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Traffic Noise Intrusion Assessment

St Luke's Grammar School – New Senior Campus
800 Pittwater Rd & 224 Headland Rd, Dee Why, NSW

REPORT No
6479-5.3R

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Prepared For:
The Anglican Schools Corporation
C/- Midson Group
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Attention: Mr Toby James

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1.0 CONSULTING BRIEF

Day Design Pty Ltd has been engaged by Midson Group on behalf of The Anglican Schools Corporation to carry out a traffic noise intrusion study for the proposed new St Luke's Grammar School Senior Campus at 800 Pittwater Road and 224 Headland Road, Dee Why, NSW.

This commission involves the following:

- Inspect the proposed development site in Dee Why.
- Determine the traffic noise impact from Pittwater Road.
- Determine the acceptable noise level inside the Senior Campus.
- Carry out noise intrusion analysis using the architectural drawings.
- Design sound insulation of critical rooms within the Senior Campus to meet the requirements of the *State Environmental Planning Policy (Infrastructure) 2007* and *Department of Planning's Development near Rail Corridors and Busy Roads*.
- Design sound insulation of outdoor areas within the Senior Campus to meet the recommended external noise levels provided by the Environment Protection Authority in the *NSW Road Noise Policy*.
- Prepare a Road Traffic Noise Intrusion Report.

2.0 PROJECT DESCRIPTION

St Luke's Grammar School propose to construct a new Senior Campus (*NSC*) at 800 Pittwater Road and 224 Headland Road, Dee Why, NSW, for 600 students.

The *NSC* is proposed to be situated on land zoned *B5 – Business Development* (800 Pittwater Road) and *IN1 – General Industrial* (224 Headland Road) under Warringah Local Environmental Plan (LEP) 2011. 800 Pittwater Road currently contains a three storey commercial building with 224 Headland Road containing at two storey industrial building.

The proposal seeks approval for the following:

800 Pittwater Road:

Village Centre: Welcoming the community into the building, cafe and heart of the building, natural daylight + green spaces and administration zone.

Gathering Spaces: Auditorium for 700+ students, library hubs and social + informal learning hubs.

Science and Maths Precinct: Speciality learning areas (Physics, Chemistry, Biology), general learning areas; connection to support units and seminar rooms.

Arts Precinct: Speciality learning areas (Visual Art, Kiln), general learning areas; connection to support units and seminar rooms.

Design + Technology Precinct: Speciality learning areas (Food technology, Design and technology), general learning areas; connection to support units and seminar rooms.

Humanities Precinct: General learning areas; connection to support units and seminar rooms.

Wellness Precinct: Pool with change facilities, dance studio, gymnasium and general learning areas; connection to support units.

Media Centre: Recording studio, editing studio, green screen and media presentation room.

External Areas: External hardcourts and open space.

Car Parking 91 spaces for staff, visitors or student and bicycle parking.

224 Headland Road:

Sports Precinct: 2 new basketball courts, existing half basketball court, existing change rooms and existing school clothing store.

Car Parking: 41 spaces for staff, visitors or student and bicycle parking.

The development is required to be staged to accommodate existing lease agreements. The development will take place over three stages, as follows:

- Stage 1 – 224 Headland Road;

- Stage 2 – Units 1, 3 and 5 (Fitness First and I-Med), 800 Pittwater Road; and
- Stage 3 – Units 2 and 4 (Officeworks), 800 Pittwater Road.

The proposed *NSC* site is bounded by land zoned *RE1 – Public Recreation* (Stony Range Botanic Garden) to the north and north-east, industrial premises to the east, Headland Road and industrial premises to the south and south-west and Pittwater Road to the west.

Short-term road traffic noise measurements have been conducted at the existing site, as shown in Figure 1 as Location 'A' and Location 'B'. Long-term noise measurements have also been conducted at the existing site, shown in Figure 1 as Location 'A'. Road Traffic noise levels for both locations are presented in Section 5.0 of this Report.

The proposal is a State Significant Development (SSD) and has been issued by the NSW Department of Planning and Environment (DoPE) with the Secretary's Environmental Assessment Requirements (SEARs) – *SSD 10291*. The SEARs require an assessment against the *"Development Near Rail Corridors and Busy Roads – Interim Guidelines"* (2008).

Acceptable intrusive noise levels to the *NSC* from road traffic noise are based on the requirements of the NSW DoPE documents *"Development Near Rail Corridors and Busy Roads – Interim Guidelines"* (2008), *State Environmental Planning Policy* (SEPP) *2007 (Infrastructure)* and *SEPP (Educational Establishments and Child Care Facilities) 2017,* and the recommended external noise levels provided in the Environment Protection Authority's (EPA) *NSW Road Noise Policy* (RNP).

The acoustic assessment was based on architectural drawings by Tonkin Zulaikha Greer Architects, for project No. 18032, dated 23 August 2019, as shown in the attached Appendix B.

Noise controls are required to reduce the noise intrusion to within acceptable internal and external noise levels and are detailed in Section 6.0 of this report.

Once the noise controls in this report have been implemented, the internal noise level from external noise will be within the acceptable limits required by the NSW DoPE, and be considered acceptable. In addition, the noise level in the external play areas of the *NSC* will be within the acceptable limits recommended by the EPA's *RNP*, and be considered acceptable.

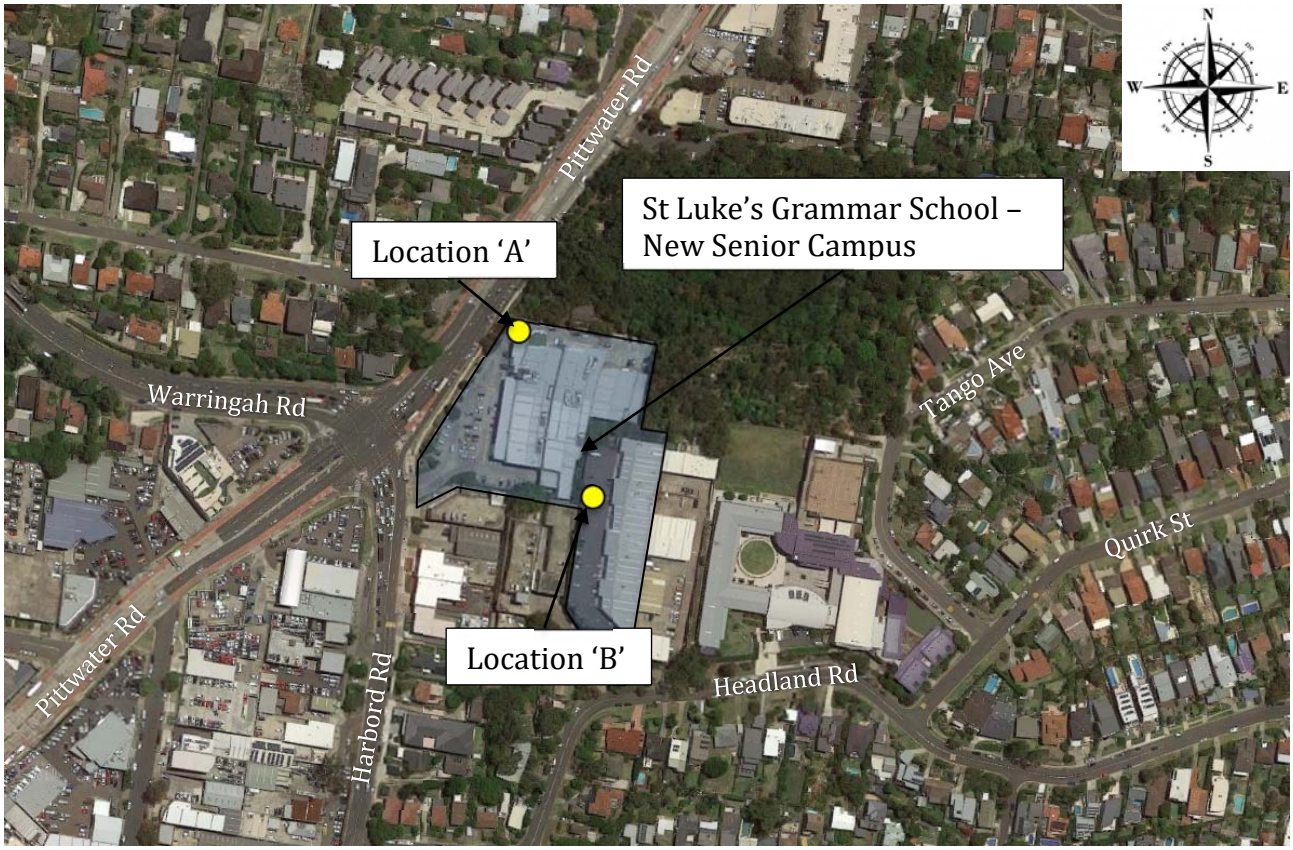


Figure 1 - Location Plan, 800 Pittwater & 224 Headland Road, Dee Why, NSW.

3.0 NOISE SURVEY INSTRUMENTATION

Noise level measurements and analysis were made with instrumentation as follows in Table 1:

Table 1 Noise Instrumentation

Description	Model No	Serial No
Infobyte Noise Logger (Type 1)	iM4	113
Condenser Microphone 0.5" diameter	MK 250	113
Acoustical Calibrator	SV30A	10839
Modular Precision Sound Analyser	B&K 2270	3011809
Condenser Microphone 0.5" diameter	B&K 4189	3099836
Acoustical Calibrator	CAL200	3646

An environmental noise logger is used to continuously monitor ambient noise levels and provide information on the statistical distribution of noise during an extended period of time. The Infobyte Noise Monitor iM4 is a Type 2 precision environmental noise monitor meeting all the applicable requirements of AS1259 for an integrating-averaging sound level meter.

The B&K 2270 Sound Analyser is a real-time precision integrating sound level meter with octave and third octave filters, that sample noise at a rate of 10 samples per second and provides L_{eq}, L_{10} and L_{90} noise levels using both Fast and Slow response and L_{peak} noise levels on Impulse response time settings. The meter is frequency weighted to provide dBA, dBC or Linear sound pressure level readings as required

All instrument systems had undergone pattern testing using instrumentation traceable to Australian National Standards and certified within the last two years thus conforming to Australian Standards. The measurement system was also field calibrated prior to and after noise surveys. Calibration drift was found to be less than 0.5 dB during attended and less than 1 dB for unattended measurements. No adjustments for instrument drift during the measurement period were warranted.

4.0 ACCEPTABLE NOISE INTRUSION LEVELS

4.1 NSW Department of Planning and Environment (DoPE)

4.1.1 Development Near Rail Corridors and Busy Roads – Interim Guidelines

The NSW DoPE (formerly NSW Department of Planning) document *"Development Near Rail Corridors and Busy Roads – Interim Guidelines"* (2008) recommends internal noise criteria in Section 3.6.1, Table 3.1 for non-residential buildings, as shown below in Table 2.

Table 2 Required Indoor Noise Levels – Non - Residential Buildings

Type of Occupancy	Recommended Max Level, dBA
Educational Institutions	40[1]

Note: airborne noise is calculated as $L_{eq\ (9\ hour)}$ (night) and $L_{eq\ (15\ hour)}$ (day).

[1] Table 3.1 does not specify an airborne noise descriptor for internal noise levels in non-residential buildings. Based on similar documents used for the assessment of traffic noise within educational facilities (NSW RNP and the Association of Australasian Acoustical Consultants Guideline for Child Care Centre Acoustic Assessment), we have assumed an assessment noise descriptor of $L_{Aeq,\ 1\ hour}$ for intrusive airborne road traffic noise.

In addition, it also states that:

"if internal noise levels with windows or doors open exceed the criteria by more than 10 dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia".

4.1.2 SEPP (Infrastructure) 2007

The NSW State Environmental Planning Policy (Infrastructure) 2007 details the following in Clause 102 with regards to road noise and vibration:

'102 Impact of road noise or vibration on non-road development

(1) This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

(a) a building for residential use,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or child care centre.

(2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.

*(4) In this clause, **freeway**, **tollway** and **transitway** have the same meanings as they have in the Roads Act 1993.'*

4.1.3 SEPP (Educational Establishments and Child Care Facilities) 2017

The DoPE published the State Environmental Planning Policy (SEPP) (Educational Establishments and Child Care Facilities) 2017 on 1 September 2017. The relevant parts of the SEPP to this proposal have been extracted and are revised below.

'Part 4 Schools - specific development controls

35 Schools – development permitted with consent

(1) Development for the purpose of a school may be carried out by any person with development consent on land in a prescribed zone..

(9) A provision of a development control plan that specifies a requirement, standard or control in relation to development of a kind referred to in subclause (1), (2), (3) or (5) is of no effect, regardless of when the development control plan was made.'

Also, 'Schedule 4 Schools – design quality principles' of the SEPP requires the following:

'Principle 5. Amenity

Schools should provide pleasant and engaging spaces that are accessible for a wide range of educational, informal and community activities, while also considering the amenity of adjacent development and the local neighbourhood.

Schools located near busy roads or near rail corridors should incorporate appropriate noise mitigation measures to ensure a high level of amenity for occupants.

Schools should include appropriate, efficient, stage and age appropriate indoor and outdoor learning and play spaces, access to sunlight, natural ventilation, outlook, visual and acoustic privacy, storage and service areas.'

4.2 NSW Environment Protection Authority – NSW Road Noise Policy

While not strictly applicable to this development, the NSW Road Noise Policy (RNP), in Section 2.3.2, sets out road traffic noise assessment criteria for non-residential land uses in Table 4. In the absence of any specific document for noise levels in the outdoor areas of a school, the road traffic noise assessment criteria set out in the RNP may be used as a guideline.

The relevant information in Table 4 of the RNP is extracted below in Table 3.

Table 3 Road Traffic Noise Assessment Criteria – Non - Residential

Road Category	Assessment criteria – dB (A)		Additional considerations
	Day (7 am – 10 pm)	Night (10 pm – 7 am)	
4. Open space (active use)	$L_{Aeq, (15\ hour)}$ 60 (external) when in use		Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion. Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, eg playing chess, reading. In determining whether areas are used for active or passive recreation, the type of activity that occurs in that area and its sensitivity to noise intrusion should be established. For areas where there may be a mix of passive and active recreation, eg school playgrounds, the more stringent criteria apply. Open space may also be used as a buffer zone for more sensitive land uses.
5. Open space (passive use)	$L_{Aeq, (15\ hour)}$ 55 (external) when in use		

4.3 Project Specific Internal Noise Criteria

Taking into consideration the above documents and policies, we recommend that the acceptable noise criteria for the *NSC* be as follows:

With Windows Closed:

- $L_{eq,\ 1\ hour}$ 40 dBA inside habitable rooms such as general learning areas (GLAs), speciality learning areas (SLAs) and office areas.

With Windows Open:

- $L_{eq,\ 1\ hour}$ 50 dBA inside habitable rooms such as general learning areas (GLAs), speciality learning areas (SLAs) and office areas.

External Play Areas:

- $L_{eq,\ 15\ hour}$ 55 dBA in the outdoor play areas.

5.0 ROAD TRAFFIC NOISE LEVELS

5.1 Measured Road Traffic Noise Levels

The proposed development is affected by road traffic noise from Pittwater Road, which carries heavy traffic volumes.

5.1.1 Long Term Road Traffic Noise Measurements

A noise monitor was placed in the north western corner of 800 Pittwater Road, shown in Figure 1 as Location 'A'. Location 'A' was approximately 18 metres from the centre of Pittwater Road.

The noise monitor gathered noise data over a period of nine days, from 28 May to 5 June 2019, to determine the road traffic noise level at the site. The measured noise levels are shown in Table 4 and attached as **Appendix A**

Table 4 Long Term Road Traffic Sound Pressure Levels (Fast response)

Location	Daytime $L_{Aeq, 1\ hour}$ Noise Level
Location 'A' – NW Corner 800 Pittwater Road	67 dBA

Meteorological conditions during the long term monitoring typically consisted of clear skies with some rain. Temperatures ranged between 8°C and 18°C.

The measured traffic noise levels in Table 4 above are representative of the traffic noise impact in the outdoor play area on the western and north-western sides of the *NSC*.

5.1.2 Calculated External Traffic Noise Levels

The measured traffic noise level at Location 'A' has been extrapolated to the façades (existing) of the proposed *NSC* buildings to determine the external traffic noise levels. The adjusted traffic noise levels are shown in Table 5, and in the sound maps attached as Appendix C.

Table 5 Adjusted Road Traffic Sound Pressure Levels (Fast response)

Location	**Daytime $L_{Aeq,\ 1\ hour}$ Noise Level**
800 Pittwater Road - Western Façade	
Level 1	62 – 64
Level 2	62 – 64
Level 3	48 – 50
800 Pittwater Road - Northern Façade	
Level 1	36 – 61
Level 2	36 – 61
Level 3	36 – 47
800 Pittwater Road - Southern Façade	
Level 1	54 – 57
Level 2	54 – 57
Level 3	53 – 57
224 Headland Road	
Western Façade	46 – 52

We are of the opinion that the noise levels in Table 5 will be typical for this area, and have adopted these values in the acoustic design of the building facade for the proposed *NSC.*

5.1.3 Short Term Road Traffic Noise Measurements

Short term attended noise measurements were also carried out to determine a representative traffic noise spectrum at the time the long term noise monitor was installed. The traffic noise spectrums have been adopted in the design of noise insulation for the proposed *NSC.* Measurements were taken in two locations at the proposed *NSC*, shown in Figure 1 as Location 'A' and Location 'B'. The measured noise level is shown in Table 6.

Table 6 Measured L_{eq} Road Traffic Sound Pressure Levels

Location	Measured Sound Pressure Levels (dB) at Octave Band Centre Frequencies (Hz)								
	dBA	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Traffic Noise Level Location 'A'- NW Corner 800 Pittwater Rd	**68**	76	71	64	63	65	59	51	44
Traffic Noise Level Location 'B'- NW Corner 224 Headland Rd	**59**	63	62	58	56	56	50	42	31

5.2 Required Road Traffic Noise Reduction

Based on the acceptable noise levels established in Section 4.3 of this report and the measured noise levels shown in Section 5.1, the required noise reduction from road traffic is shown in Table 7.

