internal duct reinforcement Seal around rods Do not use trapeze hangers Ensure hangers are evenly spaced

External Ductwork

Install ductwork exposed to weather to shed rainwater Cross-break tops to prevent ponding

Provide transverse joints with recessed flanges with hat sections for a flat external surface

Seal all joints of exposed ductwork, access doors, equipment connections and the like

Internally insulate all external supply and return air ducts

Provide galvanised brackets, hangers, nuts, bolts and other components

Finishing

Prime paint all uncoated steel surfaces



4.3.2 UPVC Ductwork

Material

Sheet

- External applications Pressed grey UPVC sheet with UV inhibitors
- Internal applications Extruded grey UPVC sheet

Circular ducts UPVC pipe, with UV inhibitors for external applications Minimum wall thickness 3mm

Rectangular Duct Reinforcement

Attach reinforcement on edge, at 600 mm maximum centres

UPVC ductwork thickness and stiffening table

Circular duct diameter (mm)	Rectangular duct width (mm)	UPVC sheet thickness (mm)	Rectangular duct reinforcement(mm)	Joint Flanges	
				Width (mm)	Thickness (mm)
≤400	≤400	3	-	25	4
>400 ≤ 600	> 400 ≤ 600	4	-	30	6
>600, ≤ 750	> 600, ≤ 680	4.5	-	40	6
>750 ≤ 900	> 680, ≤ 750	5	-	40	6
>900 ≤ 1200	> 750 ≤ 1050	6	-	40	8
> 1200, ≤ 1500	> 1050 ≤ 1300	6	40 x 5	40	8
>1500 ≤ 2100	> 1300, ≤ 1800	6	50 x 5	50	10

Welding

General Continuously weld joints, including seams, reinforcement, flanges, and corners of fabricated bends, tees and fittings Weld reinforcement on both sides Back weld slip socket joints

Butt welding Vee type Use hot air equipment

- Thickness ≤ 4mm One run of 3mm welding rod
- Thickness > 4 mm Triple welding rod or 3 runs of 3mm welding rod

Locations inaccessible for butt welding Solvent weld, with continuous UPVC H-section jointing sockets, heat formed for circular duct cross joints

Bending

Immediately before bending sheet material, heat both sides to avoid thinning and high stress concentrations Heat bend corners of rectangular ductwork to an inside radius equal to the material thickness, or 5 mm, whichever is the greater

Seams

Minimise longitudinal seams Locate welded seams away from corners, preferably in the middle of a short side

Transverse joints

Flanged Weld flanges to ductwork, and connect by means of 6 mm diameter bolts at 25 mm maximum centres using 6mm diameter stainless steel bolts Provide soft PVC gaskets or non-setting compound

Slip sockets Heat form sockets or form by welding UPVC collars on to adjoining duct sections Solvent weld overlapping duct sections before back welding



Fittings

General The same material as the duct For airtight joints fix to the duct by welding

Lobster back bends Fabricate bends for circular ductwork from at least 5 segments, butt welded, with centreline radius at least 1.5 x duct diameter

Dampers

Construct parts within ducts from UPVC

4.3.3 Kitchen Exhaust Ductwork

Standards

Commercial kitchen hood exhaust systems comply with Section 11 of AS 1668.1 *Fire and smoke control in multi compartment buildings* and local authority requirements

Material

Steel 1.2mm galvanised steel Grade 2 or Grade 3 to AS 2338 with coating Z275 to AS 1397, *Steel sheet and strip hot dipped zinc coated or aluminium/zinc coated*

Stainless steel 0.9mm to ASTM A 240/A 240M *Standard specification for heat resisting chromium and chromium nickel stainless steel plate, sheet and strip for pressure vessels alloy 304L*, finish no. 2B to ASTM A 480/A 480M *Standard specification for general requirements for flat rolled stainless and heat resisting steel plate, sheet and strip*

Ducting Provide smooth internal surfaces free of projections Do not cross-break

Joints Provide flanged transverse joints and welded or Pittsburgh lock longitudinal joints on top of duct Seal cross joints and longitudinal joints using grease and fire resistant sealant

Bends Use long radius elbows without splitters

Access doors Provide large easily accessible access doors with framed openings and sash locks with waterproof, fire-resistant and grease resistant seals as follows

- At accessible points on the sides of ducts, at 3m maximum centres in horizontal runs
- At duct junctions
- Behind hood outlet balancing dampers
- At the bottoms of kitchen exhaust risers
- On each side of changes in direction
- At sprinkler head locations and drain points

Dishwasher exhausts Grade horizontal ductwork runs back to dishwasher

Drains Provide a 25mm drain socket and plug

- At the lowest point of each run of ducting and
- With a 25mm grease arresting gutter at the bottom of vertical risers

Sprinkler heads Provide piping holes and seal around pipes

4.3.4 Internally Insulated Ducts

Drawings show clear internal airway dimension of ducts Increase dimensions of ductwork to accommodate lining thickness



4 3 5 Flexible Connections

General

General Isolate inlets and discharges of fans, ducted fan coil units, air handling units, packaged air conditioning units, evaporative coolers, and conditioner casings from ductwork, using heavy duty airtight and water proof flexible connections

Length Provide sufficient slack to ensure free movement and vibration isolation under operating, static and start up conditions

Location Install flexible connections at least 600mm upstream of axial fan inlets

Alignment Align openings of connected equipment Do not protrude connections or frames into the airstream

Fixing Fix to attachments with zinc-coated steel strip Seal joints Do not paint flexible material

Maintenance Arrange to permit easy removal and replacement without disturbing ductwork or plant

4 3 6 Flexible Ductwork

Insulated

Extent Install insulated acoustic flexible duct connections from rigid ducts to all registers in demountable ceilings Also at inlet connections to terminal units

Provide flexible duct complying with AS 1668 1, *Fire and smoke control in multi compartment buildings*

Type tests Submit test reports demonstrating flexible ductwork and duct connectors comply with burn test to UL 181 *Factory made air ducts and air connectors*, as required by AS 4254

Thermal insulation resistance 0.6m² K/W minimum

Acoustic static insertion loss 10dB per metre minimum at 500 Hz

Uninsulated

Extent For exhaust systems provide uninsulated flexible ductwork complying with AS 1668 1, *Fire and smoke control in multi compartment buildings* where shown

Type Corrugated aluminium spiral ductwork complying with AS 1668 1

Installation

Maximum length of flexible duct in any run of ductwork 3m

Provide solid circular duct extensions where necessary

Minimum length of flexible duct 1.5m

Install ducts without kinks or deformation to minimise pressure losses Connect to circular or oval spigots of equal size using worm drive hose clips or proprietary metallic bands Seal ends with two layers of adhesive tape complying with AS 4254 clause 2.2.3

4 3 7 Fire Rated Ductwork

Provide fire rated ductwork where shown on the drawings and as required by Building Code of Australia and AS 1668 1, *Fire and smoke control in multi compartment buildings*

Minimum rating 2 hour FRP

Sprayed coatings shall be cement spray system with hard set finish



Composite panels or ducting shall be fibre-cement reinforced by bonded zinc coated steel sheet

Provide integral fire rated supports for fire rated ductwork

Provide fire rated access panels in such ductwork Fire rated access panels shall be openable without tools

Provide subducts where required in accordance with AS 1668 1, *Fire and smoke control in multi compartment buildings* Minimise subduct obstruction of risers

4 3 8 Air Discharge Cowls

Provide weatherproof and vermin proof cowls for all intakes and discharges through roofs

Obnoxious exhaust to have upward discharge Provide weatherproofing at all external building penetrations

4 3 9 Subducts

Provide subducts so AS 1668 1

4 3 10 Installation of Ductwork

Offsets

The design drawings do not purport to show all offsets and transitions Provide offsets and transitions and the like required to avoid interference with structure, other services and obstructions whilst minimising air flow resistance

Light fitting clearance

Install ductwork over modular ceilings clear above the plane of light fittings to provide maximum flexibility for relocation of lights in future Allow 175mm from underside of duct flanges or insulated ductwork to underside of ceilings

Spacing

Provide minimum clear spacing, additional to duct insulation, as follows

- 25mm between adjacent ducts
- 50mm between ducts and electric cables
- 150mm between ducts and ground, below suspended floors

Set out ducts to run clear between ceiling module lines and ceiling hangers

Supports for risers Provide resilient supports for all VAV risers and other risers rated at ≥ 750 Pa

Supports for UPVC ductwork Do not fix self tapping screws into the duct

Drains

Install drains at low points in ductwork where water may accumulate eg Fresh air intake plenums, obnoxious discharge ducts and plenums

Provide 40mm drains with 100mm deep seal traps connected to suitable wastes

Cleaning

During installation progressively remove construction debris and foreign material from inside ducts

Pitot Tube Test Holes

Provide test positions to measure total air flow of each supply, return exhaust and outside air system and total air flow in each main branch (eg floor branches)



Provide minimum 10mm dia test holes with neoprene plugs in ductwork and casings for air flow measurement by pitot tube

Locate holes to BS 1042 *Measurement of fluid flow in closed conduits* Section 2.1 or *SMACNA Balancing Manual*

Fan and Air Handling Unit Test Holes

Provide minimum 10mm dia pressure test holes with neoprene plugs at fan suction and discharge duct connections and tachometer test holes in line with fan shafts

Provide test holes for measuring the temperature of air entering and leaving coils and mixing chambers

Form and plug test holes to avoid sweating, condensation and air leakage

4.4 Access Doors and Panels

Locations

Provide access to all equipment including

Fans and motors

Filters

Packaged Air Conditioning Units

Fire dampers

Electric heaters

Valves

Install access adjacent to equipment to be serviced

Application and Size

Personnel Access Doors to ducts and plenums and air handling units

> 1600 high 1500 high x 650 wide clear Where possible set sills of access doors 300mm above floor

>900 high Full height x 650 wide clear

Access Panels to Deep Filters 650 x 650 mm clear

Personnel Access Panels Ducts, plenums and air handling units >500 high - 450 x 650mm clear

Hand Access Panels Ducts <500 high - 200 x 300mm clear

Access doors and panels shall open against the air pressure

Construction

Type Double skin panel, deep formed, zinc-coated steel construction, insulated with 25mm mineral wool insulation Minimise cold bridging

Frames Provide rigid matching galvanised steel or aluminium frames attached to the unit

Seals Silicone rubber, PVC, or soft neoprene gaskets mechanically fixed to ensure an airtight seal when closed

Access door hardware Provide two chrome plated wedge type latches and handles which can be operated from both the inside and outside of the door, and two adjustable heavy duty chrome plated hinges

Access Panel Latches Wedge type anti-vibration sash latches

Number of latches



- For personnel access 4
- For hand access 2

Do not screw or bolt panels in position

4.5 Dampers

4.5.1 Locations

Dampers,

Provide dampers for outside air, return air, spill air, recycle air, coil bypass air, plant changeover and the like for air handling units, fan coil units and packaged air conditioning units

Constant volume and VAV low velocity system balancing dampers

Provide balancing dampers in branches of constant volume supply and exhaust systems and VAV low velocity ducts downstream of VAV terminals, at the following locations

- Submains at mains (eg riser take offs)
- Branches at submains
- Runouts to outlets at connections to branches for rooms with design noise levels NR35 or below and for all light air linear diffusers, excepting for diffusers in hard plaster ceilings
- Each exhaust hood outlet excepting where high pressure drop filters are installed

Refer to *Registers Diffusers and Grilles* section for register dampers and register plenums

4.5.2 Manual Dampers

Type

Single butterfly with balanced blades maximum 600 wide and 250 high or 350 diameter maximum

Opposed multiblade with maximum 230 wide and 1200 long blades with 6mm edge breaks for larger ducts
Provide intermediate mullions if necessary

Construction

General

Provide dampers which are free of rattles, fluttering or slack movement, and capable of full adjustment without excessive self generated noise

Design air pressure differential 1000 pa

Face dimensions As shown or duct size

Connections Mating angle flanged transverse joints

Frames 1.6mm minimum thickness folded zinc-coated steel or 2mm minimum thickness extruded aluminium forming channel sections at least 150mm wide and welded at corners

Blades

Material folded Zinc coated steel, stainless steel, or extruded aluminium

Form No sharp edges Sufficiently rigid to eliminate movement when locked



Specification for **ARV Warriewood Brook Retirement Village Stage 3 – Collaroy Mechanical Services**

Minimum thickness

- Steel
- Single thickness blades 1.2mm
- Double thickness blades 0.8mm

- Aluminium
- Single thickness blades 2.0mm
- Double thickness blades 1.0mm

Seals Provide frame seals on top, bottom and sides of opposed blade dampers

Bearings

Type Ceramic sleeve bearings, or nylon sleeve bearings for operating temperatures <50 C

Housings Rivet to damper frames

Spindles

Material Bright zinc-plated steel

Construction Securely fix to damper blades

Minimum diameter

- Blade lengths ≤ 600mm 10mm
- Blade lengths >600, ≤ 1200mm 12mm

Linkages

Fix securely to blades so that the opposed blades rotate equally and close tightly without slip

Adjustment

Provide for adjusting the damper and locking it in position Locate in an accessible position

Insulated ducts Provide extended shaft and stand off quadrant mounting brackets

Clearly and permanently label the open and closed positions

Fresh air intake dampers Fit galvanised bird mesh where fresh air intakes are not protected by weather louvres

Dampers at outlet branches from branch mains Provide butterfly dampers at the pops on main ducts Fit damper quadrants above accessible tile ceilings Where quadrants would not be accessible provide cable operated remote damper controls accessible by removal of register cores

4.5.3 Air Balance Modules

Install 'Variflow' or equal pre-calibrated air metering plates in fresh air connections to fan coil units Allow for easy removal and exchange of plates during balancing Provide pressure tappings for measurement of pressure drop across each module

Select modules for 50Pa pressure drop as follows

Air Flow	Module Size
0 – 30 l/s	100 x 100
30 – 45 l/s	150 x 100



45 – 60 l/s	200 x 100
60 – 90 l/s	300 x 100
90 – 120 l/s	400 x 100

During commissioning exchange plates or obstruct a percentage of orifices with silicone to obtain required air flows

4 5 4 Motorised Dampers

Standard

Air control dampers for smoke control systems To AS1668 1 Clause 2 4

Type

Opposed multiblade with maximum 230 wide and 900 long blades

Rating

Maximum working pressure differential 1000 Pa

Maximum leakage 150 L/s m² at 1.5 kPa pressure differential

Maximum operating torque 5Nm per m² of damper face

Size

Select for 10m/s at maximum air flow Do not oversize

Divide dampers into sections to match actuator torque

Construction

As for *manual dampers*, and the following

- Frame seals - top, bottom and sides Flexible aluminium or stainless steel
- Blade tip seals Neoprene or silicone rubber
- Blade type Balanced
- Linkages Provide for a separate actuator for each damper section
- Provide extended spindles, with flats for actuator attachment

Installation

Maintenance access Locate dampers and damper motors in accessible positions, for blade and motor maintenance

Mounting Sufficiently rigid to prevent flexing or distortion of the frame or ductwork during operation

4 5 5 Non Return Dampers

Construction

As for *manual dampers*

- Low friction non rattling type
- Maximum blade length 750mm
- Maximum leakage 225 L/s m² at 500 Pa reverse pressure air
- Maximum air resistance 50 Pa at 2.5 m/s
- Blades ganged with gravity closing

4 5 6 Fire and Smoke Dampers

Required Manufacturer Bullocks



Specification

Comply with AS 1682 1, *Fire and smoke control in multi compartment buildings*

Provide free cross section area at least 85% of the face area

Links

Fire dampers Frangible bulb or fusible links

Smoke dampers Actuator drive

Installation and commissioning

To AS 1682 2, *Fire dampers installation*




5. Fans

5.1 Scope of work

- Provision of all fans
- All fans to come complete with spring mounts
- All fans and fan discharges exposed to weather to be internally painted with bituminous paint. All discharges to be drained
- All fans to be direct drive complete with VSD's

Fan Types to be used

System	Fan Type
Toilet/Laundry Exhaust Fantech Silent Series	

5.1.1 Fan Static Pressures

Calculate system resistances including pressure drops across dirty filters, wet cooling coils, heating coils, sound attenuators, dampers, plenums, ductwork, terminals, registers, door grilles and the like as installed.

Amend fans, drives, motors and electrical power supplies to accord with the calculated system resistances.

Where fan sound power levels exceed scheduled values, increase acoustic attenuation to achieve required sound levels. Submit acoustic calculations for review.

5.1.2 Fan Selection

Variable speed fans for variable volume systems.

Operation from full design air flow to 10% without surge, for partial occupancy.

Stability: Select and install to avoid beating and surge down to 10% less than scheduled minimum flow rate.

Fans in parallel: Fit backdraft dampers or motorised discharge dampers to all fans running in parallel to prevent backwheeling when only one fan is running.

Noise characteristics: Select fans which do not have high levels of noise at discrete frequencies under normal operating conditions.

5.2 Quality

5.2.1 Pre Completion Tests

Type tests



Type tests in NATA accredited laboratory or equivalent Type tests to be for complete fan and casing assembly of similar geometric proportions

Fan performance To BS 848 1 *Fans for general purposes methods of testing performance*,

AS 2936, SAA fan test code,

ANSI/ASHRAE 51 or ANSI/ASHRAE 210, Laboratory methods of testing fans for rating

Fan sound power levels To BS 848 2 1985, Methods of noise testing or AS 1217 3, Acoustics - determination of sound power levels of noise sources - precision methods for discrete - frequency and narrow band sources in reverberation rooms

Fan Energy Consumption AS 1359 5 2000 Rotating electrical machines – High efficiency and minimum energy performance standard

Roof mounted smoke spill fans

To BS 7346 2, Specification for powered smoke and heat exhaust ventilators
Must be Type Tested to AS 4429 1999

Production tests

Balance assembled impellers shafts and pulleys to AS 3709, Vibration and shock - balance quality of rotating rigid bodies (ISO 1940/1) grade G6 3

Test run each fan in factory and record amps drawn and freedom from vibration

5.2.2 Contractors Submissions

Submit fan type test certificates of performance and sound power levels of each series of fans

Submit performance curves for all fans showing duty point and shaft power and demonstrating stability of operation

5.3 Fans

5.3.1 Centrifugal

Selection Ensure stable operation, so that system curve intersects with fan curve where a decrease in fan volume causes an increase in pressure

Select for high efficiency and quiet operation, not more than one fan size smaller than peak efficiency selection

Arrangement AMCA standard 99-2404 arrangement 1, 3 or 9

Casings Welded steel scroll and side plates, reinforced to prevent flexing and drumming Provide split casings where necessary for installation Fans with motors 4 kW and less may have seamed zinc coated sheet steel casings

Inlet bells Removable, shaped for aerodynamically efficient air entry and close fit to impeller

Bases

General Form from fully welded steel sections or for fans 4kW motor power or less, pressed zinc coated steel

Mounting brackets Provide mounting brackets for spring mounts

Impellers

Blade type



- Duty shaft power below 4kW select forward curved or backward inclined laminar type
 - Duty shaft power 4 to 8kW select backward inclined curved laminar type
- Duty shaft power greater than 8kW select for greater efficiency either backward inclined aerofoil or laminar type
- Characteristics
- Keyed to drive shafts using taper lock fixing devices or taper keys
- For overhung driven fans, retain onto drive shafts using positive devices such as washers and set screws into tapped holes in shaft ends

Shafts

Characteristics Provide the following

- Designed so that the first critical resonant speed of the shaft is 30% greater than maximum operating speed
- For double width fans with shaft diameter >60mm provide filleted, stepped type to permit easy impeller removal
- Keyed with taper lock pulley hubs
- Countersunk ends for tachometer application

Material Mild steel or high tensile steel, as appropriate for the duty Provide corrosion protection

Fan Bearings

For single width fans with impellers <1200mm outside diameter and for double width fans with impellers <1050mm outside diameter Provide pillow-block mounted, self aligning ball bearings, to AS 2729, *Rolling bearings dynamic load ratings and rating life* sealed for life, with a basic rating life with 10% failure, L10, of 35,000 hours

For larger fans Provide plummer-block mounted self-aligning roller bearings to AS 2729, with basic rating life with 10% failure, L10 of 35000 hours with seals and grease relief Extend grease nipples for ready access

Allow for thermal expansion of the shaft, and clamp bearings to shaft and housing by taperlock

Replace fan bearings with wooden blocks where shipment to site is over unsealed roads and refit bearings prior to commissioning

Motor Selection

Power rating For backward inclined impellers with non overloading characteristic select for at least 15% above limit load fan shaft power at design speed (to enable fan speed to be increased by 5%) plus 10% drive losses

For forward curved impellers as for backward inclined plus additional 20% for overloading characteristic

Belt drives

Standard To AS 2784, Endless wedge belt and V belt drives

Drive sizing Service factor 1.3

Pulleys For motors 5.5 kW and above, fit taper lock on fan and motor shafts Balance all pulleys to AS 2784

Belts Wedge belts to AS 2784 Multiple belts to be matched sets



Specification for ARV Warriewood Brook Retirement Village Stage 3 – Collaroy Mechanical Services

Drive adjustment Provide for adjustment of belt drive tension and alignment by either movement of motors on slide rails or by pivoting support. Adjustment by jack bolts with lock nuts. Clamp motors in place. Adjust belt tension initially and after run-in to AS 2784 Appendix B, using spring scale.

Couplings

Fit flexible couplings to all direct driven fans where fan and motor have separate bearings.

Variable Inlet Vanes

Where scheduled provide balanced low friction variable inlet vanes and linkages to reduce fan capacity to 25% of full open flow. Link both sets of vanes of double inlet double width (DIDW) fans.

Guards

Provide belt guards complying with safety standards and

- Rigid, removable and totally enclosing the drive and exposed shafts
- Provide tachometer openings at fan and motor shafts. Belts to be clearly visible and belt tensioning to be with guard in place
- Weatherproof, ventilated and drained where exposed to weather

Provide inlet and outlet guards where fans are not connected to ducting. Provide shaft and coupling guards for exposed shafts.

Finishes

External surfaces Equipment paint system, using GPC-P-162 primer

Internal surfaces Prime with zinc phosphate primer to GPC-P-162

5.3.2 Centrifugal - In - Line

General

Provide fans with non-overloading power characteristics

Selection

As for centrifugal fans

Construction

Casings

- **Steel or aluminium** Rectangular or circular with spigot or flanges for duct mounting, of zinc-coated steel sheet, spot welded. Paint spot welds. Provide access panels in rectangular casings for fan and motor removal.
- **Fibreglass or plastic** Fire retardant moulded fibreglass or impact resistant plastic with integral support foot applicable to fans up to 300 diameter

Motors Direct mounted to impellers

Electrical connection Provide terminal boxes external to fan casings and wired to fan motors



5 3 3 Axial Flow Aerofoil

Selection

Select fans with high efficiency and low noise level, in the stable region, clear of blade stall and maximum speed 24r/s and between 50% and 80% of peak pressure. Blade pitch angle to be close to mid range and not less than 5° from the maximum pitch angle for which performance data is published.

Select adjustable pitch fans and motors to allow for 5% increase in airflow and 10% increase in pressure above design.

Casings

Tubular, long type, constructed from mild steel, fully welded, hot dip galvanised to AS 1650 *Hot dipped galvanised coatings on ferrous articles* after fabrication. Provide 50 mm sight hole with closure, for impeller inspection.

Fans 450 diameter and above to have flanged casings and mounting brackets.

Impellers

General Provide aerofoil section blades. All fans exceeding 500W shaft power to have taper lock hubs and adjustable pitch blades with facility for pitch angle measurement. Blade angles to be factory preset.

Material UV stabilised glass reinforced polypropylene (excepting smoke exhaust fans), or cast aluminium. Impellers 1250mm diameter and above to be cast aluminium.

Balancing Balance all impellers. Fans up to 500 diameter may be statically balanced by selective assembly. All other fans to be statically and dynamically balanced.

Motors

General Direct mount to impellers. Adjustable pitch fans, allow power rating 15% greater than limit load shaft power at design duty to enable air flow to be increased by 5%.

Control Provide speed controllable motors for variable volume systems.

Electrical connection

Provide terminal boxes external to fan casings and wired to fan motors excepting flame proof motors with motor mounted terminals.

Open inlets/outlets

Inlet cones Provide aerodynamically shaped cones to inlets of fans.

Guards Provide galvanised steel or bronze mesh guards.

5 3 4 Roof Mounted

Impellers

Types Centrifugal, mixed flow, aerofoil axial or propeller as scheduled.

Selection Stable with high efficiency and low noise.

Vibration Balance statically. Mount motor resiliently.

Housings

General Provide compact housings enclosing fans and motors and fitted with square weathering skirts.

Material UV stabilised ABS, polypropylene, polyethylene, glass fibre reinforced polyester or zinc coated steel of neutral colour.



Corrosion protection Zinc plated or hot dip galvanised steel components

For vertical discharge type, provide weatherproof backdraft dampers to prevent rain entry when idle Dampers to close against wind pressures

Birdmesh Where backdraft dampers are not fitted, provide birdmesh guards

Motors

Control Provide speed controllable motors for variable volume systems

Mountings Resilient neoprene antivibration

Electrical connection

Provide terminal boxes external to fan casings and wired to fan motors

Kitchen exhaust fans Provide clean out doors and plugged drain holes

5 3 5 Marking

Labels

Show the following

- Manufacturer's name
- Model
- Serial number
- Size
- Direction of rotation, marked on casing

5 4 Installation

5 4 1 Installation

On Site Storage

Ensure impellers are free to rotate to prevent Brunelling of bearings, and protect motors and bearings from weather

Access

Arrange fans and accessories to allow service access for maintenance and removal and for replacement of assemblies and component parts, without disturbance of other items of plant

Duct connections

Arrange ductwork to ensure smooth air flow entering and leaving fans

Provide flexible connections to prevent transmission of vibration to ductwork Locate flexible connections at ducted inlets one diameter upstream to minimise turbulence in the entering air Provide duct transitions between fans and flexible connections, rigidly connected to the fans

5 4 2 Commissioning

Change pulleys of constant speed belt driven fans to adjust total air flow rate



6. Piping

6.1.1 Standards

General

Gas piping AG601 *Gas installation code*, or AG603 *Gas distribution code*

Hot water supply To AS 3500 4 1, *Hot water supply systems - Performance requirements*, and AS/NZS 3500 4 2, *Hot water systems acceptable solutions*

Pressure piping Comply with AS 4041, *Pressure piping* to statutory requirements

Refrigerating Systems To AS 1677, *Refrigerating systems*

Water supply To AS/NZS 3500 1 1 *Performance requirements* and AS/NZS 3500 1 2 *Acceptable solutions*

6.1.2 Design

Design

Design piping and supports to accommodate fluid pressures, weight of full piping, seismic loading, thermal expansion building movement and plant vibration

Performance

Design pressure

- Not less than the maximum hydrostatic head at the location plus the pump shut off head at the maximum impeller size
- Comply with the schedule of piping systems

Hydrostatic test pressure 1.5 times design pressure or 1 MPa, whichever is the greater measured at the lowest point of the system

Schedule of Piping Systems

System	Design Pressure (MPa)	System Type	Piping Material
Heating hot water	1.0 at 99°C	Closed	Pipes ≤ 100DN Copper Pipes > 100DN Copper or Steel
Heating hot water floor coils	0.5 at 60°C	Closed	Polyethylene
Vent pipes to open expansion tanks	1.0	Open	Copper
Condenser water	1.0 at 40°C	Open	Pipes ≤ 200DN Copper Pipes > 200DN Stainless steel
Refrigerant R410A	1.5	-	Copper for refrigeration
Cold water	1.0	Open	Copper
Drains	0.2	Open	Generally Copper Ceiling spaces Copper or UPVC
Gas, natural or LP	AG 601		Steel or copper



6.2 Piping

6.2.1 Copper Piping For Water Pipes

Standard ≤DN 100 type B, hard drawn to AS 1432, Copper tubes for plumbing, gas fitting and drainage applications

DN125, DN150 type A hard drawn to AS 1432, Copper tubes for plumbing, gas fitting and drainage applications

Fittings

Capillary fittings including adaptor capillary fittings with threaded ends or compression type connector ends. Copper or dezincification-resistant copper alloy to AS 3688, *Water supply copper and copper alloy body compression and capillary fittings and threaded end connectors*

Compression fittings including adaptor compression fittings with connector-ends for screwed or capillary joints. To AS 3688, flared type, of copper or dezincification-resistant copper alloy, up to 20mm diameter. Do not use olive type joints

Joints

Unions Bronze proprietary manufacture with ground or accurately machined face joints DN50 maximum

Flanges Brazing metal to AS 2129, *Flanges for pipes valves and fittings*

Flange bolts and nuts Above ground - zinc plated steel or stainless steel
Underground - bronze or DZR copper alloy

Alternatively for underground use zinc plated steel with insulating flange kit and wrap joint with mastic tape for protection against soil attack

Permanent Joints Provide brazed slip joints. Use either capillary fittings, or expand one pipe over the other using heat and forming tools leaving a minimum clearance and an effective overlap

Slip joint overlap table

Nominal pipe size, DN	Overlap (mm)
≥ 15, < 20	12
≥ 20, < 32	15
≥ 32, < 50	25
≥ 50, < 80	30
≥ 80, < 125	35
≥ 125, < 200	40

Demountable joints Expand pipes into unions or flanges and braze

Roll grooved water piping Victualic style 606 or approved equal

6.2.2 Copper Piping For Refrigeration

Pipes

Standard To AS 1571, *Copper seamless tubes for air conditioning and refrigeration*

Material Alloy 122 to AS 2738.2, *Copper and copper alloys compositions and designations wrought products*



Fittings and Joints

Refrigeration grade silver soldered capillary fittings, Yorkshire or equivalent

Installation

During installation continuously purge piping with dry nitrogen Plug open ends and maintain cleanliness of piping

6.3 Valves and Fittings

6.3.1 General

Function

Provide all valves, fittings and accessories necessary for operation, control and maintenance of the systems

Boilers and unfired pressure vessels

Provide valves and fittings to AS 1271 - *Safety valves and other fittings for boilers and unfired pressure vessels*

Components

Valve size Generally the nominal pipe size, unless a smaller size is necessary for throttling purposes or flow measurement

Insulated valves Provide extended shafts or bodies to butterfly and ball valves to allow full thickness of insulation

Connections

- Valves ≤DN 50 Screwed to AS 1722 1, Pipe threads of Whitworth form - sealing pipe threads
- Valves > DN 50 and valves in headers Flanged Table E to AS 2129, *Flanges for pipes valves and fittings*

Handwheels and handles Removable, with the direction of closing marked permanently on handwheels Drain cocks and vents may have diamond head

Valve closure Clockwise unless required otherwise by statutory authority

Flow direction markings Cast arrows on valve bodies

Copper alloy valves and valve spindles Dezincification resistant and stamped accordingly

6.3.2 Materials

Standards

Cast iron Grade T 220 minimum to AS 1830, *Iron castings grey cast iron*

Spheroidal graphic (S G) cast iron Grade 500 320 7 to AS 1831, *Iron castings spheroidal or nodular graphite cast iron*

Cast steel To ASTM A216 WCB heat treated

Bronze Alloy C83600 to AS1565, *Copper and copper alloys ingots and castings*

Copper Alloy Dezincification resistant, to AS 1628, *Water supply copper alloy gate globe and non return valves and AS 2345, Dezincification resistance of copper alloys*

Stainless Steel To AS 1628

Other Materials To AS 1628



Galvanic Compatibility

Select materials for valves and fittings which are less susceptible to corrosion than adjacent piping Do not use steel fittings in copper piping Do not use aluminium components in water piping systems

6.3.3 Water Valves and Accessories

Application

Systems Heating hot water and condenser water

Selection

Working pressure rating Minimum 1.4 MPa minimum or higher to suit the system pressure requirements

Working temperature rating To suit the system requirements

Gate valves

Standards

- Bronze valves To AS 1628, Water supply -copper alloy gate, globe and non return valves
- Flanged cast iron valves To AS 3579, *Cast iron wedge gate valves for general purposes*

Construction

- Body ≤DN 80 Bronze, > DN 80 Cast iron
- Seats Integral seats for bronze valves, replaceable bronze seats for cast iron valves

Ball valves

Size limit DN50 maximum

Construction

- Body Bronze or stainless steel grade 316
- Ball Hard chromed brass or stainless steel grade 316

Stem Stainless steel grade 316

Seat PTFE

Gland seal Adjustable

Reduced bore ball valves Constructed as for full bore ball valves May be used for air vents and gauges only

Butterfly valves

Standard To BS 5155, *Specification for butterfly valves*

Size limit DN 50 minimum

Manual Operation

- ≤DN 150 10 position lever Provide adjustable quadrant stop for throttling duty
- > DN 150 Geared or motorised operators

Construction

- Body Cast aluminium or cast iron
- Shaft Stainless steel grade 316
- Disc Stainless steel grade 304 and for condenser water systems grade 316
- Seat EPDM, replaceable

Globe Valves

Standards Bronze valves to AS 1628, *Water supply copper alloy gate globe and non return valves*

Construction

- Body ≤DN 80, Bronze
> DN 80 Cast iron
- Seats Bronze
- Stem ≤DN 50 Copper alloy
>DN 50 manganese bronze or stainless steel

Calibrated balancing valves

Measuring accuracy at design flow ±5%

Size To match pipe size



Construction

- Body Copper alloy or cast iron
- Seat PTFE

Submissions Provide selection details k_v values, and percentage of opening turns for design flow and pressure drop

Installation Provide straight entering and leaving piping to manufacturers recommendations

Flow limiting valves

Selection

Capacity Design flow +10%, -5%

Working pressure differential 22 to 210 kPa unless noted otherwise

Construction

- Body To suit the piping and fluid, with extended external tappings for pressure differential and temperature
- Cartridge Passivated stainless steel, spring loaded type, incorporating a self cleaning variable ported piston stamped with the manufacturer's identification number Precalibrated and site interchangeable cartridge and spring

Marking Identity, valve type and capacity

Installation Install in a section of piping between isolating valves to facilitate core removal Fit cores only when pipe flushing is complete Provide straight entering and leaving piping to manufacturers recommendations

Non return valves

Disc type

- Size ≤ 50 mm
- Body Stainless steel or bronze
- Disc and spring Stainless steel

Swing type To AS 1628, *Water supply copper alloy gate globe and non return valves*

Size ≤ 80 mm

- Body Bronze alloy or cast iron to AS 3578, Cast iron non-return valves for general purpose
- Plates Bronze alloy or stainless steel

Dual flap type

- Size ≥ 80 mm
- Body Cast iron
- Pin and spring Stainless steel
- Seat Integral EPDM
- Plates Bronze alloy or stainless steel

Pressure relief valves

Standard To AS 1271, *Safety valves other valves liquid level gauges and other fittings for boilers and unfired pressure vessels*

Size 25 mm minimum

Construction

- Body Bronze alloy or cast iron
- Valve disc and seat Bronze alloy or stainless steel

Installation Connect discharge to waste

Pressure reducing valves

Construction

- Body Bronze alloy or cast iron
- Valve disc and seat Bronze

Ball float valves

Design Balanced piston type M E Mack 9100 series or similar

Selection High or low pressure to suit application Valves $\geq DN80$ pilot operated



Specification for Mechanical Services ARV Warriewood

Copper alloy To AS 1910, *Water supply float control valves for use in hot and cold water* Bronze alloy body, needle and pins

Cast iron Cast iron body, bronze needle and pins

Installation Set low operating level for feed and expansion tanks Adjust level of cooling tower sumps to avoid vortexing of suction or overflow on shutdown

Strainers

Selection Flow resistance K factor 7 maximum

Size Pipeline diameter

Construction

- Body Bronze alloy or cast iron, Y type
- Screen Stainless steel
- Basket Holes 1mm dia where flow limiting valves are used

Strainers > 50mm diameter Fit 20mm ball valve blowdown

Automatic air vents

Construction

- Body Copper alloy, DN20 minimum excepting for radiant heating systems
- Float Non metallic
- Seat Stainless steel

Installation Fit isolation valves

Vacuum breaker valves

Construction

- Body Copper alloy or stainless steel
- Valve and seat Stainless steel

Gauge cocks

Description 90° action petcocks or ball cocks with lever handles

Material Bronze alloy

6 3 4 Refrigeration Valves and Accessories

Selection

Pressure rating To suit refrigerant and to suit system pressures

Materials Highly resistance to corrosion by refrigerant or oil Forged steel or forged brass

Isolation Valves

Back seating, key operated type with packed seal cap Hudson, Heldon or equal approved

Regularly operated valves to be packless type with handwheels

Valves for copper tubing to have solder type ends or flanged ends with soldered flange adaptors

Thermostatic expansion valves manufacture Danfoss, Sporlan or equal approved

Sensing bulbs Mount in pocket or in contact with pipe, without direct contact with refrigerant or oil

Solenoid Valves Select for low pressure drop

Refrigerant Strainers

Type Angle, cleanable without pipe disturbance

Material <50mm - Bronze alloy bodies with solder joints



≥ 50mm - Steel or cast iron with flanged ends

Screens Bronze alloy or gun metal with perforations 0.25mm maximum for liquid lines, 0.5mm for gas lines
Screen free area not less than 5 times pipe area

6.4 Piping Installation

6.4.1 General

Installation

General Install piping in straight lines at uniform grades. Arrange to prevent air locks or liquid trapping. Provide sufficient unions, flanges and isolating valves to allow removal of piping and fittings for maintenance or replacement of plant.

Layout Run piping parallel or at right angles to adjacent building elements. Co-ordinate to clear other services.

Arrangement Arrange and support piping so that it remains free from vibrations whilst permitting necessary movements. Minimise the number of joints and fittings.

Spacing Provide at least 50 mm clear between pipes and between pipes and building elements, additional to insulation.

Concealment Conceal piping in occupied areas where possible.

Accessibility

Provide access and clearance at fittings which require maintenance or servicing, including control valves and joints intended to permit pipe removal. Arrange piping so that it does not interfere with the removal or servicing of associated equipment or valves or block access or ventilation openings.

Locate valves, strainers, thermometers, pressure gauges and the like so that they are easily operated or read.

Arrangement

Install valve handles to common centres and common heights.

Space piping for clearance around insulated pipes.

Cleaning

General Before installation, clean piping and remove loose scale, burrs, fins and obstructions.

Protection During construction prevent the entry of foreign matter into the piping system by temporarily sealing the open ends of pipes and valves using purpose made covers of pressed steel or rigid plastic.

6.4.2 Joints

General

Minimise the number of joints. If practicable, provide welded or brazed joints or a proprietary pipe coupling system.

Do not use ring jointing for suspended pressure piping.

Do not use graphite based jointing compounds for systems containing copper, copper alloys or stainless steel.

Equipment Connections

Fit demountable connections adjacent to equipment with screwed connections. Fit demountable bends between isolating valves and heat exchangers, condensers and chillers to facilitate dismantling for cleaning.



Flanged joints

Metal flanges Full face flanges with undistorted machined joint faces, to AS 2129, *Flanges for pipes valves and fittings*

Minimum flange thickness 12 mm

Bolting To AS 2129 Appendix C

• Material

- Non-corrosive environments Zinc-plated steel
- Corrosive environments Material with equivalent corrosion resistance to, and compatible with, the flanges

Flange jointing material Preformed proprietary type at least 0.8 mm thick

Installation Do not correct misalignment by bolting

Screwed joints

To AS 1722 1, *Pipe threads of Whitworth form sealing pipe threads* Do not use long screws or barrel nipples
Seal threads of screwed connections using degreased PTFE tape or a thread sealing compound

Non Conductive Joints

Install electrically insulating joints wherever there is a change in metallic piping materials eg , steel to copper

Install non conductive joints where piping connects to equipment of dissimilar material eg , copper piping connections to steel hot water unit or chillers

Install non conductive joints where underground piping enters a building Provide flanged non-conductive joints with insulating flange gaskets, bolt sleeves and washers for bolts and nuts

Electrically insulate pipes of dissimilar materials from their pipe hangers by wrapping the pipe and/or hanger with insulating material

Test the electrical isolation of each non conductive joint and demonstrate >200mV potential between dissimilar metals

Alternatively install suitable non metallic pipe spacers 150mm long between dissimilar metal pipes Use UPVC, PE, ABS or reinforced neoprene In this case insulation of hangers and testing of electrical isolation is not required Anchor piping on each side of spacer

6.4.3 Supports

General

Design of supports To AS 4100, *Steel structures*

Support piping without sag, with falls for complete venting and drainage, with flexibility for expansion, contraction and vibration isolation Provide clamps, hangers, spreader beams, trapeze hangers, secondary steelwork, guides, pipe anchors, expansion devices, brackets, fixings and the like

Arrange supports to prevent pipes from transferring stress to connected equipment

Provide independent supports for metallic valves and fittings in non metallic pipe lines

Support spacing

Metallic pipe As tabulated



Specification for Mechanical Services ARV Warriewood

Non-metallic pipe Contents <20°C as tabulated Contents >20°C Half tabulated spacing

Capillary tubing Clip to cable tray at 400mm centres

Pipe Support Spacings Table (m max)

Nominal pipe size, DN	AS/NZS 3500 1 Table 5 2
	Copper, copper alloy stainless steel
15	1 5
20	1 5
25	2
32	2 5
40	2 5
50	3
65	3
80	4
100	4
125	4
150	4

Construction

Welding of supports and anchors To AS 1554, *Welding of steel structures*

Supports exposed to weather and in damp areas Hot dip galvanised steel

Other locations Steel with zinc chromate primer

Clamps and hangers

- Use saddle clamps only for pipes ≤DN 20 which operate at ambient temperature
- Use two piece pipe clamps with clevises and hanger rods for larger sizes provided the ratio of effective rod length, measured between hanger rod pivot points, to maximum pipe movement exceeds 6 1 Millstrut PC7 or PC 10 or similar
- Use heavy duty clamps for pipes ≤DN 65, Millstrut PC 2 or similar
- Hanger rods shall pass through clearance holes, with spherical washers and locknuts, excepting where ratio of effective length to pipe movement exceeds 12 1, where flat washers may be used Set hangers to be vertical at mean temperature
- Connect hangers for light piping to vertical of purlins and not to flanges

Hanger Size Table

Provide adjustable threaded hanger rods as tabled below

<u>Nominal Pipe Size (mm)</u>	<u>Minimum Rod Diameter (mm)</u>
Up to 50	10
65 to 90	12
100 to 125	16
150	20
200 to 300	25

Slides and rollers



Specification for Mechanical Services ARV Warriewood

Slides Steel sliding supports and guides with PTFE bearing surfaces may be used for movements $\leq 20\text{mm}$ for pipes $\leq \text{DN } 250$

Rollers Use roller supports and guides for pipes $> \text{DN } 250$ or movements $> 20\text{mm}$ Roller supports shall have two rollers each supported at each side by a cradle bracket Rollers shall be inclined at 30° to resist earthquake movements Provide lateral and top restraint where necessary Fully design these systems

Bearing surface for slides or rollers Attach bearing surfaces to stand off brackets welded or clamped directly to pipes, extending through insulation Seal vapour barriers to brackets

Pipe Attachments

Dissimilar metals If pipe and supports are dissimilar metals, provide industrial grade electrically non-conductive material secured to the pipe or hanger to separate them

Uninsulated pipes Clamp directly to steel pipes Slides or rollers may bear directly on steel pipes, however, reinforced bearing surfaces shall be secured to other types of pipes

Insulated pipes

- Spacers for pipe clamps Provide split cylindrical spacers between clamps and pipes Spacers to match insulation thickness and extend 25mm either side of supports

Spacer material

- Use rigid insulating material of sufficient strength to support the piping and suitable for the temperature application, such as wood, high density cork or foamed glass For cold pipes apply aluminium foil tape over the circumference of the spacers to form a vapour barrier before installing support brackets

Earthquake Bracing

Standard To AS 1170.4

Description In addition to normal pipe supports provide lateral supports to all suspended piping to resist horizontal forces in any direction of equal to half the weight of piping

Lateral bracing At every support, alternating from side to side for suspended piping

Longitudinal bracing At every second support of ambient temperature piping, alternating along the line of pipe For hot and cold piping design anchors to resist earthquake loads

Detailing Bracing to be horizontal or inclined up to 60° above horizontal, of similar size as support bracing, to allow pipe expansion, and fitted with vibration isolation where necessary

Support of multiple pipes

Horizontal pipes Use trapeze hangers, support brackets or pedestals

Vertical pipes Anchor risers not subject to expansion to galvanised steel channels at all floors Anchor expanding risers centrally or at base and provide guides at all floor levels

Support of branch pipes from thermally expanding mains

- Branches $\leq 65\text{mm}$ Flexible support by spring hangers for 5m from main
- Branches $> 65\text{mm}$ Flexible support by spring hangers for 10m from main



Embedded piping

Application Do not embed piping carrying heated or cooled fluids excepting for floor heating coils

Movement Wrap metal piping chased into masonry or encased in concrete with 4mm Denso rock wrap or equal so that movement can take place without damage to the pipe or the surrounding element

Construction Embedded piping shall be heavy wall Weld all embedded joints

6 4 4 Valves and Fittings

Valves

Requirement Provide isolating valves at all plant connections and provide throttling or balancing valves in all parallel circuits

Location Install in easily accessible positions If practicable, install with the stem horizontal

Removal Provide unions adjacent to screwed valves and fit retaining flanges to wafer valves to allow removal of adjoining piping without disturbing the valve

Working clearance Fit straight pipe to provide clearance for free movement of discs of dual flap or disc type check valves and butterfly valves

Flow measuring valves Provide at least 6 pipe diameters of straight pipe on the upstream side and 2 pipe diameters of straight pipe on the downstream side Install with pressure tapings accessible

Bends and Tees

Use long radius elbows with centreline radius 1 5 times pipe diameter, where practicable Piping bent on site shall be free of flattening or corrugation Use swept branch connections Do not use mitred fittings

Strainers

Fit strainers to the inlets of all pumps Install in a section of piping between isolating valves with space for basket removal

6 4 5 Drains and Vents

Equipment drains

Provide valved drain points at low points of equipment holding water such as condensers, chillers, hot water unit, coils and heat exchangers

Piped drains

Provide drains from pump glands, condensate trays, fresh air plenums primary automatic air vents, and relief valves

Drain size Unless shown otherwise DN 25 minimum falling at 1 80, maximum 6m long For longer runs use DN32 at 1 100 fall Drains in ceiling spaces DN 40 minimum falling at 1 500 Match equipment connection size if larger

Traps Fit water seal traps to condensate drains from air handling plant Seal depth to be sufficient to prevent blowout Provide transparent connecting hose or air break at seal outlet Seal drain line penetrations through equipment casings Make demountable connections to equipment

Discharge Pipe drains to waste points via air breaks Provide facility for rodding drains Locate drains away from damage and cover sections exposed to damage with zinc coated steel top hat sections

Rodding openings Install plugged crosses in lieu of elbows or tees

Drainage of water piping



Specification for Mechanical Services ARV Warriewood

Provide full sized dirt legs and valved drains at bottom of pipe risers and at low points to enable system to be completely drained and refilled. Provide capped hose nipples for draining and filling hose. Allow for rodding of drains and valves.