Table 7 Required Road Traffic Noise Reduction (TNR)

Location	Room Description	Required TNR
800 Pittwater Rd – Western Façade		
Level 1	Boardroom, Principal, Head of Campus, Assistant HOC, Admin Office	Up to 23 dB
Level 1	Staff Common Room, Admin Office (Large), Staff Lounge	Up to 22 dB
Level 1	GLA 1	Up to 18 dB
Level 2	GLA 1	Up to 24 dB
Level 2	Seminar Room, GLA 2 & 3, Hub 1	Up to 23 dB
Level 2	GLA 4 to 7, Student Lounge	Up to 22 dB
Level 3	GLA 1 to 3, GLA 7 & 8, Chemistry SLA, Hub 2 & 3, Flexible Learning, Biology SLA	Up to 8 dB
Level 3	GLA 11	Up to 9 dB
800 Pittwater Rd – Northern Façade		
Level 1	Auditorium	Up to 4 dB
Level 2	GLA 1 (Humanities Precinct)	Up to 24 dB
Level 2	Flexible Learning	Up to 21 dB
Level 2	GLA 1 (Wellness Precinct)	Up to 0 dB
Level 3	GLA 1 & 4	Up to 8 dB
Level 3	Art SLA, Food Tech SLA 1& 2	Up to 0 dB
800 Pittwater Rd – Southern Façade		
Level 1	Staff Lounge, Admin Office	Up to 17 dB
Level 1	GLA 1 & 2, Tutor Room	Up to 15 dB
Level 2	Student Lounge, GLA	Up to 17 dB
Level 2	Flexible Learning, GLA 8, Staff Study	Up to 15 dB
Level 3	GLA 11, Physics SLA	Up to 13 dB
224 Headland Rd – Western Façade		
All Levels	Staff Lounge, Admin Office	Up to 12 dB

6.0 RECOMMENDED ACOUSTICAL TREATMENT

We have modelled the proposed NSC buildings, and calculated the level of road traffic noise intrusion into the outdoor areas, through the roof, walls, windows and doors.

All calculations are based on the architectural drawings by Tonkin Zulaikha Greer Architects, for project No. 18032, dated 23 August 2019, attached as Appendix A.

We have assumed that all GLAs, Hubs, Flexible Learning Areas, Staff Areas and offices will have carpet flooring installed, with the SLAs other rooms having hard surfaced flooring such as vinyl installed.

The necessary noise reduction for the rooms can be achieved if the following noise control recommendations are complied with, and there are no gaps at construction joints, around plumbing penetrations in external walls, at window sills, door frames, etc., through which sound may penetrate.

6.1 Sound Barrier Wall

We recommend constructing a 1.8 metre high sound barrier wall along the entire length of the western boundary of the ground level outdoor play area, as shown in the attached Appendix D.

The sound barrier wall may be constructed from masonry, 10 mm thick solid polycarbonate sheeting, 3 rail 'solid capped and lapped' timber or 6.38 mm thick laminated glass. The construction shall be free of visible air gaps to provide an impervious sound barrier. Should an alternate construction method be proposed, it must be reviewed by an appropriately qualified Acoustic Consultant.

Once the sound barrier wall is incorporated into the design, the required road TNR is reduced in some locations due to the increased shielding of Pittwater Road provided by the sound barrier wall. The revised required road TNR is shown in the following Section (6.2).

NOTE: *Considering the staging schedule for the construction of the outdoor play areas fronting Pittwater Road, the sound barrier wall recommended above may be constructed in two stages. At the completion of Stage 2 the sound barrier wall is required to be constructed along the western boundary of the Stage 2 outdoor play area. At the completion of Stage 3 the sound barrier wall should be extended the whole length of the western boundary, as per the Appendix D.*

6.2 Revised Required Road TNR with Sound Barrier Wall

The revised required traffic noise reduction is shown in Table 8.

Table 8 Revised Required Road Traffic Noise Reduction (TNR)

Location	Room Description	Required TNR
800 Pittwater Rd – Western Façade		
Level 1	Boardroom, Principal, Head of Campus, Assistant HOC, Admin Office	Up to 17 dB
Level 1	Staff Common Room, Admin Office (Large), Staff Lounge	Up to 16 dB
Level 1	GLA 1	Up to 17 dB
Level 2	GLA 1	Up to 21 dB
Level 2	Seminar Room	Up to 19 dB
Level 2	GLA 2 & 3, Hub 1	Up to 18 dB
Level 2	GLA 4 to 7, Student Lounge	Up to 17 dB
Level 3	GLA 1 to 3, GLA 7 & 8, Chemistry SLA, Hub 2 & 3, Flexible Learning, Biology SLA	Up to 8 dB
Level 3	GLA 11	Up to 9 dB
800 Pittwater Rd – Northern Façade		
Level 1	Auditorium	Up to 4 dB
Level 2	GLA 1 (Humanities Precinct)	Up to 17 dB
Level 2	Flexible Learning	Up to 10 dB
Level 2	GLA 1 (Wellness Precinct)	Up to 0 dB
Level 3	GLA 1 & 4	Up to 8 dB
Level 3	Art SLA, Food Tech SLA 1& 2	Up to 0 dB
800 Pittwater Rd – Southern Façade		
Level 1	Staff Lounge, Admin Office	Up to 15 dB
Level 1	GLA 1 & 2, Tutor Room	Up to 13 dB
Level 2	Student Lounge, GLA	Up to 15 dB
Level 2	Flexible Learning, GLA 8, Staff Study	Up to 14 dB
Level 3	GLA 11, Physics SLA	Up to 13 dB
224 Headland Rd – Western Façade		
All Levels	Staff Lounge, Admin Office	Up to 11 dB

6.3 External Walls

6.3.1 Masonry Walls

External walls may be constructed with any selected masonry wall system.

6.3.2 Pre-fabricated Wall Systems

External walls may be constructed with an AFS or Dincel wall system, or any other similar product.

6.3.3 Light Weight Walls

External walls may be of light weight construction as follows:

- Selected cladding fixed to the outside of 90 mm timber studs or 92 mm steel studs;
- A single layer of 13 mm thick fire or sound rated plasterboard on the internal side of studs; and
- The wall cavity is to be lined with 100 mm bulk insulation (min 10 kg/m^3 density).

6.4 Ceiling and Roof System

- All roofs may be of metal deck construction;
- Thermal insulation and vapour barrier laid below the roof;
- The ceiling under the roof is to comprise of a single layer of 13 mm thick fire or sound rated plasterboard; and
- Insulation batts are to be placed between the ceiling joists. The recommended insulation specifications are 160 mm thick glasswool (min 10 kg / m^3 density).

6.5 External Glazing and Glazed Doors

Table 9 below specifies minimum sound reduction index (R_w) ratings required for various windows. Glazing in all rooms other than those specified in Table 9 may be of standard thickness with a minimum R_w 25.

A typical glazing specification is given in Table 9, however an alternative glazing specification may be used if the R_w is achieved or exceeded.

Table 9 Schedule of Glazed Windows and Door Constructions

Room Description	Min R_W	Typical Glazing Specification
800 Pittwater Rd – Western Facade		
Level 1 **–** Boardroom, Principal, Head of Campus, Assistant HOC, Admin Office, Staff Common Room, Admin Office (Large), Staff Lounge, GLA 1	30	6.38 mm laminated glass
Level 2 **–** GLA 1	32	6.38 mm laminated glass with acoustic seals
Level 2 **–** Seminar Room, GLA 2 to 7, HUB 1, Student Lounge	30	6.38 mm laminated glass
Level 3 **–** GLA 1 to 3, GLA 7 & 8, Chemistry SLA, Hub 2 & 3, Flexible Learning, Biology SLA, GLA 11	25	Standard glazing
800 Pittwater Rd – Northern Facade		
Level 1 – Auditorium	25	Standard glazing
Level 2 – GLA 1 (Humanities Precinct)	30	6.38 mm laminated glass
Level 2 – Flexible Learning	28	5 mm glass with acoustic seals
Level 2 – GLA 1 (Wellness Precinct)	25	Standard glazing
Level 3 – GLA 1 & 4, Art SLA, Food Tech SLA 1 & 2	25	Standard glazing
800 Pittwater Rd – Southern Facade		
Level 1 **–** Staff Lounge, Admin Office, GLA 1 & 2, Tutor Room	28	5 mm glass with acoustic seals
Level 2 **–** Student Lounge, GLA, Flexible Learning, GLA 8, Staff Study	28	5 mm glass with acoustic seals
Level 3 **–** GLA 11, Physics SLA	28	5 mm glass with acoustic seals
224 Headland Rd - Western Facade		
All Levels	28	5 mm glass with acoustic seals

All other windows not mentioned in Table 9 may be 5 mm glass. This schedule of construction is typical and for general guidance to the architect in preparing final construction drawings and specifications. Other constructions that provide the same or better Sound Transmission Loss performance may also be acceptable.

It is most important that any sound leakage paths around the windows be sealed off. We recommend that prior to the fitting of the architraves around the windows, the space between the frames and the wall structure be sealed off with silicone or polyurethane mastic and backing rods installed behind. The window architraves can then be fitted.

6.6 Eligible Suppliers of Windows and Glass Doors

The windows and doors are the most critical sound paths in a building. Only those companies who have conducted laboratory testing of their windows should be considered as eligible suppliers. Companies that we are aware of having conducted satisfactory testing include:

- *Architectural Window Systems,* Wetherill Park, NSW Phone: 8783 7611
- *Micos Aluminium Pty Ltd,* Hillsdale, NSW Phone: 9661 5233
- *Christoffel Pty Ltd*, Glendenning, NSW Phone: 9627 4811
- *Aska Windows*, Greenacre, NSW Phone. 9642 8588
- *James Hardie (Trend) Windows*, Girraween, NSW Phone: 9840 2000
- *Boral Window Systems*, Smithfield, NSW Phone: 9757 0555
- *Stegbar (Windows) Pty Ltd*, Lansvale, NSW Phone: 9794 5200

Approval should be sought from Day Design before any other manufacturers' products are considered. R_w ratings claimed should be supported by acoustical laboratory test reports. We suggest that you obtain confirmation from the glazier that the glazing supplied will meet the required R_w rating above.

6.7 Mechanical Ventilation

The highest external noise levels at the closest façade (to Pittwater Road) of the proposed NSC building is 61 dBA during the day time outside Level 2 GLA 1.

With windows left partially open (20% of the window area) the resultant internal noise levels are typically 10 dB less than the corresponding external noise levels.

In this instance, this equates to 51 dBA during the day.

It can be seen that the acceptable day time noise limit of 50 dBA (with windows partially open) is exceeded by up to 1 dB inside the Level 2 GLA 1.

Therefore, the GLA is to be ventilated to the standards set out in Australian Standard AS1668.2:1991.

We have been advised that the NSC buildings are proposed to be ventilated through an air conditioning system with a fresh air supply, which is considered acceptable.

6.8 Construction Disclaimer

Recommendations made in this report are intended to resolve acoustical problems only. We make no claim of expertise in other areas and draw your attention to the possibility that our recommendations may not meet the structural, fire, thermal or other aspects of building construction.

We encourage clients to check with us before using materials or equipment that are alternative to those specified in our Acoustical Report.

The integrity of acoustic structures is very dependent on installation techniques. For example, a small crack between the top of a wall and a ceiling can reduce the effective sound transmission loss of a wall from R_w 50 to R_w 40. Therefore the use of contractors that are experienced in acoustic construction is encouraged. Furthermore, two insulation products may have the same thermal R rating but the sound absorption of one may be entirely deficient, therefore the use of materials and equipment that are supported by acoustic laboratory test data is encouraged.

7.0 NOISE INTRUSION STATEMENT

Day Design Pty Ltd has been engaged by Midson Group on behalf of The Anglican Schools Corporation to carry out a traffic noise intrusion study for the proposed new St Luke's Grammar School Senior Campus at 800 Pittwater Road and 224 Headland Road, Dee Why, NSW.

Existing levels of road traffic noise have been measured along Pittwater Road, adjacent to the existing site. We are confident that the noise levels used in our assessment are typical of the average maximum traffic noise levels in this area.

Based on the architectural drawings and provided that all the recommendations in Section 6.0 of this report are satisfactorily carried out, we are confident that the intrusive road traffic noise levels will comply with the internal noise levels specified by the NSW Department of Planning's *"Development Near Rail Corridors and Busy Roads – Interim Guidelines"* (2008) and the external noise levels recommended by the NSW Environment Protection Authority's *NSW Road Noise Policy*, and will be considered acceptable.

Adam Shearer, BCT(Audio), MDesSc (Audio and Acoustics), MAAS

Acoustical Consultant

for and on behalf of Day Design Pty Ltd

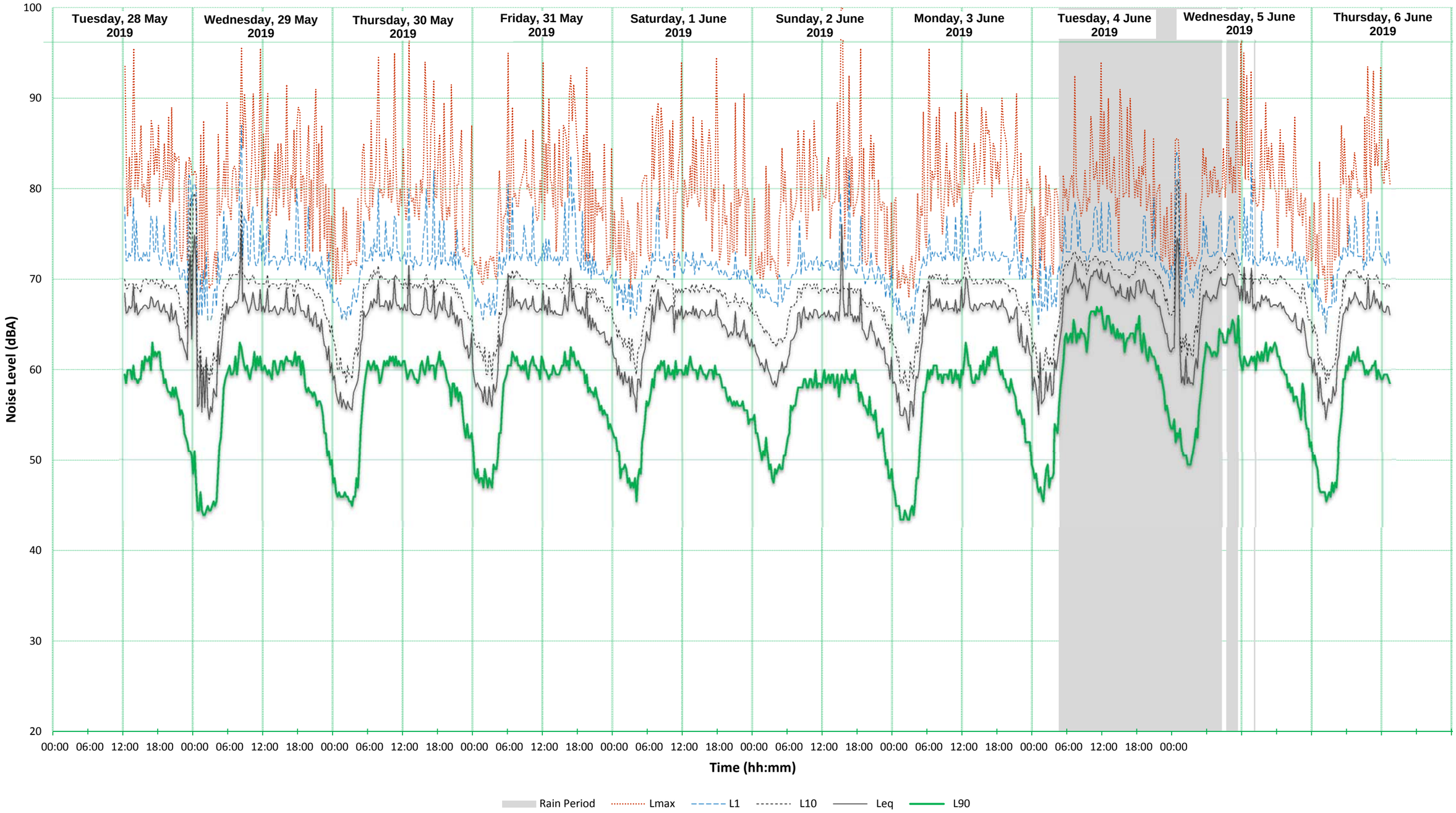
AAAC MEMBERSHIP

Day Design Pty Ltd is a member company of the Association of Australasian Acoustical Consultants, and the work herein reported has been performed in accordance with the terms of membership.

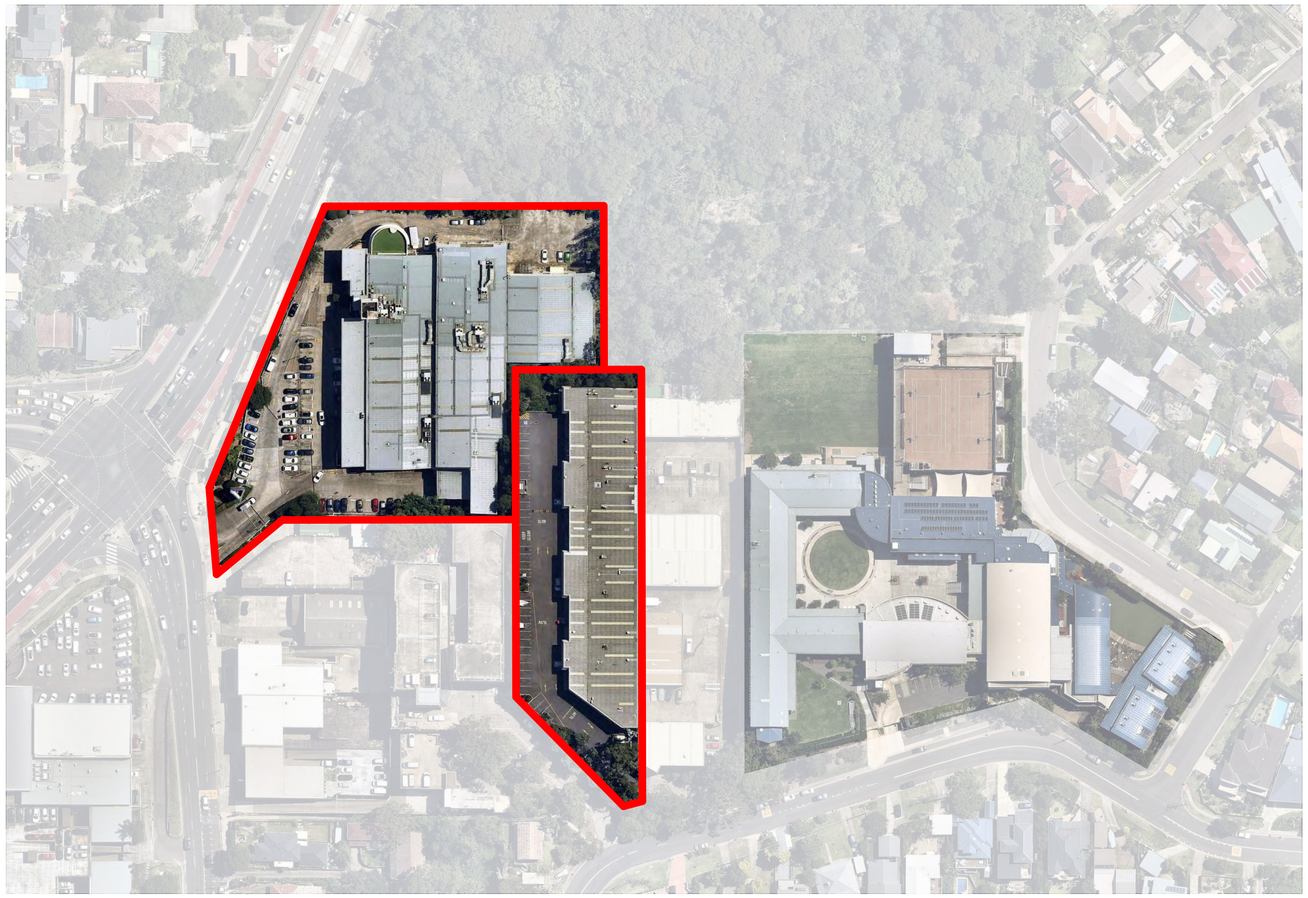
Attachments:

- Appendix A – Traffic Noise Survey
- Appendix B – Architectural Drawings
- Appendix C – iNoise Sound Map - External Noise Levels
- Appendix D – Recommended Sound Barrier Wall Location
- AC108-1 to 4 – Glossary of Acoustical Terms
- AC806-MH – External Wall, Roof & Ceiling Acoustical Detail
- AC810-6B – Silence Air

Located at 800 Pittwater Rd, Dee Why, NSW



ST. LUKE'S GRAMMAR SCHOOL - NEW SENIOR SCHOOL CAMPUS



DRAWING LIST		
		Scale @ A1
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A-114	LEVEL 4 PLAN - STAGE 2_800	1:200
A-115	LEVEL 0 PLAN - STAGE 3_800	1:200
A-116	LEVEL 1 PLAN - STAGE 3_800	1:200
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PROJECT :
ST. LUKE'S GRAMMAR SCHOOL - NEW SENIOR SCHOOL CAMPUS

PROJECT NO : 18032

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DRAWING TITLE
GENERAL
COVER PAGE

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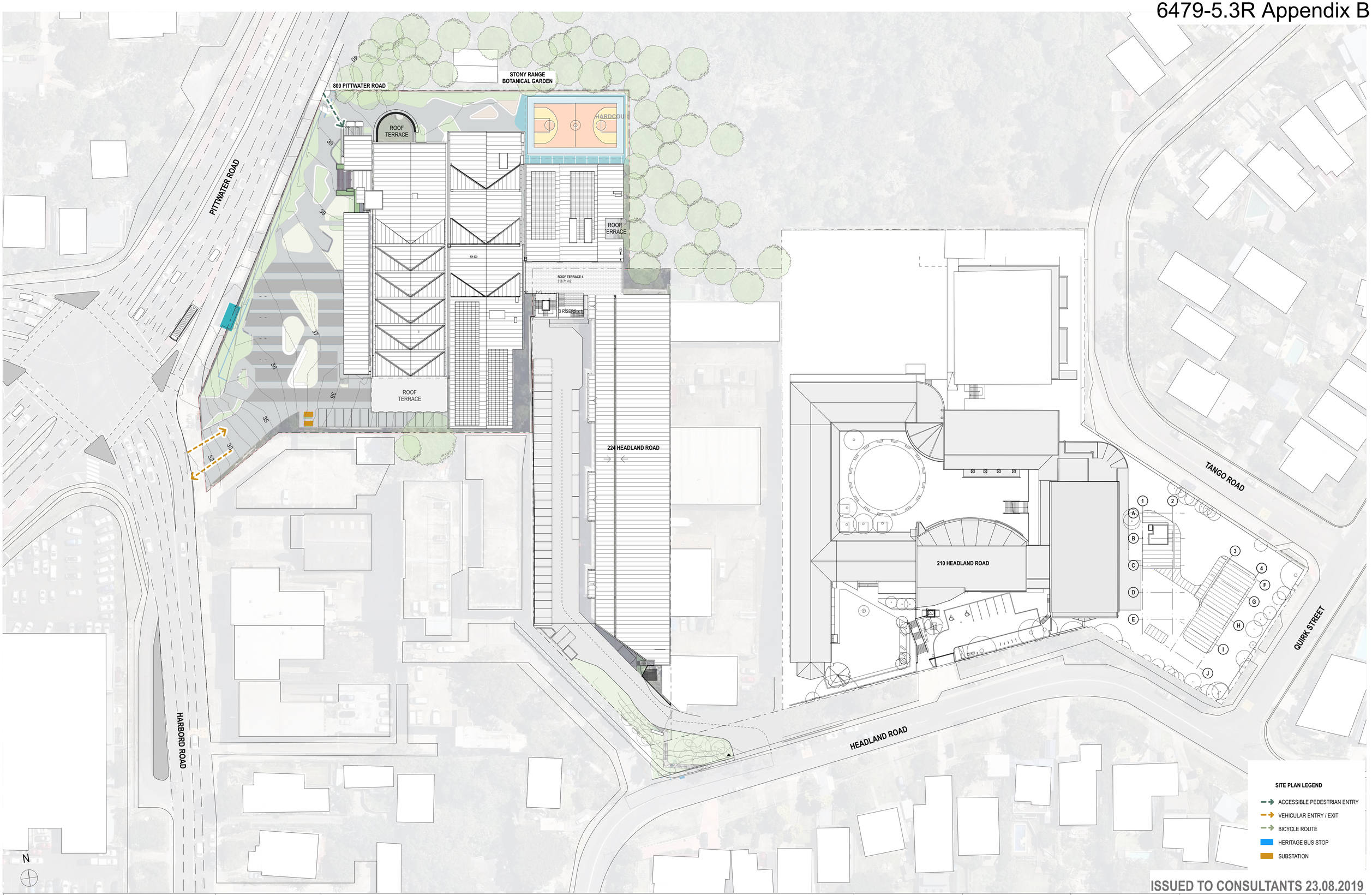
DATE 23/8/19
PHASE SD
DRAWING NO A-000
REV



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DRAWING TITLE
GENERAL
SITE PLAN

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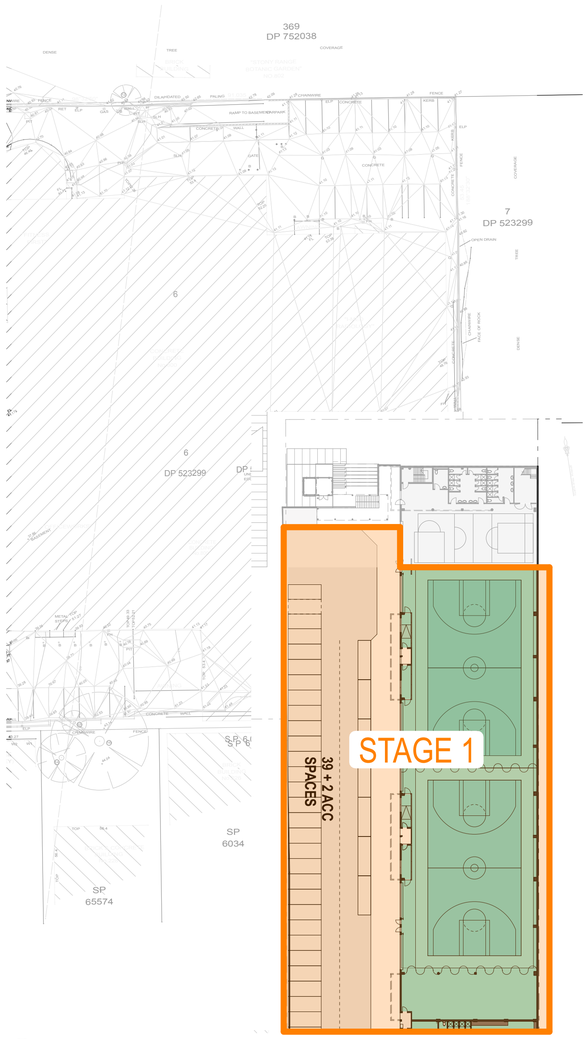
DATE 23/8/19
PHASE SD
DRAWING NO A-001
REV



1 STAGE 1
1:500

STAGE 1 OVERVIEW

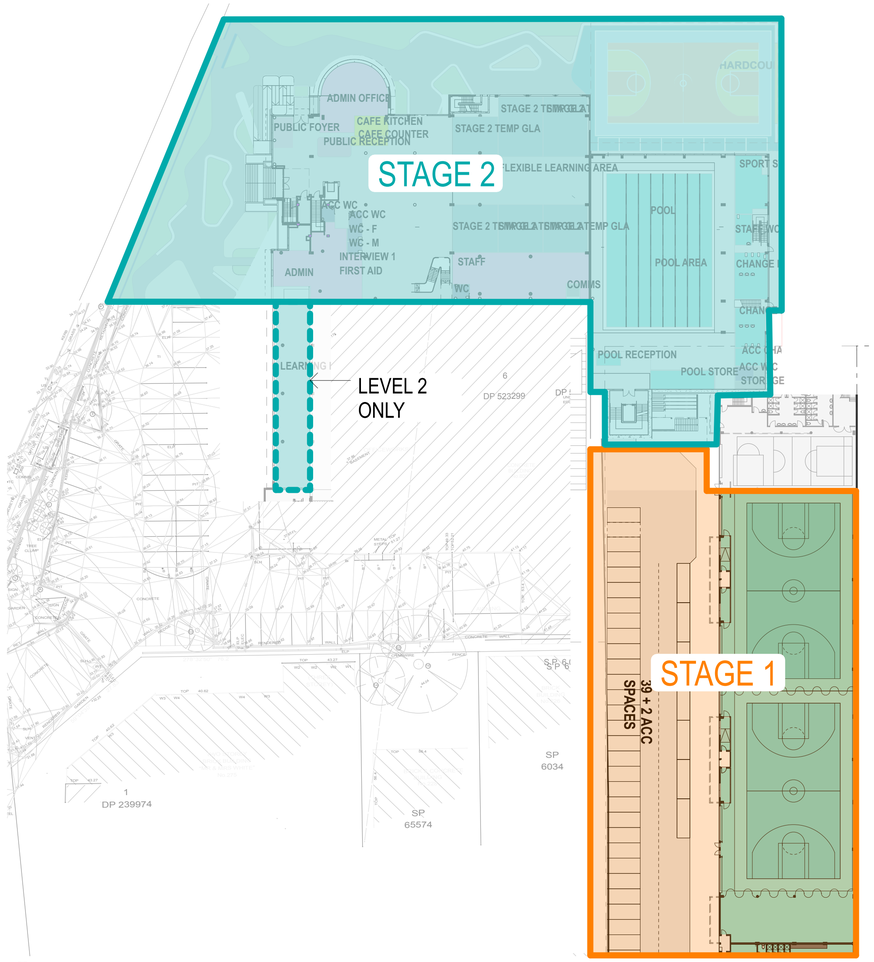
LOCATION - 224 HEADLAND ROAD

LEASE END DATE - 30 June 2022

STAGE 1 SUMMARY

1. Remove existing internal walls to create large open space for two basketball courts within footprint of former units 2-6 of 224 Headland Road.
2. In stage 1 Basketball courts will also be used as Dance Studio and Multi Purpose Hall.

ADDITIONAL STUDENTS: NIL



2 STAGE 2
1:500

STAGE 2 OVERVIEW

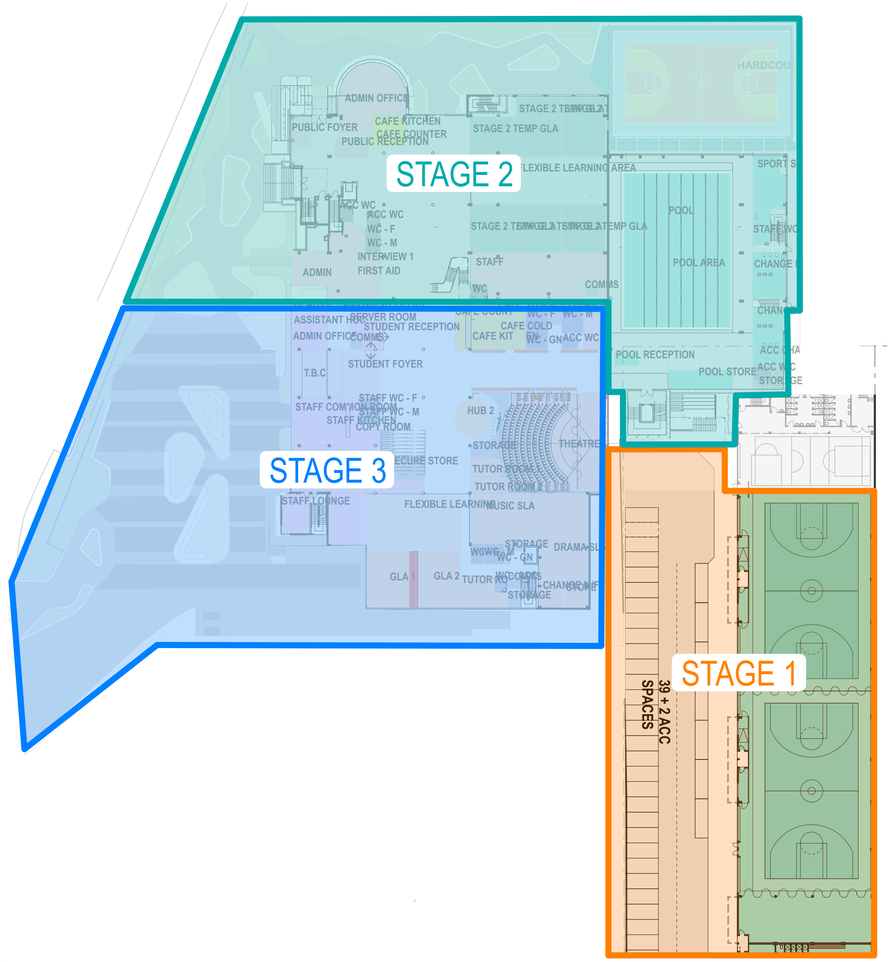
LOCATION - 800 PITTWATER ROAD

LEASE END DATE - IMED - 31 August 2024; Fitness First - 30 June 2025

STAGE 2 SUMMARY

1. Internal refurbishment of IMED and Fitness First tenancies as per Architectural drawings
2. Landscaping to Northern portion of site as per Landscape design
3. Accessible path to main entrance of school as per Architectural and Landscape drawings
4. Basement North carparking reconfigured
5. Basement South carparking retained
6. New pedestrian path from Officeworks Basement carparking to Officeworks entrance.

ADDITIONAL STUDENTS: 480



3 STAGE 2
1:500

STAGE 3 OVERVIEW

LOCATION - 800 PITTWATER ROAD

LEASE END DATE - Officeworks - 30 April 2029

STAGE 3 SUMMARY

1. Internal refurbishment of Officeworks as per Architectural drawings
2. New extension to south of existing building as per Architectural drawings
3. Temporary spaces in Stage 2 reconfigured as per Architectural drawings
4. Landscaping to remainder of site as per Landscape design
5. Front parking area to be reconfigured to accomodate bus and kiss and drop area
6. Basement carpark reconfigured, entrance to carpark relocated to South.

ADDITIONAL STUDENTS: 600

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Mrs Jane Hughes (Business Manager)
210 Headland Road
Dee Why NSW 2099

PROJECT :
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800 Pittwater Road
Dee Why NSW 2099
and
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North Curl Curl NSW 2099
PROJECT NO : 18032

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DRAWING TITLE
224 HEADLAND ROAD
STAGING DIAGRAMS

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SCALES 1:500
DATE 23/8/19
PHASE DD
DRAWING NO A-002
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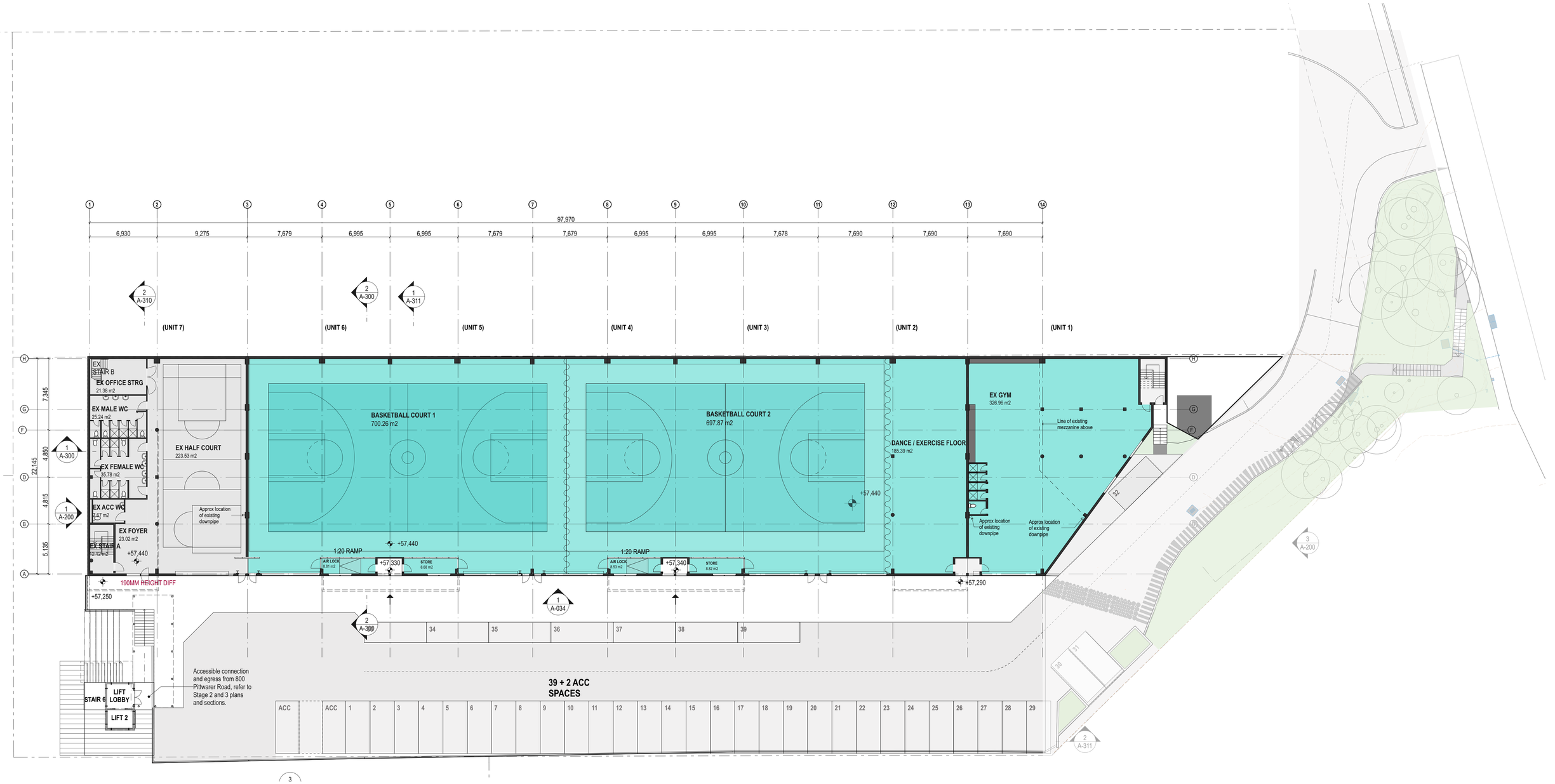

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DRAWING TITLE
224 HEADLAND ROAD
LEVEL 0 PLAN - STAGE 1 + 3_224

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SCALES 1:200
DATE 23/8/19
PHASE DD
DRAWING NO A-100
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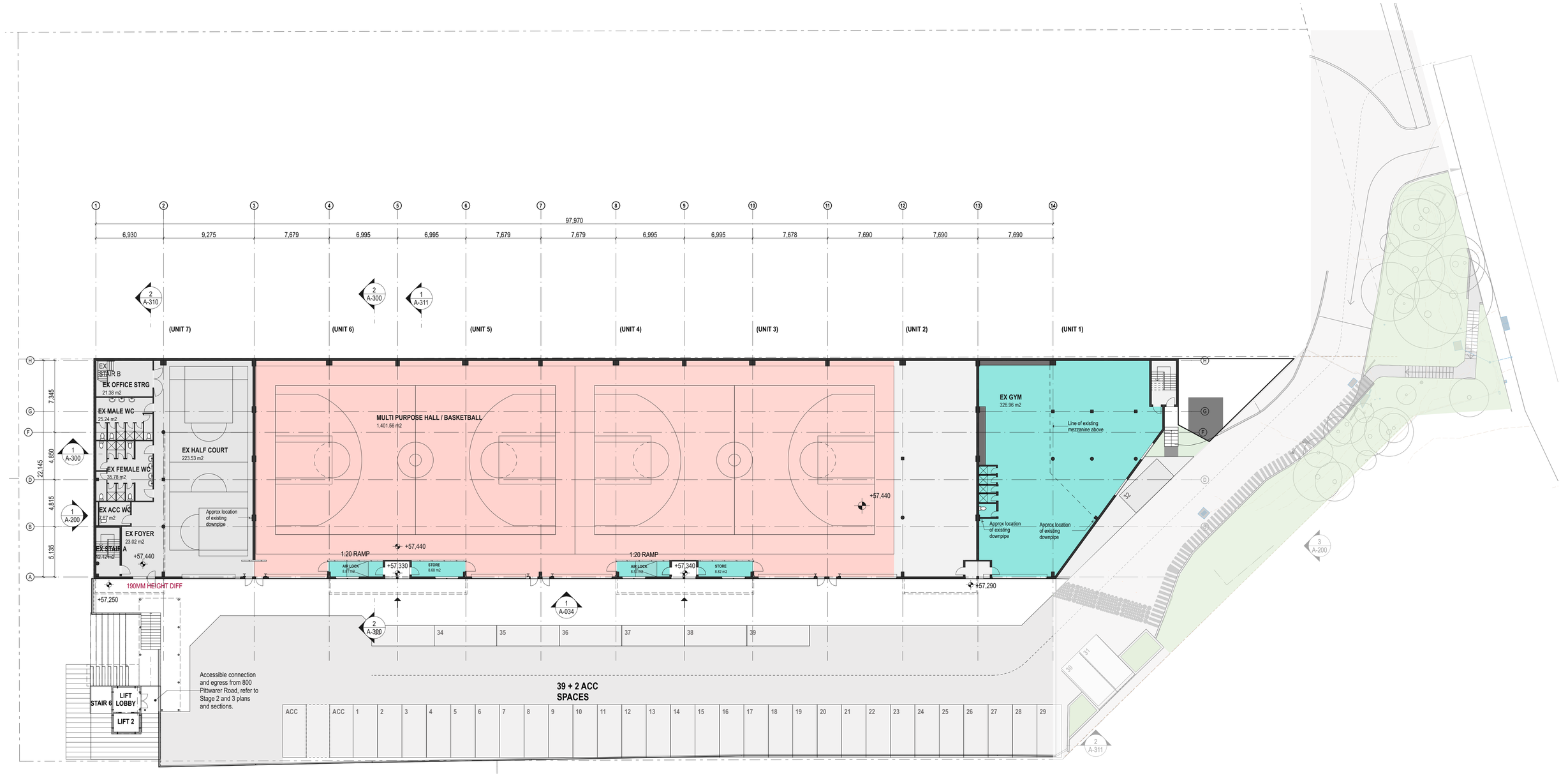

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DRAWING TITLE
224 HEADLAND ROAD
LEVEL 0 PLAN - STAGE 2_224

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DATE 23/8/19
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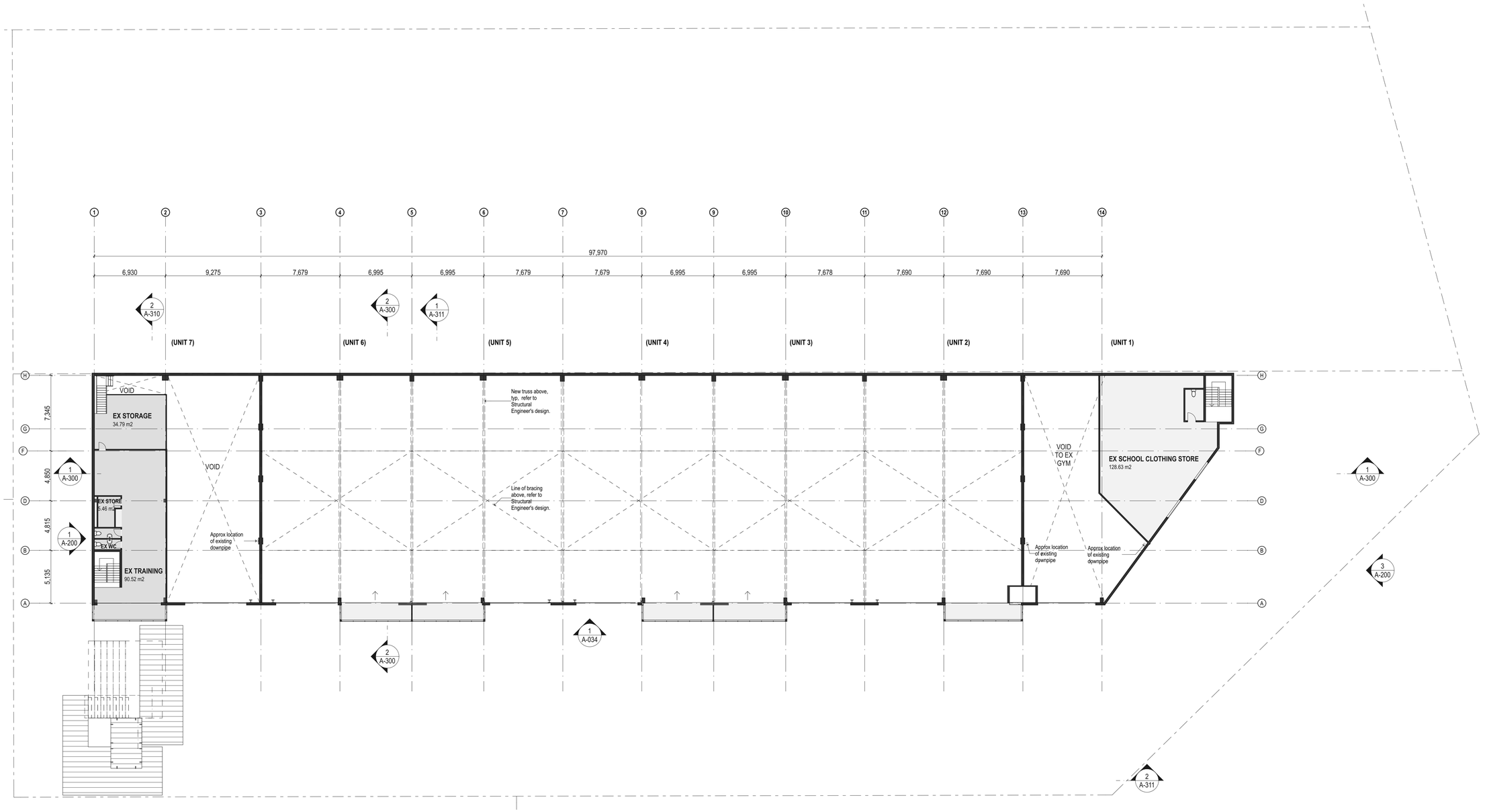

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DRAWING TITLE
224 HEADLAND ROAD
LEVEL 1 PLAN - STAGE 1_224

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SCALES 1:200
DATE 23/8/19
PHASE DD
DRAWING NO A-102
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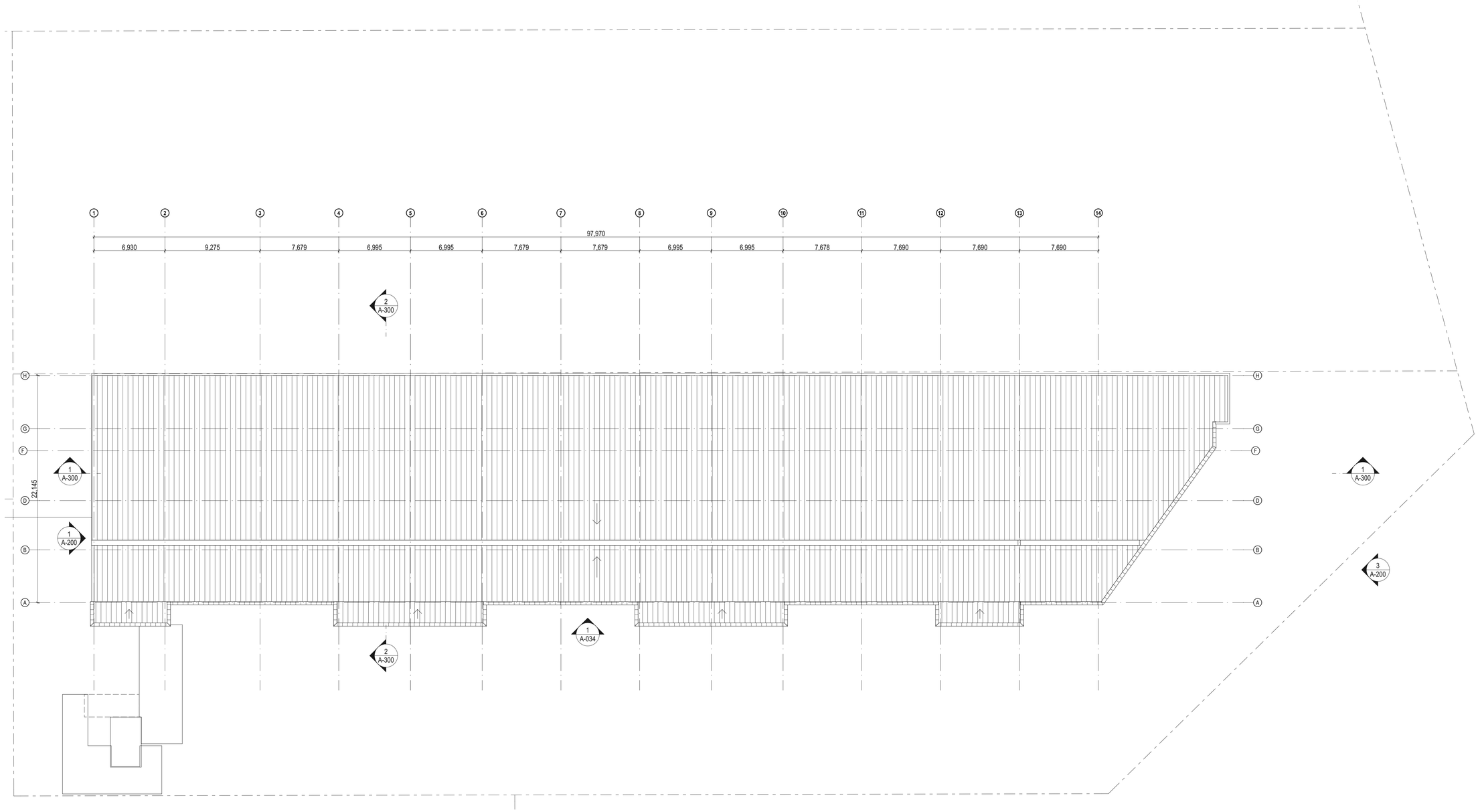

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224 HEADLAND ROAD
ROOF PLAN - STAGE 1_224

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DATE 23/8/19
PHASE DD
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ELECTRICAL SWITCHROOM
21.60 m2
COMMS ROOM
16.00 m2
STAIR 1
NEW LIFT CAR
(1400 x 1600)
LIFT 1
EX
STAIR 1
CAR PARK
52 + 2
ACC
SPACES
POOL BALANCE TANK
34.50 m2
POOL MECHANICAL PLANT ROOM
100.89 m2
CHEMICAL STORE
5.00 m2
POOL FILTRATION ROOM
89.75 m2
EX
STAIR 3
BOILER ROOM
55.98 m2
GENERAL STORE
30.99 m2
FIRE SERVICES PUMP ROOM
45.95 m2
GARDEN STORE
32.63 m2
+44,720
BICYCLE PARKING
76.23 m2
CAR PARK
22 SPACES
+37,867
STAIR 6
LIFT 2
TBD
28.34 m2
STAIR 4
GARBAGE ROOM
55.36 m2
MAINTENANCE STORE
74.35 m2
CAR PARK ENTRY
LIFT 3
GOODS AND ACCESS
LIFT L0 TO L5
STAIR 5
15 SPACES
NEW ELECTRICAL
SUBSTATIONS
EXISTING
HERITAGE
BUS STOP
EX SIGN
EX SIGN
N

1 A-310
2 A-211
1 A-310
4 A-316
2 A-310
1 A-210
3 A-211
2 A-310
1 A-311
1 A-311

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800 PITTWATER ROAD
LEVEL 0 PLAN - STAGE 3_800

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SCALES 1:200
DATE 23/8/19
PHASE SD
DRAWING NO A-115
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ACCESSIBLE PEDESTRIAN ENRTY

Existing Electrical substation to be relocated. Refer to level 0 and consultant design.