Water Piping Drain size table

Size of pipe to be drained, DN	Size of drain and valve, DN (minimum)
≤100	25
>100, ≤200	32
>200	50

Air venting of recirculating water systems

Primary Air Vents Provide primary air vents at the highest points of supply and return piping of each system. Fit 150 mm high air collecting pots set vertically above the pipes, and of pipe diameter. Fit 15mm automatic float air vent/vacuum breakers with isolating ball valves and pipe outlets to drains.

System Air Vents Provide 15mm minimum automatic air vents with isolating ball valves at the following locations:

- All high points of the system
- At the downstream end of sections horizontal piping in which air may collect

Manual Air Vents Fit manual air vents to pump volutes, coil headers, heat exchangers, and panel and baseboard radiators.

Grading

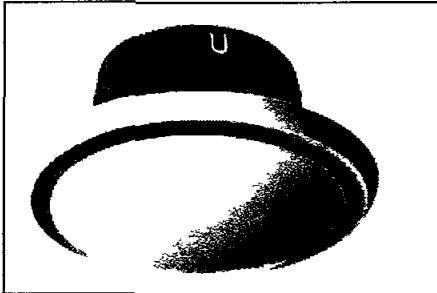
Water systems Run piping horizontally or rising in the direction of flow. Use eccentric reducers installed with top level.



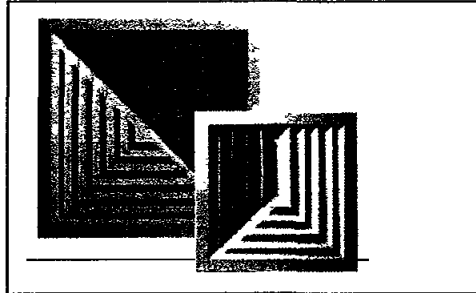
7. Registers, Diffusers and Grilles

7.1 Project Grilles Types

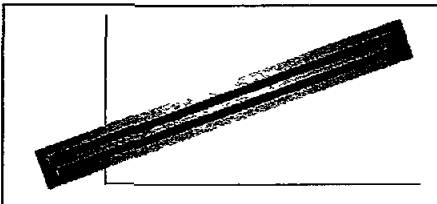
Residential – Toilet/Laundry Exhaust



Standard Apartments – AC Supply Air



Premium Apartments – AC Supply Air



7.2 Quality

7.2.1 Type Tests

Provide registers and diffusers identical to prototypes which have been type tested and rated in accordance with Air Diffusion Council ADC 1062 GRD84, *Test code for grilles registers and diffusers* or ANSI/ASHRAE 70, *Methods of testing for rating the performance of air outlets and inlets* and AS 1217 *Acoustics determination of sound power levels of noise sources* in a NATA approved test facility

If type test certificates are not available or are inadequate, conduct type tests as necessary

Test shall include air throws and static pressures for various air flow rates at two terminal velocities and sound power levels generated and sound absorption including end reflection, by octave bands. For outlets to be fitted with volume control dampers, ensure that during acoustic tests the pressure loop through dampers exceeds 15 Pa

Submit type test certificates for each type of supply air diffuser

7.2.2 Samples

Submit samples of each type of register, diffuser and grille

7.3 Diffuser Performance

7.3.1 Air Distribution During Cooling

Select air diffusers for air conditioned spaces for Air Diffusion Performance Index (ADPI) : i80



Specification for Mechanical Services ARV Warriewood

Determination Method of Testing for Room Air Diffusion, ANSI/ASHRAE 113, *Method of testing for room air diffusion*

Conditions

- Constant volume systems - full cooling

Allow for 24°C room temperature and 12°C supply air temperature

7.3.2 Air Distribution During Heating

Select perimeter registers for heating to ensure that the throw from overhead diffusers reaches to floor during heating cycle, to minimise stratification and ensure that supply air does not short circuit to high level returns

Noise Levels

Select registers, diffusers and grilles to meet the noise levels required for the space with allowances for the characteristics of the space and contributions from other registers and other mechanical and electrical noise sources

For continuous slot diffusers noise levels shall apply to 3.6m length of diffuser

Refer to *Noise and Vibration* Section

7.4 Universal Requirements

Registers, diffusers and grilles shall comply with the following

7.4.1 Material and Finishes

Material Zincanear sheet or aluminium

External finish Thermoset powder coated, colour as selected by the Superintendent unless shown otherwise
Submit colour samples for approval

Internal finish Pattern blades, volume controllers and internal components painted matt black

7.4.2 Appearance

Provide proprietary grilles

- free from distortion, bends, surface defects, irregular joints, exposed fastenings and rattles or vibration in operation
- with neatly mitred corners and well fitting joints

7.4.3 Removable Cores

Provide removable register cores where necessary for access to filters, fire dampers and the like

7.4.4 Fixing

Provide registers, diffusers and grilles with frames for flush mounting in T-bar, tile, plaster or other construction to suit the project

Provide concealed spring clips for fixing



7 4 5 Register Dampers

Provide balancing dampers behind all registers, diffusers and grilles excepting door relief grilles, transfer grilles and return slot diffusers

Type Opposed blade with concealed adjustment through register faces without removing cores

Construction Dampers which are free of rattles, fluttering or slack movement, and capable of full adjustment without excessive self generated noise

7 4 6 Register Plenums

For all diffusers connected by flexible ducts, provide sheetmetal plenums with side mounted circular spigots

Do not use neck reducers

For diffusers in hard plaster ceilings fit spigot mounted butterfly dampers operated through the register face

Acoustic or thermal insulation not required

Support Independently from above

See below for light air boots and linear diffuser plenums

7 5 Types of Registers, Diffusers and Grilles

7 5 1 Light Air Diffusers

Standard Generally to Section 5 of AS 2946, *Suspended ceilings recessed luminaires and air diffusers interface requirements for physical compatibility*

Type Single sided or double sided as shown, with 20mm wide single slots unless shown otherwise

Pattern control Fixed horizontal outward air pattern controlled by J shaped extruded aluminium low noise pattern blade Pattern blades of double boots to be adjustable to close off air flow to either side for tenancy fitout Omit linear volume control dampers

Airboots

Duct connections Single boots Oval inlets to suit 150 diameter flexible duct
Double boots Oval inlets to suit 200 diameter flexible duct

Material 0.8mm zincanneal

Air leakage Ensure tight jointing of plenum Airway to be independent of luminaire

Thermal or acoustic insulation Not required

Inactive slots in luminaires Leave open as return air path

Co-ordination Co ordinate dimensions, tolerances and mounting with luminaire manufacturer to ensure correct fit and pattern control Luminaire dimensions to AS 2946 Section 4

Installation Ensure correct register between boots and luminaires



Specification for Mechanical Services - ARV Warriewood

7 5 2 Linear Slot Diffusers

Type Continuous multiple slot extruded T-bar diffusers with pattern blades and plenum boxes

Dimensions 20mm slots at 40mm centres

Pattern control Independently adjustable 180° for each slot

Set and secure patterns as shown on drawings

Volume control Linear volume control blades are not required

Mounting To suit ceiling type Concealed brackets

Material Plenums 0.8mm zincanneal

Pattern blades extruded aluminium

Air leakage Ensure tight jointing of plenums Provide plenum ends

Joints Provide precision butt joints in diffuser at centres to match building modules with fasteners to align each joint

Corners Factory fabricated mitre corner pieces

Supply Plenums Maximum length 1200mm

Inlets Circular, centrally on side

Internal Width To match diffuser

Internal Height Inlet size plus 25mm

Low headroom plenums Where necessary reduce plenum lengths and hence inlet diameters and plenum heights Do not use high velocity reduced area plenum inlet connections such as oval connections

Return air sections Provide open airway

Inactive sections Extend inactive diffusers as shown Fit matt black blanking plates

Installation Straight and true

7 5 3 Linear Plenum Diffusers

Type Plenum diffusers designed to suit ceiling T bar system installed by other contractors

Number of slots 2 or 3 as shown

Arrangement Linear plenums with linear outlets and air pattern controls and oval duct inlets

Pattern Control Independently adjustable 180° for each slot Set and secure patterns as shown on drawings Provide linear damper for flow equalisation

Material Plenums 0.8mm zincanneal Pattern blades - extruded aluminium

Air leakage Ensure tight jointing of plenums Airway to be independent of T-bars

Supply plenums Maximum length 1200mm



Internal width Inlet size plus 25mm

Inlets Circular centrally on side

Low headroom plenums Where necessary reduce plenum lengths and hence inlet diameters and plenum heights Do not use reduced area plenum inlet connections such as oval connections

Thermal or acoustic insulation Not required

Return air sections Provide open airway

Inactive sections Extend inactive diffusers as shown Fit matt black blanking plates

Co ordination Co ordinate dimensions, tolerances and mounting with T-bar installer Ensure correct register between boots and T-bars to maintain required air distribution pattern and minimise air leakage between diffuser and plenum

Installation Support linear plenum diffusers independently from above

Louvre Face Ceiling Diffusers

Type Multi bladed, square or rectangular with removable cores

Blow control Fit baffles behind four-way faces to provide 3 way, 2 way or 1-way blow where shown Provide special 3 way, 2-way or 1 way blow cores only where specifically shown

Accessories Provide register plenums

Square Plaque Diffusers

Air pattern Horizontal for VAV cooling

Pattern control Vertical adjustment of plaque

7 5 4 Universal Supply Registers

Type Double deflection universal, with individually adjustable longitudinal aerofoil front blades and transverse rear blades

Blade spacing 20mm maximum

Blade adjustment $\pm 45^\circ$

Blade supports 600mm maximum centres

Frames For circular ducts, frames to match duct curvature

Installation Where register plenums are not used, fit multi bladed stream splitter dampers at register take offs to equalise air velocities

7 5 5 Door Relief Air Grilles

Type Horizontal chevron blades with double sided telescopic frames

Material Extruded aluminium blades and frames



Specification for Mechanical Services - ARV Warrewood

Ratio of free area to nominal face area for 600 x 600 grille to be 60% minimum, where the free area is the product of the diameter of a sphere which can pass through the airway, the length of the airway, and the number of airways and the face area is the area measured inside the frame

Blade spacing 25mm centres maximum and sight-proof when viewed from the same level

Light proof grilles Provide black finished double chevron door relief grilles where shown

7 5 6 Wall Mounted Half Chevron Grilles

Wall mounted Single deflection universal grilles

Application Return and exhaust

Type Adjustable straight aerofoil horizontal blades

Ratio of free area to nominal face area from 600 x 600 grilles, where the free area is the product of the diameter of a sphere which can pass through the airway, the width of the airway, and the number of airway 60% minimum

Blade spacing 20mm centres maximum and sight proof when viewed from the same level

Mounting Invert grilles > 1500 above floor level

7 5 7 Wall Mounted Single Deflection Universal Grilles

Application Return and exhaust

Type Adjustable straight aerofoil horizontal blades

Material Extruded aluminium blades and frame

Blade spacing 20mm maximum

7 5 8 Egg crate Grilles

Application Ceiling or high wall mounted for return, relief or exhaust air

Type 12 5 x 12 5 x 12 5 mm maximum egg-crate with 1 0mm thick aluminium core and aluminium frame

7 5 9 Mesh Grilles

Light duty type Construct using 1 5mm thick galvanised steel or bronze wire at 12mm centres fixed into a folded zinc-coated steel or aluminium frame

Heavy duty type Construct using 3mm thick galvanised steel or bronze wire at 20mm centres, welded into a 3mm thick galvanised steel frame

7 5 10 Weather Louvres

General

Provide weather louvres or cowls to all air intake and exhaust points to prevent ingress of rain

Standard Type

Horizontal extruded aluminium louvre blades at 45° with anti carryover rain trap

Blade pitch 50mm

Blade support 1000mm maximum centres



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Vermin mesh Provide removable bird/vermin screens

Installation of weather louvres

Slope ductwork plenums behind louvres towards louvres to discharge carryover moisture via louvre Paint plenums internally with epoxy resin or bitumastic paint

Provide concealed fixing and weather sealing for weather louvres

Heavy Duty Type

Vertical louvre with horizontal extruded aluminium blades which divert air through two 90° bends

Air pressure drop 50 Pa max at 1.25m/s face velocity

Water removal performance Independently tested at 1.25m/s face velocity with 75mm/hr driving rain with zero water penetration

Vermin mesh Provide 25mm x 25mm bird screens

Typical selection Email Colt ULM

7.6 Installation of Registers, Diffusers and Grilles

Mounting

General In tiled ceilings, locate to minimize cut tiles Otherwise, cut tiles symmetrically on opposite sides of outlets Provide matching escutcheons to close gaps between outlets and their surrounds Provide grilles with flanges to cover penetrations and irregularities in surrounds

Appearance Install square

Fixing

Appearance Use concealed fixings

Sealing Seal airtight between plenums and diffusers

Accessibility Use fixings which allow removal without damage to surrounds or outlets



8. Water Treatment

8.1 General

Supply, install and commission water treatment systems for the condenser water and heating hot water systems as specified complete with pipework, valves, gauges, fittings, wiring, control, and associated equipment necessary for the proper functioning of the system. The chemical treatment systems, and in particular the discharge of treated water to waste, shall comply with the requirements of Sydney Water, the Environment Protection Agency (EPA) and other authorities having jurisdiction.

Supply sufficient chemicals to maintain the required concentration of chemicals for a period of 12 months from start up. A trained water treatment technician shall test the water in each circuit monthly during this period, add the necessary chemicals and submit written reports.

Provide complete test kits as detailed in this specification.

The contractor shall ensure that the chemicals proposed will not adversely affect or be adversely affected by the materials of the components in the water systems. The chemicals shall be suitable for the required water treatment purpose and be readily available locally. Copper sulfate shall not be used to control the microbiological growth rate.

Chemicals shall be added to protect both ferrous and non ferrous metals.

All chemical storage vessels containing hazardous materials shall be identified by means of self-adhesive markers to AS1345 Clause 6.

Water treatment facilities shall comply with the requirements of AS 3666.

Submit for approval details of proposed water treatment systems, types and quantities of chemicals to the used and anticipated performance.

Prior to start up, testing and commissioning, the Contractor shall

8.2 Pre Commissioning

- (a) remove sacrificial anodes,
- (b) install sufficient normally closed flushing bypass valves suitably sized to allow equipment to be bypassed and to suit pre-commissioning cleaning of pipework,
- (c) thoroughly flush circulating water systems with fresh water to remove any dirt, dross and debris from pipework,
- (d) remove and clean all strainers and replace,
- (e) refill the system with fresh water to which has been added a suitable alkali detergent and circulate this cleaning agent for at least 4 hours,
- (f) completely drain the system, refill with fresh water and circulate for at least a further 4 hours. At regular intervals during this period the Contractor shall isolate and clean all strainers and open all drain points to remove any debris arising from the cleaning agent,
- (g) drain, fill and flush the system until all traces of the cleaning agent and debris are removed and the pH of the water in the system is in the range of 7 - 8. The water shall be tested to demonstrate compliance with this requirement,



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- (h) drain the system, add sacrificial anodes, and
- (i) refill the system with fresh water, add chemical treatment, circulate and adjust concentration

8 3 Water Treatment

Each chemical treatment system shall be complete with

- (a) chemical treatment mixing tank,
- (b) bypass slug dosing pot as detailed, minimum 12 litre Each pot shall be labelled condenser water or heating hot water as appropriate
- (c) instrumentation, and
- (d) valving and associated pipework

The circulating water systems as a minimum shall be treated to restrict corrosion, fouling and scale formation microbial growth and to control pH

Corrosion, fouling and scale formation shall not be controlled using chromate or nitrite based inhibitors The inhibitor shall contain chemicals to protect both the ferrous and non ferrous metal alloys used in the construction of the plant The pH in the water systems shall be controlled in the range of 7-8

The rate of corrosion of ferrous metals shall not exceed 0.13mm/year

8 3 1 Chemical Treatment Tank

Chemical treatment mixing tanks shall be constructed from high density polyethylene or similar, the capacity shall be determined to suit the size of the circulating water system Tanks shall be provided with suitable covers

Drains with hose connections shall be provided to enable tanks to be drained into suitable portable containers

8 4 Marking

Hazard Identification

Identify piping and storage vessels containing hazardous materials

Safety Signs

If hazardous chemicals are to be stored, provide safety signs to AS1319

8 5 Maintenance

General

Each month during the maintenance period, for each system

- (a) sample and test water for total dissolved solids (TDS) inhibitor, pH alkalinity, corrosion products, scale potential and suspended solids (SS),
- (b) if necessary, adjust dosing rates

Test to determine the levels of the levels of the various chemicals used shall be carried out to AS2029 or BS1427 as applicable

Install test coupons within the plant to monitor the annual rate of corrosion to ASTM D2688, to be changed every three months



9. Insulation - Thermal and Acoustic

9 1 General

9 1 1 Cross References

General

Comply with the *General requirements* section

Related sections

Refer to the following sections related to insulation – thermal and acoustic

- Noise and Vibration
- *Piping*, for spacers, vapour barrier and metal sheathing at pipe supports
- *Ductwork*

9 1 2 Interpretations

Definitions

To AS 2352, Glossary of terms for thermal insulation of buildings

Rock wool Entangled matt of fibres derived from molten rock or furnace slag

Glasswool Entangled matt of fibres derived from molten glass

9 1 3 Work Practices

Work Practices

Comply with the requirements of the Worksafe Australia National Standard for Synthetic Mineral Fibres and National Code of Practice for the Safe Use of Synthetic Mineral Fibres

9 2 Ductwork Insulation

9 2 1 Standard

Comply with AS 4254, *Ductwork for air handling systems* as required by AS 1668 1

9 2 2 External Insulation

Insulation Systems

System 1 50mm thick semirigid 18kg/m³ glasswool faced with aluminium foil laminate
Bulk thermal resistance, R_t = 1.4 at 20°C

Extent

Airconditioning (Refrigerated cooling)

- Rigid supply ductwork in un-airconditioned spaces, partially air conditioned spaces and roof spaces, and draw-through supply fans - System 1
- Rigid supply ductwork in airconditioned spaces and ceiling spaces below upper floors
System 2
- Flexible supply air ducts System 3 Refer Ductwork Section
- Return air ductwork in un-airconditioned spaces including plantrooms, roof spaces and subfloor voids System 2
- Omit external thermal insulation from internally insulated ducts unless shown otherwise



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Heating only, or evaporative cooling
- Supply and return ductwork – system 2

Fixing

Method Use pin method or strap and pin method

Pin method Secure insulation by pins spaced as follows

- Horizontal ducts <400mm wide Pins not required
- Horizontal ducts >400, <800mm wide One row of pins along centreline to side and bottom of ducts at 400mm maximum centres
- Horizontal ducts ≥800mm wide Pins spaced at 400 mm maximum centres both ways
- Vertical ducts <600mm wide Pins not required
- Vertical ducts ≥600mm wide Pins at 400mm maximum centres

Strap and pin method Provide 12mm wide polypropylene strapping at maximum 600mm intervals

- Horizontal ducts ≥600mm wide Hold insulation in position on the underside using fixing pins spaced at 400mm maximum centres with at least one row per duct face
- Vertical ducts ≥600mm wide Provide pins to all faces at 400mm maximum centres

Application

Insulation Apply to high pressure ducting after duct pressure testing is complete

Wrap insulation around ducts Minimise the number of joints

Joints Square cut and tightly butt together the edges of adjacent pieces of insulation

Vapour Sealing Apply pressure sensitive aluminium foil laminate tape 75mm wide to all joints
Vapour seal around all hangers and brackets with mastic sealant

Where the insulation is impaled over pins, seal the vapour barrier by covering pins using water-based mastic sealant or 75mm wide aluminium foil laminate tape

Ensure vapour barriers are free from perforations and leaks, continuous, and sealed continuously at penetrations Place vapour barriers on the hot side of the insulation

9.3 Piping Insulation

9.3.1 Systems

Insulation systems

Comply with the **Insulation systems table** for the selection and application of insulation systems

Insulation system table

System	Application for piping	Insulation Material	Insulation surface facing	Insulation fixing material
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System	Application for piping	Insulation Material	Insulation surface facing	Insulation fixing material
A	hot	glass wool	aluminium foil laminate	none required
C	cold, above freezing	polystyrene foam	aluminium foil laminate vapour retarder	adhesive

9 3 2 Application

Heating hot water and domestic hot water piping including flow, return and feed and expansion piping

System A Pipes < 100 dia, 25 thick
Pipes > 100 dia, 40 thick

condensate, feedwater, blowdown and vent piping

System A Pipes \leq 100 dia 40 thick
Pipes > 25, <100 dia, 40 thick
Pipes \leq 25 dia, 25 thick

Metallic drains for cooling coil condensate and UPVC drains within 3m of coils

System C, 25 thick

Air conditioning refrigeration suction piping, liquid piping in direct sunlight and roof spaces

System C, 38 thick or

Condenser water and refrigeration hot gas lines - uninsulated

9 3 3 Installation of Piping Insulation

System A, Glass wool

Insulation Preformed rigid glass wool sections with factory bonded aluminium foil laminate

Facing Factory bonded aluminium foil laminate with 50mm longitudinal overlap

Application Fit insulation tightly to piping surfaces without gaps Close butt ends of insulation sections Use the minimum number of joints If the insulation is in half-sections, make only half circumferential joints at any one place Seal longitudinal seams in foil laminate and fix insulation at maximum 500mm centres using polypropylene, zinc coated steel or aluminium straps

Do not use fibrous insulation such as glasswool for cold piping, except for the following

- To provide a fire rated building penetration
- For filling air gaps around valves and fittings

System C, Polystyrene foam



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Preparation Remove rust and scale from steel piping and apply one coat of rust inhibitor and one coat of bituminous paint or water proof polymer solution

Application To prevent moisture travelling along the pipes, apply a coating of non-setting bituminous mastic to butt joints, at support spacers and at either side of valves. Coat the bore of the insulation for 50mm on either side of support spacers

Longitudinal joints Stagger longitudinal joints between sections a minimum of 75mm. Seal aluminium foil laminate overlap using contact adhesive or 50mm wide self adhesive aluminium foil tape, to complete the vapour barrier

Butt joints Apply 50mm minimum width aluminium foil laminate tape over joints. Neatly finish joints and provide a vapour seal free of perforations or leaks

Straps Fix insulation at maximum 500mm centres using 12mm wide polypropylene, zinc-coated steel or aluminium straps

Bends Cut insulation into segments and seal together using adhesive, or provide preformed bends. Fix to piping

Fittings, valves and flanges Cut insulation and form it to fit around fittings, valves and flanges. Use loose mineral wool or glasswool to fill air gaps and voids. Provide a continuous vapour barrier

Vapour barrier Factory bond aluminium foil laminate to insulation with 50mm longitudinal overlap. Seal all joints with aluminium foil laminate tape

Ensure that vapour barriers of cold piping insulation are unbroken and free from leaks. Form bulkheads at regular intervals. Provide continuous vapour barriers at pipe supports, enclosing spacer blocks. Seal penetrations for instruments, valve glands and the like

Thermal expansion Allow for pipe movement in applying pipe insulation and sheathing. Incorporate expansion details recommended by insulation manufacturer



10. Mechanical Control System

10 1 General

10 1 1 Cross References

General

Comply with the General Services Requirements section

Related Sections

Refer to the following sections

- Associated work
- System description
- Electrical Switchboard
- Painting and Identification
- Design Criteria
- Motors
- Instruments
- Electrical Installation
- Testing and Commissioning
- Equipment Schedules

10 1 2 General Requirements

All controls shall be supplied, installed, tested and commissioned by a specialist controls company. All personnel engaged in the work shall be fully trained and experienced in this field.

Design, supply, install, commission, provide training, operating and maintenance instructions and maintain for a period 12 months (12 month warranty) all hardware and software necessary to permit control and monitoring of all the Air Conditioning, Refrigeration, Ventilation, Electrical, Fire, Hydraulics, Lighting and Security functions as outlined in this specification.

Practical completion shall only be granted when all tests have been carried out to the satisfaction of the Principal.

The setting and commissioning of controls shall be undertaken in conjunction with the testing and balancing of the mechanical services installations and these two activities shall be coordinated by both parties.

Documentation of the entire system

Provide complete operating and maintenance manuals, 'as-installed' drawings, and field training of operations and maintenance personnel including two copies of CAD disks for all final drawings in DXF format.

Provide conduits in columns, walls, etc for the thermostats and temperature sensors.

All necessary sensing and output devices (i.e. temperature, pressure flow, humidity sensors, micro switches, control output relays and analogue transducers, etc.) including wells where required which are necessary to meet the requirements of this specification.

The pre-commissioning of the installed system, this shall include identification and labelling of all wiring and cables, testing and safeguarding against harmful voltages.

Selection and supply of damper motors including brackets and linkages to damper shafts adjustment to linkages as required for correct damper operation.

Selection and supply of control valves for installation in piping.



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Electrical control wiring, including termination and connection, between control systems and equipment provided by others, unless specifically indicated

Wiring of devices constituting the specified control system

Wiring of power supplies to control systems from terminals in the mechanical services switchboards

Drawings and other documentation necessary to detail the works undertaken

Coordination with the other services contractors to ensure the correct cross referencing of drawings

Painting and labelling of the completed installation

At the end of the Defects Liability Period provide a back up diskette of the system and update the Operation and Maintenance Manual to reflect the final system

All controls shall preferably be of the same manufacture and where this is not practicable details on the proposed makes of controls shall be submitted for examination

Controls shall be fully coordinated with the mechanical services works to ensure a logical totally compatible system Full liaison shall be carried out between all parties

All workmanship shall be of the highest class and the materials of best quality All equipment shall be designed for easy access where necessary for inspection, maintenance and/or repair Where practical it shall be mounted below a height of 1800mm above floor level

All equipment shall be suitable rated for the maximum ambient temperatures applicable to each part of the installation and the enclosures in which the equipment is installed

All equipment and/or appliances, provided under this Specification, shall be designed so that no interference will be caused with or by any radio or the electronic transmitting or receiving equipment in the same locality, including any electronic control equipment associated with any air handling units, cooling plant, heating plant or similar items of equipment

In the event of the inherent characteristics of the electrical installation being such that interference is impossible, efficient interference suppression devices capable of eliminating such interference shall be provided

All cables, cable support systems, miscellaneous minor equipment required for the satisfactory installation of cabling whether or not shown on the accompanying drawings and/or specified herein shall be provided

Where the drawings do not detail the necessary cable support systems the requirements in respect to these shall be ascertained from architectural and associated services drawings and due allowance made for all bends and offsets

Where cable enclosures penetrate fire walls or fire barriers, penetrations shall be sealed to maintain the original fire resistance rating in accordance with AS3000 and to the approval of all relevant authorities, using Selley's Fire Stop or approved equivalent

The type of cable, cable enclosure and method of installation shall be as specified under the section "Electrical" of this specification Cable ducts and steel conduits shall be utilised for control cabling



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10 2 DDC/BMS Controls

The section covers the supply and installation of the manual and automatic controls for all systems, plant and equipment

The controls shall be of the direct digital control (DDC) type of approved manufacturer and shall be capable of performing all control functions listed in this specification

The control system shall be complete in all respects and shall have all items such as valves, motors, temperature and humidity sensors etc provided with lockable covers to prevent tampering

Where temperatures, set points, time delay periods and other criteria are nominated, the values shall be treated as indicative only All such settings shall be adjusted for optimum performance at the time of commissioning and noted in the operating instructions and commissioning records

No instruments or controls devices shall be located where they will interfere with the operation or removal of equipment, nor shall conduits or piping be run so as to interfere with the access to any equipment

This section of the specification shall be carried out in conjunction with the "Electrical" section of the specification

10 3 Scope of Works

The system requirements shall comprise the design, manufacture, bench testing, delivery, site installation, testing and commissioning of a Building Management System/Direct Digital Control System for monitoring and control of mechanical services and other building services The work shall include the following

- Distribution controllers (field devices) as required to suit the points schedule
- Wiring between distributed controllers
- All software and hardware necessary to perform the functions required by this specification or indicated on the drawings The operator interface must be fully compatible with microsoft windows base packages
- All transducers and interfacing devices to convert signals into those compatible with the digital controls Sensors shall be provided as necessary to achieve the specified control functions whether nominated in the Points Schedule or not
- Wiring to, and connection of, monitoring points on other building services equipment as supplied by others Points will either be in other services switchboards or at each item of equipment to be controlled/monitored
- Conduits and cable troughing for BMS system wiring
- Each DFP shall have 20% spare points Install additional control module(s) if required
- All hardware and software necessary to provide a completely integrated operating system
- All wiring associated with the DDC system including all control, field, communication and interface wiring



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- All software, engineering, programming and database entry required for the safe and proper operation of the system as specified
- Functional specification and points schedule, wiring diagrams etc for the complete system
- All temperature, pressure, flow current, kW etc transducers necessary to carry out the functions of the specified system and as nominated in the points schedule unless nominated as provides by others
- Dynamic graphic pages as specified elsewhere in this document
- All DDC panels including all equipment and wiring therein to achieve the required functions as detailed in the specification and on the drawings
- Power wiring from a dedicate fused single phase electrical supply at local MSSB,s in plantrooms to all DDC/Field Controllers and field devices including operator terminals
- The installation of all supplied equipment, and the provision of all relays, panels etc , together with all interface wiring to other building services trades packages at required locations (e g MSSB,s, Electrical Switchboards, Hydraulic Switchboards, Fire Indicator Panel, and devices)
- All BMS wiring to dedicated terminal strips in switchboards
- The installation and marking of wiring to include terminations in Direct Digital Controllers, Data Gathering Panels and field sensors with numbering shown on Engineering Drawings Labelling of all wiring to be numbered at both ends of wire
- Communications wiring between DDC operators' terminals and all field controllers, devices
- Responsibility for the calculation of cable sizes, transformer sizes, relay voltages, wattage etc to achieve the required functions and to suit the equipment provided shall be undertaken
- Responsibility for the correct installation of equipment and wiring shall be included and therefore all measurements and details shall be taken from site and not from tender drawings
- The pre commissioning shall include comprehensive off site witness testing of the complete BMS system including software control sequences
- Demonstration of all mounting and control points and software functions and additional features provided by the system
- All electronic and electric controls
- All necessary extra low voltage power supplies and associated wiring to any field device/actuator/motor controlled by or being sensed by the BMS
- Connection by modem to enable monitoring, starting, stopping and fault finding remotely
- Provision of trend logs at four stages during defects liability period to prove operation of systems and indicate fine tuning opportunities
- Electric control systems as specified and/or shown on the drawings
- Controls and alarm bell(s) for lift motor room ventilation and alarms



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- Digital control systems including digital field panels (DFP)
- Systems software programming, including the generation of colour graphic displays as specified



11. Mechanical – Electrical Installation & Switchboard

11 1 Extent Of Work

- 1 All new Motor Service Switchboard (MSSBs)
- 2 Termination of fire trip (provided by Fire trade) to MSSBs
- 3 All motors, starters, variable frequency drives, switchgear and safety protection equipment
- 4 Power wiring including fire rated cabling to meet statutory requirements
- 5 Control wiring in MSSB and between equipment and the MSSB including fire rated cabling to meet statutory requirements
- 6 Connection of all zone smoke control elements as required for control sequences (smoke detectors supplied by Fire Trade)
- 7 Mechanical trade to advise final electrical loads to the Superintendent on signing of contract

11 2 Mechanical Service Switchboard

11 2 1 General

The mechanical service switchboard shall be of the totally enclosed, front connected, floor or wall mounted type and shall consist of two separate compartments one shall incorporate isolation, protection and starting for each motor circuit as specified below, and the other shall incorporate control relays, time switch, alarm functions, etc The MSSB shall be designed for operation with a 415/240 volts, 3 phase and neutral, 50 Hertz AC supply and with motor control circuits operating at a maximum of 240 volts Mechanical service switchboards shall be to Form 2 requirements

MSSB shall comprise

- Auto/Off /manual switches
- Pilot lights
- Moulded case circuit breakers
- Contactor(s) and overload relays with single phase protection
- Any other additional equipment as specified

Pilot lights, instrumentation etc as specified shall be installed on the front door of the MSSB or on a separate instrument panel specifically for this purpose

All mechanical control centres shall have a lamp test facility incorporated into the control system via relays and not diodes

11 2 2 Circuit Breakers

Shall be of Terasaki or Schneider manufacture, or approved equal

11 2 3 Spare Capacity

Fully air conditioned buildings shall have a minimum 10% spare space and capacity in all switchboards This spare capacity also applies to the switchboard feeder cables Allow space and capacity also for nominated future equipment

11 2 4 Spare Consumables

Provide the following spare switchboard consumables, mounted in trays or secured by holding clips fixed to the back of the switchboard cubicle doors

- Three (3) fuses of each type and size



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- One (1) relay of each type/coil voltage
- Ten(10) indicator lamps

11 2 5 Hours run Facility

Provide at the BACS for all items of equipment that are duplicated or run in parallel, and elsewhere considered necessary or specified

11 2 6 Construction of Mechanical service switchboards

Cabinets shall be rigidly constructed from minimum 1.6mm thick first quality sheet steel and all joints shall be welded with continuous seam welds. All welds shall be ground flush after construction and the finished surface shall show no weld marks or other imperfections.

The mechanical trade shall allow for the respraying or touching up as necessary of the mechanical service switchboard paintwork prior to handover to correct scratches or chips in the paintwork.

Front access doors shall be gasketed for dustproofing, shall have chromed lift-off hinges and chromed lockable common key type latches. Latching bars shall not distort when latching or unlatching doors. All hinges and latches shall be to the complete approval of the Superintendent.

Cabinets shall be factory painted, exterior surfaces shall be painted in Orange X15 and interior surfaces in gloss white. All painted surfaces shall be baked stove enamel finish.

Refer to further sections in this specification for detailed specification of painting and finishing.

11 2 7 External Cable Connections

With the exception of the main incoming supply which shall terminate at the main switch, all incoming and outgoing wiring shall terminate at suitably rated terminal strips installed in the mechanical service switchboard.

11 2 8 Internal Busbars

Busbars shall comprise hard drawn high conductivity PVC sheathed copper bars installed in fully accessible busbars chambers.

Joints in busbars shall be of an approved type to ensure adequate conductivity and rigidity throughout the life of the equipment.

11 2 9 Internal Wiring

The mechanical trade shall provide all necessary internal wiring which shall be adequately identified with numbers corresponding to the terminal strip numbers. Phasing continuity shall be standardised by using red/yellow/blue in left to right, top to bottom and clockwise around equipment when viewed from the front of the MSSB.

All internal wiring shall be loomed and laced with approved type plastic clips and brackets.

11 2 10 Lamp Test Facility

All mechanical switchboards shall have a lamp test facility incorporated into the control system via relays and not diodes.



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11 2 11 Local Isolators

Provide suitable isolators at each item of plant

Isolators shall be of the weatherproof type when located outside and when considered necessary

11 2 12 Switchboard Illumination

Provide a GPO and single 20W fluorescent lamp in each switchboard cupboard greater than 2m² in face area

10 3 CABLING METHODS

10 3 1 Thermoplastic Insulated Cables

10 3 1 1 General

All Cables unless otherwise specified shall be 250 volt grade PVC insulated type V75 with stranded copper conductors complying with AS3147 and AS3191 and shall be rated in accordance with the SAA Wiring Rules

11 2 13 Installation

Conduit pipes or ducts shall be completely installed and cleaned out prior to the drawing in of cables. The number of cables in any conduit, pipe or duct shall not exceed the maximum laid down in the SAA Wiring Rules, inclusive of a minimum of 25% spare capacity. General building wires shall be installed on the loop in system in continuous lengths and no joints will be permitted except at equipment terminals.

11 2 14 Conduit

Polyvinylchloride conduit shall be high impact heavy gauge coloured orange unless otherwise specified Class B to AS C173 Ap

The minimum diameter of any conduit shall be 20mm. All conduit fittings and accessories shall be of approved type and manufacture. Accessories shall comply in all respects with AS C175 Ap

Inspection bends, solid bends, elbow, tees or normal bends shall not be installed except with the approval in writing of the Superintendent

Where for reason of construction PVC box faces are not flush with the wall or ceiling, purpose made extension pieces shall be employed of the same construction and dimension as the conduit box

Conduits shall be run in square and symmetrical lines and efficient means shall be adopted to provide for the drainage of condensation and the runs shall be adequately ventilated

All surface conduit runs shall be planned by the Mechanical trade before installation is commenced and shall be indicated or marked out on site for approval by the Superintendent

All bends shall be made on site, utilising an approved type of bending machine. Where wide radius bends are required, these shall be made with an approved type of bending block, always provided that the conduit is not deformed

All conduits shall be cut square and all joints shall butt together tightly in order to ensure maximum electrical continuity. Where a number of conduits converge, large malleable cast iron or approved heavy gauge sheet steel adaptor boxes shall be employed in order to avoid crossing

In no case shall wires or cables be drawn into conduits until all such conduits and conduit fittings have been permanently fixed in position and approved by the Superintendent



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'Draw in' boxes shall be provided at 8m intervals on all straight runs and after not more than two right angle bends

In no case shall conduits from different switchboards be connected to the same junction box, nor shall cables from different switchboards be enclosed in the same conduit

Flexible couplings shall be installed wherever expansion or contraction joints occur in a building and shall be installed wherever movements of the structure in excess of 4mm will occur

Expansion fittings shall be installed in all straight runs of rigid PVC conduit except those embedded in concrete or in wall chases. The spacing of expansion fittings shall not be greater than 4m

Where flexible conduits are specified they shall be of approved manufacture and shall comply in all respects with AS C90 or AS C154 as applicable

The connection between the flexible conduit and fixed conduit or terminal boxes shall be made using purpose made glands of approved manufacture

11 2 15 Duct Type Enclosures

Metal Ducts Shall be galvanised sheet steel with removable covers fixed to the ducting by galvanised bolts and captive nuts (self tapping screws are prohibited) or by an approved type sliding fit. The ducting shall be electrically continuous throughout its complete length

Plastic Ducts Shall be of the rigid PVC plastic moulded type with removable covers of the clip on type. The duct shall be adequately constructed and supported to prevent sagging and warping between supports

All separation barriers shall be continuous and securely fixed and all ducting shall be provided with cable retainers at 600mm intervals

Bends, junction boxes, and duct accessories shall be purpose made of approved design and shall be of type and finish to match the duct to which they attach. Three and four way junctions in the duct system shall have their compartments fully isolated and the effective cross sectional area of the branches shall not be reduced

Where ductwork passes through holes in the building structure, a flush cover plate shall be fixed to the ductwork before installation and shall be arranged to project at least 50mm beyond the finished surface of the wall

11 3 Motors And Associated Equipment

11 3 1 General

Motors shall be of a type suited to drive the equipment covered in this specification in a manner recommended by the manufacturers

Motors shall be strictly in accordance with AS 1359, AS 1360 and BS 5000

NOTE All motors for the Mechanical Services equipment shall be enhanced high efficiency motors. Carefully select motors to ensure that the size of the motor matches with the load to maximise part load efficiency



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11 3 2 Drives

Belt drives from motors shall comprise not less than two belts evenly matched Belts shall be of minimum 'B' section 'A' section belts are not acceptable

For direct drives, motor speed shall not exceed 24 revs/sec

Provide belt guards easily removable for maintenance Provide an inspection window on each guard for inspecting the belts

11 3 3 Motor Types

Motors supplied and installed under this contract shall be alternating current induction motors of the drip proof type unless otherwise specified

Motors exposed to weather shall be of IP 56 type

Three phase motors started 'direct on line' shall have squirrel cage rotors and stators wound for operation on voltages between 400 and 440 volts, 50 Hertz supply

The mechanical trade shall supply details of starting torque and locked rotor current for each three phase motor, and ensure that they comply with Supply Authorities regulations

Single phase motors shall be of the capacitor start capacitor/induction run, or repulsion induction type

11 3 4 Motor Speed

Unless otherwise specified motors shall have a synchronous speed not exceeding 25rev/s

11 3 5 Motor Bearings

Motors up to and including 4kW shall be equipped with sealed ball bearings at both ends

Motors above 4kW shall have sealed roller bearings at the driving end and deep groove sealed ball bearings at the non driving end

11 3 6 Motor Winding Insulation

Smoke control supply, exhaust and stair pressurisation fan motor shall have the type of insulation as required under AS 1668 Part 1 Clause 4 8 and other motors shall have class E insulation and shall be continuously rated at an ambient temperature of 40°C

11 3 7 Motor Terminals

All motors shall be equipped with an enclosed terminal block

11 3 8 Wiring to Motor

Wiring from the motor isolating switch to the motor terminal block shall consist of thermoplastic insulated conductors installed in flexible conduit (or fire rated as required)

11 3 9 Motor Isolating Switches

Every motor shall have installed adjacent to it a quick make/quick break air break switch in a standard drip proof enclosure appropriate to the location

11 3 10 Motor Starters

Provide in accordance with current regulation and authority requirements



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Direct on-Line (DOL) type	Any single phase motor Three (3) phase motors up to 15 kW rating maximum (unless indicated otherwise on drawings)
Auto transformer or Star-Delta type	Three (3) phase motors above 15 kW rating other than VSD or soft start
Variable Speed drives (Soft start)	Three (3) phase motors above and below 15 kW rating where nominated in the control schematic diagram (for VAV fans) or the relevant equipment specification/ schedule Provide suppression for radio frequency interference and filtering of harmonics and line transient in accordance with the following Harmonics The maximum AC network harmonics distortion, including voltage notching caused by the VSD controller at the point of common coupling, shall not exceed the limits the set down by AS 2279 Part 2 The harmonics generated by the VSD controller shall be limited through appropriate selection of AC line side or DC bus reactors and supplied as part of the contract The fault level at the point of the common coupling and existing level of harmonic distortion on the network shall be established to enable selection of the harmonic filters Electromagnetic Interference Electromagnetic Interference (Radio frequency Interference) generated by the VSD controller shall be within the limits stipulated by AS 2064 The VSD supplier shall provide full installation instructions for the equipment to minimise the Electromagnetic Interference If necessary, the generated Electromagnetic Interference shall be limited through appropriate selection of equipment such as RFI filters

11 4 Electrical Earth System

All metal enclosures of electrical equipment, switchgear, conduits, trays, electrical ductwork and cable armouring shall be effectively bonded to earth and the earthing of the complete installation shall comply in all respects with the requirements of the SAA Wiring Rules and those laid down by the local Supply Authority

11 5 Balance of Load

The mechanical trade shall balance the electrical load as far as possible between the individual phases of supply Particular attention in this regard is directed to the rewiring or connection to existing services The balancing must be carried out to the satisfaction of the Superintendent and the local Supply Authority

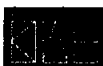
11 6 Labelling and Painting

Every switch outlet and switchboard/MSSB control shall be labelled in accordance with NATSPEC so as to provide ready identification of each and all circuits

A schedule of circuits shall be provided, mounted in a metal frame complete with plastic front protective cover, and hung adjacent to the respective switchboard/ MSSB

The size and origin of an incoming cable to any switchboard/ MSSB shall be indicated by an approved engraved laminated plastic tag as above on the outside of the cubicle in the proximity of the main control

All electrical motors, conduits (including PVC conduits), cable trays, and switchboards shall be colour coded No 5777 'Light Orange' in accordance with AS 2700 endorsement of BS 3818-1964 'Colour for Specific Purposes'



Specification for Mechanical Services ARV Warriewood

Mechanical service switchboards shall be colour coded Orange X15 (Refer to clause 'Mechanical service switchboards')

117 Tests

1171 General

On completion of manufacture at maker's works and after erection at site, the Mechanical trade shall arrange for witnessed test to be carried out together with such other tests as may be considered necessary by the Superintendent in order to prove compliance with this specification

1172 Connected Loads in Excess of 50kW

All air-conditioning switchboards with a connected electrical load in excess of 50kW must be checked by the Mechanical Contractor prior to the expiration of the Defects Liability Period using a Thermoscan unit or similar. Any defects found must be rectified and a complete report including thermal photographs must be supplied prior to the Certificate of Completion being granted



12 Testing, Commissioning and Maintenance

12.1 Quality

12.1.1 Standards

Comply with the following

- Procedural standards for testing, adjusting and balancing of Environmental Systems by the National Environmental Balancing Bureau (NEBB), Gaithersburg MD, USA
- ANSI / ASHRAE III Practices for measurement testing, adjusting and balancing of Building Heating, ventilating, air conditioning and refrigeration systems by ASHRAE, Atlanta GA, USA

12.2 Commissioning

12.2.1 Precommissioning

General

Prior to commissioning, confirm that static tests are complete, complete pre-startup checklist and rectify outstanding items

Inspection Witness Points

Give notice prior to starting of plant \geq 30kw electrical capacity

Air Systems

Check for duct leakage and sealing of filters

Water Systems

Fill, circulate chemical pre treatment through fully open system, flush systems, clean strainers, fit flow limiter cores, refill Vent air and chemically treat prior to commencing commissioning

Set up feed and expansion systems

Pre commissioning works should include, as a minimum

Requirement	Sign Off	KAE Site Witness	KAE Sign Off
Check all equipment is installed in accordance with manufacturer's data	Contractor Provide schedule	NO	YES
All equipment electrically connected and provided with correct circuit protection	Electrician Provide schedule	NO	YES
All equipment is labelled	Contractor Provide schedule	NO	YES
Phase rotation checked	Electrician Provide schedule	NO	YES
All systems cleaned and flushed	NEBB Commissioning staff Provide schedule	NO	YES
All ductwork pressure tested	NEBB Commissioning staff Provide schedule	NO	YES
All pipe work pressure tested	NEBB Commissioning staff Provide schedule	NO	YES
All refrigeration pipe work filled with nitrogen and leak tested	Contractor Provide schedule	NO	YES