EXTERNAL HARDCOURT
492.55 m2

GALLERY / CHAPEL HUB
81.22 m2

PUBLIC FOYER
15.00 m2

PUBLIC RECEPTION
17.45 m2

ENTRY

STAIR 1

761 SEATS SHOWN
AUDITORIUM
661.75 m2
221 SEATS
314 SEATS
226 SEATS

LIFT 1

ACC WC
5.83 m2

EX STAIR 2

EX STAIR 1

STORAGE
13.41 m2

EX CLOCK TOWER

WC - F
4.99 m2

WC - M
4.99 m2

BOARDROOM
35.00 m2

INTERVIEW 1
11.16 m2

FIRST AID
11.97 m2

ADMIN

PRINCIPAL
15.00 m2

IT OFFICE
17.00 m2

STAIR 2

HEAD OF CAMPUS
15.00 m2

STUDENT OFFICE
9.51 m2

SERVER ROOM
6.10 m2

ASSISTANT HOC
15.00 m2

+44.720

+41.170

STUDENT RECEPTION
15.00 m2

ADMIN OFFICE
13.62 m2

COMMS
4.00 m2

VILLAGE CENTRE

CAFE OFFICE
11.18 m2

CHAIR STORE
28.31 m2

COMMS
4.00 m2

WC
4.94 m2

CAFE COUNTER
19.28 m2

CAFE STORE
8.12 m2

CLEANERS STORE
7.95 m2

BACKSTAGE
53.29 m2

WC - F
22.76 m2

WC - M
18.86 m2

CAFE COLD
7.70 m2

CAFE KITCHEN
54.51 m2

WC - GN
4.76 m2

ACC WC
5.30 m2

STUDENT FOYER
47.12 m2

T.B.C
66.19 m2

STAFF WC - F
7.31 m2

STAFF WC - M
7.31 m2

STAFF COMMON ROOM
79.56 m2

STAFF KITCHEN

COPY ROOM
15.89 m2

STAIR 3

UNDER STAIR SECURE STORE
28.88 m2

ADMIN OFFICE
179.01 m2

HUB 2
32.10 m2

STORAGE
21.78 m2

TUTOR ROOM 1
15.41 m2

TUTOR ROOM 2
15.62 m2

THEATRE
282.85 m2
228 SEATS

STAFF LOUNGE
30.23 m2

STAIR 4

FLEXIBLE LEARNING
147.83 m2

MUSIC SLA
89.76 m2

PERFORMING ARTS PRECINCT

STORAGE
5.58 m2

LIFT LOBBY

LIFT 3

WC - F
6.83 m2

WC - M
6.82 m2

WC - GN
3.20 m2

DRAMA SLA
105.66 m2

GLA 1
70.06 m2

GLA 2
69.80 m2

TUTOR ROOM 3
39.47 m2

WC - A
5.30 m2

COMMS
4.00 m2

STORAGE
4.88 m2

STAIR 5

CHANGE M/F
20.28 m2

STORE
21.03 m2

STAIR 6

LIFT 2

POOL RECEPTION
7.77 m2

BLEACHER SEATING

POOL STORE
34.22 m2

ACC CHANGE
13.90 m2

ACC WC
7.03 m2

STORAGE
10.60 m2

SPORT STORE
45.54 m2

STAIR 7

STAFF WC
13.35 m2

POOL
430.00 m2

WELLNESS PRECINCT

POOL AREA
803.74 m2

SPECTATOR SEATING

RAMP

CHANGE F
41.21 m2

EX STAIR 3

CHANGE M
31.60 m2

EXISTING HERITAGE BUS STOP

N

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DRAWING TITLE
800 PITTWATER ROAD
LEVEL 1 PLAN - STAGE 3_800

SCALES 1:200

PHASE SD

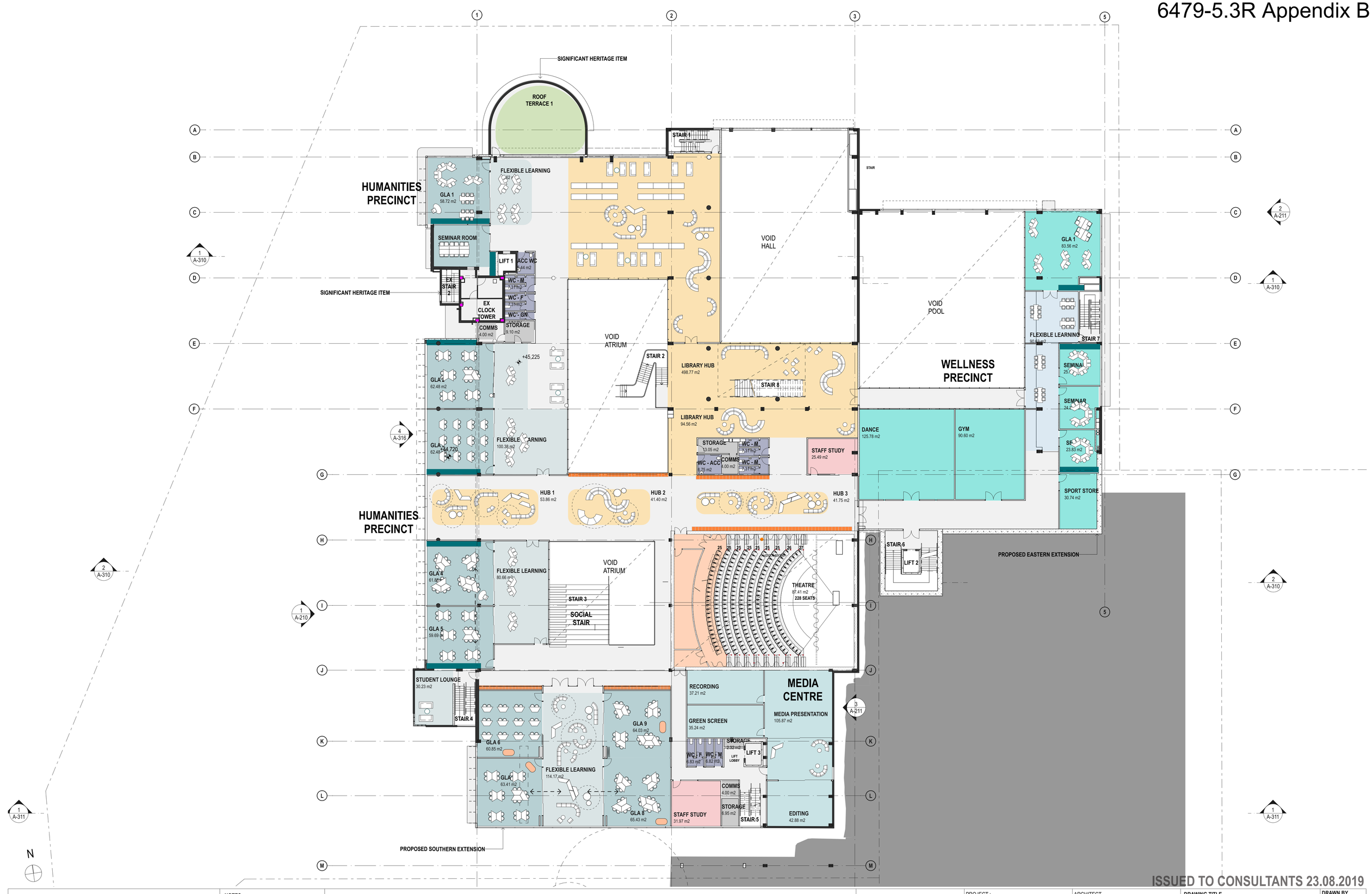
DRAWING NO A-116

DRAWN BY RM + CE + EG

CHECKED PT

DATE 23/8/19

REV



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DRAWING TITLE
800 PITTWATER ROAD
LEVEL 2 PLAN - STAGE 3_800

SCALES 1:200

PHASE SD

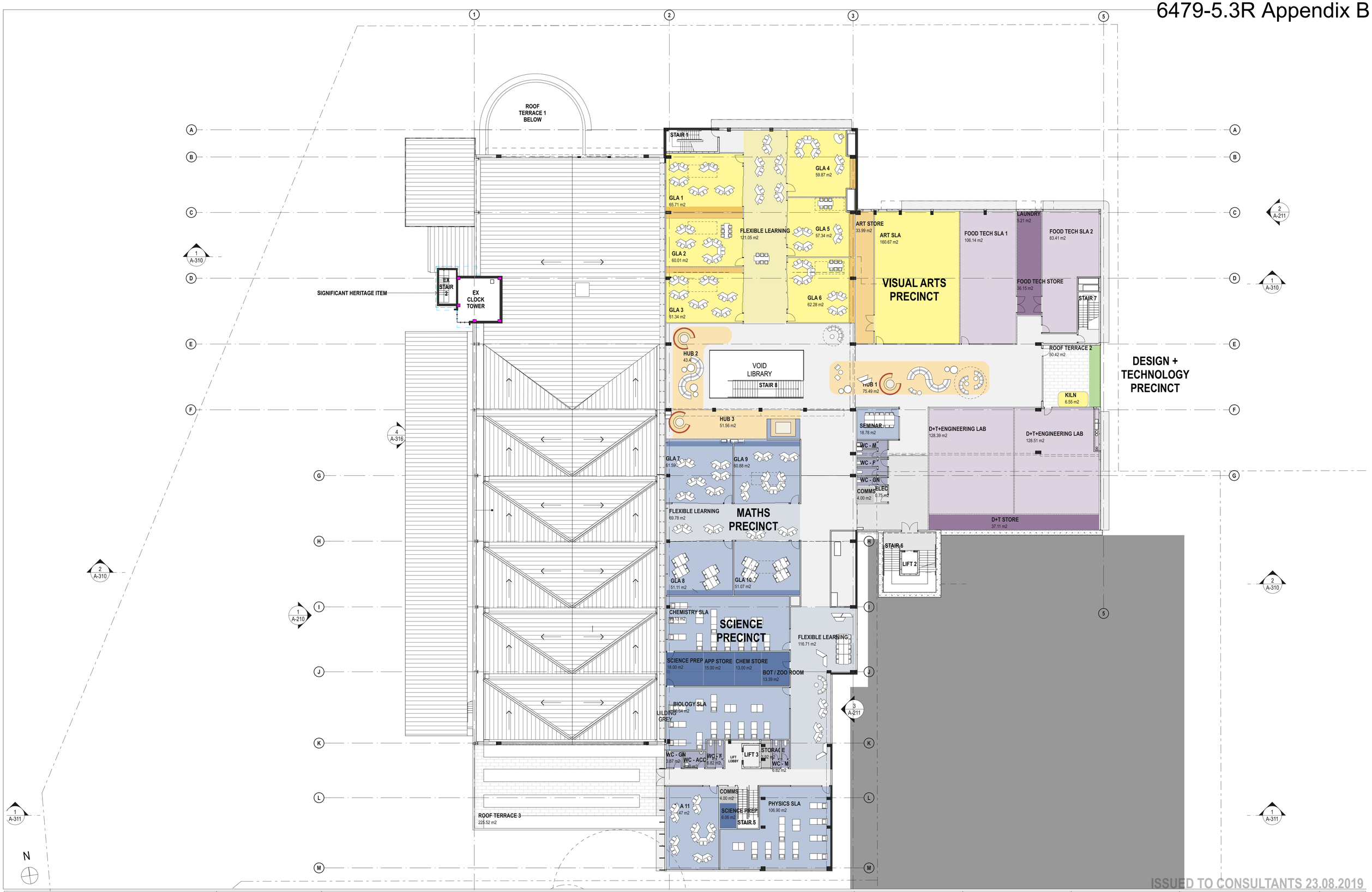
DRAWING NO A-117

DRAWN BY RM + CE + EG

CHECKED PT

DATE 23/8/19

REV



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PROJECT :
ST. LUKE'S GRAMMAR SCHOOL - NEW SENIOR SCHOOL CAMPUS

PROJECT NO : 18032

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DRAWING TITLE
800 PITTWATER ROAD
LEVEL 3 PLAN - STAGE 3_800

SCALES 1:200

PHASE SD

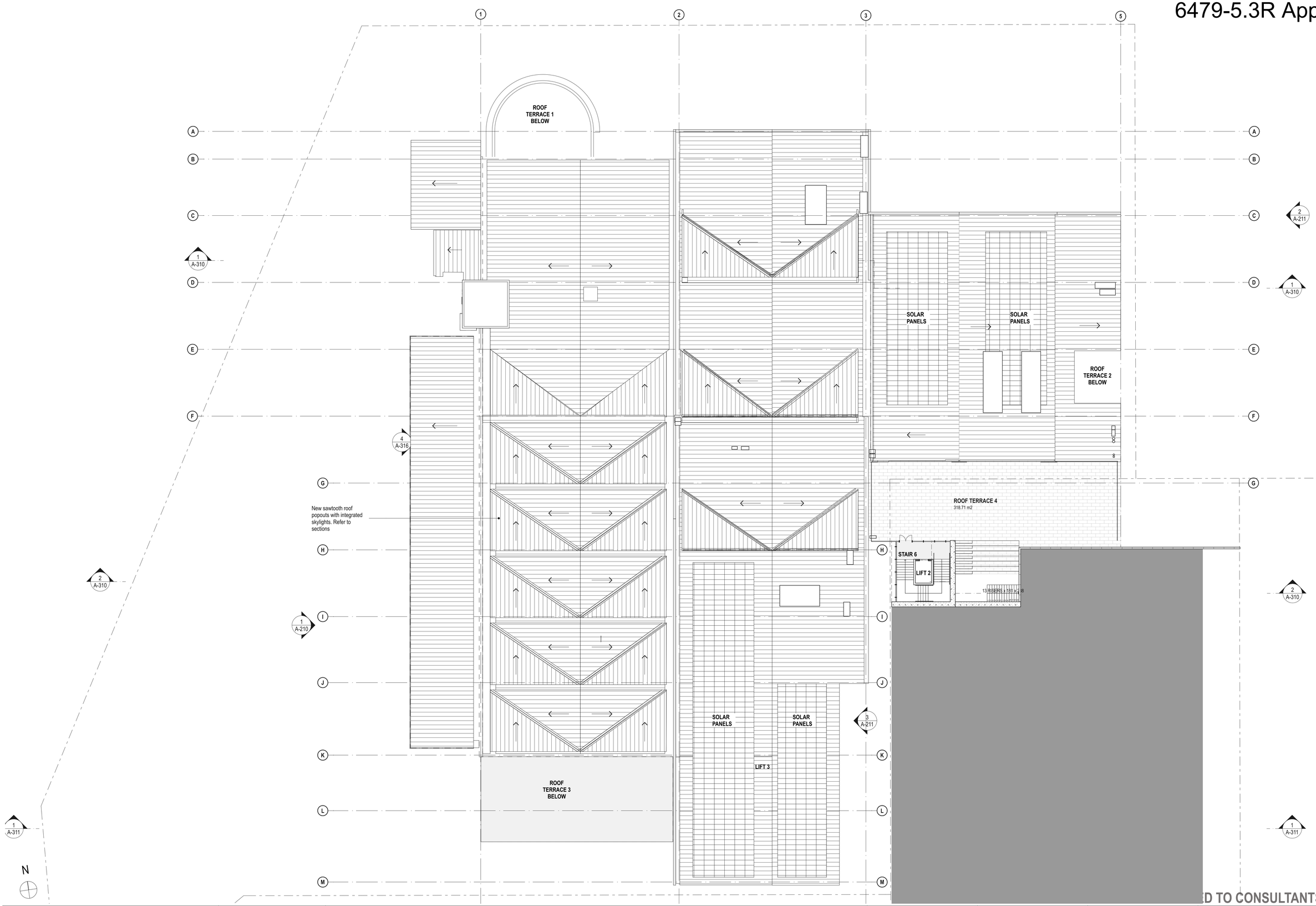
DRAWING NO A-118

REV

DRAWN BY RM + CE + EG

CHECKED PT

DATE 23/8/19



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D TO CONSULTANTS 23.08.2019

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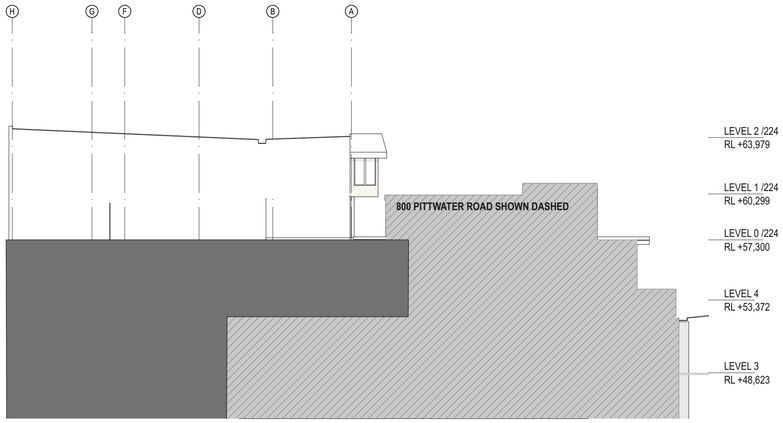
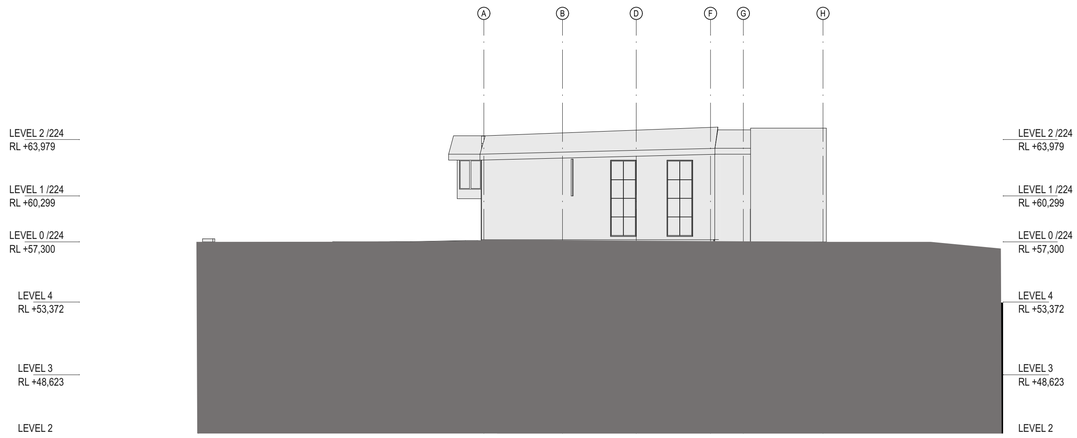
DRAWING TITLE
800 PITTWATER ROAD
LEVEL 4 PLAN - STAGE 3_800

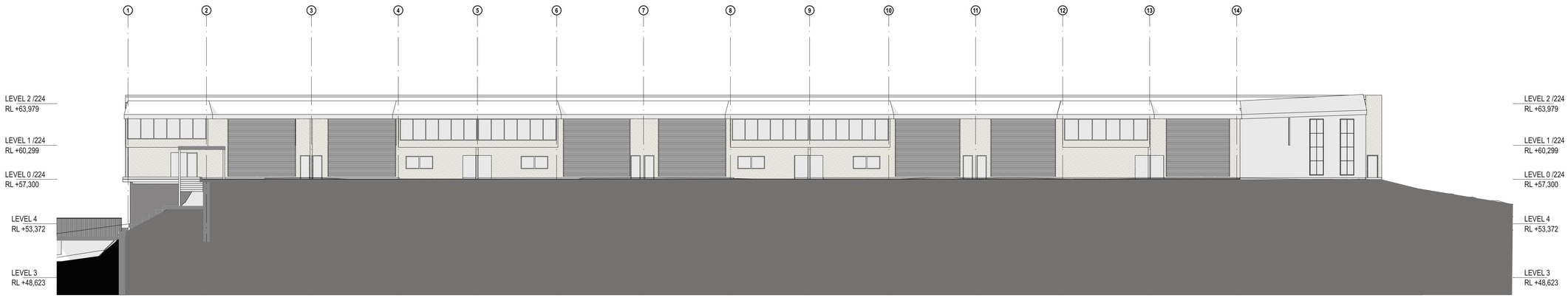
DRAWN BY RM + CE + EG
CHECKED PT
SCALES 1:200
DATE 23/8/19
PHASE SD
DRAWING NO A-119
REV



1 NORTH ELEVATION
1:200



3 SOUTH ELEVATION
1:200



2 WEST ELEVATION
1:200

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APPLICANT:
ST LUKE'S GRAMMAR SCHOOL
Mrs Jane Hughes (Business Manager)
210 Headland Road
Dee Why NSW 2099

PROJECT :
ST. LUKE'S GRAMMAR SCHOOL - NEW SENIOR SCHOOL CAMPUS
800 Pittwater Road
Dee Why NSW 2099
and
224 Headland Road
North Curl Curl NSW 2099
PROJECT NO : 18032

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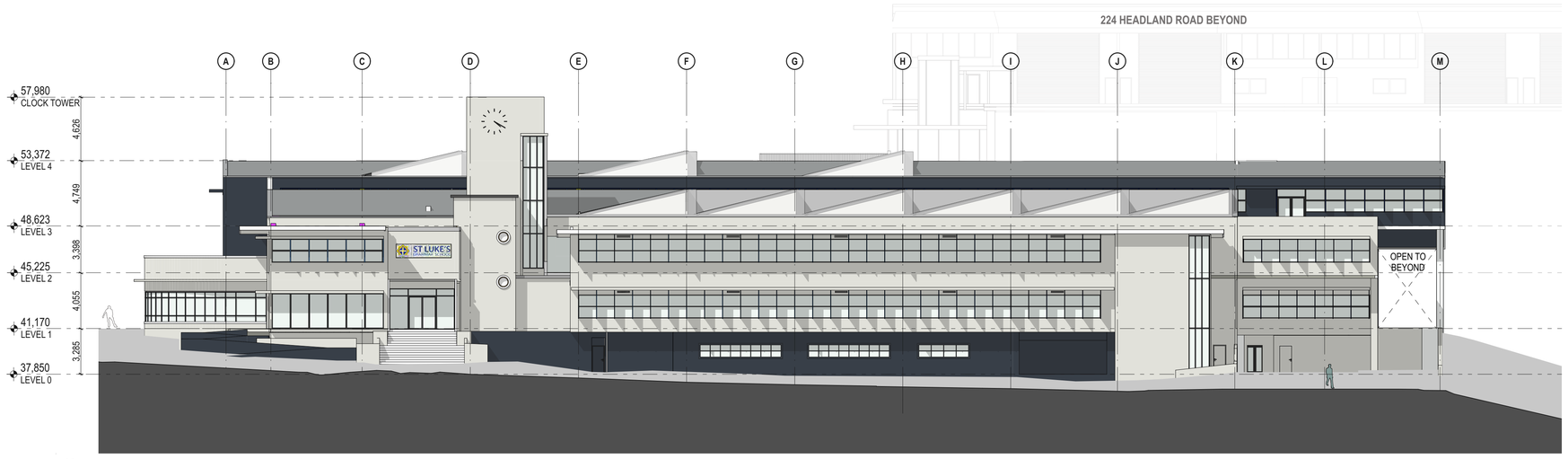
DRAWING TITLE
224 HEADLAND ROAD
ELEVATIONS_224

DRAWN BY RM + CE + EG
CHECKED PT
SCALES 1:200
DATE 23/8/19
PHASE DD
DRAWING NO A-200
REV



1 WEST ELEVATION
1:200

2 NORTH ELEVATION
1:200

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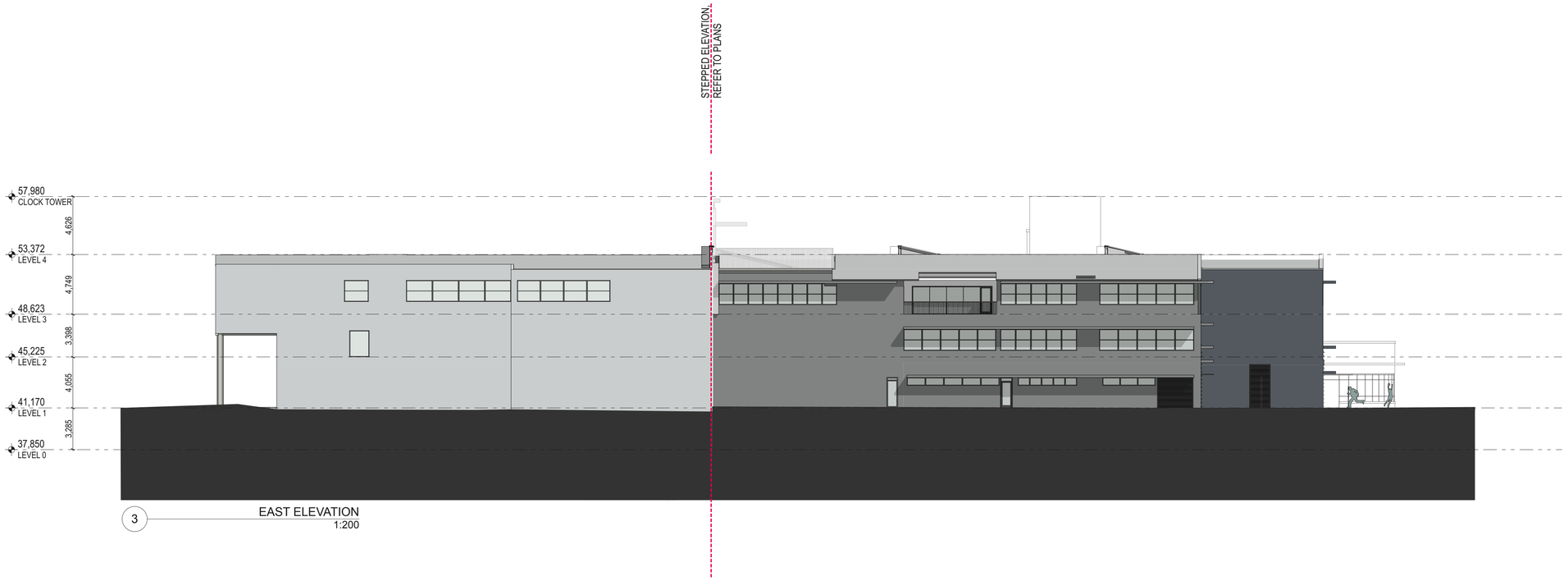
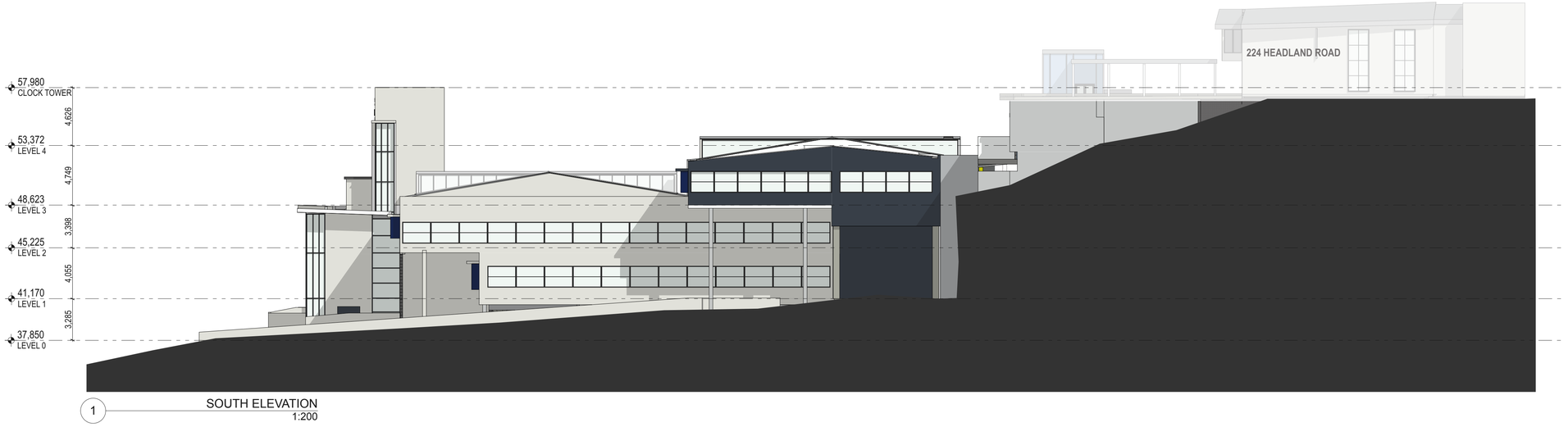
DRAWING TITLE
800 PITTWATER ROAD
ELEVATIONS WEST + NORTH_800

DRAWN BY RM + CE + EG
CHECKED PT
SCALES 1:200
DATE 23/8/19
PHASE SD
DRAWING NO A-210
REV



3 EAST ELEVATION
1:200



1 SOUTH ELEVATION
1:200

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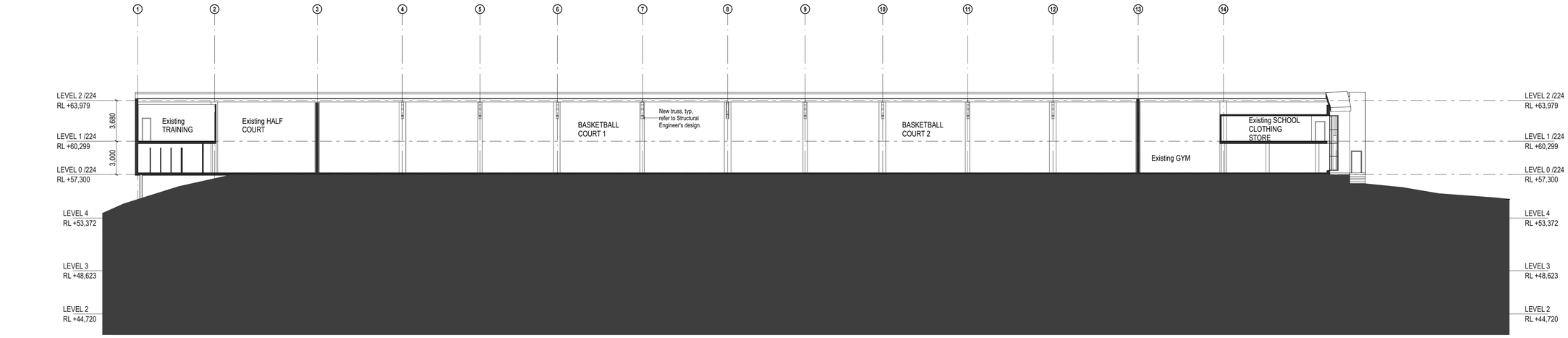
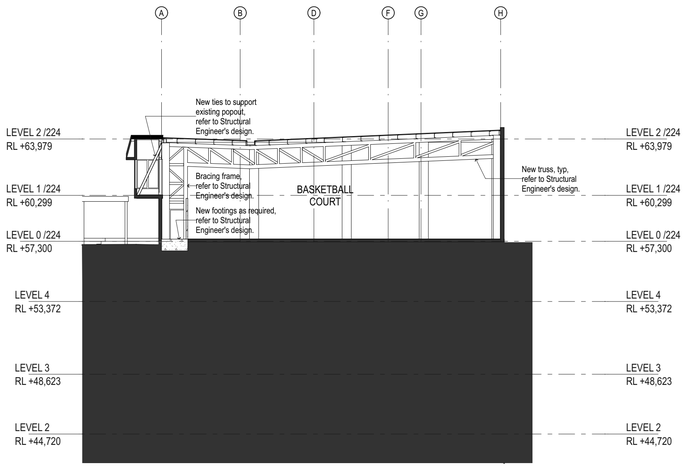
DRAWING TITLE
800 PITTWATER ROAD
ELEVATIONS EAST + SOUTH_800

DRAWN BY RM + CE + EG
CHECKED PT
SCALES 1:200
DATE 23/8/19
PHASE SD
DRAWING NO A-211
REV



1 PROPOSED N-S SECTION 1
1:200



2 PROPOSED E-W SECTION 1
1:200

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and
224 Headland Road
North Curl Curl NSW 2099
PROJECT NO : 18032
SCHOOL CAMPUS

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DRAWING TITLE
224 HEADLAND ROAD
SECTIONS 1_224

SCALES 1:200

PHASE DD

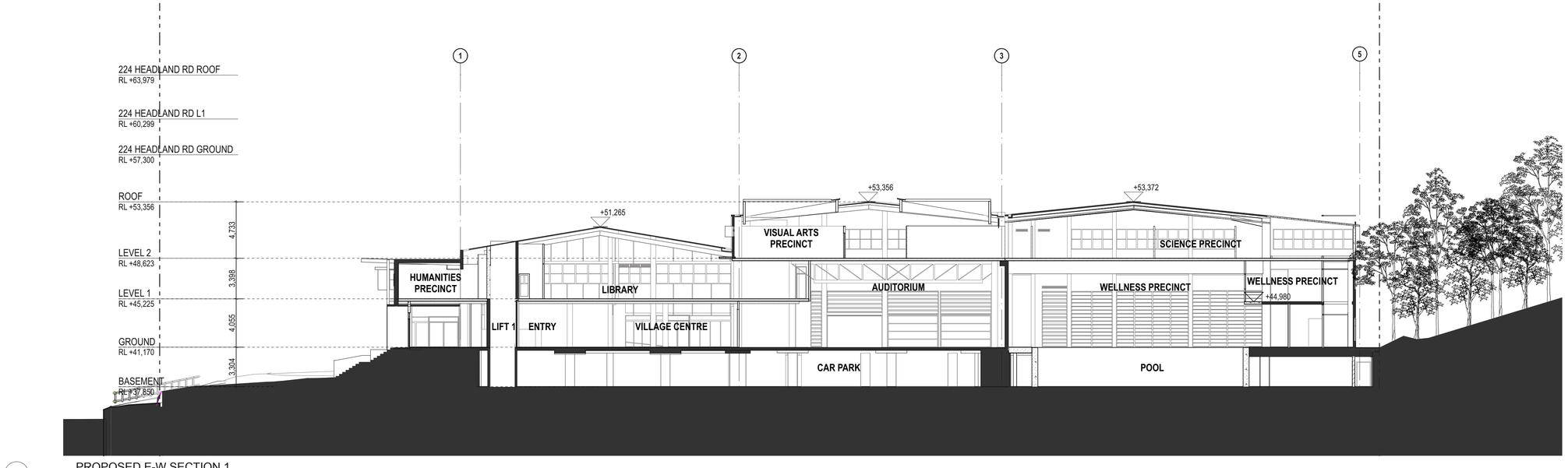
DRAWING NO A-300

DRAWN BY RM + CE + EG

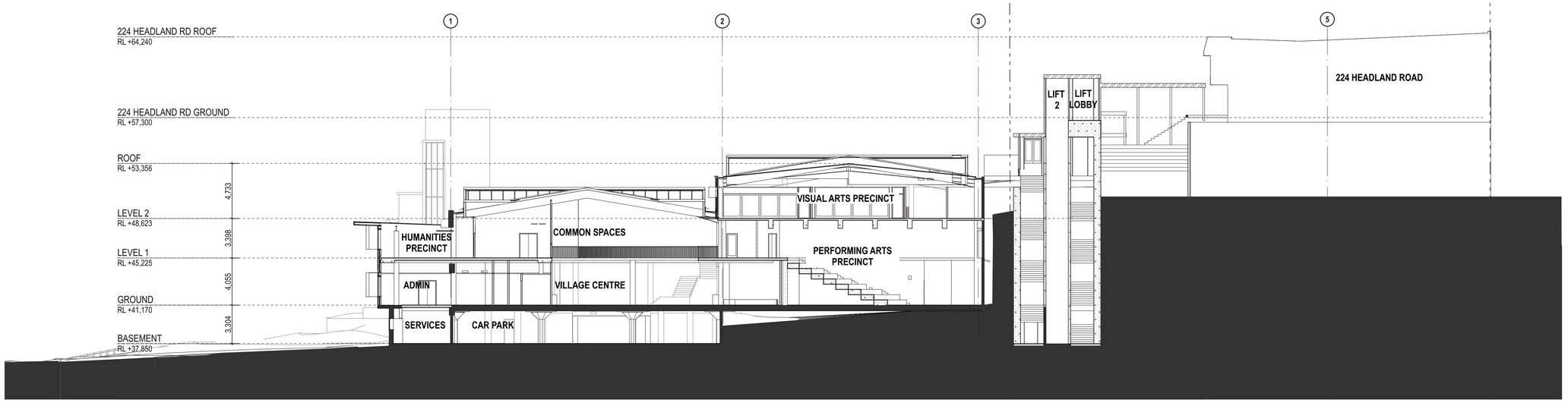
CHECKED PT

DATE 23/8/19

REV



1 PROPOSED E-W SECTION 1
1:200



2 PROPOSED E-W SECTION 2
1:200

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DRAWING TITLE
800 PITTWATER ROAD
SECTIONS 1_800

SCALES 1:200

PHASE SD

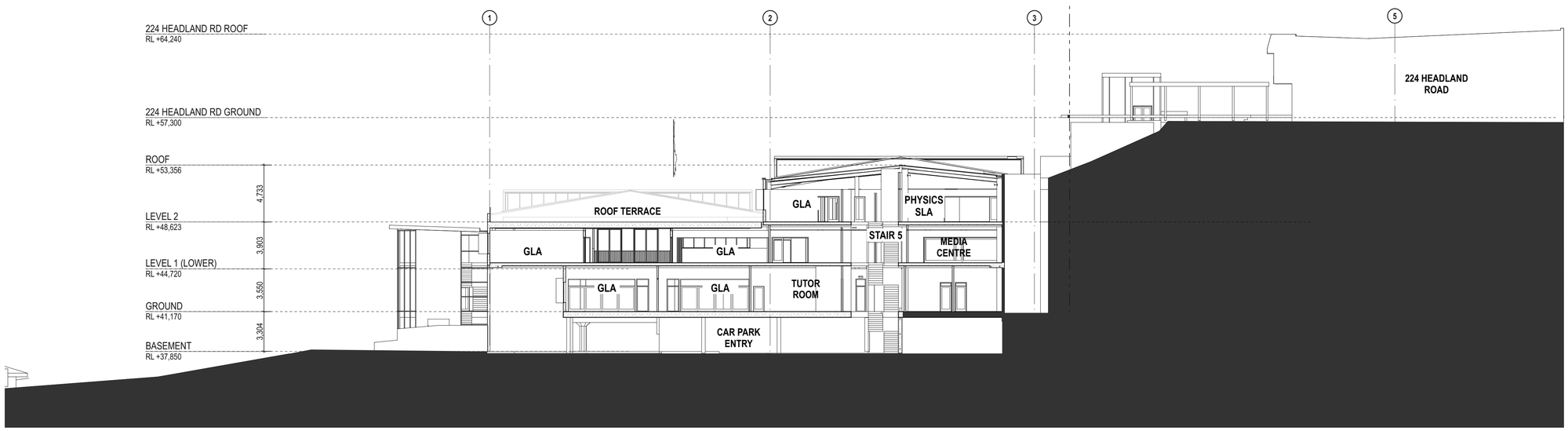
DRAWING NO A-310

DRAWN BY RM + CE + EG

CHECKED PT

DATE 23/8/19

REV



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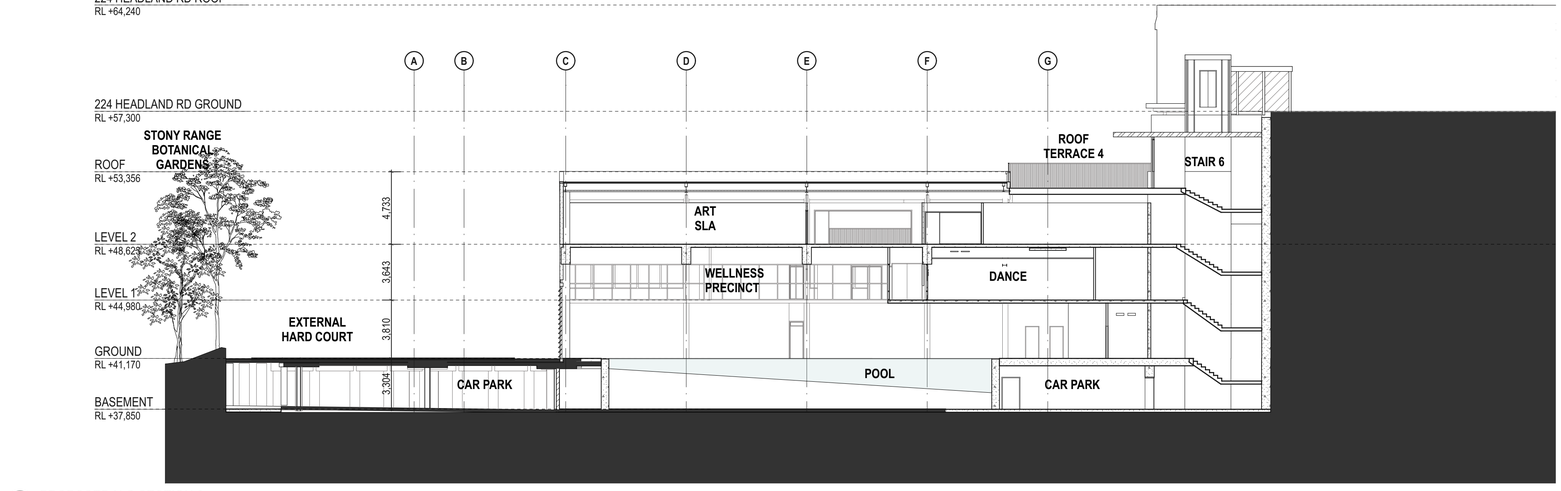
1:200