12.2.2 Commissioning

General

Standard Prior to practical completion test adjust and balance all systems in accordance with NEBB procedural standards

Instruments provide appropriate accurate instruments Current NATA certificate of Calibration prior to commencement of testing

Air Balancing

Air quantities Measure total air flow and branch flows using pitot tube and monometer

Cross check against for performance curves – both static pressure and power consumption measurements at outlets use microprocessor based back pressure corrected air results flow measuring hoods results to be used for comparison only

Tolerances Total air flows +10%, - 0%

Air flows from individual outlets +/- 10%

Test conditions For measurement of total air quantities simulate full dust loading of filters and condensate loading of cooling coils

For adjustment Operate intermediate systems supply air, such as outside air and return main proportionally balanced with all dangers of the index run fully open, adjust total air flow by varying fan speed on blade pitch angle set for minimum energy consumption at design flow

Outlet Adjustment Set air pattern adjustment to minimise draughts whilst avoiding imperative stratification Use duct dampers rather than register dampers to adjust airflows Adjustment of outlets shall not cause excessive noise on draughts

Metering Plates Balance 'Variflow' or equivalent flow metering plates by exchanging plates on plugging orifices to obtain design airflow at measured pressure drop

After the system has been balance all balancing damper positions shall be fixed and marked

Water Balancing

Water quantities

- Measure total flows via annuators, orifice plates, flow meters or certified pressure drop across factory tested water equipment
- Compare with readings of manufacturers performance curves, both lead / flow and power / flow curves
- Measure terminal flows via calibrated balancing valves annuators on control valves with published flow coefficients

Flow tolerances Total pump flows +10%, -0% Terminal flows +/-10% of design Set bypasses of three way valves at 80% of design coil flow

Balancing Valves Mark final balance positions

Reports Submit completed and certified NEBB report forms Include the following

- Total water flow tests, including pressure differentials across all equipment
- Pump tests including capacity, speed, rotar diameter, duty point, power consumption and shut off hood
- Terminal water flow tests

Commissioning of Air Handling Systems

The air handling systems including packaged air conditioning units, mechanical ventilation and exhaust systems and toilet exhaust systems shall be cleaned and tested



Specification for Mechanical Services - ARV Warriewood

Each complete system shall be commissioned by carrying out an approved systematic routine of procedures to bring each system into full operation in accordance with 'Air Balance' subsection

Perform such additional tests as are necessary or as directed by the Superintendent to establish correct operation and function of each complete system to the requirements of the specification and relevant codes

All flow rates shall be finally adjusted through all equipment

All automatic volume dampers shall be set for the minimum air quantities and recorded

Sound testing shall be carried out to achieve design sound levels as specified in the mechanical general section of specification

All tests shall be carried out in the presence of the Head Contractor and Superintendent and all sample witnessing will be carried out to the satisfaction of the Superintendent

Commissioning of Volume Control Dampers

Each volume control damper shall be set and sealed

Manual dampers shall have the air balance position marked in red paint

Verify and sign off on test sheet

Commissioning of Fire Dampers

Each fire damper shall be checked to ensure the fusible links are set. Check access panels. Commission fire dampers in accordance with AS1682.2

Instruments

Each thermometer, pressure gauge and temperature gauge shall be commissioned by checking the calibration against NATA certified instruments, setting all pointers and marking the set point

Each pressure differential gauge across each filter bank shall be commissioned by setting and sealing the bezels. Verify and sign off on data sheet

Commissioning of Automatic Controls

All controls shall be calibrated in accordance with approved Contractor's and Equipment Supplier's documents

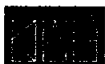
All equipment shall be set and adjusted as follows

- All set points shall be verified by measurements of the controlled medium
- All valves and dampers motors shall be adjusted for correct sequence and spring range operation
- All switches shall be calibrated for correct set point and switching differential
- All safety and alarm circuits shall be proven by operation or simulation of an alarm or unsafe condition
- All points to be individually tested
- All points shall have alarms attached
- All pressure reducing stations set for the correct pressures
- Each system shall be demonstrated to operate as specified

Perform such additional tests as are necessary, or as directed by the Superintendent, to establish correct operation and function of each complete system to the requirements of the specification and relevant codes

All control instruments shall be finally adjusted, set and sealed in conjunction with manufacturer's recommendations

Verify and sign off on data sheet



Commissioning of Electrical Installation

The complete electrical system shall be inspected and passed by the local authority and tested for electrical safety

All equipment shall be set and adjusted as follows

- All safety controls and interlocks shall be proven by the operation of each individual drive and interlock
- All starting sequences shall be checked
- All fail safe and automatic start drives shall be checked
- All motors shall be checked for the direction of rotation
- All switches and controls shall be checked and proven to operate as specified
- All switches and relays shall be calibrated for correct set point and switching differential
- All safety and alarm circuits shall be proven by operation or simulation of an alarm or unsafe condition
- All other electrical items installed under this mechanical works

Perform such additional tests as necessary or as directed by the Superintendent, to establish correct operation and function of all the systems to the requirements of the specification and relevant codes

Set all times, interlocks and relays Verify and sign off on data sheets

Testing of Piping, Equipment and Fittings for Water System

Pipework, equipment and fittings for all water supply and return, Systems shall be hydrostatically tested, cleaned out and proportionally dosed in accordance with 'Water Treatment Section

Equipment susceptible to damage under the test pressure shall be isolated before the pipeline is pressurised Verify that all drain connections and vents are clear

Air heating and cooling coils shall be factory tested

All equipment shall be factory tested for proper operation

Final Checks

Prior to the issue of the 'Final Certificate' verify the performance of all safety and control functions of each system by way of certified report from the respective manufacturers or suppliers Such checks shall be undertaken not earlier than one (1) month before the schedule expiry date of the Maintenance Period

User Training

The Mechanical Contractor shall allow for time and labour after commissioning of all plant to assist in a separate user training programme (Within one (1) month after completion) The electrical contractor shall be responsible for the user training programme However, the Mechanical Contractor shall allow 1 day for walk round of the mechanical systems for staff

All operating and instruction manuals and "as installed" drawings shall be ready in their final approved form at the commencement of the training programme

Seasonal Checks

The Mechanical Contractor shall allow to carry out a number of performance checks of the system (1 month after completion then every 3 months, 5 No in total) These checks will include full interrogation and analysis of set points and fine tuning/adjustment where deemed beneficial to ensure the control and building services systems operate appropriately and to their maximum efficiency Reports shall be provided which indicate control set points and parameters as well as energy use of all systems The external environment and weather station set points and control functions shall be given particular detailed analysis to ensure the building responds appropriately to the external environmental conditions of rain, temperature, wind speed and direction Logs shall be taken of all internal and external conditions and included within the report The Mechanical



Specification for Mechanical Services ARV Warnewood

Contractor shall liaise with the electrical / controls contractor and seek guidance/direction where required to ensure the systems respond/function as per the design intent

The Mechanical Contractor should allow for 1 week site attendance in order to carry out the analysis necessary to generate the reports The Mechanical Contractor shall liaise with the electrical / controls contractor to coordinate all necessary work on site

12.3 Apartment Air Conditioning Commissioning Schedule

The contractor will be required to complete this schedule for each apartment, prior to receipt of practical completion

Project						
Apartment						
Date of Test						
Test	Procedure	Equipment	Design Data	Record Test Figures		
1	Check apartment dry and wet bulb temperature conditions Operate A/C unit in heating mode as required to simulate test on-coil conditions of 23 deg C DB 17 deg C WB	Run heating to achieve 25-26 deg C in apartment prior to starting test Check apartment conditions with sling psychrometer	Sling psychrometer	n/a	Yes	
2	Measure A/C unit refrigerant high and low pressures and verify super heat	(i) Operate A/C unit on cooling cycle (ii) Measure refrigerant high and low pressures in accordance with manufacturer s recommendations	Refrigerant pressure hoses and fittings	(Manufacturer's data at measured condensing temperature) High Pressure= Low Pressure= Superheat=	High Pressure= Low Pressure= Superheat=	
3	Measure compressor and fan run amps	(i) Operate A/C unit on cooling cycle and measure current draw at consumer unit (ii) Operate A/C unit on ventilation and measure current draw at consumer unit	Ammeter (2 No off)	(Manufacturer's data at measured condensing temperature) Fan amps= Compressor amps= Total Amps=	Fan amps= Compressor amps= Total Amps=	
4	Measure supply air flow rate at all registers with anemometer by (i) sweep method (ii) hood method	(i) Time average velocity over face of register Repeat at least once and further times as required to less than 5% deviation Time average over 60 second interval (ii) Purpose made low loss hoods to seal to register surround	(i) Vane anemometer hoods stop watch (ii) Velometer/conical capture device calibrated with conversion factors	D= L1= L2= B1= B2= B3= Total=	(i) Sweep Method D= L1= L2= B1= B2= B3= Total= (i) Hood Method D= L1= L2= B1= B2= B3= Total=	
5	Measure differential	(i) Drnl opening in s/a	Manometer	(Manufacturer's	Differential Pressure=	



Specification for Mechanical Services - ARV Warnewood

	pressure across A/C unit	duct and measure differential pressure with hatch up between ceiling void and supply air duct (ii) Plot air flow from manufacturer s fan curve (iii) Verify against gross measured air flow and fan current draw		data at measured condensing temperature) Airflow= Percentage deviation from measured air flow=	
6	Simultaneously measure dry bulb and wet bulb temperature conditions at A/C unit supply and return air duct work	(i) Check on-coil condition approximately 23 deg C dry bulb (ii) Calibrate sling psychrometer to digital thermometer (iii) Drill opening in s/a duct and measure dry bulb and wet bulb conditions (iv) Use sling psychrometer to simultaneously measure dry bulb and wet bulb conditions at A/C unit return air spigot with access hatch/door closed (v) Convert digital thermometer reading to equivalent sling psychrometer reading	(i) Sling psychrometer (ii) Digital thermometer (2 No off)	<u>Supply</u> Dry bulb= Wet bulb= <u>Return</u> Dry bulb= Wet bulb=	<u>Supply</u> Dry bulb= Wet bulb= <u>Return</u> Dry bulb= Wet bulb=
7	Simultaneously measure dry bulb temperature conditions at A/C unit supply duct work and registers	(i) Check on-coil condition approximately 23 deg C dry bulb (ii) Calibrate sling psychrometer to digital thermometer (iii) Drill opening in s/a duct and measure dry bulb conditions (iv) Use sling psychrometer to simultaneously measure dry bulb conditions at each register (v) Convert digital thermometer reading to equivalent sling psychrometer reading	(i) Sling psychrometer (ii) Digital thermometer (2 No off)	(i) D= Duct= (ii) L1= Duct= (iii) L2= Duct= (iv) B1= Duct= (v) B2= Duct= (vi) B3= Duct=	(i) D= Duct= (ii) L1= Duct= (iii) L2= Duct= (iv) B1= Duct= (v) B2= Duct= (vi) B3= Duct=
8	Provide calibration test certificates for all test equipment/meters				



13. Schedules

13.1 Area Indicative Load

Rm No	Description	Area(Conditioned)	Cooling Total		Heating		S/A (L/s)
			GTH(KWr)	GSH(KWr)	GTH(KWr)	O/A (L/s)	
1	apartment on ground floor	64 0	5 6	5 0	3 4	55 0	
2	apartment on ground floor	64 0	5 6	5 0	3 4	55 0	
3	apartment on ground floor	64 0	5 6	5 0	3 4	55 0	
4	apartment on ground floor	60 0	5 3	4 7	3 2	55 0	
5	apartment on ground floor	55 0	6 2	5 7	3 7	55 0	
6	Apartment on level 1	68 8	6 0	5 4	3 6	55 0	
7	Apartment on level 1	74 0	6 5	5 8	3 9	55 0	
8	Apartment on level 1	74 0	6 5	5 8	3 9	70 0	
9	Apartment on level 1	74 0	6 5	5 8	3 9	70 0	
10	Apartment on level 1	57 0	5 0	4 5	3 0	55 0	
11	Apartment on level 1	70 6	7 9	7 3	4 8	55 0	
12	Apartment on level 1	72 3	8 4	7 9	5 1	70 0	
13	Apartment on level 1	83 0	5 6	4 9	3 4	70 0	
14	Apartment on level 1	83 0	5 6	4 9	3 4	70 0	
15	Apartment on level 1	83 0	5 6	4 9	3 4	70 0	
16	Apartment on level 1	83 0	5 6	4 9	3 4	70 0	
17	Apartment on level 1	64 4	4 3	3 8	2 6	70 0	
18	Apartment on level 1	58 3	5 2	4 6	3 1	55 0	
19	Apartment on level 1	70 0	6 2	5 6	3 7	55 0	
20	Apartment on level 1	110 0	14 1	13 4	8 4	70 0	975
21	Apartment on level 1	110 0	9 3	8 4	5 6	70 0	610
22	Apartment on level 1	58 3	3 5	3 0	2 1	70 0	
23	Apartment on level 1	84 0	5 0	4 3	3 0	55 0	
24	Apartment on level 1	91 5	7 4	6 6	4 4	50 0	
25	Apartment on level 1	64 4	5 7	5 1	3 4	55 0	
26	swimming pool on ground floor	210 1	20	16	25		1000
27	gym	70 7	10 34	6 99	6 2		450
28	physio	25 4	3 2	2 6	1 9		212
29	consulting room1	24 4	3 0	2 5	1 8		203
30	consulting room2	17 8	2 2	1 8	1 3		148
31	consulting room3	15 6	1 9	1 6	1 2		130
32	manager's office	12 2	2 24	1 87	1 3		150
33	admin office	32 7	4 1	3 4	2 4		273
34	reception	8 4	1 0	0 9	0 6		70
35	large meeting room	47 5	18 6	10 9	6 5		530
36	small meeting/lounge	28 5	11 0	6 5	6 6		315
37	multi-purpose room&cafe	393 7	90 1	58 3	54 1		2330

Note

The load listed in the table are indicative only it is mechanical contractor's responsibility to calculate the cooling/heating load in each space



14. Tender Schedules

14.1 Overall Price

Tender for the Supply, Delivery, Installation, Testing & Maintenance of Mechanical Services

I/We _____

Hereby tender for the supply, installation, testing and maintenance of all work exactly in accordance with Knox Advanced Engineering Specification

LUMP SUM TENDER PRICE FIXED TO _____ (DATE)

(in words)

_____ \$ _____

Tenderer _____

Signature _____

Dated _____

Witness _____



Specification for Mechanical Services - ARV Warriewood

14 2 Itemised Schedule of Prices for Mechanical Services

For the supply, installation, testing and maintenance exactly in accordance with Knox Advanced Engineering drawings and specification 10 136 D & C Specification

Item	Cost	GST
NON RESIDENTIAL AREAS		
Chillers	\$	\$
Boiler	\$	\$
Chilled water pipework and fittings	\$	\$
Poolpak unit and remote condenser	\$	\$
Air to air heat exchanger	\$	\$
Kitchen ductwork (Supply & Exhaust)	\$	\$
RACF Fan coil units	\$	\$
Gymnasium AC unit	\$	\$
Office AC unit	\$	\$
Kitchen AC unit	\$	\$
Air grilles, registers etc	\$	\$
Ductwork and fittings	\$	\$
Controls	\$	\$
Electrical	\$	\$
Commissioning	\$	\$
SUB TOTAL	\$	\$
RESIDENTIAL AREAS		
A/C units for residential units	\$	\$
Residential Toilet exhaust fans	\$	\$
Residential Kitchen exhaust fans	\$	\$
Air grilles, registers etc	\$	\$
Ductwork and fittings	\$	\$
Controls	\$	\$
Electrical	\$	\$
Commissioning	\$	\$
SUB TOTAL	\$	\$
GENERAL		
Craneage	\$	\$
Maintenance Manuals	\$	\$
Warranty	\$	\$
12 Months Maintenance	\$	\$
SUB TOTAL	\$	\$



14 3 Alternative Submissions for Mechanical Services

14 3 1 Alternative Submissions

List alternative submissions below, together with the individual price adjustment to the base lump sum tender price and the individual time adjustment to the time required to complete the contract

Submit full technical data for each substituted item of equipment

Alternative Item	Adjustment to fixed Lump Sum Tender (+) or () \$	Time Adjustment (+) or () Days
1 Air conditioning System 2		
2		
3		
4		
5		

Tenderer _____

Signed _____

Dated _____

Witness _____



14 4 Tender Form – Schedule of Rates – Mechanical Services

The following rates will be used to price approved variations, and shall include all costs, profit and sales tax associated with the design, supply, installation, testing and commissioning, and defects liability associated with such works. The rates shall allow for all materials, workshop drawing alterations, labour, cartage, freight, tools, plant scaffolding, painting, appliances etc

Should the Tenderer require differing rates for variation additions as distinct from variation omissions or reductions or differing rates during the various phases of the construction and defect liability period, then those additional rates shall be provided in addition to the following

Air Terminals	Cost
1 Supply and install one typical toilet exhaust grille with 2 metres of 150mm diameter flexible duct and spigot connection with damper	\$
2 Supply and install one three slot linear diffuser complete with 3 metres of 300mm diameter insulated flexible duct and spigot connection with damper	\$
3 Supply and install one single slot linear diffuser complete with 3 metres of 200mm diameter insulated flexible duct and spigot connection with damper	\$
4 Supply and install one variable volume electric reheat supply air box to handle 600l/s, complete with 1,500mm length of externally insulated inlet duct at box inlet size, including installation of damper controls and motor and required BMS points	\$
5 As above for 300l/s VV box	\$

Ductwork

The following prices shall be for providing and fitting sheetmetal ductwork on a cost/sqm basis, to the specification and complete with flanges, stiffeners and including sales tax, overhead, profit and amendment and resubmittal of shop drawings

0 300	\$
325 750	\$
775 1,390	\$
1,400 2,145	\$
2,150 and greater	\$



Specification for Mechanical Services ARV Warrewood

Insulation

Cost per sqm to insulate ductwork as per specification

25mm Internal	\$
25mm External	\$
50mm Internal	\$
50mm External	\$

Chilled Water and Condenser Water Pipework

The following prices shall be for 1 0 metre straight length of plain chilled water pipework to specification, without fittings, and including insulation to specification

	Steel Pipework	ABS Pipework
a) 25mm diameter	\$	\$
b) 50mm diameter	\$	\$
c) 80mm diameter	\$	\$
d) 100mm diameter	\$	\$
e) 150mm diameter	\$	\$

Hot Water Pipework

The following prices shall be for 1 0 metre straight length of plain hot water pipework to specification, without fittings, and including insulation to specification

	Steel Pipework
a) 15mm diameter	\$
b) 18mm diameter	\$
c) 25mm diameter	\$
d) 50mm diameter	\$
e) 80mm diameter	\$
f) 100mm diameter	\$

Pipe Bends

The following prices shall be for providing a full radius 90° bend for chilled or hot water piping to specification with no other fittings except thermal insulation to specification

	Steel Pipework	ABS Pipework
a) 15mm diameter	\$	\$
b) 25mm diameter	\$	\$
c) 50mm diameter	\$	\$
d) 80mm diameter	\$	\$
e) 150mm diameter	\$	\$



Specification for Mechanical Services ARV Warrewood

Pipe Fittings

The following prices shall be for providing and fitting valves, complete with flanges and all fittings, for chilled or hot water pipes, all to specification including thermal insulation

	0-1400kPa Isolating Valve (Steel)	0 1400kPa Isolating Valve (ABS)
a) 25mm diameter	\$N/A	\$N/A
b) 50mm diameter	\$N/A	\$N/A
c) 80mm diameter	\$	\$
d) 100mm diameter	\$	\$
e) 150mm diameter	\$	\$

The following price shall be for providing and fitting a double regulating valve ball valve, control valve and pressure/temperature binder test points complete with unions and including thermal insulation (Rating 1800kPa)

	0 1400kPa Isolating Valve (Steel)	0 1400kPa Isolating Valve (ABS)
a) 25mm diameter	\$N/A	\$N/A
b) 50mm diameter	\$N/A	\$N/A
c) 80mm diameter	\$	\$
d) 100mm diameter	\$	\$
e) 150mm diameter	\$	\$

Tenderer _____

Signed _____

Dated _____

Witness _____

Valves



Size	Ball	Butterfly	Gate	Double Regulating	Control Valve
15					
<i>Specification for Mechanical Services ARV Warrewood</i>					
25					
50					
65					
80					
100					

Cost to drain and refill the piping system to allow valve replacement \$

The above rates should include all associated labour and materials for the installation of one valve

Tenderer _____

Signed _____

Dated _____

Witness _____



Specification for Mechanical Services - ARV Warriewood

14.5 Schedule of Unit Labour Rates for Site Work

Trade	Normal Time \$ per Hour	Time & Half \$ per Hour	Double Time \$ per Hour
Sheetmetal Worker			
Plumber			
Insulation Applier			
Commissioning Technician			
Air Balancing Technician			
Superintendent			

The above rates should not include site allowances, travel time or other special allowances. The rates should reflect the cost of labour which is employed full time on the site.

Tenderer _____

Signed _____

Dated _____

Witness _____



14 6 Tender Schedule for Mechanical Services

1 Sub Contractors Proposed By Tender

- > Ductwork Fabrication _____
- > Ductwork Erection _____
- > Water Piping _____
- > Natural Gas Piping _____
- > Insulation _____
- > Controls _____
- > Electrical _____
- > Water Treatment _____
- > Painting _____
- > Commissioning _____
- > BMS _____
- > Others _____

Tenderer _____

Signed _____

Dated _____

Witness _____



14 7 Tender Schedules for mechanical Services Manufactures

2 Manufacturers Proposed By Tenderer For The Supply Of The Following Equipment

- > Flexible Ductwork _____
- > Dampers _____
- > Motorised Volume Dampers _____
- > Fire Dampers _____
- > Filters _____
- > Air Diffusion Equipment _____
- > Sound Attenuators _____
- > Centrifugal Fans _____
- > Axial Fans _____
- > Roof Mounted Fans _____
- > Fan Coil Units _____
- > Centrifugal Fans _____
- > Axial Fans _____
- > Roof Mounted Fans _____
- > Fan Coil Units _____
- > Unitary Air Handling Units _____
- > Packaged Air Conditions _____
- > Cooling Coils _____
- > Hot water Coils _____

Tenderer _____

Signed _____

Dated _____

Witness _____



14 8 Tender Schedules for Mechanical Services

3 Manufacturers Proposed By Tenderer For The Supply Of The Following Equipment

> Chillers

Manufacturer

Model No

> Hot water unit

Manufacturer

Model No

> Electric Motors

> Valves

> Electrical Switchboard

Tenderer _____

Signed _____

Dated _____

Witness _____



Specification for Mechanical Services - ARV Warnewood

14 9 Tender Schedules For Mechanical Services - Alternative Equipment And Materials

List full technical details, manufacturer's name, size and model of any equipment offered which does not comply exactly with the Specification

		Price \$	Manufacturer/Model No
1	[INSERT EQUIPMENT]	_____	_____
		_____	_____
		_____	_____
		_____	_____
		_____	_____
		_____	_____
		_____	_____
		_____	_____
		_____	_____
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		_____	_____
		_____	_____
		_____	_____
		_____	_____
		_____	_____
		_____	_____

Tenderer _____
Signed _____
Dated _____
Witness _____



Specification for Mechanical Services - ARV Warriewood

14 10 Technical Schedule Of Personnel

Nominate the personnel that will be assigned to this Sub-Contract

In overall charge for the Sub Contract

Name _____ Years with Company

Experience

Engineer Responsible for the Project

Name _____ Years with Company

Experience

Site Supervisor in Continuous Attendance on Site

Name _____ Years with Company

Experience

Quality Assurance

Description

Tenderer

Tenderer _____

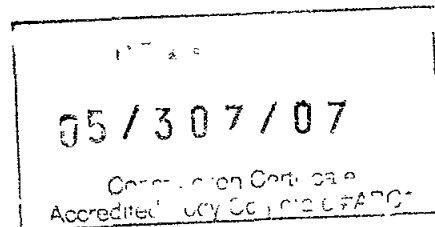
Signed _____

Dated _____

Witness _____



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SECTION 1: PRELIMINARIES

1 1 Generally

This project is located at 6-14 MacPherson Street, Warriewood and the Principal is Anglican Retirement Villages (ARV)

The project is known as Stage 3. The works described in this specification are for the construction of a freestanding building containing 25 independent living units (ILU's), a Community Centre with recreation pool as well as on grade carparking and associated civil and landscaping works.

The works which form the base of this contract are shown on the associated documents referred to in Appendix A of the contract form. These works will be completed under a fixed lump sum contract on a design and construct basis (D&C).

Stages 1 and 2 of this development are complete and are occupied by residents. The Warriewood Brook retirement village is a live occupied facility.

Anglican Retirement Villages (ARV) will retain ownership and management of the village. Residents occupy the units under a Loan License Agreement, as such ARV requires the development to be constructed with high quality, long life, low maintenance materials and construction methods.

The works include all of those works and activities necessary to construct and complete the development as shown on the drawings, described in this specification, consultants' specifications and to current Australian Standards and the Building Code of Australia.

1 2 **Names of the Parties -**

Principal	Anglican Retirement Villages Level 2, Century Corporate Centre 62 Norwest Boulevard, Baulkham Hills NSW 2153 Ph 9421-5333 Contact Michael Lockwood
Superintendent	Morgan Moore & Associates Pty Ltd Ph 9957 6188 Contact Richard Abbott
Architect	NRP Architecture Contact Morris Rosenberg
Structural Engineer	Hughes Trueman 60 Pacific Highway St Leonards NSW Ph 9439-2633 Contact Alex Hoch
Mechanical Engineer	Knox Engineering Contact Jorgen Knox
Electrical Engineer	Jim Hatz & Associates Ph 9437 1000 Contact Jim Hatz
Hydraulic Engineer	GDK Hydraulics Suite 6, 17 Burwood Road Burwood NSW 2134 Ph 9745-0700 Contact George Koutoulas
Landscape Architect	Taylor Brammer 281 Oxford Street Woollahra NSW 2025 Ph 9387-8855 Contact James Heron

1 2 Names of the Parties - Continued -

Geotechnical	Jeffery & Katauskas 115 Wicks Rd, Macquarie Park NSW Ph 9888-5000 Contact Daniel Bliss
Environmental Engineer	EIS 115 Wicks Rd, Macquarie Park NSW Ph 9888-5000 Contact Todd Hore
Private Certifier/ BCA Consultant	Steve Watson & Partners Level 5, 432 Kent Street Sydney NSW 2000 Ph 9283-6555 Contact Andrew Rhys
Quantity Surveyor	RLB Contact Jeff Gall
Civil Engineer/ Water Management	GHD 10 Bond Street, Sydney NSW 2000 Ph 9239 7100 Contact Fiona Quigley (Civil) / Rainer Berg (Water)
Surveyor	Summit Geomatic PO Box 9271 Harris Park NSW Ph 9891-1490 Contact Peter Nancarrow

1 3 Previous / other Works

The whole site perimeter has been fenced and the site is generally clear
The builder must maintain all fences for the duration of the contract programme and alter the location/extent as required by the superintendent at the cost of the builder. The builder must allow for fencing and securing this stage of the project

1 4 Preliminaries

Builder to Inform Himself

The Builder is deemed to have

- i) Examined all the information made available to him by the Proprietor for the purpose of tendering, including the Drawings, Schedules, Contract Conditions and the like, and
- ii) Examined all information relevant to the risks, contingencies and other circumstances which could affect his tender, and which is obtainable by the making of reasonable inquiries, and
- iii) Examined the site, its surroundings and access, and
- iv) Informed himself as far as practicable of all relevant physical conditions on or near the site
- v) Informed himself as far as practicable, of the nature of the work and materials necessary for the execution of the work under the Contract, the means of access to and facilities at the site and transport for deliveries to the site

Failure by the Builder to do all or any of the things he is deemed to have done under this Clause will not relieve him of his liability to perform all his obligations under the Contract

Statutory Requirements and Payments of Fees

The Builder shall comply with all the requirements of the local and statutory authorities that have jurisdiction over these works and pay all relevant fees

A Development Consent has been issued by Pittwater Council. The Builder shall comply with the conditions of that consent

The Proprietor has or will pay for Development Approval, Construction Certificate and Long Service Leave Contributions

The Builder shall obtain all other licenses, consents, and permits from all Authorities and shall make all arrangements and execute all work in accordance with their latest regulations and requirements. The Builder shall pay all fees and charges applicable

The builder must apply for all Road Opening approvals required and allow for application and inspections fees associated with these and other works

Conditions of Contract

The contract for tendering purposes is a fixed lump sum AS4902 (Design and Construct) with the general amendments as listed. The Builder is to allow here all costs which may incur not allowed elsewhere to comply with these conditions

Payment of Employees

It shall be deemed that the contract sum includes for all award payments to employees of Builder and Sub-Contractors

Sub-contractors and Suppliers

The Builder shall bind every Sub-Contractor, Specialist Sub-Contractor, supplier and all other parties necessary and involved in this Contract and the aforesaid parties shall agree to be bound by the full Terms and Conditions of this Contract

Guarantees , Warranties and As Built Information

The Builder shall be deemed by the signing of the Contract to guarantee the due and proper performance of all works involved in this Contract and to warrant that all workmanship and materials shall be of the required quality in accordance with the best practice standards

Where guarantees/warranties are required by this Specification, the Builder shall obtain such guarantees from the firm undertaking the works and shall submit them to the Project Manager for approval prior to practical completion

The guarantees shall state that workmanship, materials and installations are guaranteed for a period as specified from the date of practical completion and that any defects that may arise during the period shall be made good and any such work in other trades resulting from such making good shall be executed at the expense of the firm doing the work, upon written notice from the Project Manager to the Builder to do so

Warriewood Brook Retirement Village – Stage 3

Guarantees given at the satisfactory completion of the works must be signed by an executive of the Guarantor's company

The following information is to be provided by the builder before Practical Completion is given. This is to ensure all the relevant sign-offs, certificates, as built information, and operation manuals at hand over are complete

The As-Built Manual and other information required is listed below but not limited to the following

- 1 Contact Details
 - a Builders Details, (Company, Address and Contact Persons - Director, Project Manager, Site Manager, Foreman, Phone/Fax/Mobile numbers)
 - b Consultants Details (Discipline, Company, Address, Contact Person, Phone/Fax/Mobile numbers)
 - c Subcontractor Details (Trade, Company, Address, Contact Person, Phone/Fax/Mobile numbers)
 - d Suppliers Details (Product, Company, Address, Contact Person, Phone/Fax/Mobile numbers)
- 2 Certificates
 - a Development Consent
 - b Construction Certificate
 - c Occupation Certificate
 - d Essential Services Certificates
 - e BCA and Fire Engineering Alternatives (Fire Engineering Solutions, Independent Peer Reviews, PCA approvals)
 - f Consultant Certificates (structural engineer, mechanical engineer, electrical engineer, hydraulic engineer, lift, acoustic)
 - g Certificate of Installation (Water, Gas, Electricity)
 - h Certificates of Compliance (glazing, shower screens, mirrors, etc)
 - i Floor Finishes Certificates, with Slip co-efficient ratings, Fire Indices, Anti microbial, smoke indices, etc

Warranties/Guarantees

Warranty/Guarantee schedule

DESCRIPTION	WARRANTY PERIOD
Waterproofing (internal wet areas)	15 years
Waterproofing (roofing membrane, planters, podium)	20 years
Metal roofing	15 years
External paint system	10 years
Aluminium windows and doors	10 years
Shower screens, mirrors, robes	10 years
Taps, pans, cisterns, fixtures and fittings	2 years
Carpet	10 years
Vinyl	10 years
Appliances	5 years
Hot Water Units	10 years
Air conditioning units	5 years

- 3 Schedules
 - a Schedule of final External finishes (Location, Brand, Colour Name, Colour Code)
 - b Schedule of final Internal finishes (Location, Brand, Colour Name, Colour Code)
 - c Schedule of final fixtures/fittings (Fixture type, Location, Brand, Model No, Supplier)
- 4 Masterkeying / Access Control
 - a Masterkeying / Access Control details (Keys, Proximity Cards, E-Tags etc)
 - b Hierarchy diagram/system information/instructions
- 5 Operation Manuals (include as a minimum all operational/maintenance details for all equipment within each discipline, including part numbers, supplier contact details, work as executed drawings and schedules) for the following
 - a Electrical Services
 - b Mechanical Services
 - c Hydraulic Services
 - d Lift Services
 - e Irrigation System
 - f Audio/Visual System
 - g Kitchen Equipment
 - h Automatic Opening Doors
 - i Appliances
 - j Sectional overhead doors

The above information is to be presented in A4 size format, placed in plastic protective sheets, within lever arch folders **3 copies of this document are to be issued to the Project Manager prior to the issuing of Practical Completion**

Works as Executed drawings will be required prior to the granting of Practical Completion The works as executed drawings will include all stormwater and sewer works undertaken on site and be carried out by a registered surveyor The Project Manager reserves the right to request works as executed drawings for other building elements Instructions will be given to the builder no less than 4 weeks prior to, if this is required

The builder must allow to record the serial numbers and location of the installation (eg unit number) of all plant and machinery associated with electrical fixtures (not including light fittings, switches and GPOS), all mechanical plant and machinery and Hydraulic services equipment

Samples

When required, the Builder shall furnish for approval with such promptness as to cause no delay in the works, all samples as directed by the Project Manager Where proprietary brands of materials or equipment are used they shall be used in full cognisance and compliance with the manufacturer's directions and directly out of their brand containers

Warriewood Brook Retirement Village – Stage 3

The Builder shall be solely responsible for the consequence of delay resulting from failure to allow adequate time for the assessment and approval of samples, or from the rejection of samples, which do not comply with this Specification. The Project Manager requires ten (10) days to assess and approve samples.

Abbreviations

Abbreviations used in the Contract Documents shall have meanings as defined therein, or if not defined, as commonly accepted in the building industry.

Documents

If the Builder requests and is supplied copies of any documents in addition to those copies supplied without charge, he shall pay for the additional copies at the cost of reproduction and handling.

Do not scale drawings which are clearly diagrammatic and/or marked "not to scale" or "NTS". Written dimensions are to take precedence over scaled dimensions.

The drawings and specification supplied define the Scope of Work. Where any item of work is not wholly indicated in these documents, the Builder shall be deemed to have allowed in his price for all work required to complete that item of work in the best tradesman like manner and in accordance with the best building practices.

During the course of the works, working drawings may be issued. No variation will be approved for additional work detailed on working drawings which could reasonably be anticipated would be required from the contract drawings.

All sections of the Specification are to be read in conjunction with one another and any provisions of clauses in any one section are to be taken as referring to all other sections if such provisions or clauses are in any way applicable. The builder must issue this entire specification including these Preliminaries to all subcontractors.

Warriewood Brook Retirement Village – Stage 3

The Builder must inform the Project Manager of any conflicting information in the documents or of any missing documents, prior to making any assumptions

Proprietary Item

Due to ARV's substantial development programme and property ownership, they have negotiated bulk purchasing agreement with the following companies -

- Tapware - Brodware Industries
- Whitegoods - Fisher & Paykel, Harvey Norman

The Builder may offer alternatives to any proprietary item **The principal/superintendent is not obliged to approve these** If alternatives are offered, apply in writing for approval to use the alternative, provide samples and available technical information. State if provision of proposed alternatives will necessitate alteration to other parts of the works and advise consequent costs

Alternatives may be accepted provided that -

- The variation does not directly or indirectly result in any increase in the cost of Proprietor of the Works,
- The Builder shall indemnify the Proprietor against any increase in costs,
- The variation shall not directly or indirectly cause any delay to the Works

The Specification and drawings detail all fixtures and fittings chosen. No substitution whatsoever will be allowed without the formal approval of the Project Manager and Client. Where the words "or similar to" or "or equal" are written, the builder must formally notify the Project Manager if alternate fixtures or finishes are adopted. No change in finish or fixture will be accepted without prior written approval.

Administration

The builder must not take any instructions from any person other than the Project Manager (Superintendent). Any works undertaken without the formal approval or instruction from the Project Manager will not give rise to a variation and will be rejected.

Programme

The Builder shall, within 14 days of being awarded the project, supply to the Project Manager a programme in a format approved by the Project Manager showing the dates or the times within which the various stages of the work under the Contract are to be executed

Once accepted by the project manager, this will be the construction programme and be used for assessing critical path as well as assessment of extension of time claims

Each month the Builder shall review the construction programme in light of the progress of the work under the Contract and shall submit, if the works fall significantly behind, a revised programme for approval (To be included with Monthly Progress Reports)

Warriewood Brook Retirement Village – Stage 3

The approval of revised construction programmes shall not constitute approval for extensions of time

Consultant Team

The consultant team noted within this specification have been commissioned to complete documentation for tender and contract purposes only. This documentation is not 100% complete as it was formed for the basis of a Design and Construct contract procurement.

As such, the builder is to allow for all consultant fees required to complete any additional design works that may be necessary to complete the project as described within. This is to also include any inspections and disbursement costs associated.

Project Site Meetings

At regular intervals throughout the duration of the Contract, the Builder in conjunction with the Project Manager shall arrange meetings with appropriate Consultants and Sub-Contractors. The Project Manager shall keep minutes of such meetings and have copies thereof forwarded to those present and other concerned parties after each meeting.

The frequency of site meetings will be determined by the Project Manager and can vary in accordance with progress of works and transfer of information required.

Shop Drawings

The Builder shall submit four sets of Shop Drawings for following works -

- Post-tensioning
- Windows
- Air conditioning and ventilation
- Electrical switchboards
- Line drawing for hydraulic services
- Lifts
- Joinery items (Fixed and loose)
- Shower screens
- Wardrobes and closets,
- Roof structure/frame work,
- Any other drawings required under this specification

At the time of submission the Builder shall indicate the date by which approval is required. The Project Manager shall require a minimum, of 14 calendar days to fully approve shop drawings.

Approval from the Project Manager shall be for content only and **not for dimensions**.

Prior to submitting Shop Drawings for approval, the Builder shall check the drawings for accuracy and shall ascertain that all items having any bearing on the work shown in such drawings is accurately and distinctly illustrated and that as shown is in conformity with the Contract requirements. Omissions therefore of work or materials shall not relieve the onus of supplying such work or materials although such drawings may have been approved.

Warriewood Brook Retirement Village – Stage 3

A copy of the drawings will be returned to Builder appropriately marked - "As Approved", "Approved but minor changes required", or "Not Approved revise and resubmit" Any manufacture which commences before shop drawings are approved shall be at Builder's risk if changes are required

The builder must furnish the Project Manager with formal evidence that final as installed products do comply with approved shop drawings

Cost Adjustment

This is a Lump Sum Contract and shall not be subject to cost adjustment The Builder shall be deemed to have made appropriate allowances in the contract sum for increases in the cost of labour and materials from the date of submitting the tender price until acceptance and also for the duration of the works

Security - Retention

2 unconditional Bank Guarantees shall be provided by the Builder as security Both shall be equal to 2 50% of the Contract Sum These shall be lodged with the Project Manager prior to submission of the first Progress Certificate

Overtime Work

Overtime work shall be permitted where this is necessary to fulfil the requirements of the Contract

No extra to the Contract amount will be allowed in respect of overtime work, except where related to ordered or authorised variation work particularly calling for overtime labour as agreed with the Project Manager and such work is not the result of the Builders' error, oversight, lack of pre-planning, co-operation, co-ordination, or other related reason

Maintenance Materials

Prior to receiving Practical Completion, the Builder is to provide and deliver to a location on site and nominated by the Project Manager, the following materials as spares for repairs and maintenance by ARV staff

The materials are not to be used by the Builder in making good defects during the Defects Liability Period Materials are to be in original delivery packaging or suitably wrapped for protection and suitably labelled, noting manufacturer, reference number and where used on site

- Bathroom wall tiles - 10m² of each colour,
- Bathroom floor tiles - 10m² of each colour,
- Kitchen floor tiles - 10m² of each colour,
- Kitchen splashback tiles - 10m² of each colour,
- Carpet - 5blm of each colour,
- Stone flooring - 2m² of each colour,
- External tiling and Paving - 10m² of each colour and type,
- Timber flooring - 10m²
- Entry foyer tiles - 10 m² of each colour and type

Defects Liability

The Defects Liability Period shall be **2 years** from the date of Practical Completion for each Stage

Defects reported during the Defects Liability Period shall be rectified progressively and not allowed to accumulate Defects which affect safety, health, or which seriously interfere with the essential functions of the works shall be rectified immediately after they are reported, other defects within a reasonable period thereafter

Defects inspections shall be attended by the Builder, Project Manager and Architect The Project Manager and/or Architect shall issue to the Builder a Defects List showing defects currently outstanding

At practical completion, all internal areas of all buildings are to have all defects listed by the Project Manager completely rectified Latent defects that become apparent after practical completion or those defects which are listed by incoming residents must be rectified without delay and cannot be allowed to accumulate At Practical completion each internal area must be commercially cleaned thoroughly This clean will happen once again after any other defects are rectified

The builder is to note that residents are all elderly and rectification of the defects after the apartments are occupied must be undertaken strictly in accordance with the following criteria,

- Access is to be arranged with village management,
- No work in apartment before 9 00am,
- Works are to be complete in 1 day (if unable, all work is to be left in a clean and safe condition),
- Linen dust sheets are to be placed on all floor surfaces prior to commencement,
- On completion, carpets are to be vacuumed, tiled floors are to be washed and all surfaces to be wiped down with damp cloths

The builder is to note that in relation to floor finishes, the Project Manager will not accept evident stains or markings Any floor finish found to have any discolouration or stains due to construction traffic or excessive cleaning, is to be replaced upon notification

The builder is to make available to the proprietor, all necessary personnel on site during defects liability period to tend to all resident and client related issues These personnel will be required on site until all noted defects have been formally rectified and signed off by the Project Manager

The builder is to notify the client and Project Manager of after hours emergency contact personnel and contact details during the defects liability period

Insurances

The Builder shall effect a Builder's All Risk Insurance Policy to cover the works as the first alternative in the Conditions of Contract

The Builder shall effect and maintain Public Liability Insurance for a minimum of \$10,000,000 for any one claim

The Builder is to provide evidence of current Workers' Compensation Insurance as required by State Law

Copies of the certificates of insurance are to be provided to the Project Manager prior to works commencing on site

The Builder shall effect and maintain insurance in relation to all owned plant and equipment whether on or off the site, either purchased or hired for the purposes of the execution of the works by it

Home Warranty Insurance

Builder is to note that as the apartments are not to be sold, ownership will be retained by ARV, therefore Home Warranty Insurance is not required

Progress Claims

Submit for checking a written schedule of work completed and claimed showing

- i) Actual cost of work in position
- ii) Value of materials on site
- iii) Proportionate cost of the completed work of various trades
- iv) Value of all variations approved with proportionate cost of work completed
- v) Values claimed previously

Claims are to be submitted on the last working day of each month

Payment will not be made for materials and goods stored off-site

Draft claims must be submitted to the Project Manager/Quantity Surveyor for approval. Once the claim has been formally approved by the Project Manager or Quantity Surveyor, a final claim and Tax invoice shall be raised by the builder

Final Certificate

A Final Certificate will be issued when all outstanding maintenance work has been completed and final accounts checked and approved. Before issue of the final certificate, the Builder shall lodge with the Project Manager

- i) All guarantees specified,
- ii) Complete statements of accounts and variations to the Contract,
- iii) All defects and works completed

Provisional Sums

The Builder is to allow for the Provisional Sums detailed below

- Door Hardware for ILU's (supply only)	\$60,000
- Door Hardware for Community Centre (supply only)	\$50,000
- Community Centre Audio / Visual supply & Install	\$100,000
- Signage supply and install (not incld statutory type)	\$35,000
- Community Centre Commercial Kitchen fit out	\$100,000
- Community Centre extra over lighting supply	\$30,000
- Community Centre pool tiling extra over supply	\$25,000
- ILU Window Furnishings supply	\$45,000
- Community Centre Window furnishings supply	\$50,000
- Community Centre extra over finishes and fixtures	\$100,000
- Community Centre BBQ Equipment supply	\$15,000
- Carpark column guard supply	\$10,000

Note "Extra over" refers to those items over and above what is denoted in drawings and specification

The Builder is to allow for the net cost as shown above for each Provisional Sum Overheads and Profit shall be added to the reconciled final sum for each respective item

1 5 Site Conditions and Working Instructions

Hours of Work

The Builder is advised to adhere to the working hours as set out in the Development Consent, unless written permission is obtained from Pittwater Council to vary the working hours

Site Fencing

Allow to install 1800mm high site security fencing to the entire perimeter of the site / works area

The Builder is to maintain this during construction for site security and allow to progressively remove as the permanent perimeter fence is erected or stage completed

Site Access

Site access is available from either Brands Lane or MacPherson Street The main/dominant site access to be used is off MacPherson Street

Care of the Works and Security Deposit responsibilities

The Builder shall be solely liable for the care of the works, the temporary works, constructional plant and all materials and other things brought onto the site for the purpose of carrying out the works under the Contract by or on behalf of the Builder or any of its Sub-contractors or nominate Sub-contractors

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The Builder shall at its own cost, make good any loss or damage to the Works, the Temporary Works, Constructional Plant and the foresaid materials and other things resulting from any cause (other than the Expected Risks defined below) when such making good is necessary for the satisfactory completion of the Works, except for -

- Any negligent act or omission of the Principal, its agents or employees
- War, invasion, hostilities, revolution or insurrection
- Any risk specifically excepted in the Specification

The builder must be aware that security deposits and bonds have been lodged by the principal with Pittwater council to cover damage to council property as well as trees on site Any actions carried out by the builder or their subcontractors that prevents the full release of these deposits and bonds, will allow the principal to deduct the funds withheld by council from the contract sum

Dilapidation Survey

Prior to the commencement of the building works, the Builder shall carry out a Dilapidation Survey of adjoining and adjacent properties and all public areas. The Builder shall produce a fully detailed photographic record and report, submitting three (3) colour and signed copies to the Project Manager and the Principal.