2 PROPOSED N-S SECTION 3
1:200

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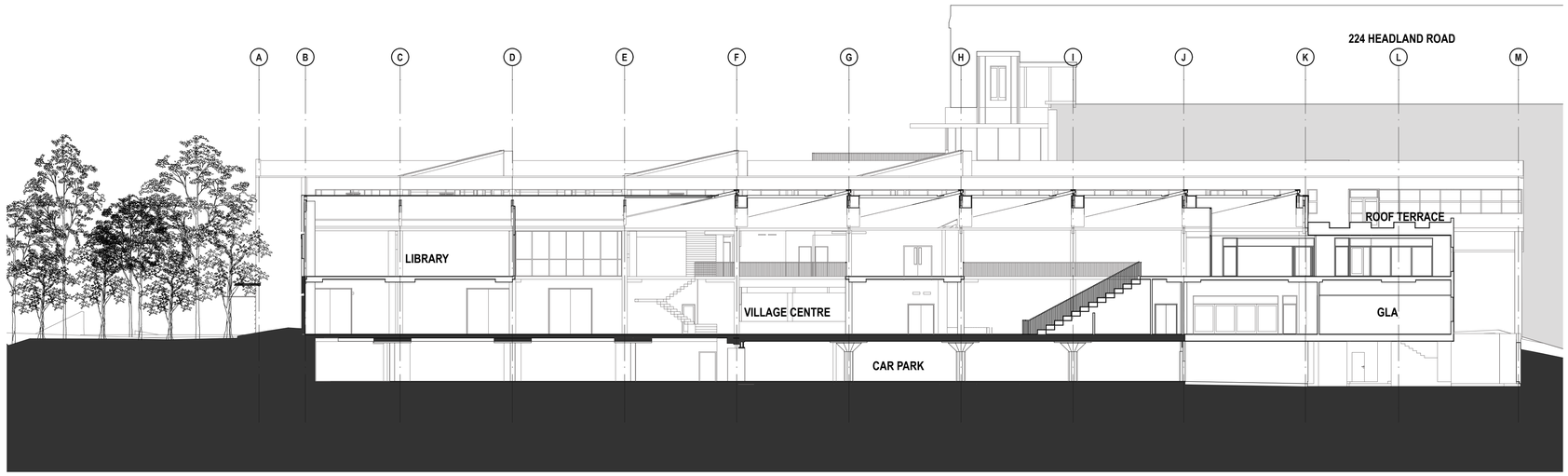
DRAWING TITLE
800 PITTWATER ROAD
SECTIONS 2_800

DRAWN BY RM + CE + EG
CHECKED PT
SCALES 1:200
DATE 23/8/19
PHASE SD
DRAWING NO A-311
REV



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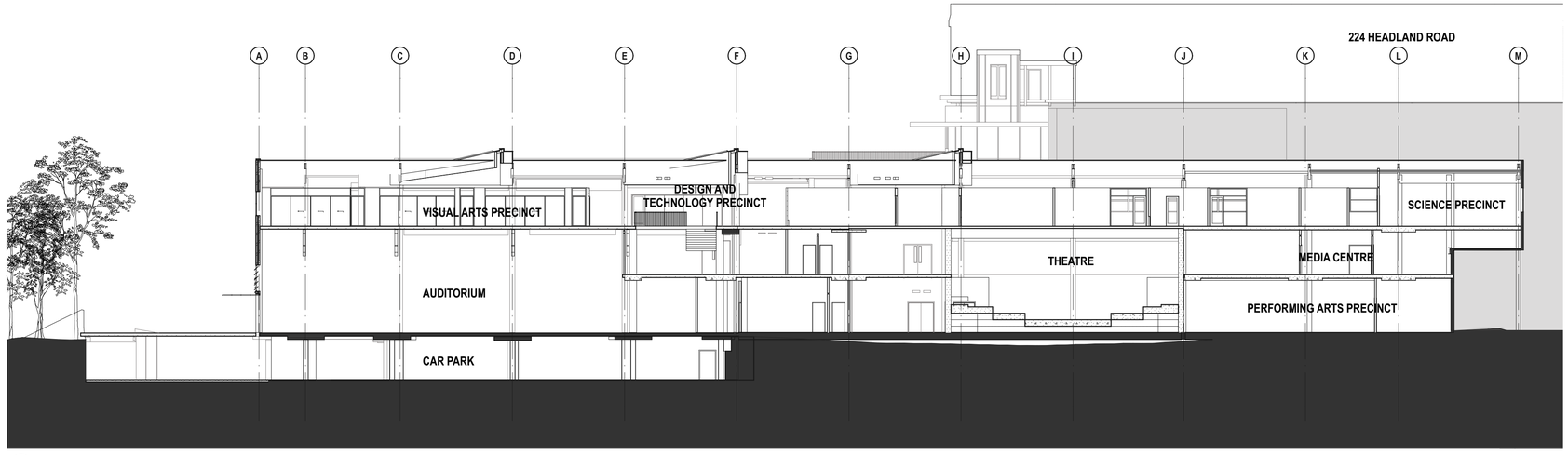

2 PROPOSED N-S SECTION 2
1:200

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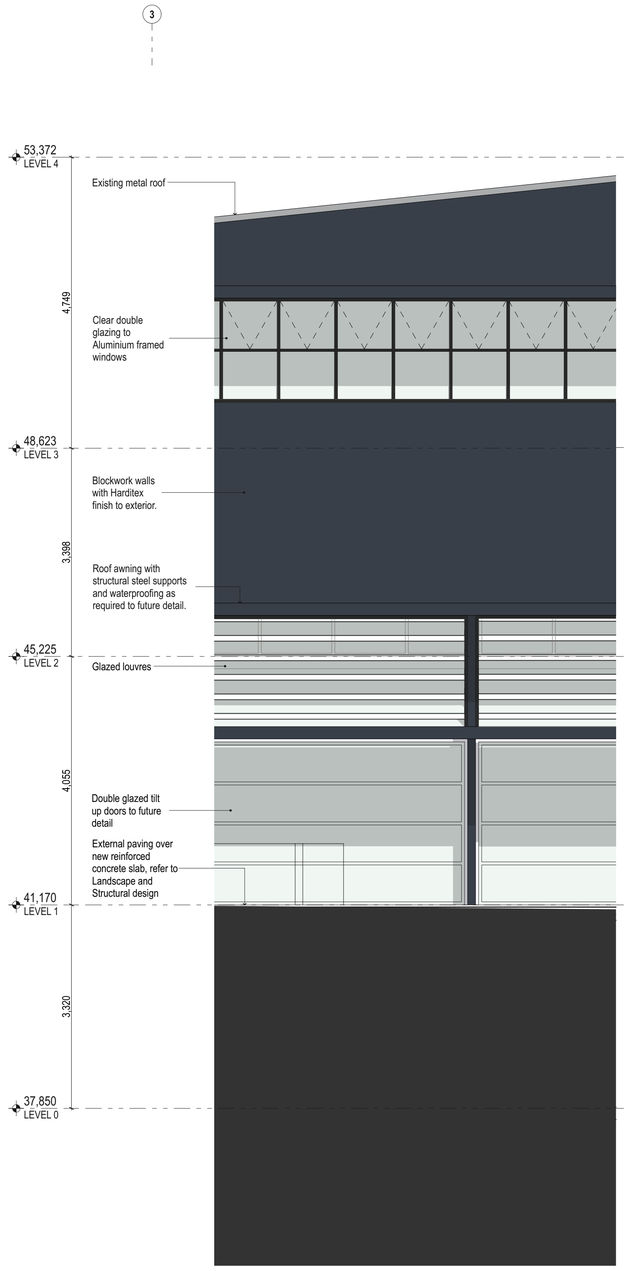
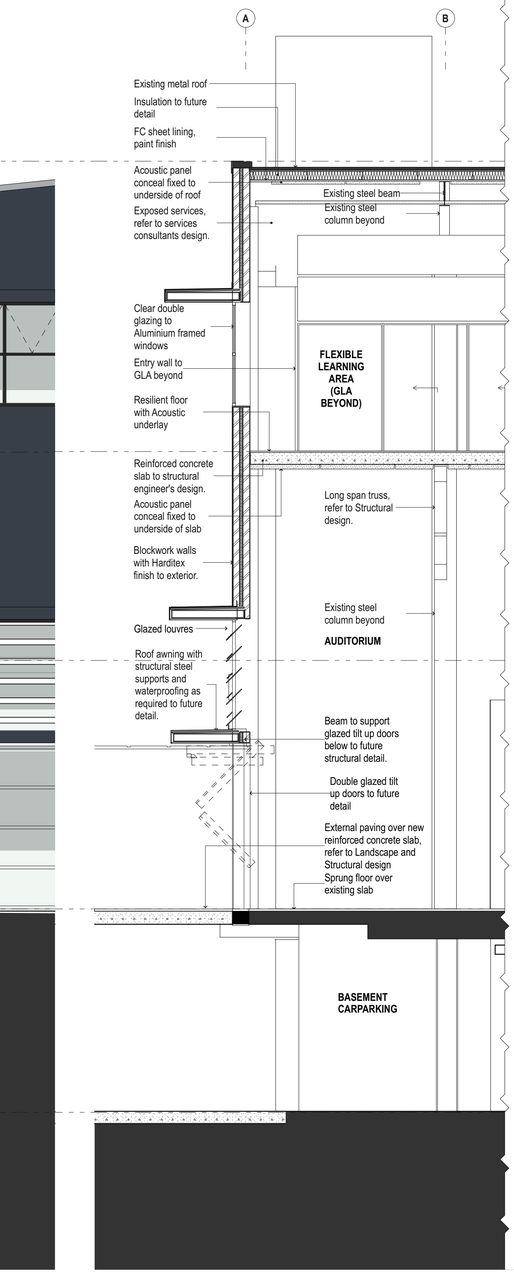
DRAWING TITLE
800 PITTWATER ROAD
SECTIONS 3_800

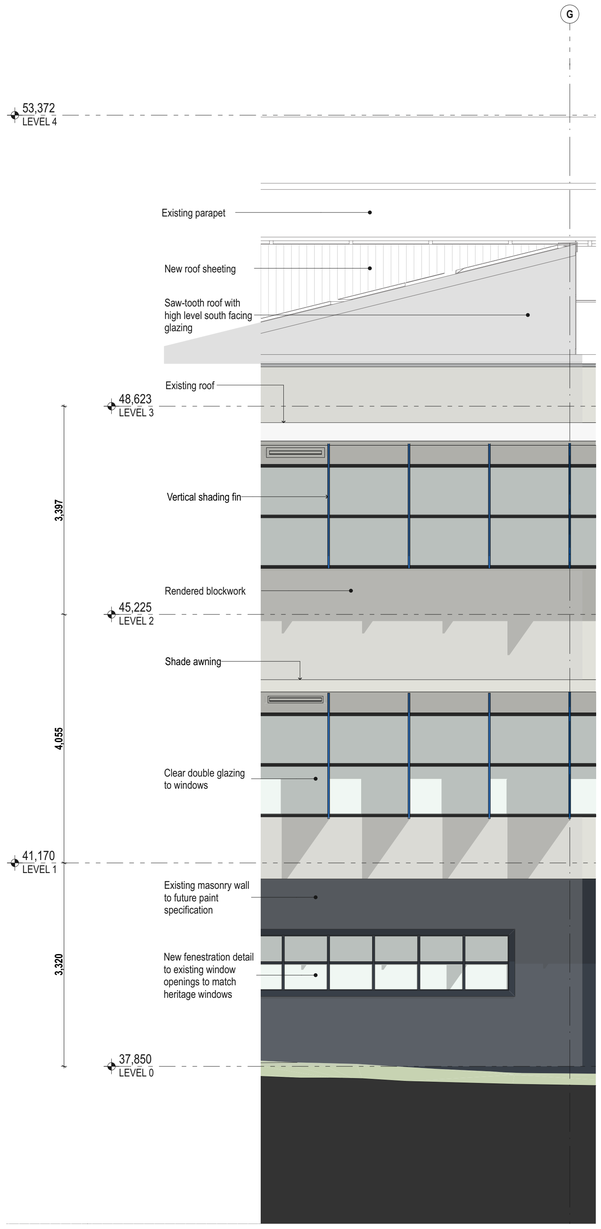
DRAWN BY RM + CE + EG
CHECKED PT
SCALES 1:200
DATE 23/8/19
PHASE SD
DRAWING NO A-312
REV