The Builder is to advise adjoining owners when and what work is to be undertaken on property boundaries, take all due care, protection temporary works required to protect adjoining property, clean up following the works, reinstate adjoining property as close as possible to its pre-construction condition or better.

Footpaths & Kerbs

Builder is to allow to reinstate or reconstruct footpath and kerb and gutter on MacPherson Street Brands Lane entrance to Pittwater Council's requirements prior to completion of the project. Builder must also allow for the removal of all redundancy laybacks, crossings, footpaths and kerb and gutter to make way/provide for new.

Builder's Staff

The Builder shall notify the Project Manager in writing, the name of the competent person he proposes to maintain on site during the project to superintend the works.

In addition, the name of any other representative at any other place in which main activities relating to the carrying out of the work under the Contract are taking place. Builder shall advise the Project Manager of any subsequent changes to these personnel.

Co-ordination of Works

The Builder shall co-ordinate the work to ensure a logical and economic sequence

The Builder shall assess requirements and organise for procurement of material, plant, equipment and services as soon as practicable after signing the contract so that the completion date of the contract is not jeopardised nor the works programme adversely affected by delays which could have been avoided

Plant and Equipment

The Builder is to provide all tools, plant and equipment necessary for the efficient and proper execution of the works under this Contract and ensure that it complies with the requirements of the relevant authorities

The Builder shall make provision for all hoists, cranes, work platforms, scaffolding, tackle and other construction and materials handling plant and equipment, temporary coverings and protective devices, also for all labour and material to install, operate, move, adapt, maintain and remove after use

Plant and equipment requiring operation by licensed or otherwise qualified personnel shall be manned during working hours

Temporary Services

Make separate connections as necessary for all temporary services required during the works. Install meters, valves and switchboards in accordance with the installation and use of such services. Alter, adopt and maintain all such services as necessary and remove on completion of the works

The Builder shall arrange for installation of a telephone service with suitable number of lines for the site offices. A mobile phone shall be provided for use by the Builders' Supervisors on site when absent from their offices

The telephone service is to be operative as soon as possible after work at the site commences. The Builder shall pre-arrange for installation to avoid delay and inconveniences and ensure that calls are answered during working hours

The Builder shall install a facsimile facility on site to receive and send instructions, requests and the like

The builder is deemed to have investigated the extent of existing services on site and made all necessary allowances to accommodate services requirements during the term of the contract

Accommodation

The Builder shall provide all site offices, change rooms, amenities and the like required by all awards or legislation. Facilities shall be regularly cleaned and properly maintained throughout the course of the project

Allow to provide a separate work desk with phone/data outlets for the superintendent

Sanitary Accommodation

The Builder shall provide for the supply, maintenance and removal of temporary mess rooms, change rooms, sanitary accommodation and washing facilities for use on site by his employees, sub-contractors and Consultants, all as required by the Awards, Authorities and Workplace Agreements

Sales Office and Site Access

ARV will also require access to the site on a fortnightly basis so that potential purchasers/residents can see their units under construction. The builder shall ensure that safe access is maintained to the units requiring inspection by ARV. Inspections times are to take place after 3 30pm and to be co-ordinated with the builder to maintain the highest level of safety to ARV staff and visitors. No inspection shall commence until the buildings are at a "lockup" stage

Also the ARV Sale department shall be establishing a temporary Sales office on the corner adjacent to Brands Lane. The builder must supply and connect water, power, two phone lines and sewer to this building as required

Safety

ARV is committed to its obligations under the *New South Wales Occupation Health and Safety Act 2000* and the *New South Wales Occupational, Health and Safety Regulation 2001* to provide, as far as reasonably practical, a safe and healthy working environment for all persons legally on their site (including contractors and visitors). As a condition of this contract, ARV require that any Principal Contractor or Subcontractors engaged to carry out work on their behalf, will at all times work in a safe manner and not expose themselves, ARV staff or others to risk to their health safety and wellbeing. The Principal Contractor shall ensure all of their management of OHS corresponds to the requirements detailed in the *New South Wales Occupational Health and Safety Regulation 2001* relevant Codes of Practice as well as any site safety rules specified by ARV

The Builder shall not at any time leave any work in an unsafe condition or in a condition, which might cause damage to other existing work, plant, machinery or equipment, but shall continue that work until it is at a safe state

The Builder shall take every precaution to ensure the safety and protection at all times of all persons on or about the site, including all workmen and others employed on the works, and to this end shall provide and maintain all facilities both necessary and proper to comply with the safety rules and regulations of any body or authority having jurisdiction thereto

The Builder shall provide safety footwear and headwear for Principal's representatives visiting the site, min 10 set of various sizes

The Builder shall take adequate precautions against fire and explosion hazards

Bulk storage at the site of highly inflammable materials, fuels, adhesives, etc , shall not be allowed

No extensions of time will be granted for industrial disputes involving safety, as the Builder is deemed to be totally responsible for the safety of the site throughout the execution of the works

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Disposal of Contaminants

Properly dispose of all solid, liquid and gaseous contaminants in accordance with all statutory and contractual requirements

Discharge gaseous contaminants in such a manner that they will be diluted with fresh air sufficiently to reduce toxicity to an acceptable level

Builder is to refer to Environmental and geotechnical reports included with this contract and ensure all site materials requiring disposal are carried out in accordance with them as well as EPA guidelines and council

Site Security

The Builder shall be wholly responsible for the proper and adequate safeguarding of the works and of fixed and unfixed materials on the site during both working and non-working hours

No claims for extensions of time or extra costs will be allowed in respect of damage or loss of materials or interruption of work due to the Builder's failure to adequately safeguard the works

Industrial Requirements

The Builder is responsible for all industrial relations and safety matters and the overall running of the site, accordingly no extensions of time or costs will be allowed for site based industrial disputes of any nature

Daywork

If the Project Manager directs that any work be carried out as daywork, the Builder shall record each day, in a manner to be approved by the Project Manager, the time spent by each workman and each item of plant and materials used for the execution of the daywork. The Project Manager shall endorse these records as true and correct or otherwise. The Builder shall present his claim for payment in writing with these records at intervals as directed by the Project Manager

The Project Manager shall determine the amount to be paid to the Builder having regard to the following

- i) The amount of wages and allowances paid or payable by the Builder at rates established by the Builder to the satisfaction of the Project Manager or at such other rates as may be determined by the Project Manager
- ii) The amount paid or payable to the Builder in accordance with any statute or award applicable to day labour additional to the wages paid or payable as stated above
- iii) The charge for equipment
- iv) The actual cost of services and of the supply and delivery of materials and equipment
- v) A charge to cover overheads, administrative costs and profits

The charges for equipment and overheads, administrative costs and profits shall, if practicable, be agreed upon in writing between the Builder and Project Manager prior to the commencement of the daywork

Practical Completion

The definition of practical completion in the contract shall read -

“Practical completion is that stage in the carrying out and completion of WUC when -

a) Internal Areas

- (i) Are complete of all defects notified by the project manager/architect
- (ii) All certificates for essential services have been provided
- (iii) Are subject to latent defects and defects to be notified by the residents

b) External Areas

- (i) Are complete except for minor outstanding works and defects
- (ii) Which do not prevent the works from being reasonably capable of being used for the stated purposes and are safe
- (iii) Which the superintendent determines the contractor has reasonable grounds for not promptly rectifying
- (iv) The rectification of which will not prejudice the convenient use of the works

c) Those tests, which are required by the contract to be carried out and passed before the works reach practical completion have been carried out and passed

d) Documents and other information required under the contract which, in the superintendents opinion, are essential for use, operation and maintenance of the works have been supplied

Without limiting the generality of the foregoing, the following particular requirements shall have been met -

- a) Air conditioning and ventilation systems are balanced and working
- b) The Builder's items of equipment have been removed from the Works
- c) A Final Occupation Certificate has been obtained by the contractor,
- d) All keys have been labelled appropriately and handed over
- e) The requirements of all Statutory Authorities have been satisfied
- f) Guarantees Warranties and As Built information are issued and approved by the Project Manager
- g) All works-as-executed drawings for the civil and stormwater works carried out on site have been issued to the Principal

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The Builder, at Practical Completion, shall produce a Hand-over Package for each apartment which shall be in strong plastic package -

- Apartment number clearly identified
- Three front door keys
- Two keys for window locks
- Two proximity cards for access system
- One E-tag sensor per apartment
- Sink and basin plugs
- Owner's Operational Manual for
 - Cooktop
 - Oven
 - Clothes dryer
 - Range hood
 - Air Conditioning
 - Remote controllers for air conditioning unit (where applicable)

The builder is responsible for obtaining the Final Occupation Certificate. Practical Completion will not be awarded until this certificate has been issued to the superintendent

At Practical Completion, the builder MUST issue to the Project Manager, certification documents as required by the Private Certifier. This will include, but is not limited to all certification required to confirm that ALL works and aspects of the project have been installed and carried out in accordance with the relevant Australian Standards, BCA clauses and good building practices

The builder must be aware and take responsibility for the provision of these certificates upon practical completion either through their subcontractors or by themselves

Any documents stating that the works were installed as per the documentation provided will be unacceptable. Certification must state compliance with the relevant standards

The builder must inform themselves as to the standard forms and procedures required by the Private Certifier for this project

It must be clearly understood that Practical Completion will not be issued until the Project Manager and Client mutually accept that each area is defect free under the terms listed above

Maintaining Design Intent and Restrictions Associated

The builder is not permitted to alter any part of the contract design with out the formal approval of the Project Manager. Strict tolerances are associated with various components of the project in order to satisfy client requirements as well as statutory restrictions.

As such

- Services and general building zones shall not impact on any space of any unit or common area. Ceiling heights, room/area sizes, cupboard spaces and the like shall not differ from the contract intent. This includes the extent and use of bulk heads, wall thickenings and riser spaces,
- A 100% clear head height of 2.5m is to be maintained in ALL carspaces. However for the first 2.16m measured from the rear of the carspace (i.e. from the basement wall), the clearance height can be reduced to conventional Australian Standards.

SECTION 2: GROUNDWORKS

2 1 Scope of Works

The scope of works includes but is not limited to,

- i) Bulk excavation to achieve nominated levels
- ii) Removal of surplus or unsuitable materials from site in accordance with Environmental engineers reports and advice
- iii) Compaction of all subgrade elements
- iv) Detailed excavation
- v) Preparation of a site management plan
- vi) Cut and filling site to achieve formation levels
- vii) Excavation with batters/shoring as necessary, and disposal of existing fill and rock
- viii) Removal and disposal of any existing services found,
- ix) Construction of temporary erosion control measures, including a detailed Plan,

This specification is to be read in conjunction with the contract conditions and all other sections of this specification. The proposed construction area is affected by landfill gas and acid sulphate soils and appropriate measures during the construction phase will need to be incorporated into the site management plan.

2 2 Geotechnical /Environmental Investigation

Geotechnical Surveys and Environmental Site Reports have been undertaken by Jeffery & Katauskas (Geotech), GHD (Geotech & Environmental) and P. Clifton & Associates (Remediation Action Plan for Asbestos)

Reports relating to the above are attached as part of this specification.

The Builder is to allow for excavation and works in material and conditions described in all of the reports.

Prior to disposal, the builder must issue to the Project Manager copies of classification reports including associated quantities of materials

Acid Sulphate Soils

Attention must be given to the summary and recommendation set out within the enclosed Acid Sulphate Management Plan prepared by GHD Longmac (1/9/2005)

The builder must allow for working within/encountering potential acid sulphate soil (PASS) zones and treatment of materials associated with these zones accordingly. This also relates to dewatering solutions and disposal of water removed from excavated areas.

2 3 Existing Services

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Should any service be found during excavation, it shall be investigated to ascertain if it is still live, if so, advise Project Manager and arrange to terminate service at a convenient location at builders cost

Builder is to allow for excavation for service connections off the site in public roadway Local Council and other authorities are to be contacted prior to any excavation proceeding and obtain and implement all authority's requirements Provision of lighting, barricades, traffic signs, signals, controls, temporary covers, etc required

Care is to be taken to avoid and work around any services found outside site boundaries

2 4 Interpretation

Definitions

General To AS 1348 1

Description and classification of soils To AS 1726

Bad ground Ground unsuitable for the purposes of the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground which is or becomes soft, wet or unstable

Discrepancy A difference between contract information about the site and conditions encountered on the site, including but not limited to discrepancies concerning

- the nature or quantity of the material to be excavated or placed,
- existing site levels, and
- services or other obstructions beneath the site surface

Line of influence A line extending downward and outward from the bottom edge of a footing, slab or pavement and defining the extent of foundation material having influence on the stability or support of the footings, slab or pavement

Rock Monolithic material with volume greater than 0.5 m³ which cannot be removed until broken up either by explosives or by rippers or percussion tools

Subgrade The trimmed or prepared portion of the formation on which the pavement or slab is constructed

2 5 Site Investigation

The geotechnical and environmental information given is information on the nature of the ground at each tested part. It is not a complete description of conditions existing at or below ground level.

2 6 Records of Measurement

Excavation and backfilling

Agreed quantities. If a schedule of rates applies, provisional quantities are specified, or there are variations to the contract levels or dimensions of excavations, do not commence backfilling or place permanent works in the excavation until the following have been agreed and recorded:

- Depths of excavations related to the datum
- Final plan dimensions of excavations
- Quantities of excavations in rock
- Quantities of fill and topsoil, imports being recorded separately

Records of measurement. Provided a copy of the agreed records of measurements certified by the Project Manager.

2 7 Inspection

Witness points

Give sufficient notice so that inspection may be made of the following:

- Items to be measured as listed in Records of measurement
- Areas to be cleared and/or stripped of topsoil
- Stripped fill and soil prior to disposal
- Areas stripped of topsoil
- Excavation completed to contract levels or founding material

2 8 Tests

Testing Authority

Use an independent testing laboratory - NATA registered

Testing

Compaction (density) Test for compliance

Retesting. Rework and retest areas which do not achieve the required density until that density is achieved.

Test methods

Field dry density. To AS 1289 5 3 1, AS 1289 5 3 5 or AS 1289 5 8 1. If using AS 1289 5 8 1 calibrate the surface moisture-density gauge in accordance with AS 1289 5 8 4 before use.

Density index. To AS 1289 5 6 1

Standard maximum dry density. To AS 1289 5 1 1

Fill. Test to AS 1141 or AS 1289 as appropriate.

Test locations

Fill. Test the areas of fill which are to support non-spanning concrete ground slabs, roads and paved areas.

Test frequency

General At least one test per 50 m³ or one test per layer per 300 m², whichever requires the more tests. Layers not to exceed 300mm in loose thickness
Fill Distribute the testing as directed, otherwise evenly throughout the fill

2 9 **Samples**

General

Submit samples of the following

- Each type of imported fill

2 10 **Submissions**

Design

Calculations Submit calculations to show that proposed excavations and temporary supports, including where applicable supports for adjacent structures, will be stable and safe

Tests

Imported fill Submit certification or test results which establish the compliance of imported fill with the contract

Materials

Submit details of materials proposed, including the following

- Sources of imported fill

Execution

Submit the methods and equipment proposed for the groundworks, including the following

- Excavation methods, stages, clearances, batters and temporary supports
- Stockpiles and borrow pits
- Placing and compaction methods and stages
- Vibration control and measurement
- Noise control and measurement
- Control of erosion, contamination and siltation of the site, surrounding areas and drainage system
- De-watering and groundwater control and disposal of surface water
- Dust control

Existing Services

All existing services still exist although all have been terminated at site boundary except for stormwater drainage

2 11 **Environmental Protection**

Erosion Control

General Plan and carry out the work so as to avoid erosion, contamination, and sedimentation of the site, surrounding areas, and drainage systems. Provide an erosion and sediment control plan to adequately specify the proposed methods and staging

Temporary Erosion Control Measures

Staging Stage operations (eg Clearing, stripping)

Drains Provide temporary drains and catch drains

Dispersal Divert and disperse concentrated flows to points where the water can pass through the site without damage

Spreader banks

or other structures Disperse concentrated run-off

Silt traps Construct and maintain silt traps to prevent discharge of scoured material to downstream areas install the grass pollutant traps adjacent to Woollooware Bay and associated stormwater/headwalls before commencing any significant site works

Temporary fencing Required

Maintenance After each rain inspect, clean, and repair if required, temporary erosion and sediment control works

Removal Remove temporary erosion control measures when they are no longer required

Builder is to allow to install all sediment control lines as required in the sediment erosion control drawings Before any excavation commences, the Builder is to provide new sediment control works to ensure all surface run-off is controlled and filtered prior to leaving the site

Maintain in good order or adjust all control measures to suit the sequencing of the works throughout, until paving or landscaping is being undertaken All the above is to be in accordance with Pittwater Council requirements, including preparation of design drawings, being submitted and approved prior to excavation works commencing The builder is to obtain copies of these council requirements and is to comply with all

De-watering

General Keep ground free of water Provide and maintain slopes, crowns and drains on excavations and embankments to ensure free drainage Place construction, including fill, masonry, concrete and services, on ground from which free water has been removed Prevent water flow over freshly laid work

Keep groundworks free of water **Dispose of groundwater and surface water in a manner approved by the Local Authority and Environmental Protection Agency** Arrange excavations to drain to collection points equipped with pumps and filtration system prior to pumping to street mains Do not permit surface or groundwater to enter adjacent properties, stormwater system or creek waters Generally the builder is deemed to have allowed for all de-watering required to undertake all works detailed on contract documents This includes all trenching indicated on drawings, regardless of depth

Siltation Control

In addition to the erosion sediment control plan, refer to the civil drawings for additional requirements

Noise and Vibration Control

Maximum allowable peak particle velocity resultant of 5mm/sec as measured immediately adjacent to the site on Alexander Avenue or the Southern boundary to the development

Restrict dust and noise to the minimum. Take precautions, including, but not limited, to the use of silenced compressors and jackhammers. Ensure mobile plant and equipment are fitted with effective silencers. Cover loads of excavated material before departure from site. Remove soil from trucks prior to leaving site. Any soil or dirt on adjacent roads is to be cleaned up immediately.

2 12 Excavating Tolerances

Surfaces

Finish groundworks to reasonably smooth and uniform surfaces conforming to the required tolerances.

Subgrades

General. The tolerances in the **Subgrade tolerances table** apply to finished subgrade levels unless overridden by the specific requirements (including tolerances) for finished surface levels and thicknesses of covering materials.

- Absolute level tolerance. Maximum deviation from design level.
- Relative level tolerance. Maximum deviation from a 3 m straight edge laid anywhere on each plane surface.

Subgrade tolerances table

Item	Level tolerance (maximum)	
	Absolute	Relative
Cut subgrade in earth and fill subgrade	+ 0 30 mm	10 mm
Cut subgrade in rock	N/A	N/A

Other Groundworks

Groundworks supporting construction. Level tolerance (maximum) +0, -30 mm.

Vertical faces and batters. Plan location tolerance (maximum) at any point on the surface +0, -50 mm, +ve being in towards the excavation.

2 13 Excavation

Extent

Where a Bulk Excavation level is not shown, the contractor must refer to contract documents and details to determine depths required.

Site surface. Excavate over the site to give correct levels and profiles as the basis for construction, paving, filling and landscaping. Make allowance for compaction or settlement.

Footings. Excavate for footings, pits, wells and shafts, to the required sizes and depths. Confirm that bearing capacity is adequate.

Proof rolling

Extent Proof roll excavations for pavements, filling and non-spanning slabs on ground to determine the extent of any bad ground Refer to civil drawings/specification for limits

2 14 Provisional Depths

Contract depths

The footing or pile depths shown on the drawings are for contract purposes They shall be adjusted by the contractor for the actual level at which the required capacity is achieved

2 15 Sub-grades Affected by Moisture

General

Where the subgrade is unable to support construction equipment, or it is not possible to compact the overlying pavement only because of a high moisture content, perform one or more of the following

- Allow the subgrade to dry until it will support equipment and allow compaction
- Scarify the subgrade to a depth of 150 mm, work as necessary to accelerate drying, and recompact when the moisture content is satisfactory
- Excavate the wet material and remove to spoil, and backfill excavated areas

2 16 Bearing Surfaces

General

Provide even plane bearing surfaces for loadbearing elements including footings Step to accommodate level changes Make the steps to the appropriate courses if supporting masonry

Deterioration

If the bearing surface deteriorates because of water or other cause, excavate further to a sound surface before placing the loadbearing element

2 17 Reinstatement of Excavation

General

Where excavation exceeds the required depth, or deteriorates, reinstate to the correct depth, level and bearing value

Particular

Below or within the "line of influence" of footings, beams, or other structural elements Concrete of strength equal to the structural element, minimum 20 MPa At underside of Lift Bases provide a structural working base with grade 32MPa concrete

Below slabs or pavements Provide selected clean filling compacted to the specified density

Backfill rock depressions and over excavation of subsoil drains using coarse subsoil filter

Line of influence
Angle from horizontal 45°

2 18 **Supporting Excavations**

Sides
Support sides of excavations as necessary to ensure safe working

Removal of supports
Remove temporary supports progressively as backfilling proceeds

Voids
Guard against the formation of voids outside sheeting or sheet piling if used. Fill and compact voids to a dry density similar to that of the surrounding material

2 19 **Placing and Compaction Fill**

Fill material
General Inorganic, non-perishable material, non dispersive
Sulphur content Do not provide filling with sulphur content exceeding 0.5% within 1000 mm of cement bound elements (for example concrete structures or masonry)

Sources
Provide clean fill imported on to the site from suitable sources

Fill types
General fill Well graded material, maximum particle size 75 mm, PI <15%
Emerson Class 5 or 6
Select fill Granular material complying with the following
Maximum particle size 75 mm
- Proportion passing 0.075 mm sieve 25% maximum
- Plasticity index $\leq 2\%$, $\leq 15\%$

2 20 **General Notes Regarding Filling**

- For deeper excavations, as noted on the drawings, the Builder is deemed to have allowed for all necessary shoring required to undertake the works
- The Superintendent will not entertain any variation submissions for excavation over that which is documented or inferred within this specification
- Builder is to assume that any excavated material will be VENM and ground water associated will be classed as “solid waste” as defined by EPA and therefore dispose of it accordingly

Subsoil filter
Subsoil filter Coarse sand or crushed stone graded to the **Subsoil grading table**

Subsoil grading table

Sieve aperture (mm)	Percentage passing (by mass)		
	Fine filter	Coarse filter	Combined filter
26.5		100	100
19.0		90 - 100	95 - 100
9.5	100	75 - 90	90 - 97
4.75	80 - 100		75 - 90
2.36	65 - 90		60 - 78
1.18		10 - 30	35 - 55
0.60		0 - 2	18 - 25
0.30	7 - 16		5 - 10
0.15	0 - 4		0 - 3

Fill subgrades

Provide general fill materials unless noted otherwise up to the top 150mm which has a maximum particle size of 75 mm

Select fill subgrades will occur under concrete driveways and carparking, asphaltic roadways

2.21

Preparation for Filing

General

Prepare the ground surface before placing fill, ground slabs or load bearing elements. Remove loose material, debris and organic matter and compact the ground to achieve the required density. In areas underneath the slab, place a geotextile fabric such as Terram 700 in accordance with manufacturers recommendations before placing the 100mm base course. Refer to Slab Plans

Under slabs, paving and embankments

Compact the ground to achieve the densities specified for these locations. If necessary loosen the ground to a depth of 200 mm and adjust the moisture content before compaction

Rock ledges

Remove overhanging rock ledges

Tolerances

Finish the surface to the required level, grade and shape within the following tolerances

- Under slabs and loadbearing elements +0, - 25mm
- Other ground surfaces ±50 mm, provided the area remains free draining and matches adjacent construction where required. Provide smoothness as normally produced by a scraper blade

2 22 **Placing Fill**

General

Layers Place fill in layers Do not exceed the specified maximum layer thickness of 300mm loose

Extent Place and compact fill to the designated dimensions, levels, grades, and cross sections so that the surface is always self draining Fill nominally 1 0m past the theoretical termination point to allow for trimming/protective landscaping

Placing at structures

General Place and compact fill in layers simultaneously on both sides of structures, culverts and pipelines to avoid differential loading

Concrete Do not place fill against concrete until the concrete has been in place for fourteen days

Moisture content

Adjustment Where necessary to achieve the required density or moisture content, adjust the moisture content of the fill before compaction

2 23 **Compaction**

Density

Compact each layer of fill to the required depth and density Provide Compaction Control Certification by a NATA registered laboratory to Level 2 control in accordance with AS3798-1990

Protection

Protect the works from damage due to compaction operations Where necessary, limit the size of compaction equipment or compact by hand Commence compacting each layer at the structure and proceed away from it

Moisture content

Adjust the moisture content of fill at the time of compaction within the range of 60 - 90% of the optimum moisture content determined by AS 1289 5 1 1 or AS 1289 5 2 1 as appropriate, in order to achieve the required density

2 24 Minimum density table

Location	Cohesive soils Minimum dry density ratio (standard compaction) to AS 1289 5 4 1	Cohesionless soils Minimum density index to AS 1289 5 6 1
Underneath Roadways Slabs (Select Fill)	98	70
Underneath Suspended Slabs (General Fill)	95	70
Behind Retaining Wall Backfill (Excluding subsoil filter layer)	95	70
External Footpaths	95	70

2 25 Geotechnical Engineers Certification

The Builder shall obtain certification from the Geotech engineer for the sub-grade preparation prior to constructing the slab on ground or pavings All fees for the all certification requirements shall be paid by the Builder

SECTION 3: PILING

3.1 Scope of Works

GENERALLY Design and construction of a complete installation of piles to meet design loads given. Piling type may be but not limited to reinforced concrete or proprietary enlarged base 'Franki Piles' or precast concrete piles or atlas (or similar) bored piers and other incidental or consequential work which is or may become necessary to complete the work. The contractor shall satisfy himself regarding the site preparation for installing piles. Alternative pile/pier designs will be considered.

General Requirements

STANDARD To AS2159 - 1995

Performance

REQUIREMENT The installed piles shall carry the working loads within the required settlement limits.

DESIGN LIFE Minimum design life of the piers will be 40 to 60 years as per AS 3600.

DESIGN RESPONSIBILITY The contractor shall design piles which, when properly installed, meet the performance requirement as noted on the structural drawings.

CALCULATIONS Submit calculations to show that the proposed piling will meet the specified requirements. Also submit the sources of geotechnical information and design parameters used in the calculations. The geotechnical investigation reports are provided for your reference. Piles are to be found into the dense layers as required for the working load specified.

Inspection

NOTICE Give sufficient notice so that inspection may be made of the following as applicable:

- Piles and piling material after delivery to site and prior to installation
- Reinforcement cages after assembly and prior to installation
- Installation of piling
- Excavated shafts, casings and sockets prior to placing reinforcement
- Excavated shafts, casings and sockets prior to concreting
- Concreting of piles
- Pile heads after preparation

Adjoining Property

DAMAGE If damage is caused to adjoining property, stop piling operations. Notify the Project Manager and apply for instructions.

Setting Out

REQUIREMENT Peg the position of each pile and establish a grid of recovery pegs to enable the setting out to be checked at any time.

Site Records

INFORMATION Record the relevant information listed in Rule 7.6 of AS2159, and furnish two copies of each record to the Superintendent

LENGTH OF PILE Record the length from the underside of the pile cap or foundation beam to the toe of the pile. If piling from the existing ground level, nominate the sacrificial length of piers

GROUND LEVEL Record the level of the surrounding ground at the time when the pile is installed

SURVEY Allow to survey installed positions of the piers at the proposed cut-off levels

Geotechnical Investigation

A Geotechnical report has been prepared which is to be used to ascertain pier founding criteria. The report is issued for information only and the Contractor should accept same as sufficient to ascertain contract founding depths or he should perform additional tests/sample pile installations to control same. No variation for pier founding depth will be considered

Excavation

The excavation shall be done with a mechanical boring tools which provide minimum disturbance to the surrounding soils. Provide liners to ensure the soundness of the pier if bored piers are adopted

Provide a cover over pier holes to exclude rain and surface water from entering and to prevent drying out. Prevent loose material from falling into holes prior to and during concreting

3.2 Quality

Quality Assurance

Cross Reference The QUALITY section of this specification applies

Concrete will be tested in accordance with AS 3600 and AS 1379 in reference to Project Control Testing with two samples being taken for each 25m³ of concrete delivered

Data Transmissions

REQUIREMENT Before piling commences, obtain and submit the following where relevant to proprietary piling systems

- Manufacturer's data** The manufacturer's published product data, including
- technical specifications
 - recommendations for installation, and
 - type test or factory test data

PRODUCT WARRANTIES The manufacturer's written statement certifying that the product complies with the specification and is suitable for the intended use

- Items for which a warranty is required **LOAD CAPACITY, DESIGN CORROSION RATE**

- **Warranty terms 7 YEARS**
- **Furnish evidence of insurance cover**

Piling Methods

REQUIREMENT Submit details of proposed piling methods, equipment and sequence. If directed submit calculations to show that the piles can be safely installed to the specified levels by the proposed method, without damaging the piles or adjacent piles or structures.

3.3 Assessment

(a) Concrete

STANDARD To AS3600 and AS2159

MIX DESIGN Select and proportion materials to attain the performance requirements specified. Submit a mix design for approval as part of the tender submission.

PERFORMANCE REQUIREMENTS

MINIMUM CEMENT CONTENT

Generally 380 kg/m³ Marine Mix or Tremie concrete or as noted on drawings

F_c = 50 MPa or as noted on drawings

Drying shrinkage at 56 days = 600 microstrain

w/c ratio ≤ 35 or as noted on drawings

Superplasticizer permitted

HIGH ALUMINA AND HIGH EARLY STRENGTH CEMENTS Use only if approved

REINFORCEMENT Provide spacers on the reinforcement cage to maintain the current cover. During installation of reinforcement in uncased holes keep the reinforcement cage clear of the sides of the hole.

Minimum cover Refer drawings

REINFORCEMENT As per the Contract documents or submit alternative for approval. Tension piers will have full depth reinforcement. Reinforcement can be curtailed dependant on load/anchorage requirement/min AS 2159 reinforcement provisions.

3.4 Installation

SAFE WORKING Observe safe working practices, including the relevant practices recommended in AS2159.

INSPECTION Provide and install facilities necessary for inspection of piling including safe access, lighting, ventilation, and the like.

LINERS Do not allow loose material or seawater to fall down pile holes prior to or during concreting. Where necessary for uncased holes, provide a liner for the top 300mm of the hole and projecting 150mm above ground level. Pack well into position.

PILING SYSTEM

CONCRETE BORED PIERS, FRANKI PILES, GROUT INJECTED PIERS, PRECAST PILES, ATLAS PILES or TIMBER PILES Concrete strength 50MPa or as noted on drawings.

PROTECTION Method of protection against deterioration if alternatives offered.

PILE CAPACITY Refer structural drawings. Piers shall have the load capability noted on the documents. Tension piers shall be reinforced full depth and splicing of reinforcement shall be by welding or mechanical means only. Compression piers will be reinforced to the Code criteria.

The loads nominated on the drawings are working loads in kN.

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TOLERANCES Maximum permissible deviations

- Cut off level + 0mm, - 50mm
- Remove laitance and roughen the surface at cut-off level Clean and straighten projecting reinforcement \pm 25mm Do not cut reinforcement
- Position \pm 75mm NOTE at proposed cut off level
- Verticality in accordance with AS 2159

Note The cut off level will be 100mm above the base of the pier caps/integral slab thickenings

3 5 Testing

DYNAMIC PILE TESTING

If a displacement pile is offered, allow to Dynamic Pile Test Ten (10) of the piers in accordance with AS 2159 8 4 Provide a report by a NPER registered Engineer with records in accordance with 8 4 7 and 8 4 8 Identify separately the cost of Dynamic Pile Testing and the unit rate for additional pile testing in the 2000-4500kN working load range

INTEGRITY TESTING

All driven piers and bored piers and Franki Piles will be integrity tested Test in accordance with AS 2159 8 5 and furnish a report by a NPER registered engineer experienced in this work The testing will be performed on the piles after they have been trimmed to the proposed cut-off level and will be performed by a Contractor familiar with the test and the following equipment,

- (I) A Oscilloscope
- (II) A Signal Processor
- (III) A Accelerometer
- (IV) Cables, batteries and other ancillary equipment

The Piling Contractor will provide or ensure the following

- (A) The pile head must be clean, accessible, sound and free of standing water
- (B) The pile specifications are to be supplied to the testor with a drawing denoting pile types, loads and referencing numbers Pile lengths are to be verified between the integrity test and the drilling record
- (C) A suitable under cover accommodation for the equipment should be provided for the duration of the integrity tests
- (D) Uninhibited access to pile positions for the duration of the pile testing
- (E) A unit rate per pile for additional integrity testing

The result of the integrity testing are to be forwarded to the Superintendent for approval Piles failing the test in terms of displaying necking or discontinuities will be replaced at the Piling Contractors expense

INTEGRITY TESTING

Static Load Tests (Steel Screw Piles) are permitted to prove the Geotechnical capacity of the founding layer (Rug) with ϕ_g in limit state design being applied to the maximum load test load if the test is not taken to failure as specified

SECTION 4: CONCRETE, REINFORCEMENT & FORMWORK

4 1 General Scope

Cross References

This section includes both the supply and placement of all pre-mixed in situ concrete required by the project

Also allow for the supply and installation of 2m precast concrete wheelstops to each individual car bay shown. Each wheelstop to be mechanically fixed to the slab associated.

4 2 Standards

Materials and construction To AS 3600

Concrete To AS 1379

Methods of Testing Concrete AS1012 (All Parts)

4 3 Interpretation

Contraction joint An unreinforced joint with a bond-breaking coating separating the concrete joint surfaces

Pour Strip A delayed pour joint to the time delay requested, fully linked with lapped reinforcement with adjacent edges propped until strip has been poured and attained strength

Pour Strip A delayed pour joint to the time delay requested, fully linked with lapped reinforcement with adjacent edges propped until strip has been poured and attained strength

Expansion joint An unreinforced joint with the joint surfaces separated by a compressible filler

Control joint A weakened plane contraction joint created by forming a groove, extending at least one quarter the depth of the section, either by using a grooving tool, by sawing, or by inserting a pre-moulded strip

Isolation joint A joint without keying, dowelling, or reinforcement, which imposes no restraint on movement

4 4 **Quality**

Inspection

Witness points

Give sufficient notice so that inspection may be made of the following

- Base or subgrade before covering
- Membrane or film underlay installed on the base
- Completed formwork, and reinforcement, cores and embedments fixed in place
Formwork shall be certified by a practising structural engineer at the Contractors' expense
- Commencement of concrete placing
- Surfaces or elements to be concealed in the final work before covering
- Minimum notice required = 24 hours

Rejection

Remove rejected concrete from the site

4 5 **Material Tests**

Material	Test method	Test frequency
- Portland and blended cement (each type used)	To AS 3972	1 per month
Fly ash	To AS 3582 1	1 per month
Ground slag	To AS 3582 2	1 per month
Admixtures (each type used)	To AS 1478	1 per 6 months
Coarse aggregate		1 per 2 months
Dense and lightweight - Particle size analysis	To AS 1141 11 and AS 1141 12	2 per month
- Particle density and water absorption	To AS 1141 6 1	1 per 3 months
Particle shape	To AS 1141 14	1 per 3 months
- Soundness	To AS 1141 Section 24	1 per 3 months
Potential reactivity	To AS 1141 Section 39	1 per 12 months
Fine aggregate		
- Particle size analysis	To AS 1141 11 and AS 1141 12	2 per month
Bulk density and water absorption	To AS 1141 5	1 per 3 months
- Friable particles	To AS 1141 32	1 per 3 months
- Organic impurities	To AS 1141 Section 34	1 per 3 months
- Soundness	To AS 1141 Section 24	1 per 3 months
Light particles	To AS 1141 Section 31	1 per 3 months
- Sugar	To AS 1141 35	1 per 2 months
- Potential reactivity	To AS 1141 Section 39	1 per 2 months

4 6 Concrete Testing

Dissemination of production information If concrete is manufactured off site, register the project in accordance with AS 1379 clause B6 4

4 7 Concrete Tests

Concrete testing methods

Sampling and testing To AS 1012 Sample the concrete on site

Test records

Records and reports To AS 1012

Control tests

Acceptance criteria

- Average strength of all samples must exceed the required value
- Strength of any one sample must be at least 0.85 of the required value
- Concrete with a specified characteristic compressive strength greater than 50MPa is liable to rejection if any specimen fails to meet the specified target strength at 7 days or the specified characteristic strength at 90 days (Note that the 95% rejection criterion will not apply for this high performance concrete)

4 8 Performance Tests

General Sample, test and assess the concrete for compliance with the specified quality parameters to AS 1379 Appendix B Testing and curing of samples shall be carried out in a laboratory registered with NATA for this purpose and approved by the Principals Representative

All concrete will be subject to both Production Assessment and Project Assessment in accordance with Section 20 AS3600

A slump cone and at least two test cylinder moulds and other necessary equipment shall be maintained on site to enable tests to be carried out if requested by the Principals Representative

Concrete shall not be discharged into formwork whilst slump or other tests are being performed which could result in its rejection

Strength grade Spread the site sampling evenly throughout the pour For each prestressed element take at least 3 samples total, at the rate of at least one sample per 2 batches, from well distributed locations including the anchorage area For concrete in columns and bearing walls, take one sample per batch

Slump Test at least one sample from each batch before placing concrete from that batch in the work Take the samples at the point of discharge on site

Water Cement Ratio will be clearly noted on the mix design and delivery dockets

4 9 Sampling

Methods and Point of Sampling

Sampling procedure shall be in accordance with AS1012 Part 1 for sampling from truck mixers and agitators

The point of sampling shall be at the kerbside or at a point on site as directed

Identification of Sample

To identify samples, the following data shall be recorded in the sampler's field note book

- Project Site
- Data and time sample taken
- Name of Subcontractor
- Delivery docket or batch number
- Sampling procedure as per Clause 5 of AS1012, Part 1
- Location of sampling
- Sample identification number
- Location of concrete batch after placement

Slump of sample

- The specified characteristic compressive strength f'c
- Temperature of sample
- Nature of sample

Frequency of Sampling

- For the purposes of Project Assessment

The minimum number of samples shall be as shown in the following table in addition to those of AS1379

1 truck	1 sample
2 to 5 trucks	2 samples
6 to 10 trucks	3 samples
11 to 20 trucks	4 samples

and for each additional 10 trucks – 1 sample

Where the source of supply or the specified quality changes during the pour, then the above table shall be used to determine the number of samples required in each instance

- For the purpose of Production Assessment

The minimum rate of sampling shall be 1 sample per 100 cu metres of each grade supplied by the plant

Manufacture of Test Cylinders

Three (3) standard test cylinders shall be made from each sample in accordance with AS1012

All specimens shall be marked with the specimen number by inserting a fine wire into the cylinder and attaching a label to this wire. The following data shall be recorded in the sampler's field note book -

- Specimen numbers
- Method of compaction
- Slump

An additional cylinder shall be made for high early strength mixes or for mixes to be used post-tensioned slabs

Hand compaction of concrete in test cylinders shall conform to AS1012 Part 8

Treatment of Test Cylinders

For a minimum of the first 18 hours after moulding the moulds shall be kept on a rigid surface which is approximately horizontal and appropriate precautions taken against vandalism, accidental disturbances and adverse climatic conditions. If possible, the moulds shall be kept in a locked shed or room. If this is not possible they shall be protected by box-like covers marked "Test Cylinders – DO NOT TOUCH". Such covers shall be adequate to protect the specimen from sunshine, rain, wind and frost. The storage conditions shall be such that the temperature of the air adjacent to the moulds remains, during the 18 hours, between the temperatures laid down in AS1012 Part 8

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Final curing and testing of specimens shall be carried out by a NATA registered Laboratory Demoulding and transportation of specimens shall be in accordance with AS1012 Part 8

4 10 Testing

Slump Test

The slump test from each sample shall be made in accordance with AS1012 Part 3

Compression Testing

Capping and testing of the specimens shall be done by a NATA registered laboratory in accordance with AS1012 Part 9 Of the three cylinders for each sample one shall be tested at seven (7) days and two at twenty-eight (28) days 7 days results shall be issued within 9 days, and 28 day results after 30 days The weight of each test specimen and its density shall be determined before subjecting it to the compression test and these shall be recorded with other test results

4 11 Acceptance of Concrete

Slump

The concrete shall be deemed to comply with the specified slump if

- When the specified slump is 60mm or less, the measured slump is within \pm 10mm of the specified slump
When specified slump is between 60mm and 80mm the measured slump is within \pm 15mm of the specified slump
- When the specified slump exceeds 80mm, the measured slump is within 30mm of the specified slump
When the specified slump is greater than 110mm, the measured slump is within \pm 30mm of the specified slump

The specified slumps refer to on-site delivery slumps For pumping or placement purposes, the specified slump may be increased to a maximum of 80mm (or as agreed) using a super plasticizer which conforms and is added in accordance with AS1478 At no stage from the time of mixing shall water be added to the concrete to increase slump

Compressive Strength

The compressive strength of the concrete shall be considered acceptable if it conforms to Appendix B of AS3600 for both Production Assessment and Project Assessment

The test cylinders shall be considered as being representative of all the concrete from which the sample was taken

Causes for Rejection of Concrete

The following shall be causes for rejection of concrete

The concrete fails to meet the slump, 28 Day Compressive Strength, density and abrasion resistance values specified on the respective drawings or within this specification

The concrete exceeds the values of chloride and sulfate content and drying shrinkage specified on the respective drawings or within this specification

Non-compliance with materials and methods specified herein

A delivery docket as specified under "Mixing and Delivery" is not available immediately

If delays in placing the concrete exceed the maximum time at which the Subcontractor is prepared to guarantee his product

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Furthermore the Principals Representative may have any concrete analysed in accordance with AS1012 or may arrange for core samples to be taken and tests carried out in accordance with Clause 21.4 of AS3600. Should the results of any such analysis prove unsatisfactory then the work may be rejected.

Test Certificates

Test certificates from a laboratory registered with NATA, shall be produced to conform compliance with this specification and the Standards specified. The results of tests shall be recorded in tabular form in a suitable book kept on site.

Special-class concrete parameters

- Duration of air drying 8 weeks
- Sampling frequency From trial mixes and one per month for each class
- Acceptance criterion Average strain of 3 specimens from each sample shall not exceed the required value

Testing for liquid tightness (to AS 3735)

Not Applicable

Embedded pressure pipes

Leak tests: Before embedment, leak test pipes which will contain liquid or vapour at a pressure > 10 kPa.

Drying shrinkage (to AS 1012.13)

Either 450, 650 or 1000 microstrain at 56 days. Refer to the documents for specific locations. A minimum of two tests on each microstrain of concrete shall be performed.

4.12

Sub-Contractor's Submissions

Sub-contractors

Submit names and contact details of proposed ready mixed concrete suppliers, and alternative source of supply in the event of breakdown of ready mixed or site mixed supply.

Mix Design

Submit tests: Before supplying concrete submit test certificates based on samples from the most recent production or from stockpiles for the project, for the materials and properties listed in the

Material tests schedule Submit additional certificates at the scheduled frequency during the course of the works.

Dissemination of production information: Submit copies of materials

Materials

General: Submit details of proposed sources of materials.

Foamed concrete: Submit details, including aggregate grading and mix proportions.

Curing compounds: If it is proposed to use a liquid membrane-forming curing compound submit the following information:

- Certified test results for water retention to AS 3799 Appendix B
 - Evidence that an acceptable final surface colour will be obtained
 - Evidence of compatibility with applied finishes, if any
- Methods of obtaining the required adhesion for toppings and render

Execution

General Submit proposals for mixing, placing, finishing and curing concrete including the following

- Site storage, mixing and transport methods and equipment, if applicable
 - Addition of water at the site
 - Handling, placing, compaction and finishing methods and equipment
 - Temperature control methods
 - Curing and protection methods
 - Target strength, slump and proposed mix for each type and grade of concrete
 - Cutting or displacing reinforcement, or cutting hardened concrete
 - Sequence and times for concrete pours, and construction joint locations
- Sawn joints Submit proposed methods, timing and sequence of sawing joints

Pre-mixed supply

Delivery docket For each batch, submit a docket listing the information required by AS 1379, and the following additional information

- The concrete element or part of the works for which the concrete was ordered
- The total amount of water added at the plant and the maximum amount permitted to be added at the site
- The amount of water, if any, added at the site
- Details of any additives

4 13 Materials

Polymeric Film Underlay

General

Under internal slabs on ground including integral ground beams and footings, provide a 200 micron vapour barrier or, in areas prone to rising damp or salt attack, a damp-proofing membrane

Standard

Vapour barriers and damp-proofing membranes To AS 2870

Base preparation

According to base type, as follows

- Graded stone base 20mm Blue metal or larger (max particle size 75mm) as noted on the drawings
- Concrete working base Remove projections above the plane surface, and loose material

Installation

Lay over the base, lap joints at least 200 mm and seal the laps and penetrations with waterproof adhesive tape Face the laps away from the direction of concrete pour Take the underlay up vertical faces as far as the damp proof course where applicable, and fix at the top by tape sealing Locate vertical laps only on vertical or inclined surfaces Patch or seal punctures or tears before pouring concrete

4 14 Concrete

Ready mixed supply

Method Use the batch production process Deliver in agitator trucks

Admixtures Do not provide admixtures containing significant chlorides

Addition of water The addition of water to mixes of any strength and containing silica fume is not permitted Workability shall be adjusted through the approved use of admixtures No water shall be added to concrete on site

Plastic cracking Design the concrete mix to minimise plastic settlement and shrinkage cracking

Elapsed delivery time

Elapsed time between the wetting of the mix and the discharge of the mix at the site must not exceed the criteria in the **Elapsed delivery time table**

Elapsed delivery time table

Concrete temperature at time of discharge (°C)	Maximum elapsed time (hours) 40 MPa and less	Greater than 40MPa
< 24	2 00	1 00
24 - 27	1 50	1 00
27 - 30	1 00	1 00
> 30	0 75	0 75

4 15 Concrete Types

Foamed concrete

Refer to drawings for specific requirements Any proposed mix design will be forwarded for approval by the Principals Representative before installation

4 16 Fixings and Embedded Items

Adjoining elements

For adjoining elements to be fixed to or supported on the concrete, provide for the required fixings Where applicable provide for temporary support of the adjoining elements during construction of the concrete

Structural integrity

Fix cores and embedded items to prevent movement during concrete placing In locating embedded items, do not cut or displace reinforcement, or cut hardened concrete

Tolerances on placement

Maximum deviation from correct positions

- Embedded items generally □ 10 mm
- Fasteners, including anchor bolts □ 3 mm
- Anchor bolt groups for structural steel To AS 4100

Inserted fixings

Methods Unless shown on the drawings, do not insert fixings using drilling (including masonry anchors), or using explosive tools

4 17 Placing and Compaction

Placing

General Use placing methods which minimise plastic settlement and shrinkage cracking

Layers Place concrete in layers such that each succeeding layer is blended into the preceding one by the compaction process

Placing slabs and pavements Place concrete uniformly over the width of the slab so that the face is generally vertical and normal to the direction of placing

Horizontal movement

Use suitable conveyors, clean chutes, troughs or pipes Do not use water to facilitate the movement

Vertical movement

In vertical elements, limit the free fall of concrete to 1500 mm per 100 mm element thickness, up to a maximum free fall of 3000 mm, using enclosed chutes or access hatches in forms As far as practicable keep chutes vertical and full of concrete during placement, with ends immersed in the placed concrete

Rain

Do not expose concrete to rain before it has set, including during mixing, transport or placing

Sequence of pours

Minimise shrinkage effect by pouring the sections of the work between construction joints in a sequence such that there will be suitable time delays between adjacent pours

Compaction

General Remove air bubbles and fully compact the mix

Methods Use immersion and screed vibrators accompanied by hand methods as appropriate Use rubber tipped vibrators

Vibrators Do not allow vibrators to come into contact with formwork, partially hardened concrete, or reinforcement embedded in it Do not use vibrators to move concrete along the forms Avoid over-vibration that may cause segregation

Placing records

Keep on site and make available for inspection a log book recording each placement of concrete, including the following

- Date
- The portion of work
- Specified grade and source of concrete
- Slump measurements
- Volume placed

4 18 Cold Weather Placing

General

Maintain the temperature of the freshly mixed concrete within the limits shown in the **Cold weather placing table** "Outdoor" air temperature applies to the air temperature at the time of mixing and to the predicted or likely air temperature at any time during the subsequent 48 hours

Cold weather placing table

Outdoor air temperature	Temperature of concrete	
	Minimum	Maximum
≥ 5°C	10°C	32°C
< 5°C	18°C	32°C

Additives

Do not provide calcium chloride, salts, chemicals or other material in the mix to lower the freezing point of the concrete

Frozen materials

Do not allow frozen materials or materials containing ice to enter the mixer, and keep free of frost and ice any forms, materials, and equipment coming in contact with the concrete

High early strength cement

Provide in severe weather conditions to enable the concrete to develop sufficient strength to permit formwork removal within the specified time Do not provide as a substitute for the heating of materials or for adequate protection of placed concrete against low temperatures Do not provide high alumina cement

Heating

General Heat the concrete materials, other than cement, to the minimum temperature necessary to ensure that the temperature of the placed concrete is within the limits specified

Maximum temperature of water 60°C when it is placed in the mixer

4 19 Hot Weather Placing

Mixing

Surrounding outdoor shade temperature > 38°C Do not mix concrete

Handling

Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses Mix, transport, place and compact the concrete as rapidly as possible

Placing

Before and during placing maintain the formwork and reinforcement at ≤ 32°C using protection, cold water spraying, or other effective means When placed in the forms, the temperature of the concrete must not exceed the criteria in the **Hot weather placing table**

Hot weather placing table

Concrete element	Minimum temperature
Normal concrete in footings, beams, columns, walls and slabs	35°C

Temperature control methods

Select one or more of the following methods of maintaining the specified temperature of the placed concrete

- Use chilled mixing water
- Spray the coarse aggregate using cold water
- Cover the container in which the concrete is transported to the forms
- Cool the concrete using liquid nitrogen injection before placing
- For details of temperature control of massive concrete elements refer to drawings

4 20

Curing

General

Protection Protect fresh concrete, during the curing period, from premature drying and from excessively hot or cold temperatures

Curing period Cure continuously until the total cumulative number of days or fractions of days, during which the air temperature in contact with the concrete is above 10°C, is at least the following

- Other surfaces 7 days

Curing compounds

Standard To AS 3799

Substrates Do not use wax-based or chlorinated rubber-based curing compounds on surfaces forming substrates to concrete toppings and cement-based render

Application Provide a continuous flexible coating without visible breaks or pinholes, which remains unbroken at least seven days after application

Hot weather curing

Do not use curing compounds After placement, either

- immediately cover the concrete using an impervious membrane, or hessian kept wet, until curing begins, or
- if the temperature exceeds 25°C or if not protected against drying winds, protect the concrete using a fog spray application of aliphatic alcohol evaporation retardant

Visually important surfaces

Produce uniform colour on adjacent surfaces

Curing schedule

Generally	All	Compound or other approved for 7 days
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4 21 **Protection**

Loading

Notice Give notice before loading the concrete structure

Protection Protect the concrete from damage due to load overstresses, heavy shocks and excessive vibrations, particularly during the curing period Do not place construction loads on self-supporting structures which will overstress them

Surface protection

Protect finished concrete surfaces from damage

4 22 **Construction Joints**

Location

Do not relocate or eliminate construction joints, or make construction joints not shown on the drawings This includes emergency construction joints made necessary by unforeseen interruptions to the concrete pour

Joint preparation

Roughen and clean the hardened concrete joint surface, remove loose or soft material, free water, foreign matter and laitance Dampen the surface just before placing the fresh concrete

Finish at construction joints

Butt join the surfaces of adjoining pours In visually important surfaces make the joint straight and true, and free from impermissible blemishes relevant to its surface finish class

4 23 **Expansion Joints**

Note Allow to place expansion/movement joints between all materials which are non-similar (ie brick to block, brick to stud plasterboard, etc)

Jointing materials

Type Provide jointing materials compatible when used together, and non-staining to concrete in visible locations

Foamed materials (in compressible fillers) Closed-cell or impregnated types which do not absorb water

Bond breaking Provide back-up materials for sealants, including backing rods, which do not adhere to the sealant They may be faced with a non-adhering material

Joint filling

Preparation Before filling, dry and clean the joint surfaces, and prime

Joint filling Fill with jointing materials Finish visible jointing material neatly flush with adjoining surfaces Refer to the documents for joint filler specification

Watertightness Apply the jointing material so that joints subject to ingress of water are made watertight Fire rate permanent building joint filler in accordance with the architectural specification to a rating of 120 minutes

4 24 **Dowels**

Joint dowels

Provide galvanised steel reinforcing rod dowels in expansion and contraction joints, where required Embed dowels normal to the plane of the joint, so that half the dowel lies on each side of the joint Heavily grease or bitumen coat one half and fit an expansion cap to that end

4 25 **Concrete Finishes**

Tolerance classes

Determine tolerance classes using a straight edge placed anywhere on the surface in any direction

Tolerances class table

A	3 m straight edge	3
B	3 m straight edge	6
C	600 mm straight edge	6

SURFACE MODIFIERS

Seal stripper

Thoroughly clean the surface before the application of finishes to masonry and cementitious floors. Remove wax (buffable, self-polishing and acrylic paste types), heavy duty polymer finishes, and clear resin sealer using a seal stripper

Surface hardeners

Suitable for cementitious toppings or as laid surfaces. Apply to clean surfaces. Do not apply to non-slip topping

UNFORMED SURFACES

Screeding

Finish slab surfaces to finished levels, to tolerance class B

Finishing methods

Scored finish After screeding, give the surface a coarse scored texture using a stiff brush or rake drawn across the surface

Machine floated finish Finish the screeded surface to a uniform smooth texture using a machine float. Hand float in locations inaccessible to the machine float

Steel trowelled finish Use steel hand trowels to produce the final finish free of trowel marks and uniform in texture and appearance

Wood float finish Produce the final finish using a wood float

Broom finish After floating use a broom to produce an even textured slip-resistant surface

Integral finishes schedule

Location	Concrete Paths, Roads	Insitu Concrete
Tolerance class	A	B
Finish	Machine Float to falls, then light broom non slip finish	Machine Float Finish
Other		

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Other locations Locations not referred to in the schedule shall have a finish appropriate to covering proposed and shall be coordinated by the Sub-Contractor
Tolerance class shall be B unless covering requires a higher level of tolerances

REJECTION

Concrete which is rough, segregated and boney in appearance if not conforming to this specification may be rejected

4 26

Concrete Reinforcement

Related sections

This section relates to both the supply and placement for all conventional reinforcement required by the project The subcontractor is responsible at all times for work completed by others throughout the duration of his work and shall employ a qualified Structural Engineer, (registered to NPER-3 Structural with the Institution of Engineers Australia), to check and certify that the reinforcement has been installed in accordance with the Structural drawings
Refer to the following sections Concrete – Formwork, Concrete – In Situ, Concrete – Finishes

4 27

Standards

General

Reinforcement To AS 1302, AS 1303 and AS 1304

4 27

Inspection

Witness points

Give sufficient notice so that inspection may be made of the following

- Reinforcement fixed in place Minimum 24 hours
- Cores and embedments fixed in place adjacent or through reinforcement
- The inspection of the reinforcement does not relieve the subcontractor of his responsibility to carry out his own inspection and ensure compliance with the contract documents The subcontractor shall allow sufficient time for these inspections and any necessary rectification

4 28

Sub-Contractor's Submissions

Tests

Certificate of compliance Submit either the manufacturer's certificate of compliance with the relevant standard, or an independent testing authority's test certificates demonstrating compliance

Execution

Changes Submit proposed changes, if any, in the reinforcement shown on the drawings, including additional splicing

Mechanical splices If mechanical bar splices are proposed or required submit details and test certificates for each size and type of bar to be spliced

Damaged galvanising If repair to AS 1650 Appendix F is intended, submit proposals

Bending Schedules Shall be prepared by the Subcontractor, indicating shapes, dimensions and details of bar reinforcement Two copies of bending schedules shall be submitted for approval and for guidance in fixing of reinforcement

4 29 Reinforcement Generally

General

Extent Provide reinforcement, including tie wires, support chairs, spacers and accessories

Identification Supply reinforcement which is readily identifiable as to grade and origin

Reinforcement schedule

Structural element	Reinforcement type	Coating	Support type	Tie wire
General u n o	Refer drawings	Nil	Refer 3 4	Mild steel

Dowels

Standard To AS 1302 grade 250R Galvanised to R2

General Provide each dowel in one piece, straight, with square cut ends free from burrs Apply 2 coats of bitumen emulsion to half the length of the dowel at one end Embed the unpainted half of the dowels in the concrete placed first

Tolerances

- Location \pm half the diameter of the dowel
- Alignment 2 mm in 300 mm

Welding

General Give notice before welding reinforcement Do not weld reinforcement within 75 mm of a section which has been affected by bending or re-bending Special care shall be taken by the Subcontractor to protect formwork during any oxyacetylene activities

Standard To AS 1554 3

4 30 Protective Coated Reinforcement

Extent

For concrete elements containing protective coated reinforcement, provide the same coating type to all that element's reinforcement and embedded ferrous metal items, including tie wires, stools, spacers, stirrups, plates and ferrules, and protect other embedded metals with a suitable coating

Galvanising

Coating (minimum) 700 g/m²

Preparation Pickling to AS 1627 5

Damage

If damage occurs to the coating replace the damaged reinforcement The use of heat for bending or re-bending of galvanised reinforcement will not be permitted

Un-encased reinforcement

General Provide protection for "starter bars" and other items projecting from cast concrete for future additions, and exposed to the weather

Supply proposals for starter bar protection for approval by the Structural Engineer

4 31 Fixing Reinforcement

Fixing requirements

General Secure the reinforcement against displacement by tying at intersections with either annealed iron 1 25 mm diameter (minimum) wire ties, or clips Bend the ends of wire ties away from nearby faces of forms so that the ties do not project into the concrete cover

Mats For bar reinforcement in the form of a mat, secure each bar at alternate intersections, and at other points as required

Beams Tie ligatures to bars in each corner of each ligature Fix other longitudinal bars to ligatures at 1 m maximum intervals

Columns Secure longitudinal column reinforcement to all ligatures at every intersection

Bundled bars Tie bundled bars together so that the bars are in closest possible contact Provide tie wire at least 2 5 mm diameter at centres ≤ 24 times the diameter of the smallest bar in the bundle

Concrete cover

General structures To AS 3600 unless specifically noted on the structural drawing and the General Notes

Structures for retaining liquids To AS 3735

Provision for concrete placement

Notice If spacing or cover of reinforcement does not comply give notice

Reinforcement cover schedule

Concrete surface	Minimum cover (mm)
Cast against ground	Refer drawings
Cast on vapour barrier	Refer drawings
Formed and backfilled	Refer drawings
Exposed externally	Refer drawings
Enclosed/interior	Refer drawings

4 32 Treatment of Reinforcement

Bending, Splicing and Welding

Reinforcement bar which has been supplied bent shall not be subject to further cutting or bending without approval of the superintendent If it is necessary the following clauses apply after approval has been given to such cutting and bending Reinforcement shall be bent or straightened in a manner that will not damage it and to the requirements of Clause 19 2 3 of AS3600

The dimensions of hooks and bends shall conform the Rule 19 2 3 2 of AS3600

The use of heat for bending or re-bending of galvanised reinforcement will not be permitted

When splices not already shown on the drawings are found necessary, the details of the proposed splices shall be submitted for approval

Reinforcement shall not be welded nor shall the use of tack welding be permitted in the manufacture of reinforcement cages without the specific approval of the superintendent

4 33 Replacing of Reinforcement Steel

Tolerances

Reinforcement shall be placed within the tolerances specified in Clause 10 5 3 of AS3600

Alignment

Reinforcement shall be free from bends not required on the drawings, kinks and similar defects and shall be securely fastened and maintained in position

Support of Reinforcement

Reinforcement shall be securely held in position by using spacers or stools made of plastic or plastic tipped metal, by metal hangers or by other approved means
Reinforcement shall not be held in position by bare steel supports which extend to the surface of the concrete Reinforcement shall not be supported on pieces of wood, brick, aggregate or like material

Sufficient means of support shall be provided to ensure that the reinforcement does not sag between supports and to allow the reinforcement to be walked upon without damage

The concrete cover to reinforcement nominated on the drawings shall be maintained at all times

Reinforcement shall be tied at intersections with black annealed 1 25mm dia iron wire The free ends of the wire shall be bent inwards toward the centre of the section of the concrete

Reinforcement for concrete slabs poured on ground in conjunction with a vapour barrier shall be supported on bar chairs which are supported on spreader plates sufficient to prevent the bar chair puncturing the vapour barrier

Lifting of reinforcement through wet concrete will not in any circumstances be permitted

Spacers, stools and tie wire will be provided by the Subcontractor

4 34 Cores and Embedments

General

The supply and fixing of cores and embedments is included in other sections of the specification Reinforcement shall not be cut to provide space for core holes or embedments Reinforcement may be moved slightly to allow fitting of cores
Approval of the superintendent shall be obtained

4 35 Fabrication

Bending, Splicing and Welding of Reinforcement

Reinforcement shall be bent or straightened in a manner that will not damage it and to the requirements of Clause 19 2 3 if AS3600

The dimensions of hooks and bends shall conform to Clause 19 2 3 2 of AS3600

When splices not already shown on the drawings are found necessary, the details of the proposed splices shall be submitted for approval

Fabrication Tolerances

Reinforcement shall be fabricated to the shape and dimensions shown on the drawings and within the tolerances specified in Clause 19 2 2 of AS3600

Cleanliness of Reinforcement

Reinforcement shall be supplied free from loose mill scale, loose rust, clay, mud, oil, grease and other coatings, which would reduce the bond between the concrete and the reinforcement

4 36 Delivery, Unloading and Storage

Delivery

Fabricated reinforcing steel shall be bundled and securely tied to ensure that it does not sustain damage during delivery or unloading

Each bundle or piece shall be identified by a wired-on-metallic tag showing the 'mark' of that bundle. The 'mark' shall refer to the bending schedule.

A different coloured tag shall be used to identify each of the separate modules on the project.

Reinforcement shall be delivered to the project site by the Subcontractor.

Unloading and Storage on Site

Fabricated reinforcing steel shall be unloaded and stored on site in such a manner that it does not sustain damage or become contaminated by material liable to influence its effectiveness as reinforcing in concrete.

4 37 Cleaning of Formwork

General

At the completion of each area of work the Subcontractor shall remove all unused material, and deleterious waste matter to a location nominated by the superintendent. Any cleaning required to be done by others prior to the concrete pour will be background to the Subcontractor.

4 38 Reinforcement Supports

Support types

General Provide purpose-made concrete, metal or plastic supports.

Exposure classification A1 Provide a protective coating to ferrous metal supports which extend to the surface of the concrete.

Exposure classifications more severe than A1 Provide either

- plastic supports of adequate strength and of a shape appropriate to the location, or
- concrete supports of the same concrete quality as the concrete element
- Plastic supports mandatory for exposed concrete surfaces

Supports over membranes

Prevent damage to waterproofing membranes or vapour barriers. Place a metal or plastic plate under each support to prevent puncturing.

Support spacing

Bars no more than 60 diameters

Fabric not more than 750mm

Protective Safety Caps

Are to be installed and maintained on all projecting vertical reinforcement and in any position that represents an obvious hazard to worker safety, particularly at upper torso or head level.

4 39 Protection of Others Work

General

The Subcontractor is responsible at all times for the protection of work completed by others throughout the duration of his works

Special care shall be taken by the Subcontractor to protect formwork during any oxy acetylene activities

4 40 Concrete Post-Tensioning

Extent

The work covered by this specification comprises of the design, supply and placing of all prestressing components, the stressing of tendons, the grouting of ducts, the completion of anchorage ends and related items necessary to complete the work indicated on the drawings and as further specified

Division of Responsibilities

The subcontractor shall be responsible for the carrying out of the prestressing works in accordance with this specification and the associated contract documents and for the provision of the necessary technical supervision and certification of the prestressed slab and beam designs

The subcontractor shall refer to relevant items included in other specifications relating to the work such as

- Concrete Supply and Testing
- Concrete Placing and Finishes
- Reinforcement Supply
- Reinforcement Fixing
- Formwork

4 41 Standard Specification

Wherever reference is made to Standards Association of Australia (SAA), the requirements of the current editions and amendments to them at the date of tendering shall apply to the relevant materials or operations and be deemed to be incorporated in this Specification

Standard Specifications or Codes of the British Standards Institute (BS), or the American Society for Testing and Materials (ASTM) are referenced only when relevant SAA publication does not exist. Current editions shall apply, as specified above

In case of a conflict between the referenced Standard or Code and this Specification,

the more stringent provisions shall apply

The Subcontractor, upon request, shall furnish a certificate from the manufacturer that the materials or products delivered to the project meet the requirements of the relevant Standard. However, such certification shall not relieve the Subcontractor of the responsibility to comply with any additional requirements of this specification

The prestressing works shall conform to the current requirements of the following codes and standards except where modified by this specification

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AS1310	Steel Wire for Tendons in Prestressed Concrete
AS1311	Steel Tendons for Prestressed Concrete – 7-Wire Stress Relieved Steel Strand for Tendons in Prestressed Concrete
AS1313	Steel Tendons for Prestressed Concrete – Cold worked High Tensile Alloy Steel bars for Prestressed Concrete
AS1314	Prestressing Anchorages (metric units) for reference
AS1349	Burdon Tube Pressure and Vacuum Gauges
AS3600	Concrete Structures

Any other Standard Code or Specification mentioned in the body or in the preface of the above Standards, shall be considered as part of this specification
Concrete Institute of Australia – Recommended Practice – “Grouting of Prestressing Ducts and Ground Anchors”

In conjunction with the above specified codes, all workmanship shall be carried out in accordance with the “Guide to Concrete Construction”, published by the Cement and Concrete Association and Standards Australia – 1994

4 42 Safety

A prestressed tendon when tensioned contains a considerable amount of stored energy. In the rare event of a tendon breaking, serious injury to personnel and damage to equipment can be caused by the sudden release of this energy. Therefore reasonable precautions shall be taken when working with or near tendons which have just been or are in the process of being tensioned or that have been tensioned but not yet grouted.

4 43 Definitions

Terms used in this specifications shall have the meanings assigned to them as follows

“Approved” shall mean approved in writing by the Superintendent

“Or equal approved” shall mean equivalent in performance, quality and price to that specified, and approved by Superintendent

4.44 Design Criteria

The design will be carried out in accordance with AS3600 and AS1170 1

A CONCRETE OUTLINES AND FORMWORK

A1 The structural engineer shall be responsible for the documentation and co-ordination of concrete outlines to their basic structural requirements and for the overall structural design and co-ordination of the building. These concrete outlines will include all penetrations greater than 400x400mm. The post-tensioning design and construction by the post-tension sub-contractor shall be based on these concrete outlines. **In addition, one (1) co-ordinated drawing showing all service penetrations will be provided by the respective subcontract trades prior to the concrete pour to avoid clashes with the prestressing tendons.** This will be co-ordinated by the contractor and issued to engineer and the architect for documentation.

A2 All the formwork stripping and backpropping shall be in accordance with The Formwork Specifications. Stressed slabs will not be overloaded with dead load and formwork loads of structures overhead.

A3 The Post Tension Sub-contractor shall direct all queries regarding concrete outline and structural design through the Engineer for the project.

A4 Falls in exposed slab top surfaces are to be taken out by slab thickenings. Generally, typical floor soffit formwork will be level, unless agreed otherwise (in writing) by Superintendent.

B CONCRETE

B1 Required concrete strengths at time of stressing are as shown on engineers drawings,

B2 All concrete cylinders are to be stored and cured on site prior to testing,

B3 All concrete shall be in accordance with The Concrete Specification

C ANALYSIS

C1 To limit the amount of moment transferred to the columns, the frame analysis will be carried out using 50% of the full column stiffness for Transfer Level

C2 No allowance shall be made in the design for wind or earthquake loading Lateral forces have been analysed and absorbed by the shear, Lift walls and the columns nominated in the project

C3 Deflection limits will be in accordance with AS3600 as follows -

a) Long Term L/250 (L/125 cantilevers)

b) Incremental * Internal L/500 (L/250 cantilevers)

c) Incremental */external L/1000 (L/500 cantilevers)

*For members supporting masonry partitions

Note The Subcontractor shall be responsible for ensuring that the partitions have adequate jointing and provision to tolerate the degree of movements expected, based on the above deflection criteria The Subcontractor should direct any queries regarding this matter through the Engineer

D DESIGN LOADS AND GENERAL CRITERIA

D1 Applied loads will be in accordance with the Engineer's and architect's drawings,

#Note The SDL includes all ceilings, services, finishes and partitions

D2 Patterned live loading and live load reductions will be applied to applicable areas

In reference to non-prestressed reinforcement inherent in the Subcontractor's post-tension design, the tender is to clearly nominate the total tonnage of non-prestressed reinforcements which is not to be exceeded, for the transfer levels This tonnage excludes columns, walls, lift shafts, stairs, balustrades, external masonry leaf corbels, cantilevered concrete hoods, plinths, hobs but includes beams, floor slabs, upturn structural beams, anti-burst reinforcement, step reinforcement, balcony reinforcement A minimum prestress level after losses for any waterproof roof slabs shall be 2 OMPa This includes all external concrete which form the roofs over the garages

In reference to shear transfer to the columns, the Subcontractor shall be responsible for the design, supply and installation of shear transfer mechanisms such as transverse shear ties and stud rail if required by his design The workshop documents should clearly note which columns require shear transfer mechanisms and his tender should nominate a maximum number of columns/walls expected to have such devices

E DURABILITY

E1 Slab fire ratings will be	Residential (typical)	90/90/90
	Plant Room	120/120/120

E2 SLAB EXPOSURE classification shall be as follows

a) Internal slabs A1

b) Exposed slabs B1

* Refer to AS3600 Figure 5 4 2 (B) for Beams (fire rating) and Table 4 10 3 2 for Durability

4 45 Sub-Contractor

Submit the proposed system and the name and contact details of the post-tensioner

4 46 Shop Drawings and Calculations

The subcontractor shall submit complete hardcopy drawings, the prestressing works for approval. These drawings and/or additional documents shall include but not be limited to

- a) Coordinated Concrete formwork outlines with profiles of all tendons including all offsets
- b) The size and details of all tendons
- c) Proprietary anchorage components
- d) Duct laying sequence
- e) Stressing sequence
- f) Jacking forces
- g) Tendon elongations (net extensions)
- h) Duct sizes
- i) Assumed friction coefficient
- j) Assumed wobble coefficient
- k) Draw-in
- l) Corrosion protection procedures to pre-installed tendons
- m) Mean concrete strength at transfer (f_{cm}) and 28 day Characteristic Concrete Strength (f_c)

The shop drawings shall be accompanied by calculations for the jacking forces and tendon elongations showing the basis of assumed losses. The jacking force calculated shall be such as to satisfy the effective force after all losses and/or the initial force at transfer shown on the drawings. If requested, acceptable test data substantiating the friction coefficients and anchorage slip for the system proposed shall be submitted. The drawings and calculations shall be submitted not less than 28 days before the installation of any prestressing components.

Approved hardcopy drawings will also be made available electronically in Autocad 2002 version or equivalent.

4 47 Substitutions

Where a tendered price is based on a strand or anchorage system differing in any way from that shown on the drawings, full details of the alternate system shall be supplied with the tender. Jacking loads shall be amended for different sized strands so that the total tendon forces shown on the drawings are achieved.

4 48 Inspection of Works

The subcontractor shall give sufficient notice and in any case not less than 24 hours upon the completion of the placing and fixing of all prestressing components and of the stressing and grouting operations and shall allow a further sufficient time, and not less than four working hours, for the carrying out of the inspections by the Supervising Engineer for each prestressed element. The subcontractor shall ensure quality checking of the assembled cable layout with certification before pouring concrete.

4 49 Certification

The Subcontractor shall certify at the end of the project that the design and installation conforms to the requirements of AS3600 and this specification and amendments if approved. The certification will be by a Registered NPER 3 Structural Engineer employed by the Prestressing Subcontractor.

4 50 Tendons

The prestressing tendons shall be designed by the Subcontractor or, as shown on the shop drawings, and forwarded to the Supervising Engineer for review. Each coil or bar shall be identified in accordance with AS1310, AS1311 or S1313 as applicable.

Ten days prior to the stressing operations NATA certified stress-strain curves for each ten coils shall be submitted by the subcontractor and these shall be used as data for the stressing of the tendons made from these coils.

Samples of materials to be used in the tendons, to allow testing of the material as set out in AS1310, AS1311 and AS1313 "Sampling and Frequency of Test", shall be made available free of charge on request.

Tendons, when inspected for cleanliness or damage, shall comply with clause 19 3 4 3 of AS3600.

Tendons shall not be subject to welding sparks, ground current or excessive temperatures. Materials which show injurious defects during or prior to installation in the work shall be rejected and removed from the site.

Cutting shall comply with clause 19 3 4 1 of AS3600.

4 51 Ducts and Sheathing

Ducting and sheathing shall conform with the requirements of clause 19 3 1 1 of AS3600.

Ducts shall be so placed that tendons can move within them freely and the ducts shall be so jointed that they are waterproof under the normal pressures to which they will be subjected during concreting.

Duct-forming materials shall be strong enough to retain its shape, resist damage during construction and prevent the entrance of cement paste and water from the concrete. Material left in place shall be of such composition that no deterioration or electrolytic action will occur. The subcontractor shall submit for approval a sample of the duct he intends to use.

Where duct size is not specified the diameter of the duct shall be of such size to allow as necessary for the feeding of tendons and for grouting. The duct forming material shall be strong enough to transfer the tendon stresses into the body of the concrete. Steel sheathing shall be galvanised. The internal dimension of the duct shall be at least 5mm greater than the corresponding external dimensions of the group of strands or wires or as specified on the drawings.

4 51 Joints

Joints in adjacent ducts shall be staggered by at least 500mm as and when the situation occurs.

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4 52 Supervision during Concrete Pours

The subcontractor shall provide an experienced supervisor to attend all concrete pours whose specific responsibility is to ensure that ducts, anchorages, coupling and the like are maintained in their correct position, all in accordance with the requirements of the specification

4 53 Bleed & Vent Points

12mm diameter vent points shall be provided at each end and in positions along all multistrand ducts corresponding to each high point in the cable profile or where indicated on the drawings 12mm diameter bleed points shall be provided at low points to facilitate cleaning of ducts 12mm diameter vent points shall be provided at each end of slab ducts

Intermediate vent points would be required where tendon lengths are greater than 40m or where indicated on the drawings

4 54 Anchorage and Couplers

The anchorages and couplers shall be as shown on the contract drawings or, where modified by the subcontractor and approved by the Superintendent, as shown on the shop drawings The anchorages and couplers shall conform to the requirements of AS1314 Prestressing Anchorages

When requested, satisfactory test data confirming the adequacy of the proposed device shall be submitted by the subcontractor In the absence of satisfactory test data, the steel to concrete bearing surface of the proposed device shall be of sufficient size to keep bearing stresses within the limits allowed by AS3600

If and when required, only approved couplers shall be placed in approved Strands which are coupled shall have the same "twist" of "lay" to prevent rotation

4 55 Reinforcement

The reinforcement required in the prestressed concrete elements of the structure shall be as shown on the post-tension Subcontractor's shop drawings or, where modified by the subcontractor and approved in writing, as shown on the shop drawings The reinforcement shall comply with the provisions of AS3600

4 56 Grout

Grout complying with clause 19.1.8 of AS3600 shall contain no sand unless the gross inside area of the duct exceeds five times the tendon area in which case fine sand may be added All fine aggregate used shall pass a 1.18mm sieve Minimum compressive strength shall be nominated as part of the approval process

The water/cement ratio shall not exceed 0.5 by weight of cement Calcium chloride shall not be used

4 57 Tests and Test Certificates

The components of the prestressing works shall be tested in accordance with the requirements of AS1310, 1311, 1313, 1314, 3600 and certificates containing all relevant information shall be submitted for approval 14 days prior to the placing of any such component

4 58 Testing of Tensioning Steel

Testing of tensioning steel shall be carried out by an approved NATA Testing Laboratory and shall cover the following

- a) Minimum breaking load
- b) 0.2% Proof load
- c) Minimum elongation to fracture of a 600mm long sample
- d) Modulus of elasticity

The following test certificates for the tensioning steel shall be submitted to the Superintendent

- a) A certified stress-strain curve for each sample tested with the results of the above tests at least ten (10) working days before installation of any tendon covered by the tests
- b) A copy of the manufacturer's original test certificate for comparison
- c) A manufacturer's certificate to the effect that the steel has the specified relaxation characteristics

4 59 Test of Grout

A sedimentation test shall be carried out by an approved NATA Testing Laboratory on a sample of grout in which a column at least 100mm high of freshly mixed grout shall be left to stand for three hours. After that time the depth of water at the top of the grout column shall not exceed 3% of the original column height. The cylinder shall be covered during the test to prevent evaporation.

Prepare and moist cure three sample cubes 50mm x 50mm x 50mm, for each batch prepared for grouting operations, and arrange for a 7 day crushing test (or otherwise specified by site requirements) to be carried out by an approved NATA Testing Laboratory.

Test results shall be submitted to the Superintendent for each batch after installation of any grout covered by the tests.

CONSTRUCTION AND WORKMANSHIP

4 60 Placing and Protection of Tendons and Accessories

Tendons when stressed shall not deviate from their correct position at any point more than 3mm for pre-tensioned tendons and 5mm for post-tensioned tendons, except that for post-tensioned tendons in slabs up to 300mm thick the deviation from the correct vertical position shall not exceed 3mm. Regardless of the permitted deviations specified above the required concrete cover shall not be reduced.

End anchorage shall be placed in accordance with clause 19.3.3 of AS3600. End anchorages which will be permanently protected with concrete/mortar (as applicable) shall be kept free of loose rust, grease, oil, paint and other foreign matter. The means of anchoring the tendons shall not damage the steel to an extent that the ultimate strength of the tendon is impaired.

4 61 Tensioning

The stressing shall be carried out in accordance with clause 19.3.4.5 of AS3600. The anchoring of tendons shall be carried out in accordance with clause 13.1.6 of AS3600 and draw-in (if applicable) treated in accordance with clause 6.4.2.4 of AS3600.

No stressing shall be carried out when the temperature of surrounding air is less than 0°C.

Measurement Of Initial Forces

The subcontractor shall provide confirmation that the calculated initial forces have been achieved by measuring the nett elongation of the tendon, and applying the load-elongation curve to it and by measuring the jacking force or pressure and deducting any appropriate transfer losses from it. The measurement of force and elongation shall be within a tolerance of 3% (+/- 2%). Where discrepancies between the two methods of determining initial force exceed 10%, the subcontractor shall ascertain the cause of the discrepancy and rectify to the satisfaction of the Superintendent before proceeding with the grouting.

Calibration and Maintenance of Equipment

Prestressing jacks and gauges shall be calibrated and friction losses in jacks measured at least once a year, or after resealing. Dynamometers, pressure gauges, load cells and scales shall be calibrated. The prestressing equipment shall be maintained in a serviceable condition and its calibration shall be checked periodically. The subcontractor shall provide current calibration certificates of all tensioning and tension measuring equipment at least two days prior to commencement of stressing and keep separate copies on site. Pressure gauges shall be concentric scale conforming to AS1349 and operating between 50% and 90% of their full capacity and shall be not less than 150mm in diameter. Jacks, gauges and pumps shall be tested as a complete assembly.

4 62

Records

The subcontractor shall complete a written schedule of jacking loads and cable extensions during the tensioning operations. The cable numbers referred to in the schedule shall correspond with those on the contract drawings and the schedule shall include, but not be limited to

- a) The exact description of the concrete elements being tensioned
- b) Cable numbers with subscripts for each strand where strands are jacked individually within cable
- c) Jacking load
- d) Gauge pressure
- e) Piston area
- f) Personnel
- g) Calibration Factor
- h) Strand extension anticipated
- i) Strand extension achieved
- j) Strand slip at anchorage (draw-in)
- k) Extension remaining after release of jack
- l) Breakage of strands
- m) Concrete strength at time of stressing
- n) Identification numbers for all equipment used

All records shall be supplied to the Superintendent within 24 hours of stressing. Certified copies of these records, including the subcontractors confirmation or otherwise of the achievement of the specified initial forces, are to be given to the Superintendent for examination immediately after the completion of tensioning. No cutting tendons or grouting is to be done until this examination is complete and approved to proceed is given by the Superintendent the Supervising Structural Engineer.

4 63 **Grouting**

Except as provided by this specification, grouting shall be in accordance with clause 19 3 4 7 of AS3600 All ducts containing tendons shall be pressure grouted with the approved grout mixture within 48 hours after the completion of the stressing operation unless noted otherwise on the drawings or approval to proceed has not been given by the Superintendent, in which case it is to be done as soon as approval is granted and in no case more than three weeks

Multistrand ducts for grouting shall be blown free of water with oil free air immediately after curing has commenced and shall be kept dry until grouted A dependable high pressure water supply shall be provided before grouting is begun

Grout shall be injected into all voids between prestressing tendons and ducts and anchorage fittings Flow shall continue until grout of the consistency equivalent to that injected flows without the presence of air bubbles from all vent openings Vent openings shall be closed progressively in the direction of flow

In the event of a blockage or an interruption of grouting all grout shall be removed from the duct by flushing with water The grout shall be removed from site in a manner approved in writing by the Superintendent After completion of grouting, grind the tube flush with finished surface of the concrete slab Grout fill all indents level with the adjacent floor slab

4 64 **Protection**

On completion of stressing and grouting all anchorage and tendon parts shall be permanently protected Unless otherwise shown on the drawings protection shall be provided by the Post Tensioning Contractor by the following methods

Multistrand – supply and installation of dense concrete adequately secured to the main concrete and reinforced (by others) Minimum $F_c = 40\text{MPa}$

Slab Edge Anchorages – supply and installation of cement mortar Minimum $F_c = 40\text{MPa}$

Slab Top Anchorages – supply and installation of cement mortar (by others) Minimum $F_c = 40\text{MPa}$

Finish of the concrete/mortar shall match the class of finish and colour of the surrounding concrete in exposed areas shall be done by others Unless otherwise shown on the drawings, the type of finish provided by the Post Tensioning Contractor shall include the following

Concealed Anchorages – wood float flush with concrete face

Exposed Anchorages – recess mortar 10mm from concrete face

Cover to components and reinforcement shall comply with the provisions of clause 4 10 of AS3600 Where anchorages are exposed directly to moisture, epoxy paint or approved equivalent shall be used to provide adequate protection

Remove all staples used for post-tensioning ducts in exposed areas,

This includes but not limited too, Balcony Soffits

All Unit Ceilings

Foyer/Ceiling

Any slab soffit which does not have a permanent ceiling underneath

General

The Builder is to provide the full design for post-tensioned slabs, as shown on Structural engineers drawings

Shop drawings and calculations are to be submitted prior to installation

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Builder is to ensure that the post-tensioned slabs conform with the exact profiles, details and dimensions shown on Architectural and Structural drawings

Builder is to submit for approval by the Structural Engineer a complete slab design for each Post Tensioned level (Including steel reinforcement and post-tensioning) This is to occur prior to construction

Post-tensioning is to be designed and installed to AS 3600

The following clauses shall be read in conjunction with the drawings and other applicable specifications

This section relates to all aspects of prestressing required by the project

4 65 **Formwork**

General

Formwork design and construction To AS 3610

Witness points

Give sufficient notice so that inspection may be made of the following

- Completed formwork before concrete placing
- Evaluation of the finish
- Used formwork, after cleaning and before reuse

4 66 **Contractor's Submissions**

Design

Submit calculations to show that allowable concrete stresses will not be exceeded if

- formwork procedures or loadings differ from the information included in the project documentation,
- project documentation does not include formwork shoring or stripping procedures or allowable loadings from stacked materials, or
- props above a floor do not coincide with the props below

Certification Submit certification by a qualified structural engineer for the following formwork slabs/beams

Tests

Void formers Submit test certificates to confirm that the formers comply with the following requirements, under laboratory conditions, when placed on damp sand and loaded with a mass of wet concrete at least the mass of the beams or slabs they are required to support

- Deflection during placing and compaction of the concrete is less than the span of the beam or slab divided by 1000
- Additional deflection between initial set and 7 days does not exceed span/400
- Collapse and loss of load carrying capacity will occur not more than 48 hours after flooding with water, creating a void at least 60% of the original depth of the void former

Execution

Documentation Submit formwork documentation and details of proposed form linings, form coatings, release agents and, where applicable, reuse of formwork

Reshoring If intended, submit proposals

Surface repair method Before commencing repairs, submit the proposed method

Slip formwork Show on formwork drawings the method of lifting the forms during construction and the average rate of movement Demonstrate that the proposed average rate will permit the production of concrete of the specified quality and surface

4 67 Formwork

General

General Design and construct formwork so that the concrete, when cast in the forms, will have the required dimensions, shape profile, location and surface finish Allow for dimensional changes, deflections and cambers resulting from the application of prestressing forces, applied loads, temperature changes and concrete shrinkage and creep

Openings In vertical forms provide form openings or removable panels for inspection and cleaning

Cleaning Remove free water, dust, debris and stains from the forms and the formed space before placing concrete

Stripping of formwork To AS 3600 where these requirements are more stringent than the relevant requirements of AS 3610

Reshoring Do not reshore

Release agent

Before placing reinforcement, apply a release agent compatible with the contact surfaces, to the interior of the formwork, except where the concrete is to receive an applied finish for which there is no compatible release agent Clean the reinforcement to remove all traces of release agent

Defective formwork

Remove rejected concrete, form construction joints, reconstruct the formwork and recast the concrete

Permanent loading

Do not place permanent loads, including masonry walls, on the concrete structure while it is still supported by formwork

Formwork removal

Remove formwork, other than steel reinforcement decking, including formwork in concealed locations

4 68 Dimensional Tolerances

Dimensional tolerances

Position Construct formwork so that the position of finished concrete is within the tolerances stated in the **Position tolerances table**

Plumb of elements ≤ 8 m high >

Position tolerances table

Formwork class to AS 3610	1	2	3	4
Maximum deviation from correct position (mm)		5	10	

Dimensional tolerance schedule

Dimension or measurement	Location or element	Tolerance (mm)
Floor perimeter length		10mm

4 69 Formed Surface Finish

Visually important surfaces

For concrete of surface finish classes 1, 2 or 3, set out the formwork to give a regular arrangement of panels, joints, bolt holes, and similar visible elements in the formed surface. Form 45° bevels, 25 mm on the face on corners and angles

Formed surfaces schedule

Surface finish class to AS 3610	Concrete element or surface	Integral finish	Form lining type	Bolt hole filling
Class 1				
Class 2	Columns/Slabs/Beams	Yes	-	Yes
Class 4				
Class 5				

4 70 Form Tie Bolts

Removable bolts

Remove the bolts without causing damage to the concrete

Cover

Position formwork tie bolts left in the concrete so that the tie does not project into the concrete cover

Bolt hole filling

General Provide material matching the surface colour

Recessed filling Fill or plug the hole to 6 mm below the surface

4 71 Void Formers

General

Cast designated suspended ground floor slabs and beams on unwaxed cardboard or fibreboard void formers, which are collapsible on absorption of moisture. Keep void formers dry until use, place them on a firm level surface, cover with a waterproof membrane, and place reinforcement and concrete with minimum delay

SECTION 5: MASONRY

5 1 Scope of Works

The works comprise

- Retaining walls,
- Brick Veneer and Cavity walls,
- Internal and external Concrete brick walls
- Fair face finish to blockwork or brickwork as work proceeds
- Cavity gutters, damp proof courses, cavity wall ties, lintels, slip joints, building in door frames and windows
- Core filling blockwork walls
- Fire and acoustic sealants to joints
- Concrete blockwork including fire rated blockwork
- Acoustic insulation built into cavity walls on construction joints

5 2 Standards

Masonry works are to comply with following standards -

- AS 3700 Brickwork Code
- AS 4455 Masonry Units
- AS 2904 Damp proof courses
- AS 3972 Cement
- AS 2758 Sand
- AS 4680 Wall ties

5 3 Materials and Components

Brickwork

To details as shown and scheduled on the drawings

Control Joints to comply with AS 3700 Construct vertical control joints to be 15mm wide x depth of brickwork with approved backing rods and polysulphide based sealing compound of colour to match mortar

Cut Brickwork with masonry saw where cutting would be exposed

Steel Components

Corrosion resistance rating to AS3700,
Lintels to comply with AS3700,

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Concrete Blockwork Units

Concrete blockwork - Select units of a size and type suitable for the application and in accordance with manufacturer's recommendations Concrete blocks to be smooth faced – colour grey Do not expose hollow cores at tops of walls Use 200 high coping course as wall closure to all locations

Concrete blocks natural to be 200 x 400 x 400mm plain faced grey, detailed and reinforced to engineers detail

Characteristics Compressive Strength –12 Mpa Stretcher bond throughout Provide blocks to achieve fire rating shown on drawings

Control Joints - To comply with AS 3700 Construct vertical control joints, to be 15mm wide x depth of brickwork with approved backing rods and polysulphide based sealing compound of colour to match mortar

Mortar Joints, all joints to be flush Colour to match the colour of body course Joints to face brickwork to be rodded

Weepholes to comply with AS 3700 and at spacing not exceeding 1200mm Cut blockwork with masonry saw where cutting would be exposed

Mortar Materials

Sand - AS 2758 Part 1 and ASA 123 Clause 1 5, with a low clay content and free from efflorescent salts, Bush sand must not be used

Additives - Do not provide additives

Cement type to AS3972 - GP Work can be in natural grey cement

Mortar Mix Table

Mortar Type to AS 3700	Mortar Proportions (cement lime sand)	Location
M4	1 0 – 0 25 3	Load bearing masonry
M3	1 1 6	Other masonry

5 4

Construction

General

Do not chase masonry in acoustic rated walls without prior approval

Clean masonry progressively as the work proceeds Clean and remove mortar smears, stains and discolouration All cleaning methods to be in accordance with the masonry unit manufacturer's specifications

With high pressure cleaning, do no use unless approval has been obtained Use only clean water containing no acids or additives

Do not lay masonry units until they have been out of the manufacturing plant for at least 28 days

Joins and Cutting

Set out masonry with joints of uniform width All exposed cutting of block work shall be by masonry saw Holes, sleeves and chases to be build in during erection

Mortar joints, bed joints and perpendicular joints shall be 10mm thick Mortar to be fully bedded across the brick joint

Built-in steel door frames, fill the backs of jambs and heads solid with mortar as the works proceeds

Ensure flexible acoustic/fire rates joints are placed between the top course and underside of concrete slabs or as directed by architect or shown on documentation within the contract

5 5 Damp Proof Courses

To comply with AS 3700 and AS 2904 Extra super heavy bituminous coated aluminium damp proof material (min 0.45mm alum thickness)

Provide dampproof courses in the locations shown on drawings and where required by good building practice

Lay dampproof courses in long lengths Lap full width at angles and intersections and at least 150mm at joints Step as necessary, but not exceeding 2 courses per step Sandwich dampproof courses between mortar

Preserve continuity of dampproof at junction of dampproof courses and waterproof membranes, keep cavity wall clean of mortar as work proceeds and clean out at least at completion of each days work Form weepholes as open perpend with approved plastic inserts Maximum spacing 900mm

Location, provide weepholes to external leaves of brick walls in the course immediately above flashings and cavity fill and at the bottoms of unfilled cavities Set out the weep holes to the brick wall to achieve an even spacing across the elevation Align the weepholes vertically

5 6 Wall Ties

Wall tie type and spacing shall be in accordance with AS 3700 and generally spaced 600mm in each direction and 300mm centres at return walls, control joints and around openings

Category to AS 2699	Service Conditions
Light duty	Not to be used
Medium duty	Masonry veneer, normal cavity construction and at abutments
Heavy duty	Cavities > 60mm wide

- Wall ties installation, fix masonry ties at abutments -
- To concrete elements to be masonry anchors
 - To steel frames to be screw fixed/shot fixed

5 7 Slip Joints

On the top of any load bearing walls install proprietary slip joints between brickwork and concrete slab. Clean top of brickwork to remove all mortar, dags and other protrusions prior to laying slip joint.

5 8 Control Joints

Filler material, provide compatible sealant and bond breaking back materials, which are non-staining to masonry. Do not provide bituminous materials with absorbent masonry units. Fire stopping materials is required for joints to fire rated walls.

Backing rod is to be closed cell resilient, semi rigid polyethylene bond breaking material as recommended by the manufacturer for the location and services conditions.

Bond breaking materials, non-adhesive to sealant, or faced with a non-adhering materials.

Proprietary item, equal to Sika Australia Limited "Sika Prima 1" with "Sikaflex – PRO 2HP" polyurethane joint sealant. Jointing detail, preparation and the installation of the sealant to be in accordance with manufacturer's specification. Colour to match mortar colour.

Installation

Clean joints thoroughly before sealing. Vertical joint width equal to mortar points. Sealant depth 0.67 – 1.0 times joint width.

Locations as shown on drawings or generally at points of potential cracking. Expansion/contraction joints shall be at a maximum of 4m from return walls or other restraints and 8m generally.

Tooth joints are not permitted.

Requirement where a control joint occurs in an element of construction required to have a fire resistance rating, construct the control joint, using suitable fire stopping materials such as intumescent sealants, so that the fire resistance rating of the elements is not reduced.

5 9 Reinforced Blockwork

Reinforced blockwork is required as shown on engineer's drawings, using standard concrete blockwork units.

Use purpose-made cleanout blocks or machine cut a cleaning hole at the base of each reinforced core. Locate on the side of the wall which is to be rendered or otherwise concealed. Cover the hole with formwork and grout the core. Ensure all core are fully filled solid with concrete.

Reinforcement, 12mm diameter galvanised rods as detailed on engineer's drawings.

5 10 Lintels

Steel Lintels

Provide over all openings in masonry in sizes as set out below in galvanised class Z600, lintels

Steel Lintels Table

Max span (mm)	Lintel dimensions (mm)
950	50 x 10
1050	75 x 10
1200	75 x 75 x 8
1350	90 x 90 x 8
1500	90 x 90 x 8
1650	100 x 75 x 8
1800	100 x 75 x 8
2100	125 x 75 x 10
2400	125 x 75 x 10
3000	150 x 90 x 12

Submit details to engineer prior to ordering

The above table to be used if no specification/detail is provided on architectural or structural drawings

Shelf Angles

Builder is deemed to have allowed for supply and installation of any shelf angles required to complete the design intent

Angles are to be mechanically fixed using a proprietary Hilti product or equivalent

5 11 Fire Rated Joint Sealing

In order to maintain fire resistance levels between units and levels, builder is to supply and place fire rated flexible joint material between the inside face of the external brick veneer skin and the outside edge of slabs between habitable building levels Product to be “Promat Promaseal Fyrestrip”

SECTION 6: STRUCTURAL STEEL & LIGHT STEEL FRAMING

6 1 Structural Steel

General Scope

- Generally as shown on all project drawings,

Roofing Members

Refer to Structural Engineers and Architects drawings for further specification detail

The roof framing and any associated steel vertical support members are to be designed and installed by the contractors nominated sub contractor

The profiles and outlines shown on the architects and structural engineer's documents as well as services within must be accommodated by this design. No deviation is permitted without approval by the superintendent

The final design of these elements is to be documented and submitted to the superintendent for comment and approval prior to construction

Note If the contractor wishes to provide a design for a timber framed alternative, this is permitted so long as the above general principles are adhered to and any further works relating to the introduction of timber elements (ie termite treatment) is considered and allowed for in full

6 2 Standard

General

Materials, construction, fabrication and erection To AS 4100

6 3 Adjoining Elements

General

Provide for the fixing of adjoining building elements to be fixed to or supported on the structural steel

6 4 **Quality**

Inspection

Witness points - off site

Give sufficient notice so that inspection may be made at the following stages

- Materials including welding consumables before fabrication
- Testing of welding procedures and welder qualification tests
- Commencement of shop fabrication
- Commencement of welding
- Before placement of root runs of complete penetration butt welds
- Completion of fabrication before surface preparation
- Surface preparation before shop painting
- Completion of protective coating before delivery to site

Witness points - on site

Give sufficient notice so that inspection may be made at the following stages

- Steelwork on site before erection
- Tensioning of bolts in categories 8 8/TB and 8 8/TF
- Steelwork and column bases erected on site, before grouting, encasing, site painting or cladding
- Anchor bolts in position before casting in

Hold points - Satisfactory engineers site inspection and approval of shop drawings

6 5 **Tests**

Non destructive weld examination

General Have the examination performed by an independent testing authority
 Repairs Repair faulty welds revealed by non-destructive examination and repeat the examination

Schedule of non-destructive examination (NDE)

Type of weld and category	Examination method	Extent (% of total length of weld type)
GP	Visual	90%
Full Penetration Butt Weld	X Ray	5%

SAMPLES

Special finishes

General Submit samples of finished steel listed in the **Special finishes schedule**

Minimum sample sizes

- Surface finish samples 0.1 m²
- Weld samples 300 mm run of weld

6 6 **Contractor's Submissions**

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Subcontractors

Submit names and contact details of proposed fabricator and installer

Shop drawings

General Submit 5 hard or paper copies of shop drawings showing the following information

- Relevant details of each assembly, component and connection
- Information relative to fabrication, surface treatment, transport and erection

Particular Include the following information

- Identification
- Steel type and grade
- Dimensions of items
- Required camber, where applicable
- Fabrication methods including, where applicable, hot or cold forming and post weld heat treatment
- Location, type and size of welds or bolts
- Weld categories and bolting categories
- Orientation of members

Shop drawings

- Surface preparation methods and coating system
- Procedures necessary for shop and site assembly, and erection
- Temporary works such as lifting lugs, support points, temporary cleats and bracing which are required for transport and erection of the structural steelwork
- Required fixings for adjoining building elements

Tests

Steel Submit evidence that the steel used in the work complies with the cited material standards

Acceptable evidence Certified mill test reports, or test certificates issued by the mill

Alternative Have the steel tested by an independent testing authority for compliance with the chemical composition and mechanical test requirements of the cited material standard

Materials and components

Masonry anchors If masonry anchors are required or proposed for the support or fixing of structural steel, submit evidence of the anchor capacity to carry the load

Execution

Splicing If splicing of structural members is intended, submit proposals

Welding procedures Submit details of proposed welding procedures, using the form in Appendix C of AS/NZS 1554.1

Distortions If a member is distorted during the galvanising process, submit proposals for straightening

6 7 Materials and Components

**STEEL TYPE AND GRADE
Standards**

Cold-formed sections To AS/NZS 4600

Steel grade table

Type of steel	Grade
Universal beams and columns, parallel flange channels, large angles to AS/NZS 3679 1	300
Flat, small angles, taper flange beams and columns to AS/NZS 3679 1	250
Welded sections to AS/NZS 3679 2	300
Hot rolled plates, floor plates and slabs to AS/NZS 3678	250
Hollow sections to AS 1163	
Circular sections less than 265 mm outside diameter	250
- Sections other than the above	350
Cold formed purlins and girts to AS 1397	G450 Z275
Steel rails to AS 1085 1	(one grade only)

Steel grade schedule

Type of steel	Grade
Steel castings to AS 2074	250
Hot-rolled plate, sheet and strip to AS 1594	250
Cold-rolled sheet and strip to AS 1595	450
Hot-dipped zinc-coated or aluminium/zinc-coated sheet and strip to AS 1397	

6 8 Execution

Splicing

General Provide structural members in single lengths

Beam camber

f beam members have a natural camber within the straightness tolerance, fabricate and erect them with the camber up

Site work

Other than work shown on the shop drawings as site work, do not fabricate or weld structural steel on site

Connection bolts

For connection bolts not shown on the drawings, provide hot-dipped galvanised high strength bolts, nuts and washers to AS/NZS 1252 and snug tight bolting category 8 8/S

Foundation bolts

General Provide each foundation bolt with 2 nuts and 2 oversize washers and provide sufficient thread to permit the levelling nut to be set below the base plate

Hexagonal commercial bolts To AS/NZS 1111

Hexagonal nuts Class 5

Extra large flat washers To AS 1237 Appendix A

Lock nuts

General Provide lock nuts for bolts in moving parts or parts subject to vibration and for vertical bolts in tension

Method of tensioning To AS4100 Erection in accordance with the grade of bolt specified

6 9 Welding

Weld category

Category GP welds For weld categories not shown on the drawings, provide category GP to AS/NZS 1554 1

Site welds

Wherever possible locate site welds in positions for down hand welding

6 10 Erection

Temporary connections

Do not attach cleats except as shown on shop drawings

Hand flame cutting

Do not hand flame cut bolt holes

Movements

Provide for thermal movements during erection

Anchor bolts

For each group of anchor bolts provide a template with setting out lines clearly marked for positioning the bolts when casting in

Grouting at supports

Temperature Do not grout if the temperature of the base plate or the footing surface exceeds 38°C

6 11 Finishes

General

Provide marks or other means for identifying each member, and for the setting out, location, erection and connection of the steelwork If the work includes more than one bolting category, mark bolted connections to show the bolting category

Surface Preparation

Methods To AS 1627

Site connections After completing the connection, prepare the surface of the connection, adjacent unprimed surfaces and surfaces damaged during erection
 Steel surfaces generally Remove loose millscale, loose rust, oil, grease, dirt, globules of weld metal, weld slag and other foreign matter

Marking

On the contact surfaces of friction type joints, confine the use of marking ink to the minimum necessary for marking hole positions

Abrasive blast cleaning

Do not use silica abrasive for dry blasting Use phosphate inhibitors when wet blasting

6 12 Protective Coatings

General

Shop work Apply the primer coat or protective system to the structural steel before delivery to the site

Transport and handling Protect paintwork from damage during transport and handling Do not handle or transport steel members until the paintwork is dry

Site work After erection, repair damage to the shop coating and apply coating omitted at site connections

Priming

Time delay Prime the steel surface as soon as possible after surface preparation and before the surface deteriorates If the surface is contaminated or rust bloomed, repeat surface preparation before priming

Fast drying primers Do not provide fast drying primers where surface preparation is less than class 1 5

Concrete encasing Where members are part concrete encased extend the priming 25 mm into the surface to be encased

Inaccessible surfaces

Where surfaces will be in contact or near contact after fabrication or erection, apply the finish and allow it to dry before assembly

Paint coatings schedule

Steel member or surface	Abrasive blast cleaning to AS 1627 4	Protective system			Minimum dry film thickness (µm)
		1st coat	2nd coat	3rd coat	
Refer to structural drawings					

6 13 Galvanising

Structural sections

Cold worked items Anneal to 650°C before galvanising

Coating mass Other than nut and bolt thread surfaces

- Average 600 g/m²
- Minimum 550 g/m²

Friction-type bolted connections

General Treat contact surfaces to achieve the required slip factor

Method Wire brushing or light grit blasting

Galvanising schedule

Steel member or surface	Coating mass
Refer to structural drawings	

6 14 Special Finishes

Special finishes schedule

Defined special finish	Steelwork location
Refer to architectural drawings	

6 15 Metal Spraying

Metal spray schedule

Steel member or surface	Abrasive blast cleaning to AS 1627 4	Metal spray type	Seal coat
Refer to architectural drawings			

6 16 Fire Protection Coatings

Fire protection coatings schedule

Steel member	Surface preparation	Fire protection system
Refer to structural drawings		

6 17 Completion

Temporary connections

Remove temporary cleats on completion and restore the surface

6 18 **Light Steel Framing**

General

This section relates to the manufacture, supply and installation of light steel framing for roof and wall elements, and should be read in conjunction with the consulting structural engineers general notes

Standards

Design To

AS 1170 1 – 1989	Dead & Live Loading
AS 1170 2 – 1989	Wind Loads
AS 1538 – 1988	Cold Formed Steel Structures
AS 4055 – 1992	Wind Loads for Housing

Materials To

AS 1397 – 1993	Steel Sheet & Strip – Hot Dipped Zinc Coated
AS 1538 – 1988	Cold Formed Steel Structures
AS 3623 – 1992	Domestic Metal Framing
AS 3566 – 1996	Screws – Self Drilling
BHP Building Products – Steel Wall Framing in Non-Cyclonic Areas Manuals	

6 19 **Quality**

INSPECTION

Witness points

Give sufficient notice so that inspection may be made of steel framing erected on site before lining or cladding

The inspection is to be carried out by a suitably qualified structural engineer with NPER qualification, at the Builders cost. Final certification shall be submitted to the consulting engineer

6 20 **Contractor's Submissions**

Design

Wall frame member sizes. Submit a schedule of prepared member sizes, certified by a suitably qualified structural engineer as meeting stated project requirements. Refer to Drawing S0 for specific technical criteria in reference to stud selection

Shop drawings

Wall framed. Submit shop drawings certified by a suitably qualified structural engineer

- stating that the frames have been designed to AS 1538 for the span, spacing and loading
- Showing on an elevated diagram the size and section type of each member, and specifying the method of assembly, fixing, tying and bracing

6 21 **Materials and Components**

Corrosion protection

Steel sheet and strip sections

- Coating class (minimum) Z275 or AZ150

6 22 **Execution**

CONSTRUCTION GENERALLY

Fabrication

Length Cut members accurately to length so that they fit firmly against abutting members

Service holes Form holes by drilling or punching

- Bushes Provide plastic bushes or grommets to site cut holes
- Swarf Remove swarf and other debris from cold-formed steel framing immediately

Fastening

Type Select from

- self-drilling, self-tapping screws,
- blind rivets, or
- proprietary clinching system

Welding

Type Use the metal inert gas (MIG) technique or carbon arc welding

Touch up Clean the weld and coated areas affected by welding and touch up with zinc rich organic binder within 20 minutes of welding

Prefabricated frames

Protect frames from damage or distortion during storage, transport and erection

Bracing

Use diagonal noggings or tensioned straps Refer consulting structural engineers general notes

Metal separation

Install lagging to separate non-ferrous service pipes and accessories from the metal framing

Earthing

Permanent earthing Required

Temporary earthing Provide temporary earthing during erection until the permanent earthing is installed

CCA treated timber

Do not fix contact with cold-formed steel framing

6 23 **Wall Framing**

Wall studs

General Provide studs in single lengths without splices Place a stud under, or within 40mm from, each structural load point from roof or ceiling (except for openings) Provide multiple studs at points or concentrated load

Maximum stud spacing 600mm

Heads to openings

Use lintels consisting of either a stiffened top plate or a truss built up from frame members, depending on load and span

Splicing

Splice plates at ends to maintain continuity and alignment

Additional support

General Provide additional support in the form of noggings, trimmers and studs for support fixing of lining, cladding, hardware, accessories, fixtures and fittings

Maximum spacing of noggings 1350mm centres

6 24 **Completion**

Cleaning

On completion of framing remove debris from the cavities of members

SECTION 7: CARPENTRY & JOINERY

7 1 Extent and Scope of Work

The works in this section comprise the following -

- Apartments,
 - Entry doors
 - Proprietary internal doors
 - Pelmet to windows and doors
 - Kitchen cupboards and bench tops
 - Vanity cupboards
 - Laundry sink joinery and storage cupboards
 - Built-in wardrobes
 - Bathroom cabinets
 - Linen, coat and storage cupboards
 - Timber skirting and architraves
 - Window boards,
 - Operable Walls

- Meeting Rooms,
 - Joinery fittings

7 2 Standards

All works are to comply with relevant Australian Standards

Ensure all hinged external and common area doors as well as apartment entry doors are fitted with a Dorma TS93 door closer (not including cupboards)

7 3 Fire Rated Doors

Fire rated doors are to comply with AS 1905

All doors are to be paint grade, complete with required tag to certify fire rating

Provide separate Form 15 Certificate on completion of each building

Ensure clearances required under and around frames are strictly complied with

Steel door frames to be built in as work proceeds and fill frame solid with mortar

7 4 **Proprietary Doors**

Internal doors to apartments are to be hollow core Corinthian Balmoral MBAL2 style door of standard sizes from Corinthian Doors Pty Ltd, Phone 9673 7111

Doors are to be hung with 1½ pair of slim line hinges and fitted with hardware as detailed in schedules (Lift off hinges required to all bathroom and ensuite doors)

7 5 **Apartment Entry Doors**

Main apartment entry door is to be fire rated as shown in door schedule Use Pyropanel PFD 060-38 with a bolection moulding to architect details

Supply and install Lorient batwing acoustic/smoke seal to top and sides of every apartment entry door and Lorient model #8010 seals on the bottom

Paint seal top and bottom of door before installing

7 6 **Weatherseals**

All external doors to the project are to be fitted with recessed drop down "Raven RP60" weather seals

7 7 **Kitchen Cupboards & Bench Tops**

Set-out of cupboards tops, shelving, etc to be set out as Architect's lay-out drawings

Cupboards shall be constructed of high moisture resistant particleboard with shelves, side, bases, divisions, edges, doors, skirtings and tops as detailed by the Architect and interior designer

Internal cupboard and drawer surfaces shall be melamine faces, all exposed faces and edges shall be polyurethane as specified Support base on 100mm x 32mm high timber framed plinths, adjustable to take up irregularities in concrete floor, polyurethane faced kickboard Scribe kickboard to follow any deviations in floor Neatly fit sinks and fill all voids and gaps with waterproof flexible silicon

Drawer runners are to be double action runners with soft close mechanism, manufactured by Blum

Doors and drawer fronts are to be as detailed by Architect and interior designer and have soft close mechanism

Benching shall be constructed to the general detail and in the locations and of lengths shown on the drawings

Neatly seal around all services within under bench cupboard space

Provide painted MDF panel behind fridge space to close cavity behind over head cupboards Where mechanical or hydraulic services run within this cavity, place 50mm tontine insulation within and seal around entire MDF panel

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Provide and fix each cupboard door one pair of all metal 145 degrees cupboard hinges to all corner cupboards and 110 degree elsewhere equal to Blum

To each drawer front, provide and fix one handle as detailed by the Architect and interior designer Drawers to have metal runners with mechanism to prevent drawer being accidentally fully removed Provide one plastic cutlery drawer insert to each bench cupboard

Shelves in all cupboards are to be adjustable, fixed on chrome pins and cups in division panels to provide 3 fixing positions

Overhead cupboards shall be fixed to walls, with two rows of 8 gauge countersunk screws, fixings at 450 centres, fixed through 50 x 25 ledgers

Cupboard doors shall be set in from return and side walls 50mm minimum, to ensure handles, etc clear walls Provide matching polyurethane infill closure pieces

Allow for all necessary routing and chasing of electrical and hydraulic services within the joinery pieces No exposed surface mounting is permissible Place an escutcheon plate over all penetrations made for services

7 8 Kitchen finishes & Hardware

Refer to the attached finishes schedule and Architects details

Skirting/Kickplate

All kitchens are to have MDF kickplate with a satin polyurethane finish as shown on drawings

Doors & Drawer Handles

As per architects schedules

7 9 Vanity Benches

Neatly fit basins and ensure there are no gaps between the vanity and basin

Benches and splashbacks shall be constructed to the general detail and in the locations and of lengths shown on the drawings

Handles and hardware to be as detailed by Architect and specified in schedules forming part of this contract

7 10 Built-in Wardrobes

To locations shown provide built in robes comprising shelves and hanging rails at 1550mm above finished floor level

Robes shall be Norska or Stegbar standard wardrobe assembly or approved equivalent complete with rollers and trims Doors to be flush 19mm MDF with Polyurethane finish Internal faces to be finished in white melamine

Wardrobes to be supplied and installed by Norska or Stegbar or their approved installer unless formally approved otherwise by the principal

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All robes to have a front and rear pelmet support to the top shelf made from 80mm x 16mm wide melamine strip neatly fixed to underside of shelf and rear wall

Ensure all hanging rails are adequately fastened at ends and supported in centre of rod to ensure no sagging occurs

7 11 **Bathroom Cabinets**

Bathroom cabinets with mirrors are to be installed in all ensuites and bathrooms as shown on the architectural plans Allow for fixing each cabinet with 4 no 8 gauge screws with plastic caps in matching colour

Allow for all necessary framework and structural support necessary to fix/recess them in walls

Where bathroom/ensuite cabinets are denoted on the architect's documents as surface mounted, again allow for fixing each cabinet with 4 no 8 gauge screws with plastic caps in matching colour

7 12 **Linen, Coat and Storage Cupboards**

To locations shown, provide 18mm MDF melamine finished shelves and divisions shown on Architect's drawings Fix shelves on a 50 x 25mm melamine finished wall plates secured with 8 gauge screws with plastic caps in matching colour

Generally unless shown otherwise on Architects drawings provide 4 equally spaced melamine shelves to each linen closet

Coat cupboards to consist of one chromed hanging rail secured at either end as well as one overhead shelf Hanging rail to be mounted at 1550mm above the finished floor level unless shown otherwise on Architects drawings

Storage cupboards to consist of one shelf mounted at 1500mm above the finished floor level unless shown otherwise on Architects drawings
If and where any cupboard space has not been shown or detailed on the Architects drawings, allow for fitout as per linen closet

Doors to be finished as shown on Architects door schedule and associate details
Ensure all exposed end panels are finished in polyurethane to match doors

7 13 **Timber Skirting**

Provide finger jointed pine timber skirting to base of all walls in areas as shown on Architect drawings

Skirtings are to be neatly mitred at junctions and intersections, butt joint up to door architrave and other stop ends Screw fixing to walls with countersink screws and filled with suitable filler to sanded smooth finish

7 14 **Architraves**

Finger Jointed Pine Architraves to be installed to both sides of all internal door frames, including wardrobes unless inside a cupboard. Tightly butt joint to floor finish.

Screw fixing to walls with countersunk screws, countersunk filled with suitable filler, sanded smooth for painting.

7 15 **Window Boards**

To all windows in apartments, install 20mmx150mm window boards, finger jointed pine as detailed on Architects drawings. Neatly butt joint to plasterboard reveals at either end. Window sill to be in single-length for each window and countersunk screw fixed with countersink filled with suitable filler, sanded smooth for painting.

For more information refer to the Architects drawings.

Neatly route the underside of the sill board to enable the plasterboard sheet under to be recessed within.

7 16 **Meeting Room Joinery**

Install joinery in all Meeting rooms/lounges to ILU lobby as detailed on Architects and interior designers drawings. Generally the joinery shall consist of a timber carcass housing 4 drawers under and 3 underbench cupboards with hinged doors. A Clarke stainless steel sink shall be placed within the bench top. Allow for a melamine kickplate to perimeter of carcass.

Benchtop to be laminate finish by Laminex (unless scheduled otherwise) whilst carcass shall be melamine finishes with stainless steel handles equal to that nominated for ILU kitchens.

7 17 **Building Entry Doors (ILU Lobbies)**

Refer to architects documents for further information. In the event the drawings do not show this information, allow for the following,

To each building entry point allow a powder coated glazed suite with two **sliding** doors and associated automatic door operator. Allow to have a proximity system incorporated into the frame.

Pelmets

Provide 18mm thick MDF timber pelmets as detailed on architects drawings. Pelmets to be located over all windows (except for bathroom/ensuite). Fix pelmets using 80mm x 80mm steel brackets with two fastening screws within each end.

SECTION 8: **HARDWARE**

8 1 Extent of Work

The work comprises the supply and installation of the following -

- I Door hardware
- II Bathroom accessories
- III Signage

8 2 Supply

Supply and fix hardware items as detailed on the Architects drawings, door schedule and in this specification

8 3 Installation

Install hardware in accordance with manufacturer's recommendations, in a proper manner so that any warranty from the manufacturer is not negated by wrong application

Furnish any recommendations from the manufacturer for the proper maintenance of the items installed

Do not damage screw heads when driving screws Replace damaged screws

On completion, leave hardware clean, with all required lubrication and in working order

8 4 Hinges

Supply the hinges specified below with broad butts where necessary to achieve the door swings shown, but not otherwise

Nominal length of butt hinges shall be 100mm unless otherwise specified

Hang external doors, external doors in aluminium frames with three 100 x 40mm cadmium plated butt hinges Internal doors in steel frames are to be hung one pair of 100mm interfold hinges

Provide removable lift-off hinges are required to doors to all ensuites and bathrooms in units and toilets in common areas

8 5 Keying Hardware

Keys shall be nickel alloy, not brass Supply keys to all locks Fit keys with plastic tags, labelled appropriately

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Number of Keys 3 for each lock

Supply keys in the following quantities

Grand master keys	10
Master keys	10
Sub Master keys	10

Arrange for master keys to be delivered direct from the manufacturer or supplier to the Principal in a fully labelled metal master key box for storage of the entire system. A secondary storage box is also to be provided for the storage of emergency call system keys.

Deliver all other keys to the Principal upon Practical Completion.

All pin-tumbler locks, including key-in-lever locks, shall have six-pin cylinders capable of being master-keyed.

The master key system shall be capable of future extensions to accommodate an additional 140 units and 60 additional common doors.

Have the lock manufacturer or supplier keep a record of the master key system showing each lock type, type of key supplied, key number for re-ordering and name of the supplier. Supply two copies of the record to the Principal upon Practical Completion.

Ensure that all keys to all units are keyed alike (ie apartment entry, windows, sliding doors, security & screen doors).

The keying system is to a restricted type for client use and access only. No cutting of keys are permitting without the restricted users permission (ie the client).

8.6 Handles, Push plates, Kick plates Generally

Lock and latch furniture, pull handles, push plates and kick plates, where specified or scheduled to doors, shall be in pairs, one to each side of the door unless otherwise specified and shall be suitable for use with lock or latch specified.

Plates shall be provided with lock cylinder holes and keyholes where appropriate and turn knobs if so specified. Exterior plates shall have concealed screw fixing.

8.7 Door Stops

For all doors fix door stops behind each door where door furniture would otherwise strike walls or features.

8.8 Toilet roll holders, towel and shower Rails

All towel and shower rails to be positioned in accordance with Architects drawings. Ensure a solid timber panel is placed in cavity of wall to ensure a structural fixing point is available for the rails.

8 9 Signage

Allow Provisional Sum, as detailed in Preliminaries for provision and installation of all signage required

8 10 Toilet Partitions

To common area toilet rooms in locations shown in Architects drawings, install toilet partitions equal to Laminex Structural MR system as supplied by The Laminex Group Panel sizes and colours are to be as shown in Architects drawings and on finishes schedule Edge Finish to be 2mm ABS with edge colour to match panel All aluminium components to be powder coated in the same colour as the actual partition

8 11 Door Hardware

Refer to door schedule

SECTION 9: METALWORK

9 1 Extent and Scope of Work

The works comprise the following -

- I Aluminium windows and doors
- II Door frames
- III Car park over head sectional doors
- IV Security Screens to ILU's
- V Bollards
- VI Balcony balustrades
- VII Stair handrails
- VIII Roof safety systems
- IX Letter boxes
- X Metal Grilles
- XI Pergola Structures
- XII Clothes Lines
- XIII Metal Fencing & gates
- XIV Column Guards

9 2 General

All work is to comply with relevant Australian Standards

Fabricate pre-assembled items in the workshop wherever practicable

Keep edges and surfaces clean, neat and free from burrs and indentations

Remove sharp edges without excessive radiusing

Form neat joints in pre-finished materials and other materials where seamless joints are not required or necessary Form joints mechanically with concealed fixings Where weatherproofing is necessary, incorporate waterproof sealant or gasket of appropriate materials into joints Do not use sealant which will discolour the pre-finish, or soften and leak out from the joints

Form bends in tubes without distorting the tube

Separate electrolytically incompatible materials by suitable means and materials which will not be visible in the finished works

Provide for thermal movement in joints and fastenings and in the installation of assemblies such as frames

9 3 Aluminium Windows and Doors

Standards – Windows & Entry Door

Materials To AS 2047 1

Construction and installation To AS 2047 2

Performance General

Performance Criteria As installed, the window system and associated work shall remain intact and waterproof under local and ambient conditions of wind loading and rainfall

Ambient Climatic Conditions

Window loading To AS 1170 2 with terrain category 3

Samples – Requirement

Submission submit samples of the following to the window installation

- Accessory and hardware including locks, latches, handles, catches, sash operators and weather seals

Shop Drawings

Requirement The general arrangements of the windows are shown on the drawings Submit shop drawings showing the following information

- Lay-out (sectional plan and elevation) of the window assembly
- Full size sections of members
- Methods of installation, including fixing, caulking and flashing
- Junctions and trim to adjoining surfaces
- Hardware, fittings and accessories
- Glazing details

Windows and doors shall be fabricated from the following standards framing

Residential

- Sliding Doors - Lidco 132 Suites
- Hinged Doors - Lidco 150 Suites
- Sliding Windows - as above
- Bifold doors - Lidco 744 system
- Louvre Windows - Lidco 610 system

Finish shall be a powdercoat of thickness required by AAMA Code and Australian Standards for the location, colour to be selected from the standard Dulux Colour range

All windows are to be key locked Windows and doors are required to have acoustic rating in accordance with the BCA and Australian standards Rubber seals are to be installed on all opening leaves Mohair seals are not acceptable

Provide three (3) sets of window keys for each window installed

Provide cut-outs for electric strikes to all doors to each building as required

Fabrication – Make accurately fitted joints with concealed fixings Use non-staining jointing materials Ensure moving parts operate freely and smoothly Remove temporary protective materials before making joints and from exposed surfaces on completion

Provide aluminium compatible flashings and weatherings where they form part of the assemblies Install flashings, weather bars, drips, storm moulds, caulking and pointing to prevent water entering the building through or around the window or door assemblies

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Installation – Install frames with members plumb, level, straight and true within tolerance of 1 500 Adequately anchor or fix frames to the building structure with non-corrosive fixings and anchors fabricated from stainless steel or hot dip galvanised steel Ensure no building loads, including loads induced due to long-term deflection of the structure, will be carried by the window and door assemblies Pack behind fixing points with durable non-corrosive packing

Allow tolerance for thermal movement, settlement, structural deflection and wind load deflection, not exceeding 10mm gap between window frame at sill and reveals, and 20mm at heads Provide matching storm moulds externally and internal trim angles

Fly Screens

Fly screens in light aluminium frame with powdercoat finish to match windows are to be fitted to all opening windows and doors, except main entries and bi-folding doors

Sliding doors are to have sliding flyscreens

Flyscreen must be readily removable for maintenance and window cleaning

Security Screens

Provide powdercoated aluminium security screens to all ground floor and first floor unit doors including balcony sliding door and unit entry doors

Screens to be lockable and have flyscreen fabric within and be keyed the same as the unit entry door (ie same key opens both) Screens to be equal to Crimsafe proprietary system

Locks

Provide keyed locks to all aluminium windows and doors Build into door stiles, with striker plates and tongue recesses in frames of inactive stiles of pairs of doors Windows locks shall be surface-fixed type and mounted at 1000mm above finished floor level All locks are to be 100mm clear of any obstructions to enable the user to operate locking device

9 4 Door Frames for Timber Doors

Door frames in masonry walls shall be fabricated from 1 1mm thick zinc-coated steel sections to AS 1397, incorporating rubber buffers, c p strike plates, spreaders, mortar guards, switch boxes, fixing ties or brackets, and cavity flashing with suitable provision for fixing hardware

Stiles and head shall be double rebated C-section of overall width to suit wall construction with return flanges at back Overall depth of frame to be 50mm with 12mm rebates to non fire rated doors and 25mm rebates to fire rated doors Shop prime frames ready for painting

Make suitable provision for fixing hardware including hinges and closers, using 4mm backplates and lugs Screw fix the hinges into tapped holes in the back plates

Build in to masonry by means of galvanised rod ties attached to stiles at 600mm maximum centres, grout up solid

9 5 Car Park Sectional overhead Doors

Powdercoated section overhead commercial grade door comprising hinged horizontal panels that travel along a vertical and horizontal track system, which are counter-balanced by a torsion spring system connected to the door by cables of galvanised steel multi-strand wire rope

Panels to be constructed from expanded aluminium mesh incorporated in an aluminium frame. The door is inclusive of all hardware and accessories as supplied standard from the manufacturer for satisfactory performance. Powdercoat Colour to match adjacent steel mesh panels

9 6 Balcony Balustrades

To all apartment balconies, install aluminium toughened glass balustrade to locations shown on Architects drawings. All aluminium is to have "Duratech" finish and glass is to be clear. Balustrade system to be Lidco 614 suite

Balustrade is to be 1100mm high above finish and balcony tiling and to comply with provision of BCA. End fix top rails with concealed fixing to masonry abutments. Provide mullions at centres to provide equal panels in each opening. Provide a metal powder coated escutcheon over each core hole

9 8 Stair Handrails

Unless otherwise shown on Architects drawings, to all fire stairs provide either balustrade in centre of stairs, or to one side of wall of enclosed stairs. Handrail, mid rail and balusters are to be 50mm diameter galvanised tube

Where possible, manufacture prior to galvanising in as long lengths as practicable, minimise site cutting and welding. Form neat radius bends at top and bottom of each handrails to provide 150mm section horizontal with landing with end cap

Fix balusters with 150 x 100mm plate masonry bolted to side of concrete stair stringer. For wall fixed handrail, mount on 12mm bent rod, housed into wall with circular escutcheon

All handrails are to be free of rust and primed and painted in a colour to be nominated by Architect

9 9 Roof Safety Line

Install "Safe Master Safety Link" system to all roofs. Liaise with supplier to determine location of fixing points on roof levels

9 10 Letter Boxes

Install letter boxes to each building in location shown on Architect's drawing "Arcon Industries Mailsafe 7 range" Finish powdercoated Each box to have engraved apartment number and provided with 2 no keys

9 11 Column Guards

Allow to supply and fix steel angle column guards to all columns Guard to be mounted on all faces of the column Guards to be 150x150x12mm thick on each corner of the column Prime and paint guard Colour to be nominated by architect

9 12 Fencing and Gates

Supply and install metal fencing to extent as shown on landscape architects drawings

9 13 Clotheslines

Supply and install clotheslines to each of the ILU's Install HillsFD45316 (long) Also, generally allow to install 2 clotheslines lines to all drying courts and 1 for each unit

9 14 Ventilation Louvres

To locations shown on Architects and Mechanical engineers drawings, install Lidco 611 system louvres with powdercoat frame

9 15 Garbage room ventilation slats

Install Metalart industries Supaslat powdercoated aluminium batten system (75x15nom) in locations shown on architects drawings Install as per manufacturers requirements

SECTION 10: ROOFING & WATERPROOFING

10 1 Extent of Works

The extent of work shall comprise the following

- i) Metal roofing
- ii) Membrane to all roofs over basement, under basement slabs, 1st floor terraces and balconies generally
- iii) Flashings to penetrations and upstands
- iv) Waterproofing to retaining walls
- v) Membranes to balconies

10 2 Standards

All work is to be undertaken in accordance with relevant Australian Standards

10 3 General

The roofing shall be complete with all associated and ancillary work and material necessary to produce a completely weatherproof and waterproof roof. The selected roofing systems and components shall comply with the written specification and recommendations of the roofing systems and components Manufacturers.

10 4 Membrane

Supply and install Tremco waterproof membrane system to the areas as noted below. Remove all loose materials and projections on concrete areas prior to installation. Dress up and over all upstands, parapets and down into any outlets as per manufacturer's recommendations in order to obtain **20-year** guarantee of weather tightness. Quality Assurance sheets are to be issued by the subcontractor and builder formally confirming the installation and finished product is as per suppliers recommendations and has met required standards.

Refer to general specification and Tremco detailing as shown on Structural Engineers drawings. For further detail and advice on product, refer to John Medland of Tremco on 0412-333-789.

Tremco Membrane to be generally installed to

- Entire concrete slab area which may have a landscaped/tiled or exposed area above and a basement and/or habitable area below,
- 1st floor terraces located over ground floor units,
- External Basement walls,
- Beneath basement slab area,
- Balconies generally,
- Any balconies/terrace over a habitable area

The membrane work is to include finishing at all perimeters and effective spanning of any expansion joints.

Allow to detail to all window sills, sub sills, pipes, plinths, joints, edges and protrusions to ensure a full, guaranteed waterproofing system.

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Generally – terminations/laps/bonding

The membrane shall

Have all terminations either cast into the concrete or fitted into saw cuts as specified herein. Terminations of the seal type will not be permitted,

Have all laps and connections fully homogeneously placed

Generally - quality assurance

Tremco must inspect and certify the installation of the membrane works to ensure full compliance with the specification and all manufacturers recommendations. This liability includes (but is not limited to) the following activities

Provide shop drawings of all details, which are not included in standard published manufacturer's drawings. The shop drawings are to take full account of the coordination requirements of connecting trades,

Approve the selection/design of all termination and similar details before installation. Approve any detail changes as may be needed during the work, for coordination, variation or any reason,

As each area nears completion, thoroughly inspect, log any defects found, arrange for their rectification, reinspect and certify that the work is correct and complete. Issue signed inspection sheets for each case,

On completion, take full liability for the quality, correctness and sufficiency of the Workmanship as part of the single point Warranty specified hereafter

Warranty

Submit a warranty for the Membrane against defective materials and workmanship, issued solely by the manufacturer or distributor of the membrane material. The Warranty liability by the manufacturer or distributor to the Owner is to be singular and complete and no separate or parallel warranty offer is to be made by the applying contractor

The Warranty shall not contain elements of "pro rata" cost sharing

For associated materials, such as concrete repair, insulation and wall coatings, obtain the manufacturers' guarantees, made in favour of the Owner and pass to the Owner at Practical Completion

Warranty Period 20 years

All membrane junctions are to be homogeneously placed - adhesives or tapes are not to be used for jointing nor detailing to pipes, penetrations etc. Detailing is to include sealants only where indicated on the Standard Guide Details or shop drawings prepared by manufacturer

Where sealants are so specified, they are to be installed so as to be permanently accessible for service, wherever practicable

Laying is only to be performed by applicators licensed by manufacturer and evidence of their licensed status is to be provided before the work commences

10 5 **Substrate Preparation**

Concrete/masonry is to be finished to smooth standard, without ridges, boniness or sharp changes of plane

Formed concrete to be minimum Class 3 with "sharps" knocked off

10 6 **Terminations**

All membrane terminations are to use manufacturers recommended details and are to be self sufficiently waterproof at each termination This responsibility does not extend to the internal waterproof integrity of the substrates, such as masonry walls

Where the cut in profile is specified, the preparation by the Applicator is a sawcut 5 mm wide x 20 mm deep, which is prefilled with one part urethane The profile is inserted while the sealant is wet and a second run of sealant is applied after the membrane welding is completed

Where the cast in extruded reglet is specified, it is to be supplied and fixed to the form shutter by the Membrane Applicator The Applicator is to clean off any laitance or fixing media after strip before welding the membrane to the profile

10 7 **Shop Drawings**

All details which are not precisely as the Standard Guide Details, are to be the subject of shop drawings prepared by manufacturer submitted by the Applicator for the approval of the Superintendent The contractual responsibilities remain unchanged by such approval

Before commencement the Applicator is to coordinate with manufacturer to ensure the shop drawings are provided in adequate time for approval, allowing time for resubmission if needed

No variation to the Applicator's price is to result from any shop drawing (nor manufacturers advice), unless the detail is the result of a legitimate contract variation instructed by the Builder

10 8 **Bolt Fixings**

Where handrail standards, pergola posts, columns and the like are to be installed such that their fixings penetrate the membrane, the fixings are to be installed before the membrane They are to be of a type which leaves a firm stud, threaded rod or similar projecting from the substrate The Membrane Applicator will detail the membrane to those studs The installation of the standard, column etc is to be closely supervised by the Membrane Applicator

Door and Glazing Unit Sills/Thresholds

Where the pond height at the sill (internal FFL minus external FFL) is less than 100 mm, it is preferred that the membrane is carried beneath the sill or subsill To achieve this it is necessary that the sills be fitted in conjunction with the Membrane Applicator Refer also the clause "Bolt Fixings" above

Applied Finishes

Ideally any finish applied directly to the Membrane should be performed by the Membrane Applicator to maximise Warranty protection

If the applied finishes are required to be performed by others, their installation shall be closely supervised by the Membrane Applicator The Builder is to ensure that appropriate arrangements exist in the contract to cover the Membrane Applicator's attendance on such works

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Gravel or similar ballast is to be applied only by the Membrane Applicator

- a) **Toppings, tile beds** It is preferred that the Membrane Applicator supply and adhere abelflex or similar to all upstand faces and supply, place and tape a PE slip plane to the surface of the membrane
- b) **Bar Reinforced slabs** The protection methods should be discussed with the Membrane Applicator before the tender is finalised. If not specified otherwise, the Membrane Applicator is to allow for supply and placement of Projex Shockmat in lieu of the PE slip plane, to minimise reinforcement steel placement damage
- c) **Planters - Drainage Cells / Media** Where such materials are to be laid onto the Membrane, the Membrane Applicator is to place A64 geotextile fabric onto the Membrane beforehand. Drainage cells are to be placed by the Membrane Applicator, to avoid "cut-edge" and/or tight fit damage
- d) **Presurfacing Damage Check** The membrane is to be checked for damage and signed off by the Membrane Applicator immediately prior to pour or covering up

10 9 Protection

Where specified (or recommended by manufacturer), protective media for backfill, concrete, pavings, plantings/garden beds and the like are to be supplied and fixed by the Membrane Applicator, so that the Warranty responsibilities remain clear

No work by others is to proceed over the Membrane unless the Membrane Applicator's advice as to protection media is sought AND FOLLOWED

In all cases where temporary protection is to be provided, or a finish is to be applied by others, the Builder must notify the Membrane Applicator, giving two working days notice before protection removal or commencement of finished works, to inspect the Membrane and certify it as being undamaged. The Builder is to accept the cost of any repairs found necessary as a consequence of any such works

Product Selections – details to be as per Tremco requirements

Subgrade (under basement slabs and up the back of the basement walls) – Paraseal LG Dual membrane Bentonite system,

Landscaped slab / Planter Box – Tremproof 3000/Anti Root modified torch on membrane system,

Wet Areas – Vulkem NEM single component polyurethane system,

Podiums/Balconies – Vulkem NEM single component polyurethane system

10 10 Roof Insulation

Provide Air-Cell "Glareshield" as a roof insulation system to all buildings. Install as per manufacturers recommendations

10 11 Roof sheeting and Downpipes/gutters

To all building roofs and external garbage rooms, install Lysaght Spandek Hi-ten 0 42mm BMD sheeting with colorbond finish. Installation to be as per manufacturers recommendations

Fascia to be Fielders Colorbond steel fascia system

Downpipes to be Fielders Colorbond 100 diameter system in Ironstone colour

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Rainwater head to be Fielders Steel eaves gutter type R30 with colorbond finish

Gutter to be Fielders halfline gutter in Ironstone colour Install Hills Eliminator UV stabilised polypropylene mesh leaf guard

10 12 Skylights

Allow to supply and install Sky Solutions SD800 sky light High Impact clear 6mm acrylic c/ control-a-vent Locations as per Architect plans

SECTION 11: WALL LINING & FINISHES

11 1 Extent of Work

The scope and extent of works comprise the following

- i) External Weatherboard Cladding
- ii) Plasterboard wall linings including steel stud framing
- iii) Steel studwork and plasterboard or villaboard lining to acoustic wall
- iv) Ceramic wall tiling to bathrooms
- v) Blockout timber supports for grabrails
- vi) Ceramic splashback to kitchen and laundries
- vii) External render
- viii) Fascias, Parapets and other external linings
- ix) Fire rated wall linings and Risers

Standards

All work is to comply with relevant Australian Standards

11 2 Plasterboard Wall Linings

To face of masonry walls install 13mm recessed edge plasterboard to AS 2558 and AS 2589 Plasterboard is to be fixed with stud adhesive or cornice cement dabs at centres recommended by plasterboard manufacturer Joints are to be taped and set flush with jointing compounds

To external areas, stop ends, internal joints, install metal casing beads and bed with jointing cement and finish coats Fix sheets either vertically or horizontally so as to avoid end joints Cut and fit neatly around service outlets so that cover plates cover all raw edges

Ensure all services cupboards are lined with 10mm Plasterboard throughout

All plasterboard, Villaboard and Fibre cement sheeting to have vertical and horizontal expansion joints as shown on Architects drawings and in accordance with the manufacturers standards

Allow for express joints to all 9mm Fibre Cement linings to fascias and parapets

11 3 Studwork Lining to Acoustic Walls

To location shown on Architect's drawings requiring acoustic rating, construct one leaf of cavity wall in 64 mm steel stud framing at 450mm centres from floor to underside of slab above with head and sill plates Studs to be 10mm clear of masonry wall Install 30mm in cavity, secured to studs Tontine insulation

Line studwork on one side with 13mm recessed edge plasterboard, screw fixed to steel studs Set flush joints and recessed screw heads to plasterboard manufacturer's recommendations

Plasterboard to be cut tight to soffit of slab and joint at top and bottom filled with

plaster, prior to skirting and cornice being fixed

Where studwork occurs in bathrooms, line with 6mm recessed edge villaboard sheeting to AS 2908 2, flush joint to manufacturer's recommendation under tiled finish

Preserve the sound reduction properties of walls by sealing sound transmission paths during installation, including but not necessarily limited to junctions between walls and other building surfaces, and cut-outs for services. Avoid cut-outs adjacent to or back-to-back with each other

11 4 Wall Tiling

Bathrooms

As shown on Architect's and interior designers drawings, install wall tiling in bathrooms and ensuites

Tiles are specified in Finishes Schedule and to have sound surface quality. Reject any tiles that are chipped, defective glazed or irregular in colour or any dimension intolerance. In positions where edge of tile is exposed, provide purpose made boarder tiles with exposed edges, glazed on exposed corners. Mitre if purpose edge not available

Fix tiles to wall waterproof membrane and villaboard wall lining with compatible proprietary tile adhesive to AS 2358 and to manufacturer's recommendation

Maintain regular and even tile joints, set out tiling as shown on drawings or seek set-out details before commencing tiling

Once adhesive has set, grout tiles with cement based white grout, to fully fill joints with neat flush joint, clean off surplus grout and wash down with clean water

Cut tiles around service penetrations or up to other finishes with neat diamond tipped masonry saw

Provide white anti fungal flexible silicone caulked joint around sanitary fittings and internal corner joints

Kitchen & Laundries

To kitchens, install specified tile from bench top to underside of overhead cupboards, breakfast bar and open walls as detailed

In laundries, tile recess around sink and washing machine and as shown on Architect drawings

11 5 Selection of Finishes

The principle has selected three finishes schemes. Refer to Finishes schedule attached for all nominated items

11 6 **External Render**

External render to areas shown on drawings to be in accordance with AS CA27 Render/Finish to be Rockcote Finecote using Rockcote Coarse Patch and primer systems

Before rendering, make good any defects in the substrate, hack off excessive projections, fill voids with render mix not stronger than the substrate

If substrate is not sufficiently true to comply with thickness limits of one coat, carry out work in two coats, having final coat regular thickness. To chases and junctions of different substrate material, cover with expanded stainless steel metal lath extending 75mm beyond each side

For work to concrete, provide proprietary bonding agent or dash coat of cement slurry

Render is to be 1 1 6 cement, lime and sand in single coat work 12-15mm thickness. Finish surfaces with tolerance of 6mm in 3m, finish corner angles edges with the same tolerance

Return render into reveals & sills and recesses

Joints in each days work are to be at change in direction of rendered surface or at horizontal recesses. Joints between work on different days in body of render will not be tolerated

Provide even wood float finish to render suitable to receive paint finish

Allow for rendering one external wall panel in exposed sunlight for approval prior to commencing other areas. Principal to formally sign off this sample prior to proceeding

11 7 **Block Timber supports for Grabrails**

In each ensuite and bathroom as well as in locations shown on Architects typical details, provide solid timber section within stud wall to cater for future installation of Grab rails in shower recess and adjacent toilet pan. Section to be installed in both the bathroom and the ensuites to all apartments

If the panel is **not shown** on the architects internal elevations, allow for 2 of 1 1m x 1 1m solid ply panel to be fixed within the stud wall of each bathroom and ensuite as directed by the architect

11 8 **Fire Rated Walls and Risers**

All fire rated party walls to the ILU's to be constructed using fire rated plasterboard on 64mm steel stud framing. Where a wet area forms a party wall, use water resistant board of the same thickness. Refer to Architects wall details for detailing of other miscellaneous fire rated walls

Risers throughout the ILU buildings to be constructed in accordance with Architects details. Generally plasterboard linings to risers to be 3 x layers of 16mm fireshield plasterboard fixed with laminated screws. Where a riser abutts an external wall, place Alcor flashing between the end of the plasterboard and the external wall. Refer to Architects drawings for further detailing.

11 9 Wall Framing

Wall Studs

General Provide studs in single lengths without splicing. Place a stud under, or within 40mm, from each structural load point from roof or ceiling (except for under openings). Provide boxed studs at points or concentrated loads.

Max stud spacing is 600mm

Heads to openings

Use lintels consisting of either a stiffened top plate or a truss built up from frame members, depending on load and span.

Splicing

Splice plates at ends to maintain continuity and alignment.

Additional support

General Provide additional support in the form of noggings, trimmers and studs for support fixing of lining, cladding, hardware, accessories, fixtures and fittings.

Max spacing of noggings is 1350mm centres.

All walls to have Insulco Polycoustic R2.0 installed within as shown on Architects details.

11 10 External Weatherboard Cladding

To the extent shown on the architect documents, install James Hardie Linea 150x16mm external wall cladding as per manufacturers requirements.

Window Architraves to be Linea 84x16mm trim (double thickness). External Jointing to be Linea Slimline boxed corner which is etch-primed and painted whilst internal corners to be Linea Internal corner mould which is etch-primed and painted.

External walls to have Insulco polyester batt (R2.5) installed within.

SECTION 12: CEILINGS

12 1 Extent of Work

The works comprise the following

- i) “Granopatch” setting to concrete soffits on all common balcony soffits and all balconies
- ii) Suspended plasterboard with set joints to,
 - Internal areas in all ILU buildings, including common corridors
- iii) Acoustic rated ceilings to bathrooms, ensuites and laundries
- iv) Plasterboard bulkheads in apartments as shown
- v) Plaster cornice to all the above ceilings as shown on arch Drawings
- vi) Fire rated ceilings to plant areas
- vii) Access panels
- viii) Suspended Soffits

12 2 Standards

All work is to comply with relevant Australian Standards

12 3 Granopatch Setting

Generally to comply with AS 2592 Place “Granopatch” setting system (3mm thickness) to soffits of all balconies and any other concrete finish to take a paint finish as nominated on the Architectural drawings

Before applying, hand set finish, remove all lips and projections from concrete slab, if soffit of slab is out of alignment, make good in order to produce a smooth even finish

Allow to set all stair soffits throughout to take paint finish

12 4 Suspended Plasterboard

Provide 13mm gypsum plasterboard installed and finished with set flush joints, in accordance with the Manufacturer's specifications Screw fix at max 300mm centre to proprietary steel suspension system

Finish all joints and recess screw fixing flush to form jointless finish

Suspension system to be proprietary system, similar to Rondo, comprising furring channels, crossrails and hangers Suspension rods to be spring bow to allow adjustments to true level finish

12 5 Acoustic Rated Ceiling

To bathrooms, ensuites laundries and any other areas noted in all buildings, provide acoustic ceiling comprising 1 layers of moisture resistant plasterboard and tontine insulation on proprietary suspension system in accordance with Architects details

Screw fix each layer with staggered joints, finish all joints and screw heads with flush joints Provide 50mm layer of Tontine insulation on top of plasterboard

Where electric cables and other services penetrate the ceiling, fill around the cables and opening solid with gypsum plaster

If any mechanical or hydraulic service runs outside a nominated acoustic rated ceiling space, ensure the service is wrapped in acoustic insulation similar to tontine

12 6 Plasterboard Bulkheads

To locations shown on drawings, provide bulkheads to underside of plasterboard ceiling

Provide 64mm steel stud framing fixed to concrete soffit to form shapes and lines required, line with 13mm plasterboard

Arises and junctions to top of cupboard are to be finished with metal casing beads to provide neat true lines with plaster flush finish

12 7 Cornices

To all wet areas, living, study, bedrooms and kitchens, finish junction of ceiling and wall with plaster cornice as nominated in finishes schedule and shown on Architects drawings

Cornices are to be secured with cornice cement on both edges, use full lengths of cornice between walls to avoid end joints, neatly mitre and finish flush all junctions Neatly patch and sand any chips or indentations from the cornice prior to panting

12 8 Access Panels (Acoustic Rated)

Install proprietary acoustic rated access panels to sizes noted on drawings with steel frame to provide flush finish in set plasterboard ceilings

Over and above the locations shown on the drawings or inferred in this specification, allow to supply and install an additional 40 of 400x400 access panels in a location to be nominated by the architect

Access panel shall be frameless hinged metal type with budget lock finished flush with ceiling

Allow for all necessary ceiling treatment to maintain the ceiling acoustic rating required

12 9 Fire Rated Ceilings

Builder is to allow to conceal any services penetrating all plant, service rooms and fire stairs with a sealed fire rated bulkhead or ceiling if necessary

12 10 Suspended Soffits

All external suspended soffits to be lined with 9mm villoboard sheeting unless shown differently on Architect details. Suspension system to be fixed to either steel elements within soffit cavity or concrete slab (whichever ever is applicable). Seal and neatly finish all joints to take paint finish. Allow for any metal trims and flashings to meet adjoining elements.

SECTION 13: FLOOR FINISHES

13 1 Extent of Works

The work comprises the following

- i) Ceramic tiling to kitchens, bathrooms and laundries
- ii) Ceramic tiling to apartment entries
- iii) Ceramic tiling to balconies and drying courts
- iv) Waterproofing to wet areas
- v) Carpet to living, dining, study and bedrooms
- vi) Carpet to corridors
- vii) Carpet to miscellaneous meeting rooms
- viii) Mat at entry doors
- ix) Entry lobby floors
- x) Garbage room

13 2 Selection of Finishes

The Principal has selected three (3) colour schemes for internal finishes as shown on the attached finishes schedules. The Principal reserves the right to nominate which colour scheme is provided in which apartment.

13 3 General

Provide all floor finishes as scheduled or required by the drawings. All materials shall comply with the applicable Australian Standard. All finishes shall be applied in accordance with the current applicable Australian Standards.

All finishes shall meet all necessary and current regulations regarding health and safety.

Prior to receiving practical completion the builder must issue to the Project Manager test results confirming the slip-coefficient ratings noted have been achieved for each specified floor finish.

13 4 Tiling

Tiles to wet areas shall be laid on a cement and sand bed to falls to the floor waste in shower recess and common area. All floor tiling grout shall be a high quality pre-mixed type to ensure a consistent grout finish/colour is obtained.

Tiling to apartment entries is to be with a proprietary thin bed adhesive directly to concrete floor. All tiling is to be grouted with grey cement grout.

At doorways and junctions with other finishes, provide a clear anodised aluminium angle to allow all finishes to sit flush with one another. Tiles are to be laid in standard stack bond from set-out points nominated on drawings.

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Tiles shall be laid in a standard stack bond pattern to the entire area receiving a tiled finish

To all bathrooms and ensuites install a 50x50mm stainless steel angle in the set down junction at the doorway Allow to ardit floor under carpet immediately outside these areas in order to maintain a level threshold with no difference in height

It is vital that the falls within the wet areas to common buildings as well as the units are achieved as documented on Architects drawings The Project Manager will not accept any floor which has the ability for water to pond or where the water does not flow directly to a floor waste or where the water flows outside the wet area and into an adjoining room In the instances where this does occur, the project manager may instruct the builder to remove defective tiles and relay to achieve required falls

13 5 Tiled Area Waterproofing

To internal areas provide a Tremco Vulkem NEM membrane to structural floor of room dressed down into floor waste Turn membrane 100mm up wall with reinforced joint between walls and floor angle Extend membrane to full extent of tiling and entire shower recess

Apply strictly in accordance with manufacturer's specification and leave compartment completely watertight

All areas with applied waterproof membranes are to have individual quality sign off sheets as completed by the subcontractor and the builder to show that each areas is watertight and installed to manufacturers standards and recommendations

13 6 Carpet

Uniformity

Ensure that carpet laid in a single area and of a single type, quality, colour and design comes from one manufacturing batch and dye lot

Laying Carpet

Builder is to allow to repaint all skirting boards upon final installation of the carpet

Lay the carpet in continuous lengths without cross joints in the body of the area Where unavoidable cross joins occur at doorways, locate the joins directly below the closed doors Lay carpet on standard domestic rubber underlay Provide all smooth edges to walls and open ends against tile floor Where abuts kitchen floor, install aluminium angles to secure the edge of the carpet

Do not place small sections of carpet If carpet is damaged, builder to allow to replace entire room

Where carpet abutts another material or opening, ensure a smooth, level junction is formed to avoid any trip hazards

Carpet – Common Corridors/entry area

Carpet to common corridors to be carpet tiles as specified. Glue fix all tiles onto a clean and level surface. Please Ardit to sub surface prior to laying if surface is not true and level.

13 7 Garbage Room

Provide a cement and sand covered skirting 100mm high and seal floor and skirting with PR-grade clear Rockite sealer.

13 8 Entry Door Mat

Provide "Pedimat II" carpet inlay aluminium fully recessed entry mats from Construction Specialties Australia Pty Ltd. Finish to be clear anodised aluminium with #9303 Sandbar carpet inlay.

Provide setdown in slab and aluminium angle surround for mat, so adjoining finishes are flush with entry mat. Allow for drainage at base of each entry mat and connection nearest stormwater line.

Locations of mats to be,

- 1 Entry into ILU lobbies from any external areas,
- 2 Entry into any lobby from all carpark areas

13 9 Car Park Floors

For internal areas with a steel trowelled finish. Apply PR-grade Rockite sealer to the whole area in accordance with the manufacturer's written instructions.

13 10 Slip Co-efficient Ratings

Each floor finish chosen for this project has a slip co-efficient rating which meets standards required by the principal. These are as follows,

All External Surfaces
Internal Tiling/Paving
Internal Timber flooring
Internal Lino/Vinyl flooring

The builder must ensure that each material specified reaches or exceeds the co-efficient rating associated with each tile.

13 11 Drying Courts

Allow to install floor tiles to each drying court floor area. Tile to be same as balcony tile specified for the ILU balconies. Allow to fall tiles to floor waste shown on hydraulic drawings.

13 12 Acoustic treatment to External Tiled areas

To any external tiled area located over a habitable room, supply and lay an acoustic mat equal to “Embleton Impactamat”

13 13 Acoustic Treatment to Internal floor Tiled or Timber floor areas

To any internal floor tiled areas located over a habitable (as defined by the room) Lay tiles on 4mm “Asaphonic Adhesive” or equal

SECTION 14: GLAZING

14 1 Extent of Works

The work comprises the following -

- i) Glazing to all window, sliding, hinged or folding glazed doors
- ii) Mirrors to bathrooms
- iii) Shower screens
- iv) Window coverings

14 2 Design

To AS 1288, where no glass type or thickness is given

Ambient Climatic Conditions

Window Loading To AS 1170 2 with terrain Category 3 Wind speed 41m/sec

14 3 Acoustic Requirements

Builder must ensure all glazing requirements meet the acoustic standards set out within the Australian Standards, BCA and local government regulations
Glazing details shown within the contract must be amended accordingly if required for certification purposes

14 4 Glass

Glass and Glazing Materials

Glass and glazing materials generally must be free from defects, which detract from appearance or interfere with performance under normal conditions of use

Glass tolerances size, squareness and flatness to AS/NZS 2208

Float Glass Standard to ASTM C 1036

All glass is to be clear sheet glass unless shown/detailed otherwise

Provide stick on safety markings to all sheets fixed in sliding, hinged doors and fixed areas as well as the fixed sheets adjacent to each opening

14 5 Glazing Materials

Jointing Materials

Provide recommended jointing and pointing materials which are compatible with each other and with contact surfaces and non staining to finished surfaces Do not provide bituminous materials on absorbent surfaces

Glazing Tapes

Standards To AAMA 804 3, 806 3, 807 3 as applicable

14 6 Glass Schedule

Subject to the provisions of acoustic requirements, being predominant glass, thickness must be increased if required to comply with AS 1288 as minimum standard

14 7 Mirrors

To sizes and locations shown in ensuite and bathrooms, provide mirror of silver layer deposited on the glass with protective coating Electrolytic copper coating and 2 coats of mirror backing and edge sealing paint

14 8 Fixing Mirrors

Frameless Fixing

Supply and fix frameless glass with ARRISS edging to bathroom and amenity areas as shown on Architects drawings

14 9 Shower Screens

To each ensuite and bathroom, provide a screen system with clear toughened glass shower door System to be the Grange series manufactured by Stegbar Screens

Fix showers after completing floor and wall tiling Shower screens to be installed to manufacturer's recommendations and provided with standard fittings in finish nominated by Architect Allow for all necessary trims and bracings to ensure a stiff and neat finish

Generally refer to Architects details and finishes/fixtures schedule for further information

14 10 Window Coverings

Blockout Blinds

Supply and install manual chain operated roller blockout blinds to all windows in the apartment and meetings Include all necessary fixings and accessories (including chain fasteners)

Blinds to be side winder rollers Roller tube to be 80mm Chains to be stainless steel bead (stopping in any position) Blinds to have a spring booster Base bars to be white in colour and fabric to be blockout

Where a window is covered by more than one blind, blinds to align with the window mullions Ensure blinds travel past and does not strike skirting

Fixing

Fix blockout blinds with the appropriate fixing brackets to manufacturers standards Blinds are to be fixed square and plumb and any creep in the fabric is to be rectified

Blind System Luxaflex Commercial Flexi glide w/extra flocke blackout fabric
Colour TBA

14 11 **Glass Louvres**

To all drying court façades, install louvred glass assembly Lidco 610 system, 102mm with powder coated frame as shown on architects details

SECTION 15: PAINTING

15 1 Extent of Works

The work consists of the preparation of sub-strate and application of paint systems to internal and external surfaces of building elements

Paint finish is required on the following

- i) Plasterboard wall and ceiling linings
- ii) Timber doors & steel frames
- iii) Skirtings, architraves, window sills
- iv) Concrete soffit of balcony slabs
- v) External render,
- vi) External Concrete,
- vii) External facade cladding,
- viii) Sealed concrete floors in car park
- ix) Concrete columns and lift walls basement car parking
- x) Line marking and directional arrows in car park
- xi) Metal work and all external timber

NB Factory applied finishes of powder coating to windows, balustrades, etc are covered in Metalwork of this Specification

15 2 Standards

Workmanship and materials are to comply with relevant Australian Standards

15 3 Materials

Use only premium quality lines from approved manufacturers

Notify the proposed brand of paint and paint line prior to placing orders. Change neither the brand nor the paint line without approval. Do not combine paints from different manufacturers in a paint system. Deliver paints to the site in the manufacturer's labelled and unopened containers. Use only the type and quantity recommended by the paint manufacturer. Colour tinting shall be by the manufacturer unless otherwise approved.

Add tinters or stainers only if approved, and only of in accordance with the manufacturer's recommendations as to type, quality and tinting formula, and provided the tinting produces the required colour without detriment to the durability or aesthetic performance of the product.

15 4 **Primers, Sealers, Undercoats**

Ensure that primers, sealers and undercoats are suitable for the substrate and compatible with the finish coat and each other. Except for stains and other clear or translucent finishes each coating shall be of a noticeably different tint from the preceding coat.

15 5 **Workmanship**

Unless otherwise specified, before commencing to paint, complete the work of all other trades as far as is practicable within the area to be painted.

Do not paint in dusty conditions, or otherwise unsuitable weather.

Do not paint when the relative humidity exceeds 85% or when the surface temperature of the substrate is less than 10°C or more than 50°C, unless the paint is suitable and recommended for such conditions.

Before painting in any section of the Works, clean the area out and protect it against dust entry. Use drop sheets and masking wherever necessary to protect finished work or other surfaces liable to damage during painting. Repair or replace any accessories or surfaces that are damaged directly or indirectly as a result of painting.

Remove door furniture, switch plates, light fittings and the like and replace on completion of painting.

During preparation of surfaces, painting and inspection, maintain light levels such that the luminance (photometric brightness) of the surface is at least equal to that produced under daylight and/or maximum permanent artificial illumination conditions.

Adequately ventilate the areas in which painting is being carried out. Mix and apply paint in accordance with the manufacturer's recommendations. Do not mix paint in areas or on surfaces liable to damage.

Clean off marks, paint spots and stains throughout, restoring damaged surfaces to their original condition. Where necessary for aesthetic reasons, touch up damaged paint work or misses only with the paint batch used in the original application.

15 6 **Application**

Apply paint and related materials in accordance with the manufacturer's recommendations. Cut in between different finishing coats neatly in straight lines unless otherwise specified. Allow each coat to harden for the drying time (or time between coats) recommended by the manufacturer. Apply primer or sealing coats as required by manufacturers instruction for the use of paint on different surfaces.

Ensure each coat of paint is uniform in colour, gloss, thickness and texture and free of runs, sags, blisters, or other discontinuities. The standard of workmanship with regard to final colour, gloss and texture shall match the sample area.

Internal coatings on flat ceiling and wall surfaces may be applied by roller, otherwise apply all coating by brush unless otherwise specified, or unless approval is first obtained for alternative methods, sand down and dust clean before re-coating.

15 7 **Substrate Preparation**

Prepare substrates to receive the systems specified. Procedures shall include, but not necessarily be limited to, the following:

Cleaning

Clean down and remove oil, grease and loose foreign matter, including laitance, efflorescence, moss, mould, mildew, dirt and corrosion, in a manner which causes neither undue damage to the substrate nor damage to, or contamination of, the surroundings.

Glossy Surfaces

Adequately scuff and/or solvent or chemically etch as appropriate to provide satisfactory adhesion for subsequent paint coats.

Filling

Fill cracks and holes with fillers, sealants or grouting cements as appropriate for the finishing system and substrate, and sand smooth.

Drying

Unless otherwise specified, ensure that surfaces are cured and dry before painting commences.
Recontamination

Apply the first coat of paint immediately after cleaning and before contamination of the substrate can occur. Where contamination of intermediate coats occurs, clean in accordance with the coating manufacturer's recommendations.

15 8 **Paint Finishes**

Full Gloss Enamel

Shall be approved first quality, high gloss, opaque alkyd enamel. It shall be non-toxic, lead free, having high resistance to abrasives, fair resistance to chemicals and solvents.

Interior Satin Acrylic Paint

Shall be approved washable satin, opaque, water-borne, acrylic paint. It shall be non-toxic, lead free, having good resistance to abrasives and chemicals.

Interior Flat Acrylic Paint

Shall be approved washable flat, opaque, water-bourne acrylic paint It shall be non-toxic, lead free and have good resistance to abrasives and chemicals

15 9

Paint Systems

<u>Location</u>	<u>Coats</u>	<u>Paint Type</u>
Interior Plasterboard	1	Taubmans Acrylic Sealer/Undercoat
	2	Taubmans Wash and Wear Low Sheen Acrylic
All Ceilings	1	Taubmans Acrylic Sealer/Undercoat
	2	Taubmans Wash and Wear Flat Acrylic
Wet Area Walls	1	Taubmans Oil based Undercoat
	2	Taubmans Wash and Wear low sheen Acrylic
Steel Door Frames	1	Taubmans All Metal Primer
	2	Taubmans Semi-Gloss Super Enamel
Exterior Fibre Cement	2	Taubmans Exterior Acrylic Low Sheen
Interior Timber Trim and doors if not Pre-finished	1	Taubmans Oil based Primer
	2	Taubmans Semi-Gloss Super Enamel
Exterior Timber ie Entrance structure Fence, etc	2	Taubmans Timber Colour
Exterior Galv Steel Louvre Frames, etc	1	Taubmans Galv Iron Primer
	2	Taubmans Exterior Acrylic Low Sheen
Exterior Render/Façade		Taubmans Moroka as per D191&192 data sheet

Ensure that all cupboards and robes are painted on both sides of the doors frame

Also ensure that all services cupboards are lined with 10mm plasterboard and painted throughout

For further details refer to the fixtures and finishes schedules attached to this contract

Warriewood Brook Retirement Village – Stage 3

External render or concrete

- Water Permeability – No water evident (ASTM E514-74)
- Water vapour transmission > 35g/24hrs/sqm
- Elongation > 240%
- Film thickness > 350 microns / 2-3 coats
- Dulux Acrashield with Elastometric 201 Paint meets this criteria

15 10 **Linemarking**

The paint shall be coloured white

Apply the paint to surface by spraying to provide a wet film thickness of between 0.35 and 0.40 mm. The lines shall be crisp and even without side splatter.

Car space markings shall be 75mm wide and of lengths shown on the Architects drawings.

15 11 **Carpark**

Allow to paint all columns, soffits and lift walls to colour as chosen by architect.
Paint to be Dulux Acrylic low sheen.



Warriewood Brook Stage3

External Finishes and Colour Schedule

Revision B 11 November 2010

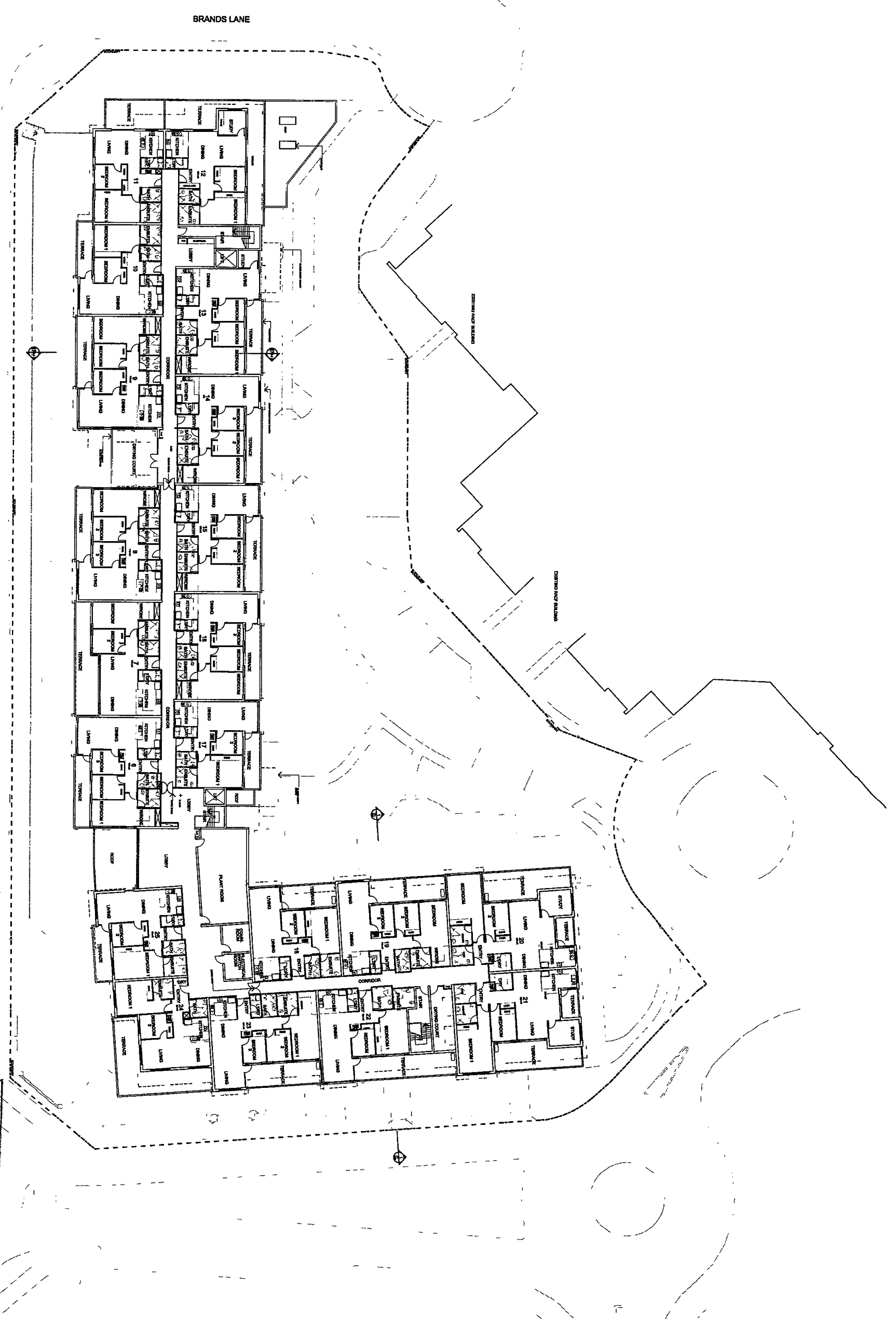
Element	Base/Finish	Colour/comments
Roof	Colorbond Steel	Colorbond Colour Ironstone
Gutter	Colorbond Steel	Colorbond Colour Ironstone
Downpipes	Colorbond Steel	Colorbond Colour Ironstone
Fascia Boards	Colorbond Steel	Colorbond Colour Ironstone
Soffits	Fibre cement/paint	Dulux Paints Colour Ecrú – P15 D1 Finish Exterior Semi gloss
Louvre	Aluminium	Dulux Powdercoat Colour To match adjacent wall colour Finish Gloss
Walls Rendered	Brickwork/Rendered/Paint	Textured acrylic paint system refer to Architectural Specification Colour Dulux Pear Ash P12 81 & Bull Ring P06 87 Finish Exterior Semi gloss
Walls Brickwork	Brickwork Face	Bowral Bricks Colour Simmental Silver Mortar As per specification
Walls Weatherboard	Weatherboard/Paint	Dulux Paints Colour Ecrú P15 D1 Finish Exterior Semi gloss
Window trim	Weatherboard/Paint	Dulux Colour To match PC Pear White – 81880 Finish Gloss
Lintels	Galvanised steel	Dulux Paint Colour To match adjacent wall colour Finish Gloss
Window frames/Sashes	Aluminium/paint	Dulux Powdercoat Colour Pear White – 81880 Finish Gloss
Door frame & side lights	Aluminium/paint	Dulux Powdercoat Colour Pear White – 81880 Finish Gloss
Door leaf	Aluminium/paint	Dulux Powdercoat



		Colour Pear White – 81880 Finish Gloss To be advised
Sectional Overhead Garage Door	Colorbond Steel	
Handrail and Balusters	Steel/paint	Dulux Powdercoat Colour Pear White – 81880 Finish Gloss
Privacy Screen	Aluminium/Paint	Supaslat Colour to be advised Finish Powdercoat
Skylight frame	Steel/Paint	Dulux Powdercoat Colour to match colorbond roof colour Finish Exterior Semi Gloss
Balcony Tiling		Refers to PC Schedule
Terrace Tiling		Refers to Landscape documents
External paving		Refers to Landscape documents

Revision B – Revisions indicated in bold
11 November 2010



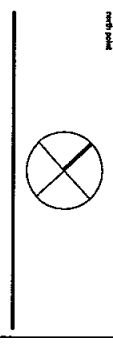


MACPHERSON STREET

BRANDS LANE

05/307/07
 Construction
 Accredited

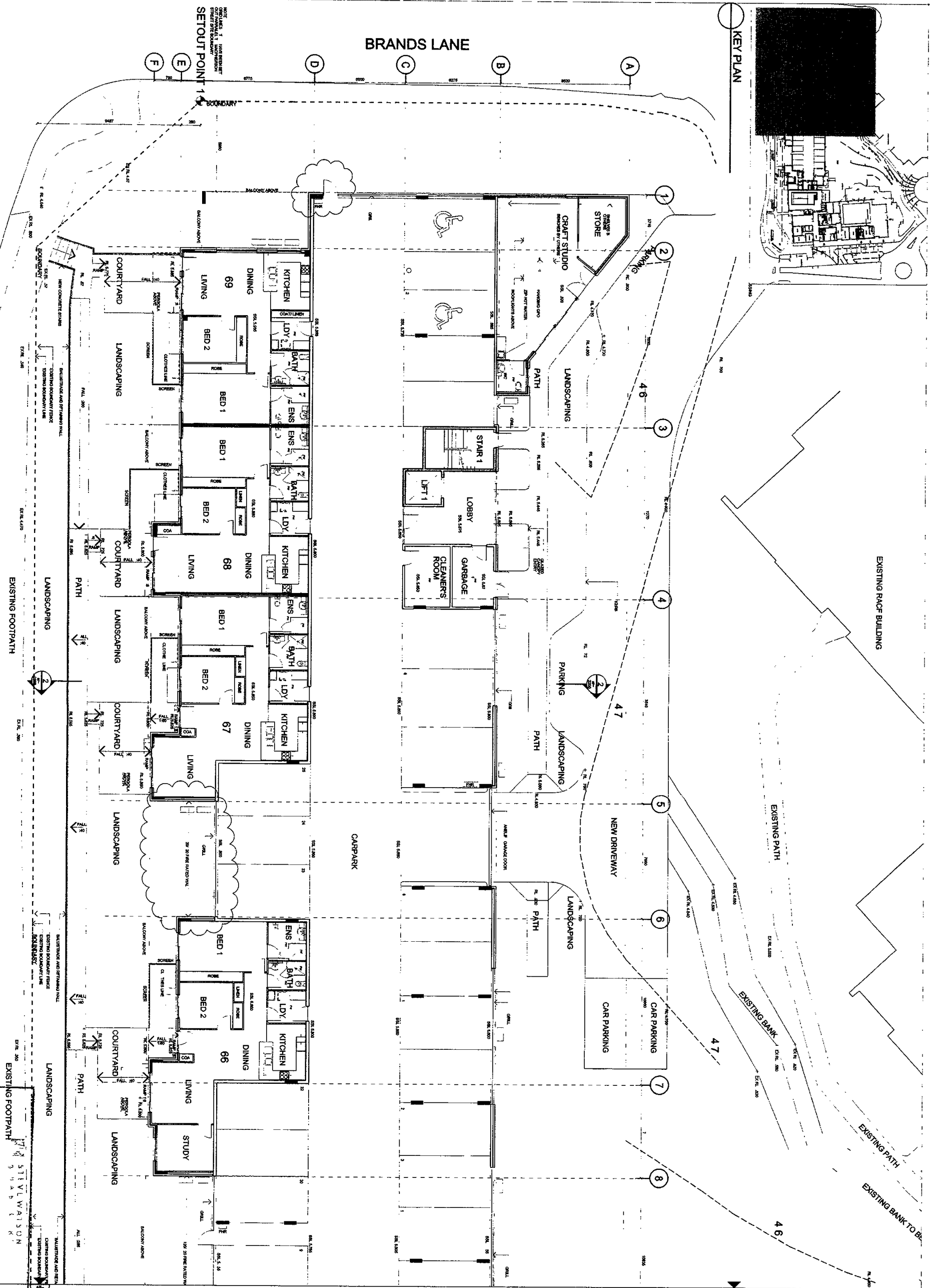
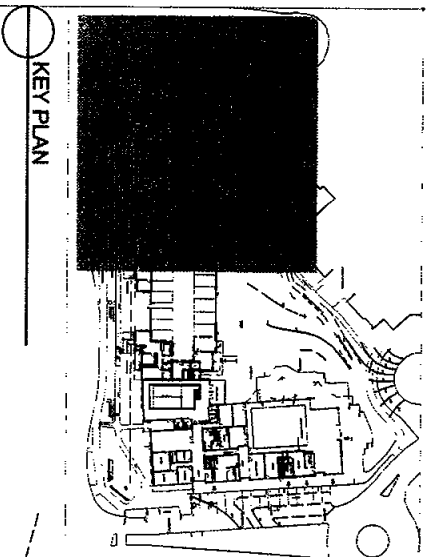
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ANGELCAN RETIREMENT VILLAGES
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 16/18-15 hnp street, ch 1.w. d n.w. 2067
 p. box 8038 w. 1. colwood n.w. 1515
 t. (02) 8888 8001 f. (07) 8888 8128
 m. mail@angelcanretirement.com

ANGELCAN RETIREMENT VILLAGES
 WARRIEWOOD BROOK RETIREMENT VILLAGES
 Stage 3
 6-14 Macpherson St
 Warriewood NSW 2102

OVERALL FIRST FLOOR PLAN
CC ISSUE
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 a1 - 1201 a01



MACPHERSON STREET

BRANDS LANE

SETOUT POINT 1
 NOTE: SETOUT POINT 1 HAS BEEN SET BY THE LOCAL GOVERNMENT
 STREET SETBACKS

05/307/07
 COSTA ARCHITECTURE
 11/11/2017
 ABC01

GENERAL NOTES:

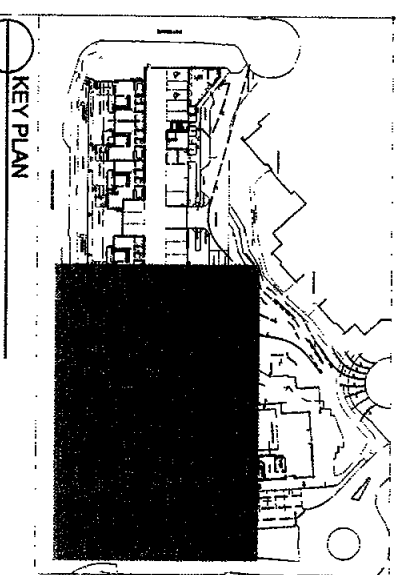
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2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS FROM THE LOCAL GOVERNMENT.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING ALL EXISTING SERVICES AND STRUCTURES.
4. ALL MATERIALS AND WORKMANSHIP SHALL BE SUBJECT TO INSPECTION AND APPROVAL BY THE LOCAL GOVERNMENT.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION AND REPAIR OF ALL ADJACENT PROPERTIES.
6. ALL WORK SHALL BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DISPOSAL OF ALL WASTE MATERIALS.
8. ALL WORK SHALL BE COMPLETED TO THE SATISFACTION OF THE ARCHITECT AND LOCAL GOVERNMENT.

harsen yuncken
 ARCHITECTURE
 1/10/18 11/11/2017
 1/10/18 11/11/2017
 1/10/18 11/11/2017
 1/10/18 11/11/2017

ANGELICAN RETIREMENT VILLAGES
 Warneford Brook Retirement Village Stage 3
 6-14 Macpherson St
 Warneford NSW 2102

GROUND FLOOR PLAN
 SHEET 1

CC ISSUE
 BY 1100 AM
 4/20/20
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 Accredited by City of Sydney #AABC1
05/307107

ANGELCAN RETIREMENT VILLAGES
 Warrawood Brook Retirement Village
 Stage 3
 6/14 Macpherson St
 Warrawood NSW 2102

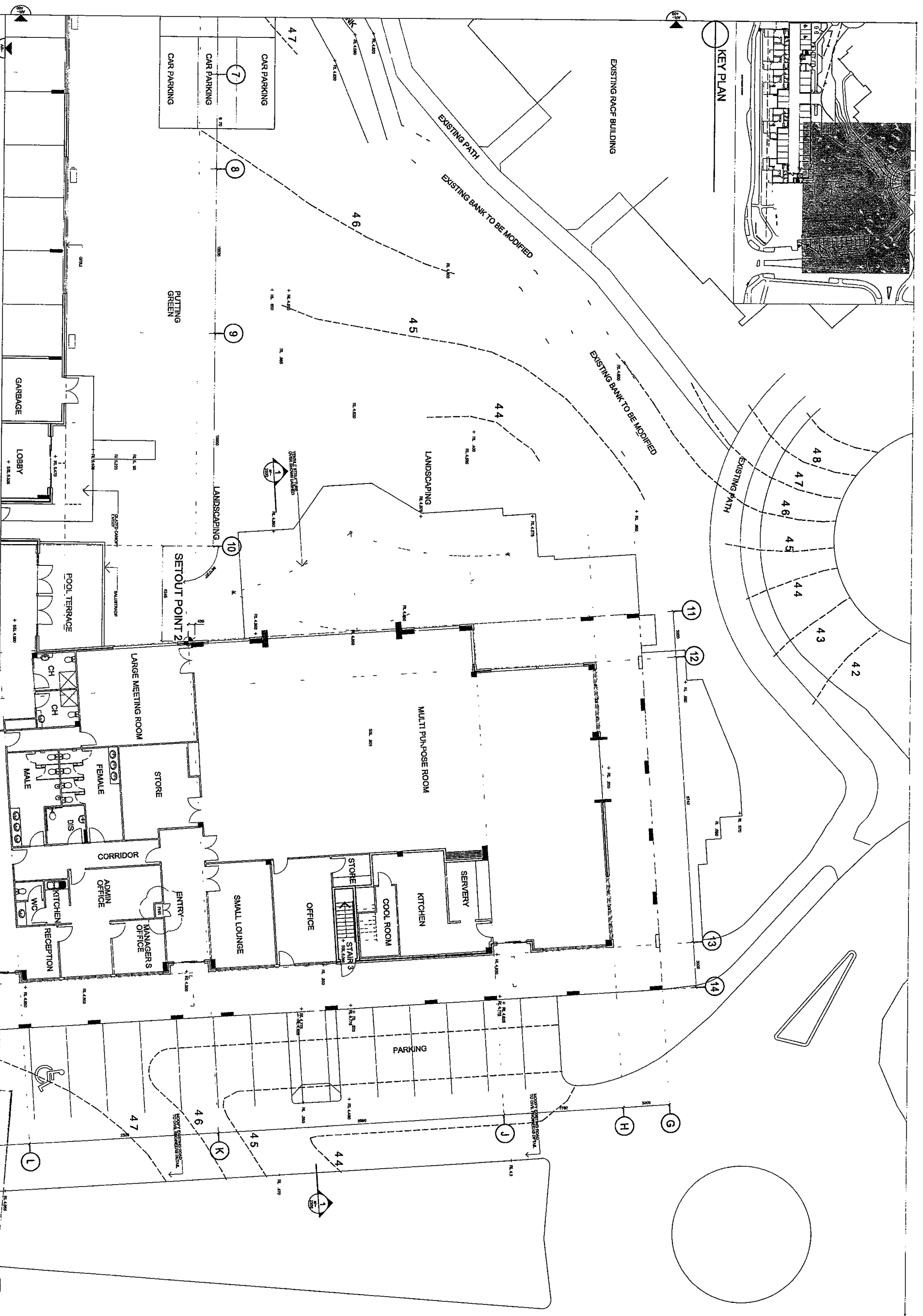
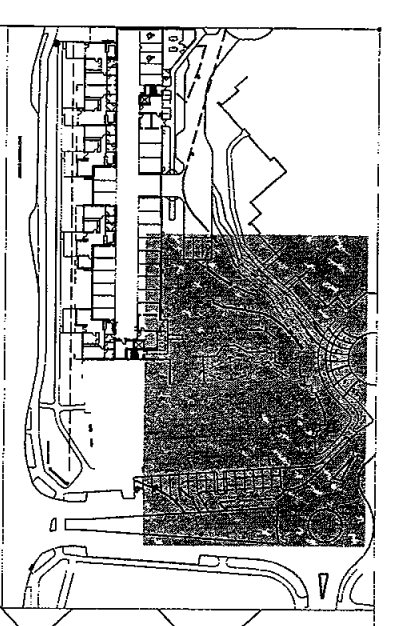
ARCHITECTURE
 Hansen Yuncken
 1/18, 16/180, 1/1 Centre St W 2057
 (02) 8861 1111 (02) 8861 6128
 hansen@hansenyuncken.com.au

GROUND FLOOR PLAN SHEET 2

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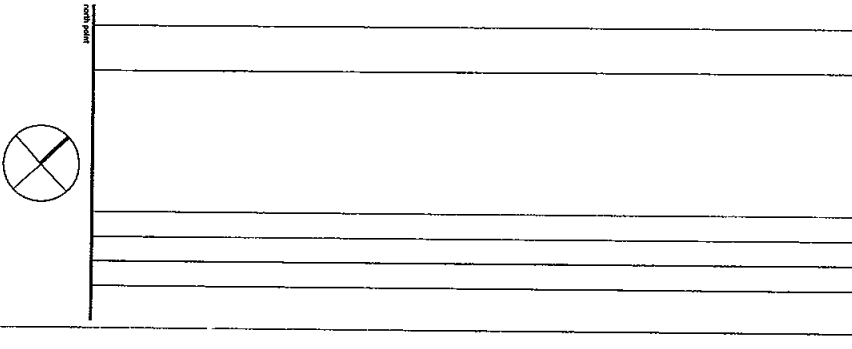
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Cons. Lic. Certificate #ABC1
Accredited site

CONTRACTOR'S STATEMENT OF WORKS

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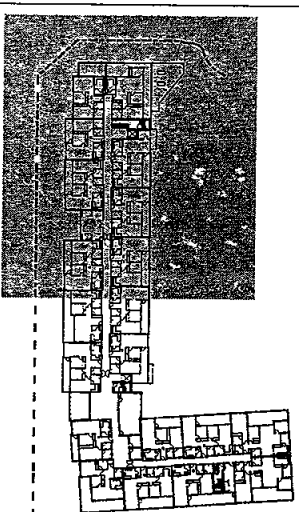
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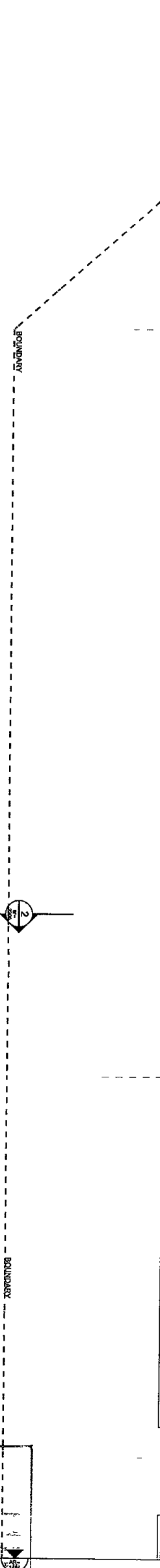
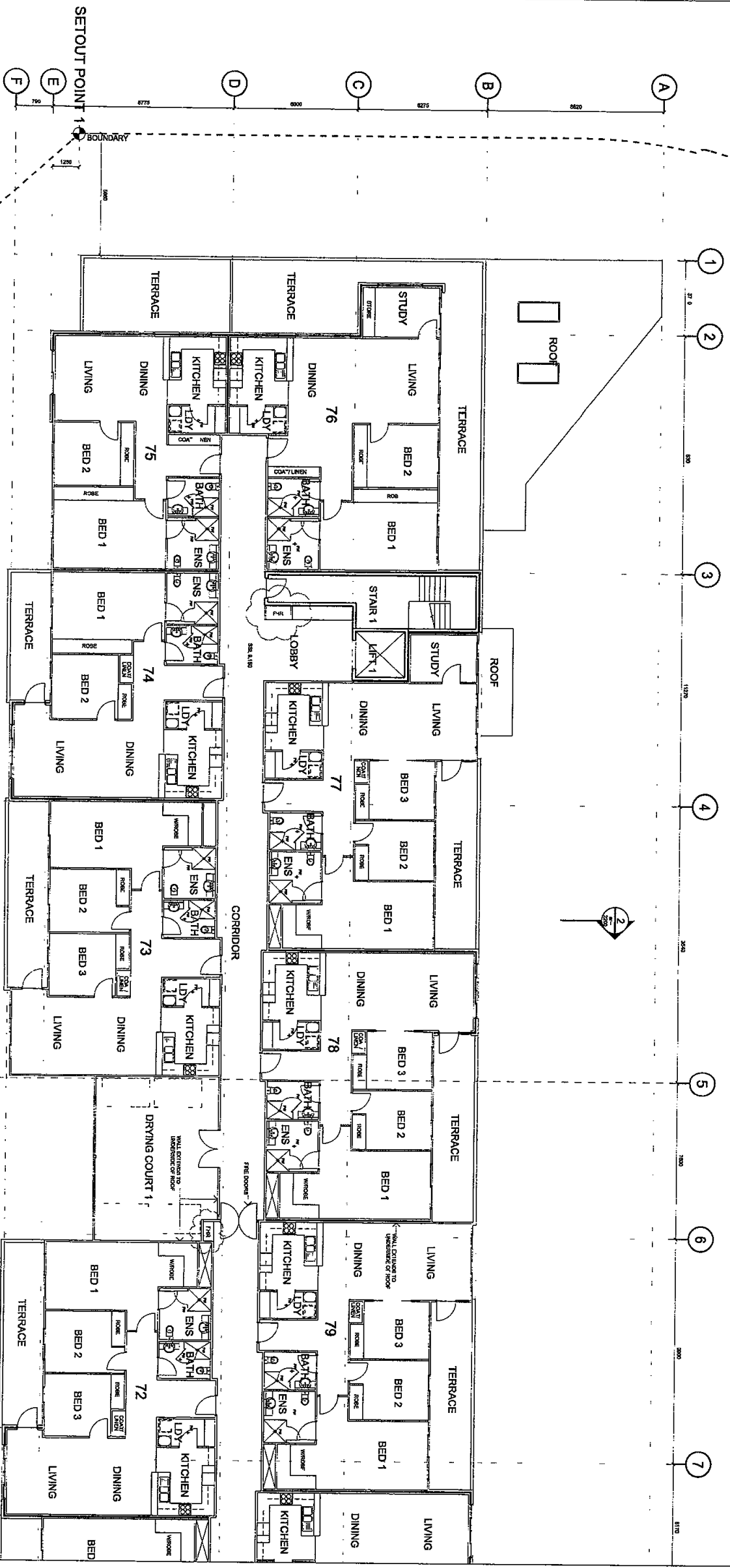


ANGELICAN RETIREMENT VILLAGES
DUNES CENTRE
Waterwood Brook Retirement Village
Stage 3
6/14 Macpherson St
Waterwood NSW 2102

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KEY PLAN



05/307/07
 Construction Co Pty Ltd
 Accredited by V.C.C.

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ANGICAN RETIREMENT VILLAGES
 Warneford Brook Retirement Village
 Stage 3
 6/14 Macpherson St
 Warneford NSW 2102

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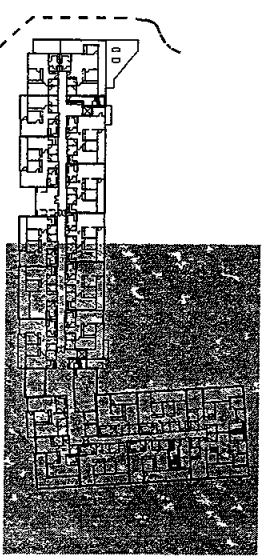
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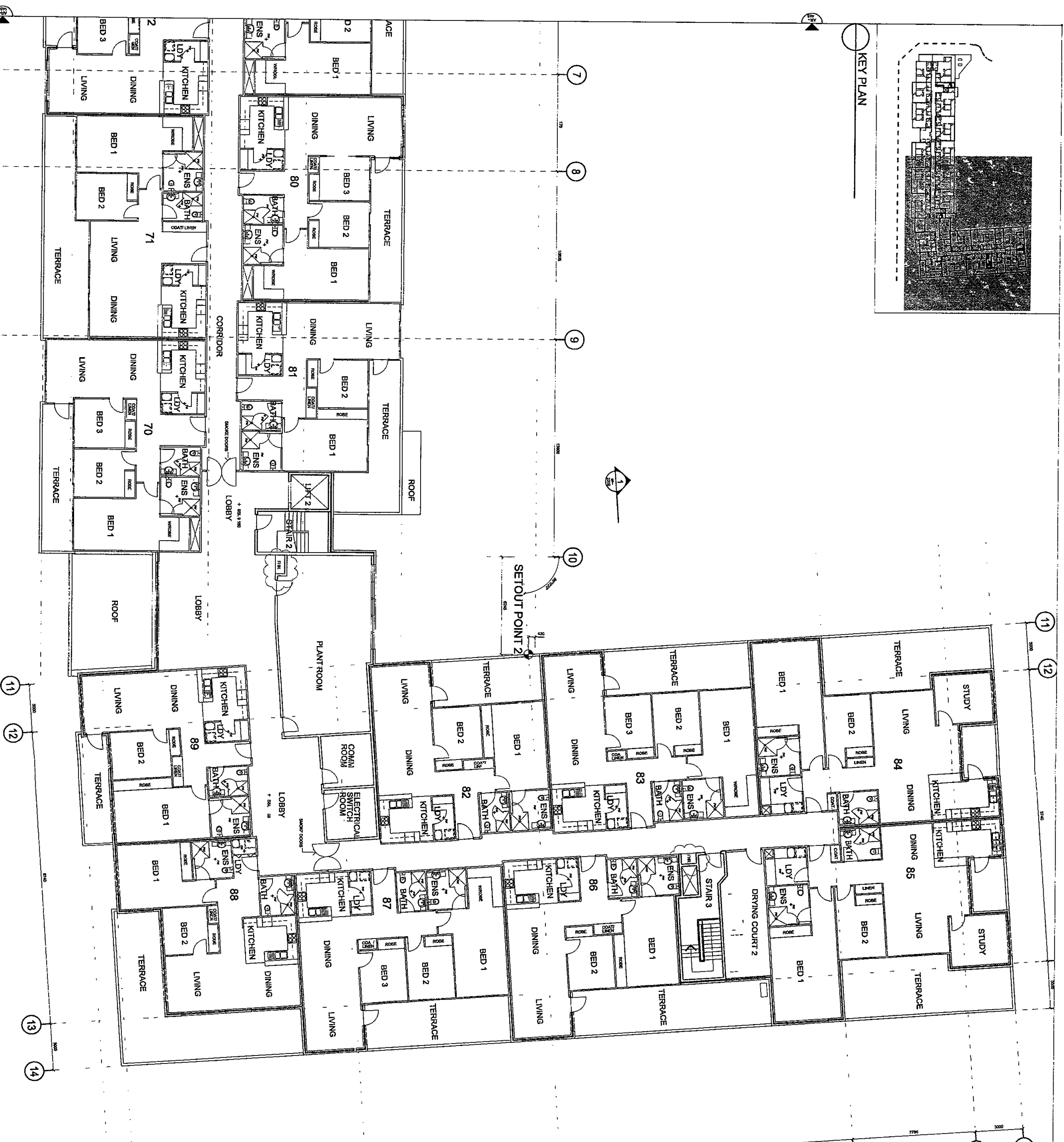
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 Stage 3
 6/14 Macpherson St
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 Warneford NSW 2102



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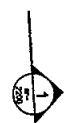
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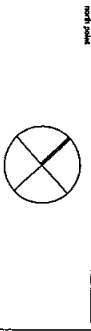
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05/307/07
 Construction Certificate
 Accredited E.P.A.

NO.	DESCRIPTION	DATE	BY	CHKD BY	APP'D BY



hansen yurcklen
 ARCHITECTURE

1/8 ISL B Street, Ch. 1 W of A W 2087
 P.O. Box 5558, W. 1 h. low d. W 1515
 T (02) 8888 8001 F (02) 8888 8128
 M (02) 8888 8128



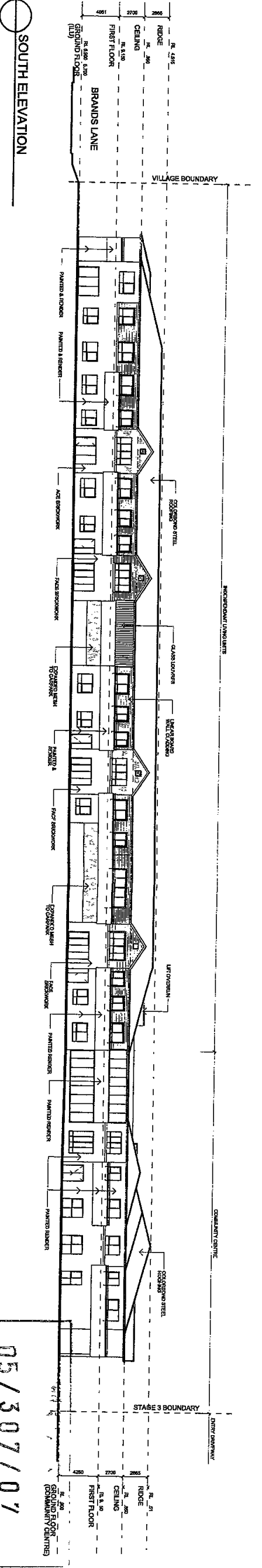
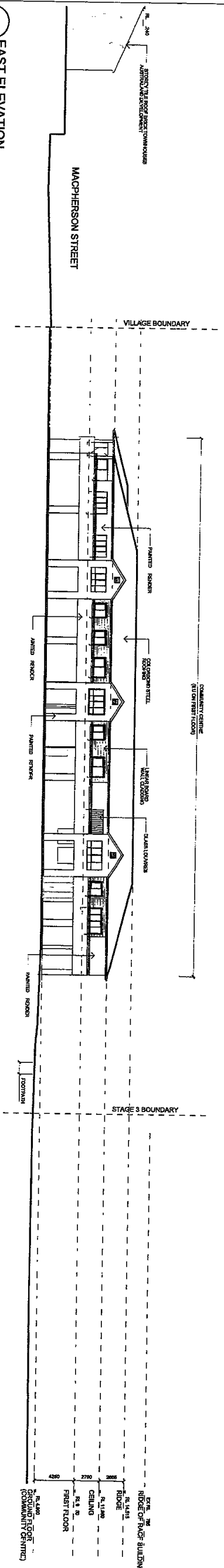
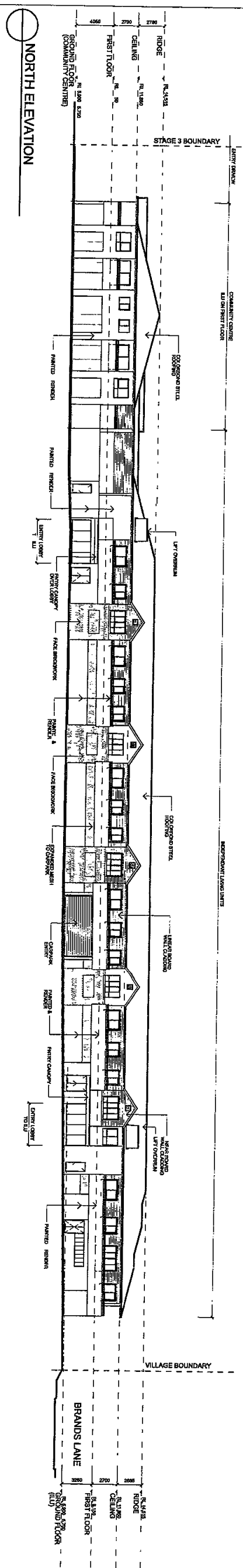
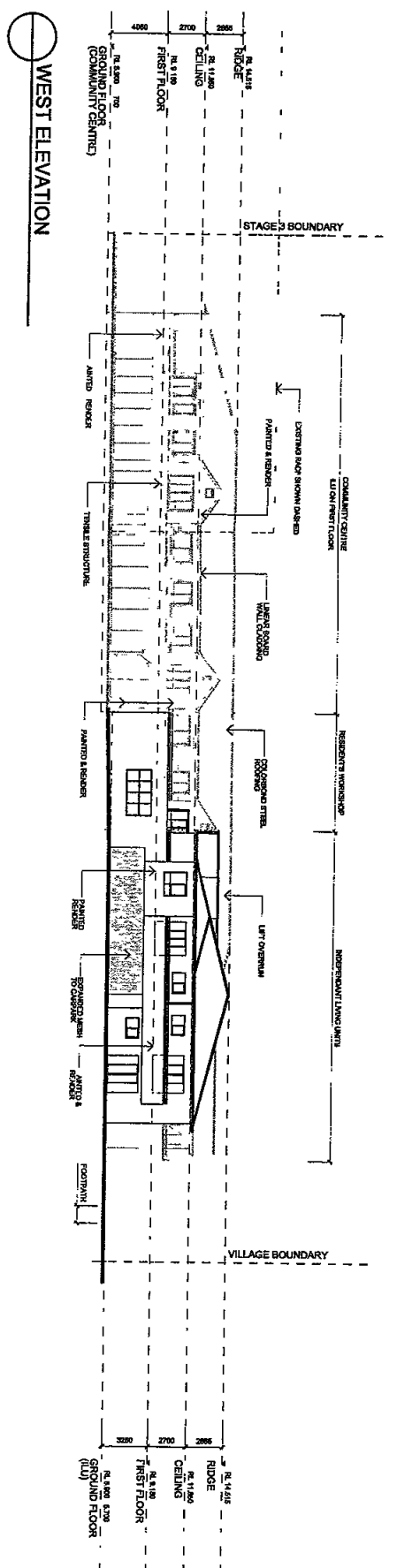
Anglican Retirement Villages
 Marrowood Brook Retirement Village
 Stage 3

9/14 Macpherson St
 Marrowood NSW 2102

FIRST FLOOR PLAN
 SHEET 2

05/307/07

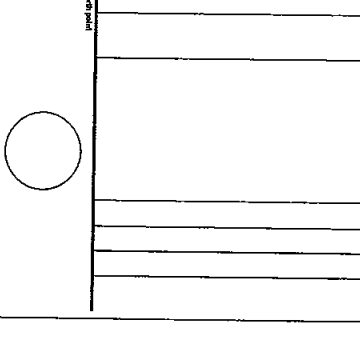
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CONTRACTOR'S RESPONSIBILITY STATEMENT

The contractor has read and understood the full requirements of the contract and has accepted the same. The contractor is responsible for the construction of the works in accordance with the contract documents and for the safety of the works. The contractor is also responsible for the welfare of the workers and the environment.

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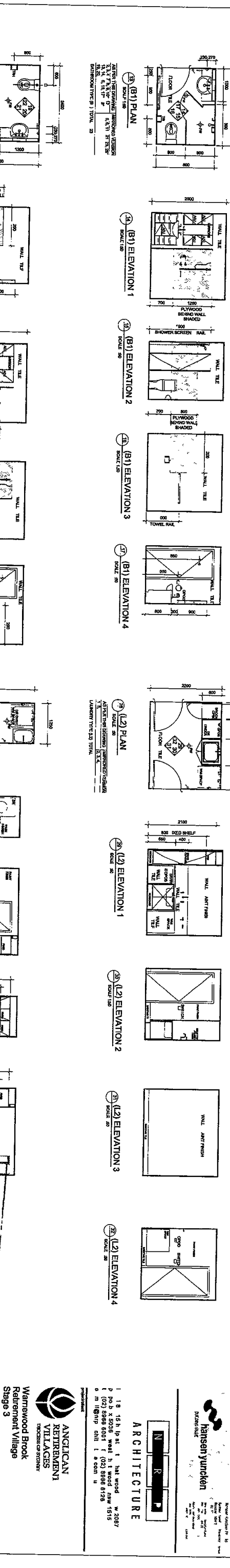
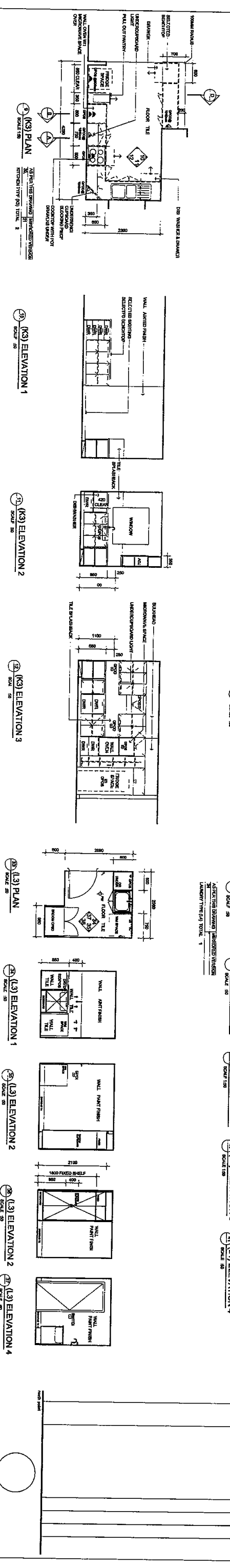
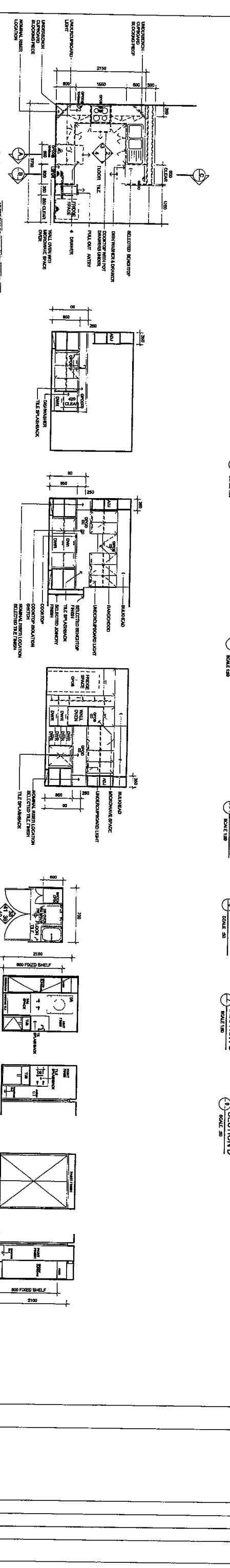
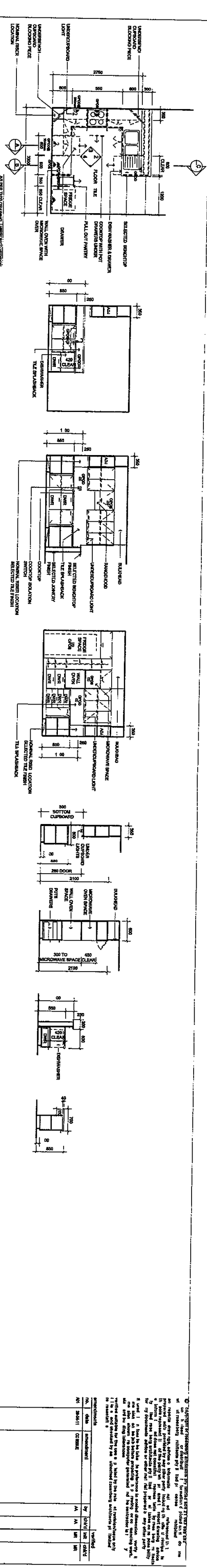


hansen yunker
 ARCHITECTURE
 18-15h St
 P.O. BOX 408
 WARRIMOO NSW 2578

ANGELICAN RETIREMENT VILLAGES
 WARRIMOO BROOK RETIREMENT VILLAGE
 Stage 3
 6-14 Macpherson St
 WARRIMOO NSW 2102

Issue
 Project No: 4203-00
 Drawing No: 01
 Date: 1/2/00
 Scale: AA

05/307/07
 Consultant Accredited

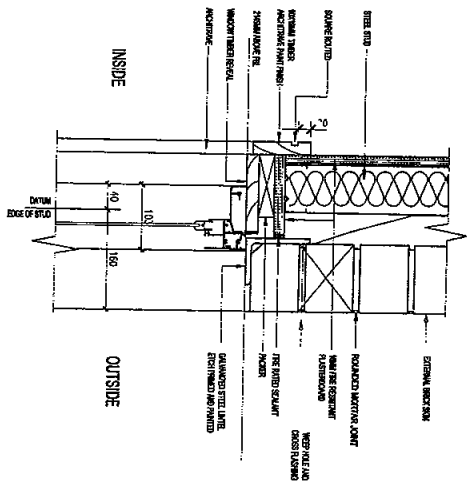


NOTE
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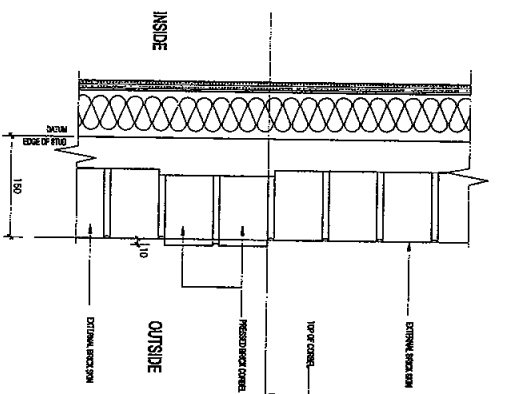
CONSULTANTS
ANGELICAN RETIREMENT VILLAGES
Warwood Brook Retirement Village
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ARCHITECTURE
Hansen Jurkden
18-15 Bp St, Hallwood NSW 2087
P 02 8508 5088, Fax 02 8508 6128
E h.j@hjp.com.au, j.hansen@hjp.com.au

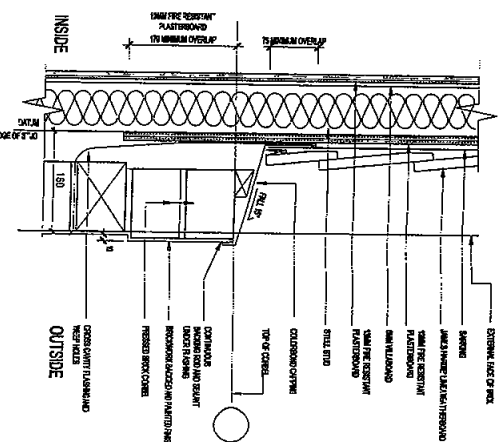
CCISURE
B1 150 AA 4203-00
3201 201



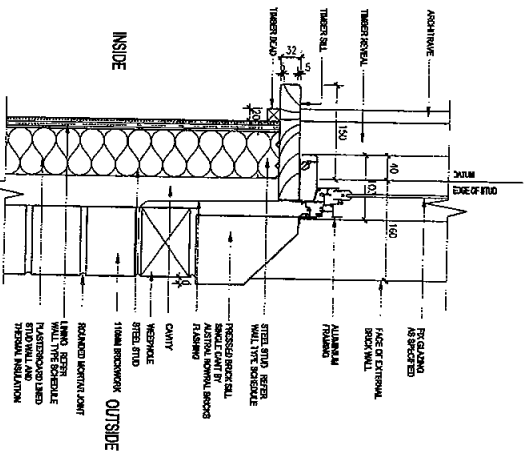
1 WINDOW HEAD DETAIL (BRICK VENEER)
1/5 SLIDING WINDOW



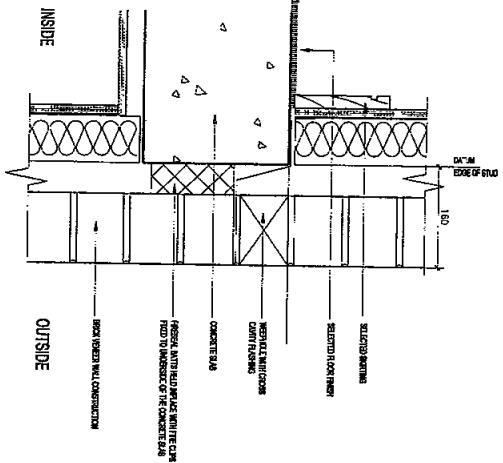
4 CORREL DETAIL (BRICK VENEER)
1/5



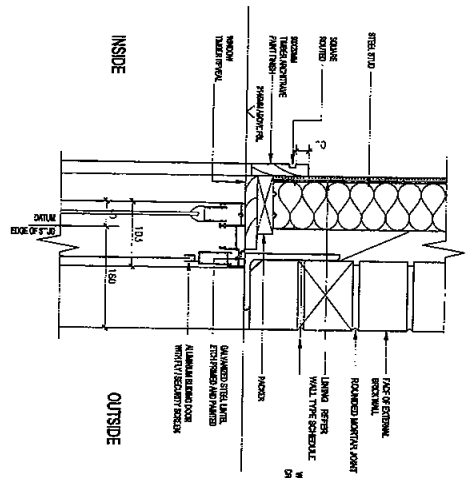
7 CORREL DETAIL
1/5 BRICK VENEER WALL/FLOOR LINING



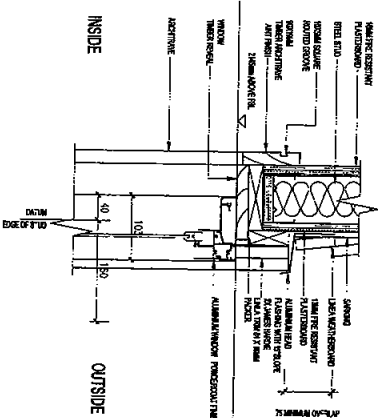
2 SILL DETAIL (BRICK VENEER)
1/5 SLIDING WINDOW WITH FIXED BOTTOM PANE



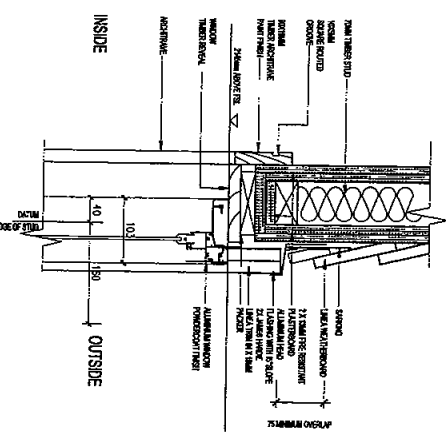
5 FINE SEPARATION DETAIL (BRICK VENEER)
1/5 FLOOR TO FLOOR



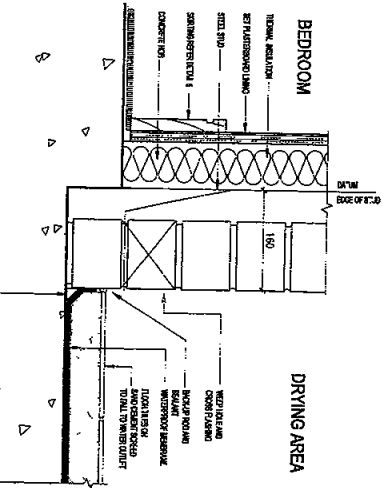
8 DOOR HEAD DETAIL (BRICK VENEER)
1/5 SLIDING DOORS



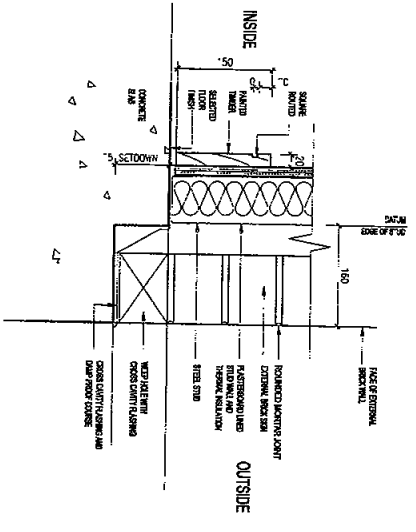
10 HEADLAMBS DETAIL (DRY STEEL STUD WALL)
1/5 SLIDING WINDOW



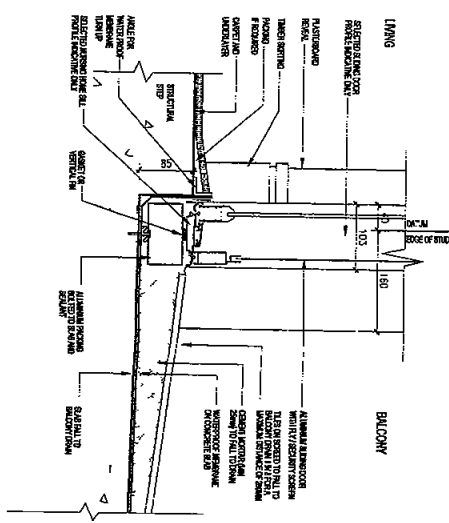
12 HEADLAMBS DETAIL (DRY TIMBER STUD WALL)
1/5 SLIDING WINDOW



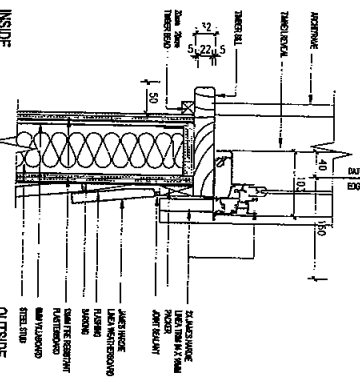
3 EXTERNAL FLOORWALL JUNCTION (BRICK VENEER)
1/5



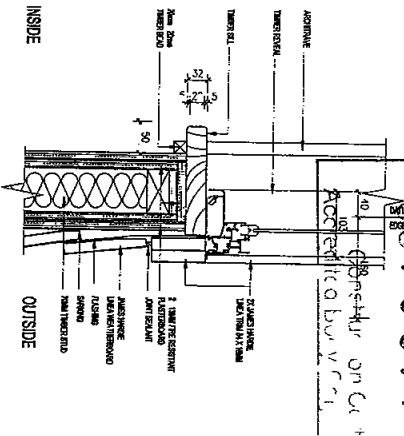
6 SKIRTINGS/LAB EDGE DETAIL (BRICK VENEER)
1/5 GROUND LEVEL



9 THRESHOLD DETAIL (BRICK VENEER)
1/5 UPPER LEVEL BALCONY SLIDING DOORS



11 SILL DETAIL (DRY STEEL STUD WALL)
1/5 SLIDING WINDOW WITH FIXED BOTTOM PANE



13 SILL DETAIL (DRY TIMBER STUD WALL)
1/5 SLIDING WINDOW WITH FIXED BOTTOM PANE

NO.	DATE	DESCRIPTION	BY	CHECKED	SCALE
1	15/07/07	ISSUED FOR PERMIT	CCISSUE	AA	AS SHOWN
2	15/07/07	REVISED PER PERMIT COMMENTS	CCISSUE	AA	AS SHOWN
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15/307/07

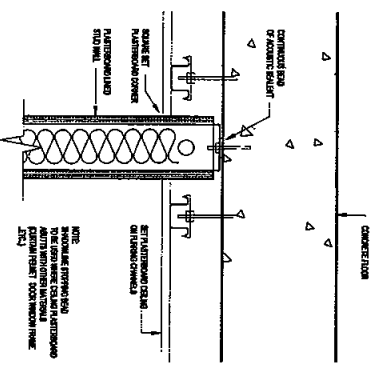
Architects on Call Pty Ltd
Architects on Call Pty Ltd
1/8-15/307/07

ANGLICAN RETIREMENT VILLAGES
Warwood Brook Retirement Village Stage 3
6-14 Macpherson St
Warwood NSW 2102

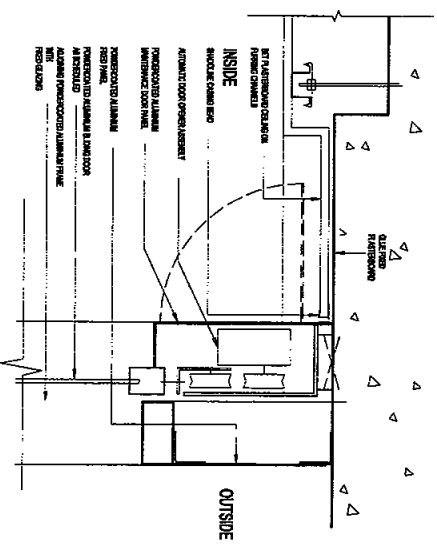
hansen yurcklen
ARCHITECTURE
1/8-15/307/07
P.O. Box 8088, Warfield NSW 1515
m.hansen@hansen-yurcklen.com.au

CCISSUE
INDICATIVE DETAILS (USED IN STAGE 1)

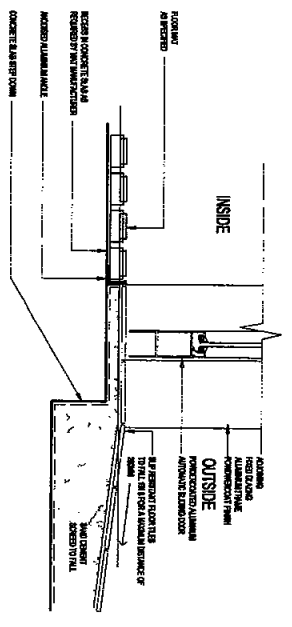
air 9001
PROJECT NO. 4203-00
DATE 15/07/07



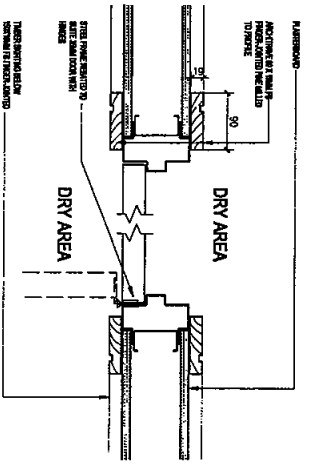
1 CEILING/WALL JUNCTION TYPICAL (STEEL STUD)
15



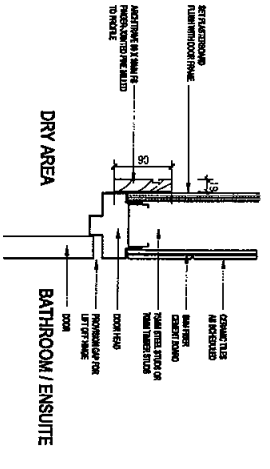
2 BUILDING ENTRY DOOR HEAD
15 GROUND FLOOR



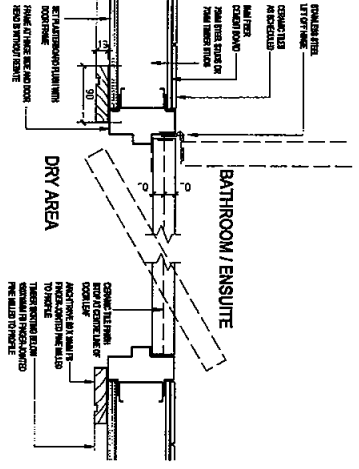
3 BUILDING ENTRY DOOR THRESHOLD
15 GROUND FLOOR



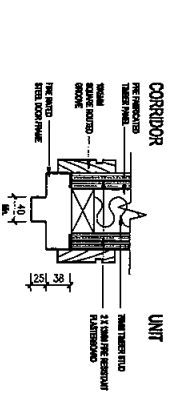
4 DRY TO DRY AREA DOOR (STUD WALL)
15 INTERNAL DOOR JAMB PANEL DETAIL



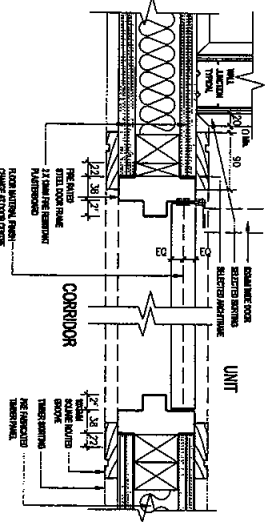
5 BATHENSUITE DOOR (STUD WALL)
15 DOOR HEAD SECTION DETAIL WITH ESCAPE HINGE



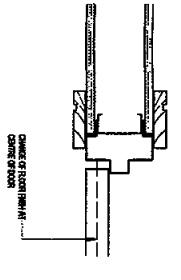
6 BATHENSUITE DOOR (STUD WALL)
15 DOOR JAMB PANEL DETAIL WITH ESCAPE HINGE



7 UNIT ENTRY DETAIL (TIMBER STUD WALL)
15 DOOR HEAD SECTION DETAIL (FIRE RATED)

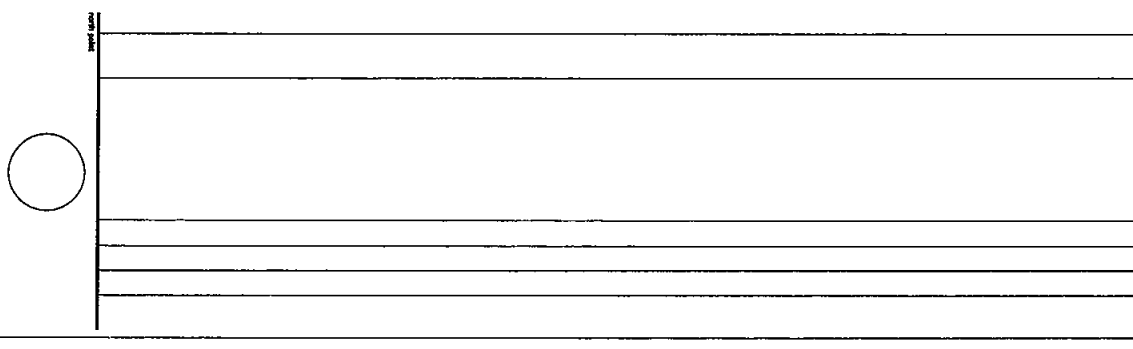


8 UNIT ENTRY DETAIL (TIMBER STUD WALL)
15 DOOR JAMB PANEL DETAIL (FIRE RATED)



9 DOOR JAMB AT CHANGE OF FLOOR FINISH (STUD WALL)
15 INTERNAL DOOR JAMB PANEL DETAIL

No.	Date	Revised/Issued	By	Checked	Scale
01	20/01/11	ISSUED	AA	AA	1:50



ANGELICAN RETIREMENT VILLAGES
DISCOVER THE LIFE

1 18-18 h p street, cn lewood nsw 2087
P O BOX 8088 W ST CHARLES NSW 1515
E mail@angelicaretirement.com.au

ARCHITECTURE

Richseny Jundken
ARCHITECTURE

1 18-18 h p street, cn lewood nsw 2087
P O BOX 8088 W ST CHARLES NSW 1515
E mail@angelicaretirement.com.au

ANGELICAN RETIREMENT VILLAGES
DISCOVER THE LIFE

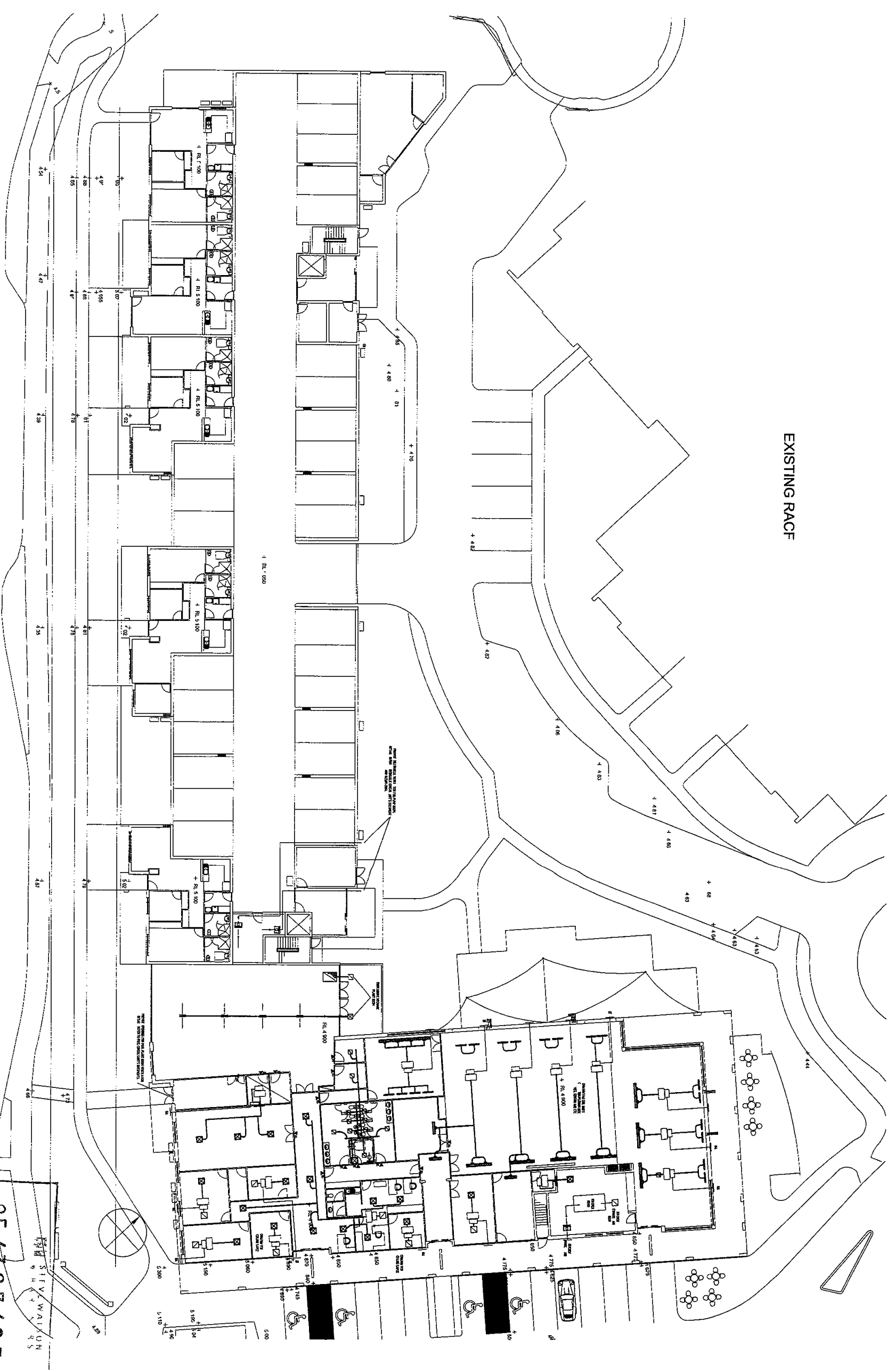
Warrimoo Brook Retirement Village Stage 3
6-14 Macpherson St
Warrimoo NSW 2102

05/307/07
INDICATIVE DETAILS
(USED IN STAGE 1)

Con'tin C't (1919)
Accredited Body (0111) 1111

ISSUE

Project No: 4209-00
Date: 15/01/11
Scale: AA
Sheet: 201



EXISTING RACF

GROUND FLOOR A/C LAYOUT - SINGLE LINE
SCALE 1/200

05-307107

COMPANY: STYVAISON
ACCREDITED BY: COUNCIL OF ARCHITECTS

PRELIMINARY ISSUE
NOT TO BE USED FOR CONSTRUCTION

NO.	REVISION	DATE	BY	CHK
1	ISSUED FOR CONSTRUCTION			
2	REVISED			
3	REVISED			
4	REVISED			
5	REVISED			
6	REVISED			
7	REVISED			
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10	REVISED			

KNOX ADVANCED ENGINEERING

ENVIRONMENTAL
ESD
PLANNING
NOISE
STRUCTURE

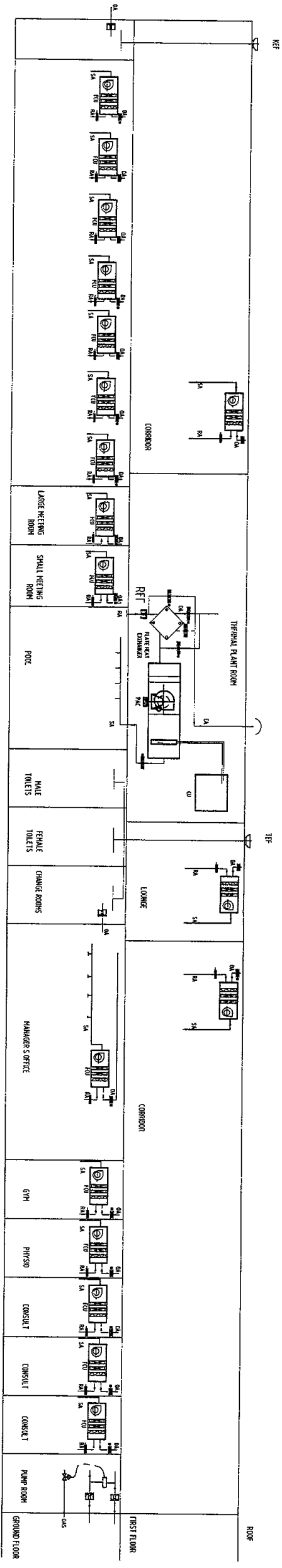
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H.B. 031 345 9779
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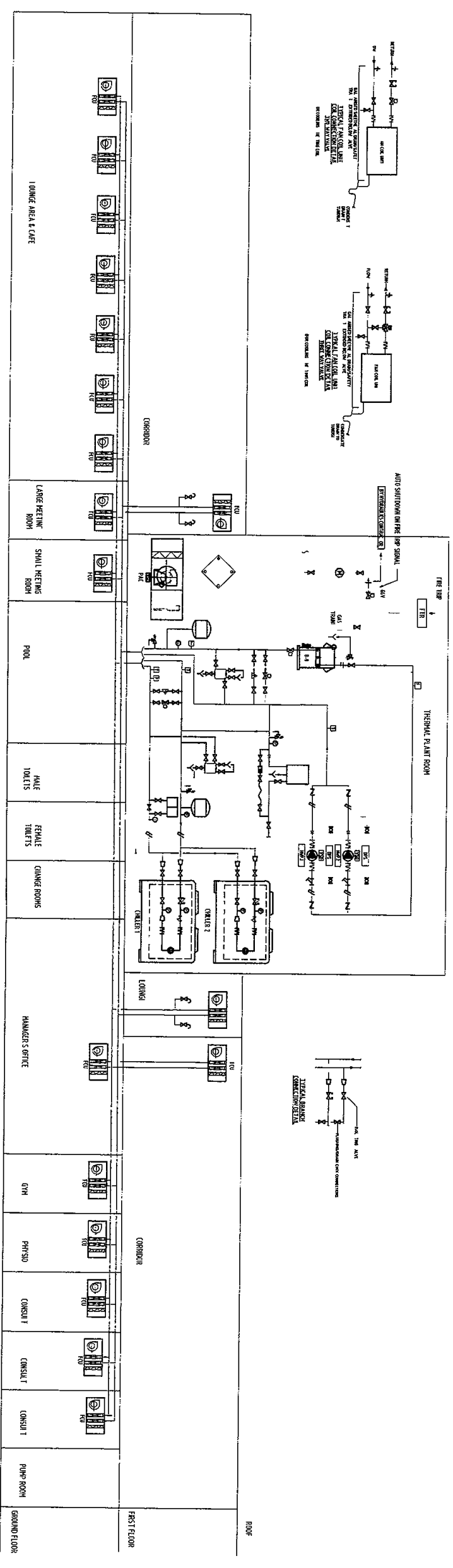
ANGLICAN RETIREMENT VILLAGES
WARREWOOD BROOK RETIREMENT VILLAGE STAGE 3

MECHANICAL SERVICES
SINGLE LINE LAYOUT 1 OF 2

10 136 M02
P1



AIR SCHEMATIC
SCALE NTS



WATER SCHEMATIC
SCALE NTS

05 / 307 / 07
 CONSULTING ENGINEERS
 Accredited by the Engineering Council
 10136 M04

ANGLO-CAN RETIREMENT VILLAGES 	
WARRENWOOD BROOK RETIREMENT VILLAGE STAGE 3	
MECHANICAL SERVICES AIR & WATER SCHEMATIC	
PROJECT NO: 10136 M04 DATE: 10/13/2014	DRAWN BY: [Name] CHECKED BY: [Name]