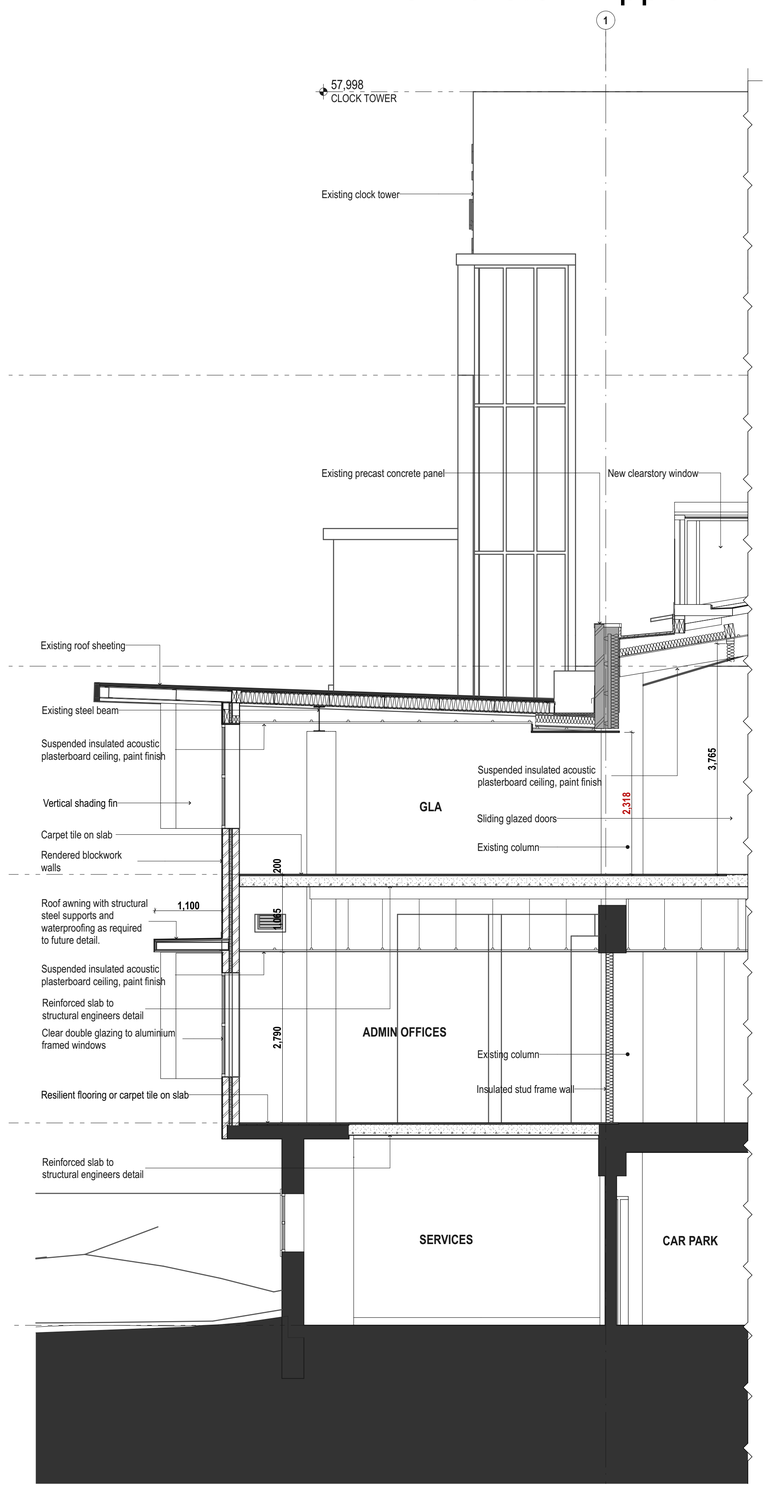
1 E1 DETAIL NORTH ELEVATION
1:50



2 NORTHERN FACADE DETAIL SECTION
1:50



4 DETAIL WEST ELEVATION
1:50



3 WESTERN FACADE DETAIL
1:50

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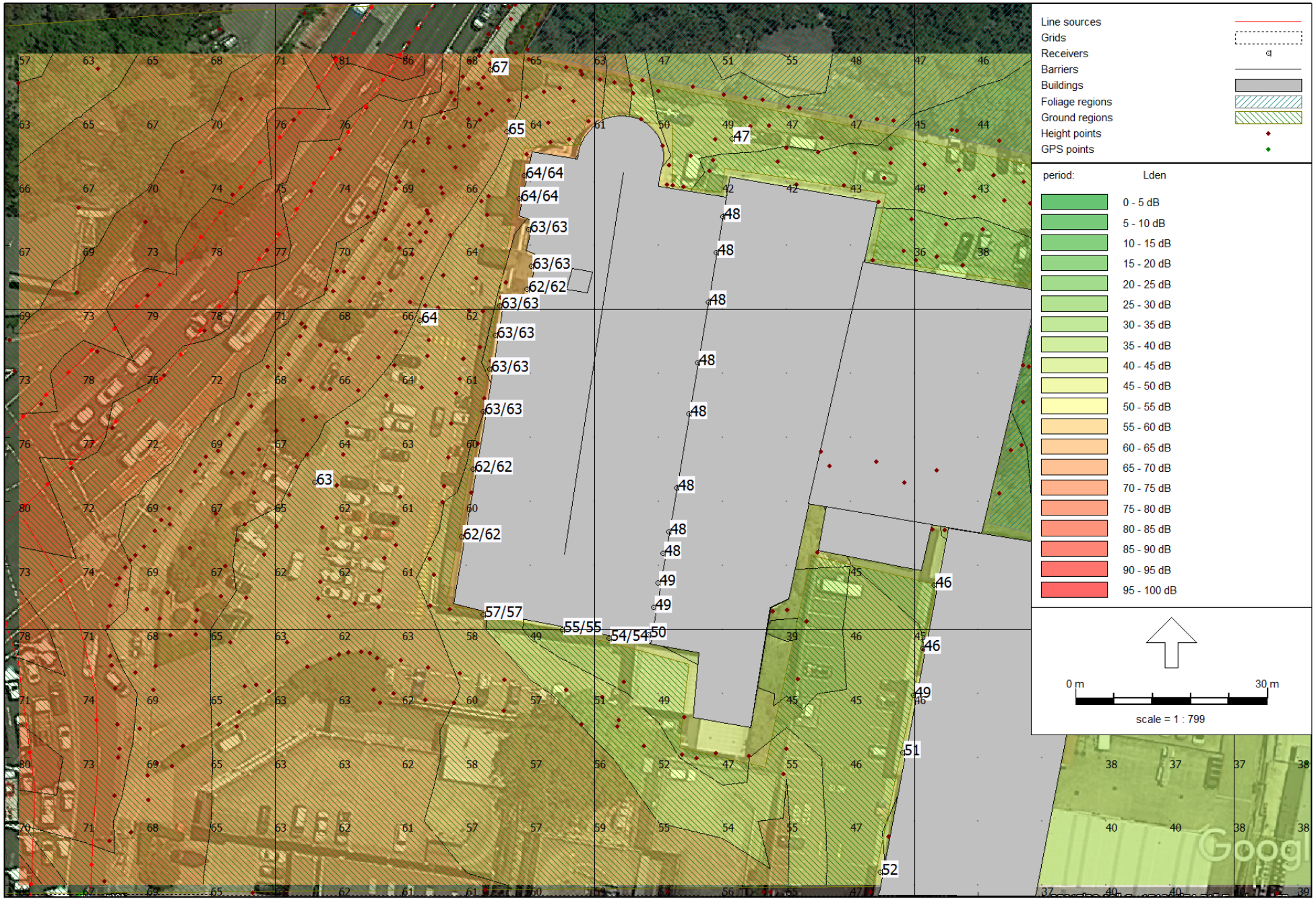
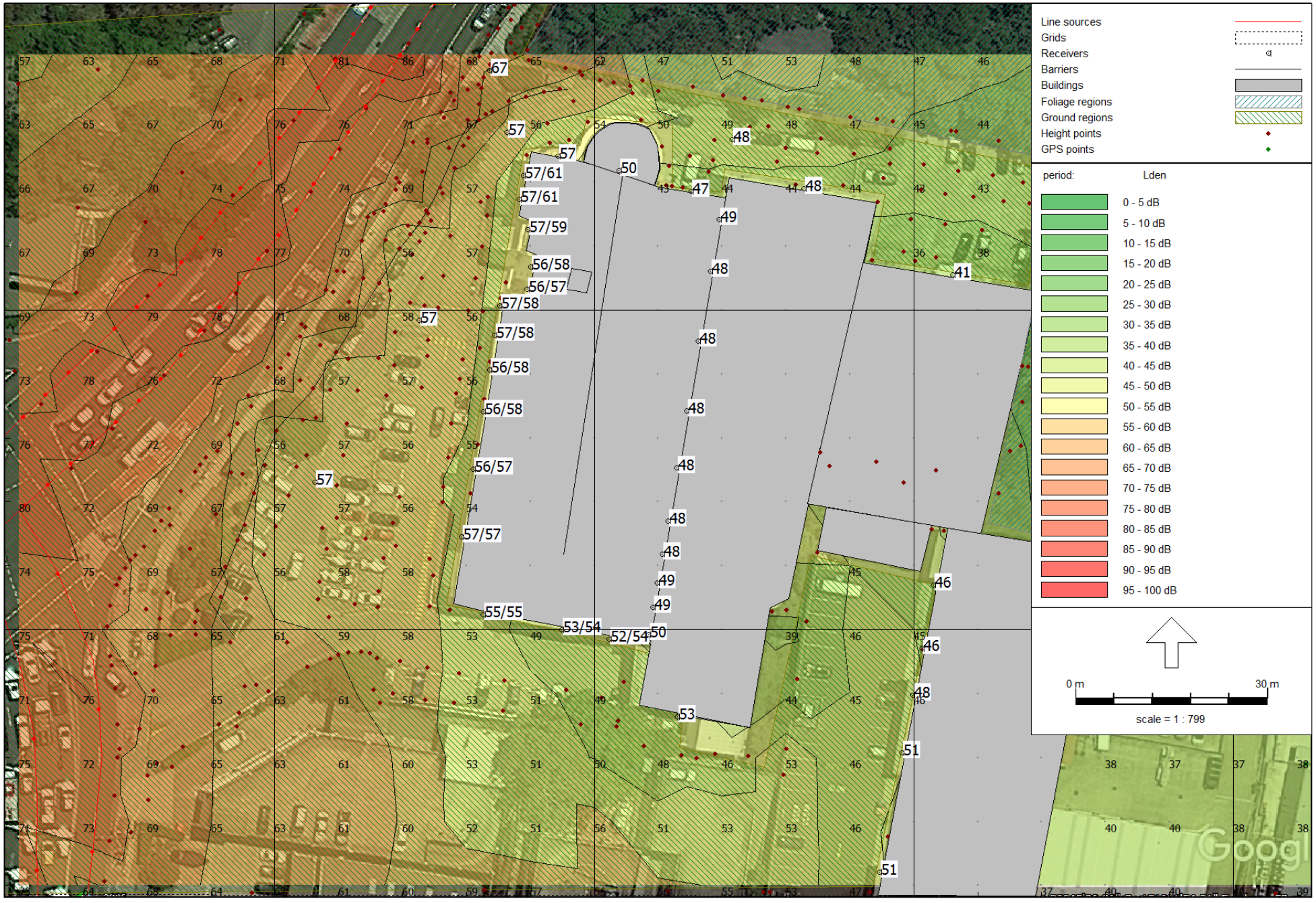
DRAWING TITLE
800 PITTWATER ROAD
TYPICAL WALL SECTIONS

DRAWN BY RM + CE + EG
CHECKED PT
SCALES 1:50
DATE 23/8/19
PHASE SD
DRAWING NO A-316
REV



Updated Building Heights and Layouts NO BARRIER
27 Sep 2019, 09:34

Adam Shearer - Day Design



Updated Building Heights and Layouts
27 Sep 2019, 11:53

Adam Shearer - Day Design

Recommended Sound Barrier Wall Location

6479-5.3R Appendix D

1.8 m Sound Barrier Wall

ACCESSIBLE PEDESTRIAN ENRTY

Existing Electrical substation to be relocated. Refer to level and consultant design.

EXTERNAL HARDCOURT 492.55 m2

GALLERY / CHAPEL HUB 81.22 m2

PUBLIC FOYER 15.00 m2

PUBLIC RECEPTION 17.45 m2

ENTRY

STAIR 1

761 SEATS SHOWN AUDITORIUM 661.75 m2 221 SEATS

314 SEATS

226 SEATS

LIFT 1

ACC WC 5.83 m2

EX STAIR 2

EX STAIR 1

STORAGE 13.41 m2

EX CLOCK TOWER

ACC WC 5.83 m2

WC - F 4.99 m2

WC - M 4.99 m2

BOARDROOM 35.00 m2

PRINCIPAL 15.00 m2

HEAD OF CAMPUS 15.00 m2

ASSISTANT HOC 15.00 m2

ADMIN OFFICE 13.62 m2

INTERVIEW 1 11.16 m2

FIRST AID 11.97 m2

IT OFFICE 17.00 m2

ADMIN

STAIR 2

STUDENT OFFICE 9.51 m2

SERVER ROOM 6.10 m2

STUDENT RECEPTION 15.00 m2

COMMS 4.00 m2

+44.720

+41.170

VILLAGE CENTRE

CAFE OFFICE 11.18 m2

WC 4.94 m2

CHAIR STORE 28.31 m2

COMMS 4.00 m2

CAFE COUNTER 19.28 m2

CAFE STORE 8.12 m2

CAFE COLD 7.70 m2

CAFE KITCHEN 54.51 m2

WC - F 22.76 m2

WC - GN 4.76 m2

CLEANERS STORE 7.95 m2

WC - M 18.66 m2

BACKSTAGE 63.29 m2

ACC WC 5.30 m2

STUDENT FOYER 47.12 m2

T.B.C 66.19 m2

STAFF WC - F 7.31 m2

STAFF WC - M 7.31 m2

STAFF COMMON ROOM 79.56 m2

STAFF KITCHEN

COPY ROOM 15.89 m2

STAIR 3

UNDER STAIR SECURE STORE 28.88 m2

ADMIN OFFICE 179.01 m2

STAFF LOUNGE 30.23 m2

STAIR 4

FLEXIBLE LEARNING 147.83 m2

GLA 1 70.06 m2

GLA 2 69.80 m2

HUB 2 32.10 m2

STORAGE 21.78 m2

TUTOR ROOM 1 15.41 m2

TUTOR ROOM 2 15.62 m2

TUTOR ROOM 3 39.47 m2

MUSIC SLA 89.76 m2

PERFORMING ARTS PRECINCT

STORAGE 5.58 m2

LIFT LOBBY

LIFT 3

WC - F 5.83 m2

WC - M 5.82 m2

WC - GN 3.20 m2

WC - A 5.30 m2

COMMS 4.00 m2

STORAGE 4.88 m2

STAIR 5

DRAMA SLA 105.66 m2

CHANGE M/F 20.28 m2

STORE 21.03 m2

THEATRE 282.85 m2 228 SEATS

25 25 25 25 25 25 25 26 27

STAIR 6

LIFT 2

WELLNESS PRECINCT

POOL 430.00 m2

POOL AREA 803.74 m2

SPECTATOR SEATING

RAMP

SPORT STORE 45.54 m2

STAIR 7

STAFF WC 13.35 m2

CHANGE F 41.21 m2

EX STAIR 3

CHANGE M 31.60 m2

ACC CHANGE 13.90 m2

ACC W/C 7.03 m2

STORAGE 10.40 m2

POOL RECEPTION 7.77 m2

BLEACHER SEATING

POOL STORE 34.22 m2

2,573 1,200 2,000 2,000 2,000 2,000 2,000 2,000 2,000 2,000 3,815

2,551 509 25,000 500 3,500 1,000 3,418

EXISTING HERITAGE BUS STOP

N

ISSUED TO CONSULTANTS 23.08.2019

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ST. LUKE'S GRAMMAR SCHOOL - NEW SENIOR SCHOOL CAMPUS

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DRAWING TITLE
800 PITTWATER ROAD
LEVEL 1 PLAN - STAGE 3_800

DRAWN BY RM + CE + EG
CHECKED PT
SCALES 1:200
DATE 23/8/19
PHASE SD
DRAWING NO A-116
REV

ACOUSTICAL – Pertaining to the science of sound, including the generation, propagation, effects and control of both noise and vibration.

AMBIENT NOISE – The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including road traffic, factories, wind in the trees, birds, insects, animals, etc.

AUDIBLE – means that a sound can be heard. However, there are a wide range of audibility grades, varying from "barely audible" to "just audible", "clearly audible" and "prominent". Chapter 83 of the NSW Environment Protection Authority – Environmental Noise Control Manual (1985) states:
"noise from a particular source might be offensive if it is clearly audible, distinct from the prevailing background noise and of a volume or character that a reasonable person would be conscious of the intrusion and find it annoying or disruptive".

It follows that the word "audible" in an environmental noise context means "clearly audible".

BACKGROUND NOISE LEVEL – Silence does not exist in the natural or the built-environment, only varying degrees of noise. The Background Noise Level is the average minimum dBA level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by cicadas, lawnmowers, etc. It is quantified by the L_{A90} or the dBA noise level that is exceeded for 90 % of the measurement period (usually 15 minutes).

- **Assessment Background Level (ABL)** is the single figure background level representing each assessment period – day, evening and night (ie three assessment background levels are determined for each 24hr period of the monitoring period). Determination of the assessment background level is by calculating the tenth percentile (the lowest tenth percent value) of the background levels (L_{A90}) for each period (refer: NSW Industrial Noise Policy, 2000).
- **Rating Background Level (RBL)** as specified by the Environment Protection Authority is the overall single figure (L_{A90}) background noise level representing an assessment period (day, evening or night) over a monitoring period of (normally) three to seven days.

  The RBL for an assessment period is the median of the daily lowest tenth percentile of L_{90} background noise levels.

  If the measured background noise level is less than 30 dBA, then the Rating Background Level (RBL) is considered to be 30 dBA.

DECIBEL – The human ear has a vast sound-sensitivity range of over a thousand billion to one. The decibel is a logarithmic unit that allows this same range to be compressed into a somewhat more comprehensible range of 0 to 120 dB. The decibel is ten times the logarithm of the ratio of a sound level to a reference sound level. See also Sound Pressure Level and Sound Power Level.

Decibel noise levels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dBA, and another similar machine is placed beside it, the level will increase to 53 dBA, not 100 dBA. Ten similar machines placed side by side increase the sound level by 10 dBA, and one hundred machines increase the sound level by 20 dBA.

dBA – The human ear is less sensitive to low frequency sound than high frequency sound. We are most sensitive to high frequency sounds, such as a child's scream. Sound level meters have an inbuilt weighting network, termed the dBA scale, that approximates the human loudness response at quiet sound levels (roughly approximates the 40 phon equal loudness contour).

However, the dBA sound level provides a poor indication of loudness for sounds that are dominated by low frequency components (below 250 Hz). If the difference between the "C" weighted and the "A" weighted sound level is 15 dB or more, then the NSW Industrial Noise Policy recommends a 5 dBA penalty be applied to the measured dBA level.

dBC – The dBC scale of a sound level meter is similar to the dBA scale defined above, except that at high sound intensity levels, the human ear frequency response is more linear. The dBC scale approximates the 100 phon equal loudness contour.

EQUIVALENT CONTINUOUS NOISE LEVEL, L_{Aeq} – Many noises, such as road traffic or construction noise, vary continually in level over a period of time. More sophisticated sound level meters have an integrating electronic device inbuilt, which average the A weighted sound pressure levels over a period of time and then display the energy average or L_{Aeq} sound level. Because the decibel scale is a logarithmic ratio the higher noise levels have far more sound energy, and therefore the L_{Aeq} level tends to indicate an average which is strongly influenced by short term, high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closely to the L_{Aeq} noise level.

FREE FIELD – This is a sound field not subject to significant reflection of acoustical energy. A free field over a reflecting plane is usually outdoors with the noise source resting on hard flat ground, and not closer than 6 metres to any large flat object such as a fence or wall; or inside an anechoic chamber.

FREQUENCY – The number of oscillations or cycles of a wave motion per unit time, the SI unit being the Hertz, or one cycle per second.

IMPACT ISOLATION CLASS (IIC) – The American Society for Testing and Materials (ASTM) has specified that the IIC of a floor/ceiling system shall be determined by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The IIC is a number found by fitting a reference curve to the measured octave band levels and then deducting the sound pressure level at 500 Hz from 110 decibels. Thus the higher the IIC, the better the impact sound isolation.

IMPACT SOUND INSULATION ($L_{nT,w}$) – Australian Standard AS ISO 717.2 – 2004 has specified that the Impact Sound Insulation of a floor/ceiling system be quantified by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The Weighted Standardised Impact Sound Pressure Level ($L_{nT,w}$) is the sound pressure level at 500 Hz for a reference curve fitted to the measured octave band levels. Thus the lower $L_{nT,w}$ the better the impact sound insulation.

IMPULSE NOISE – An impulse noise is typified by a sudden rise time and a rapid sound decay, such as a hammer blow, rifle shot or balloon burst.

INTRUSIVE NOISE LEVEL, L_{Aeq} – The level of noise from a factory, place of entertainment, etc. in NSW is assessed on the basis of the average maximum noise level, or the $L_{Aeq\ (15\ min)}$. This is the energy average A weighted noise level measured over any 15 minute period.

LOUDNESS – The degree to which a sound is audible to a listener is termed the loudness. The human ear perceives a 10 dBA noise level increase as a doubling of loudness and a 20 dBA noise increase as a quadrupling of the loudness.

MAXIMUM NOISE LEVEL, L_{Amax} – The rms maximum sound pressure level measured on the "A" scale of a sound level meter during a noise survey is the L_{Amax} noise level. It may be measured using either the Fast or Slow response time of the meter. This should be stated.

NOISE RATING NUMBERS – A set of empirically developed equal loudness curves has been adopted as Australian Standard AS1469-1983. These curves allow the loudness of a noise to be described with a single NR number. The Noise Rating number is that curve which touches the highest level on the measured spectrum of the subject noise. For broadband noise such as fans and engines, the NR number often equals the dBA level minus five.

NOISE – Noise is unwanted sound. Sound is wave motion within matter, be it gaseous, liquid or solid. "Noise includes sound and vibration".

NOISE REDUCTION COEFFICIENT – See: "Sound Absorption Coefficient".

OFFENSIVE NOISE - (Reference: Dictionary of the Protection of the Environment Operations Act 1997). *"Offensive Noise means noise:*

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or likely to be harmful to) a person who is outside the premise from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances prescribed by the regulations."

PINK NOISE – Pink noise is a broadband noise with an equal amount of energy in each octave or third octave band width. Because of this, Pink Noise has more energy at the lower frequencies than White Noise and is used widely for Sound Transmission Loss testing.

REVERBERATION TIME, T_{60} – The time in seconds, after a sound signal has ceased, for the sound level inside a room to decay by 60 dB. The first 5 dB decay is often ignored, because of fluctuations that occur while reverberant sound conditions are being established in the room. The decay time for the next 30 dB is measured and the result doubled to determine the T_{60}. The Early Decay Time (EDT) is the slope of the decay curve in the first 10 dB normalised to 60 dB.

SOUND ABSORPTION COEFFICIENT, α – α Sound is absorbed in porous materials by the viscous conversion of sound energy to heat energy as the sound waves pass through it. Sound is similarly absorbed by the flexural bending of internally damped panels. The fraction of incident energy that is absorbed is termed the Sound Absorption Coefficient, α. An absorption coefficient of 0.9 indicates that 90 % of the incident sound energy is absorbed. The average α from 250 to 2000 Hz is termed the Noise Reduction Coefficient (NRC).

SOUND ATTENUATION – If an enclosure is placed around a machine, or a silencer is fitted to a duct, the noise emission is reduced or attenuated. An enclosure that attenuates the noise level by 30 dBA, reduces the sound energy by one thousand times.

SOUND EXPOSURE LEVEL (SEL) – The total sound energy of a single noise event condensed into a one second duration or in other words it is an L_{eq} (1 sec).

SOUND PRESSURE LEVEL, L_p – The level of sound measured on a sound level meter and expressed in decibels, dB, dBA, dBC, etc. $L_p = 20 \times \log (P/P_o)$ ... dB

where P is the rms sound pressure in Pascal and P_o is a reference sound pressure of 20 µPa. L_p varies with distance from a noise source.

SOUND POWER LEVEL, L_w – The Sound Power Level of a noise source is an absolute that does not vary with distance or with a different acoustic environment.

$L_w = L_p + 10 \log A$ ... dB, re: 1pW,
where A is the measurement noise-emission area in square metres in a free field.

SOUND TRANSMISSION CLASS (STC) – An internationally standardised method of rating the sound transmission loss of partition walls to indicate the decibels of noise reduction of a human voice from one side to the other. (Refer: Australian Standard AS1276 – 1979)

SOUND TRANSMISSION LOSS – The amount in decibels by which a random sound is reduced as it passes through a sound barrier. A method for the measurement of airborne Sound Transmission Loss of a building partition is given in Australian Standard AS1191 - 2002.

STATISTICAL EXCEEDENCE SOUND LEVELS, L_{A90}, L_{A10}, L_{A1}, etc – Noise which varies in level over a specific period of time (usually 15 minutes) may be quantified in terms of various statistical descriptors:

The L_{A90} is the dBA level exceeded for 90 % of the time. In NSW the L_{A90} is measured over periods of 15 minutes, and is used to describe the average minimum or background noise level.

The L_{A10} is the dBA level that is exceeded for 10 % of the time. In NSW the L_{A10} measured over a period of 10 to 15 minutes. It was until recently used to describe the average maximum noise level, but has largely been replaced by the L_{Aeq} for describing level-varying noise.

The L_{A1} is the dBA level that is exceeded for 1 % of the time. In NSW the L_{A1} may be used for describing short-term noise levels such as could cause sleep arousal during the night.

STEADY NOISE – Noise, which varies in level by 6 dBA or less, over the period of interest with the time-weighting set to "Fast", is considered to be "steady". (Refer AS 1055.1 1997)

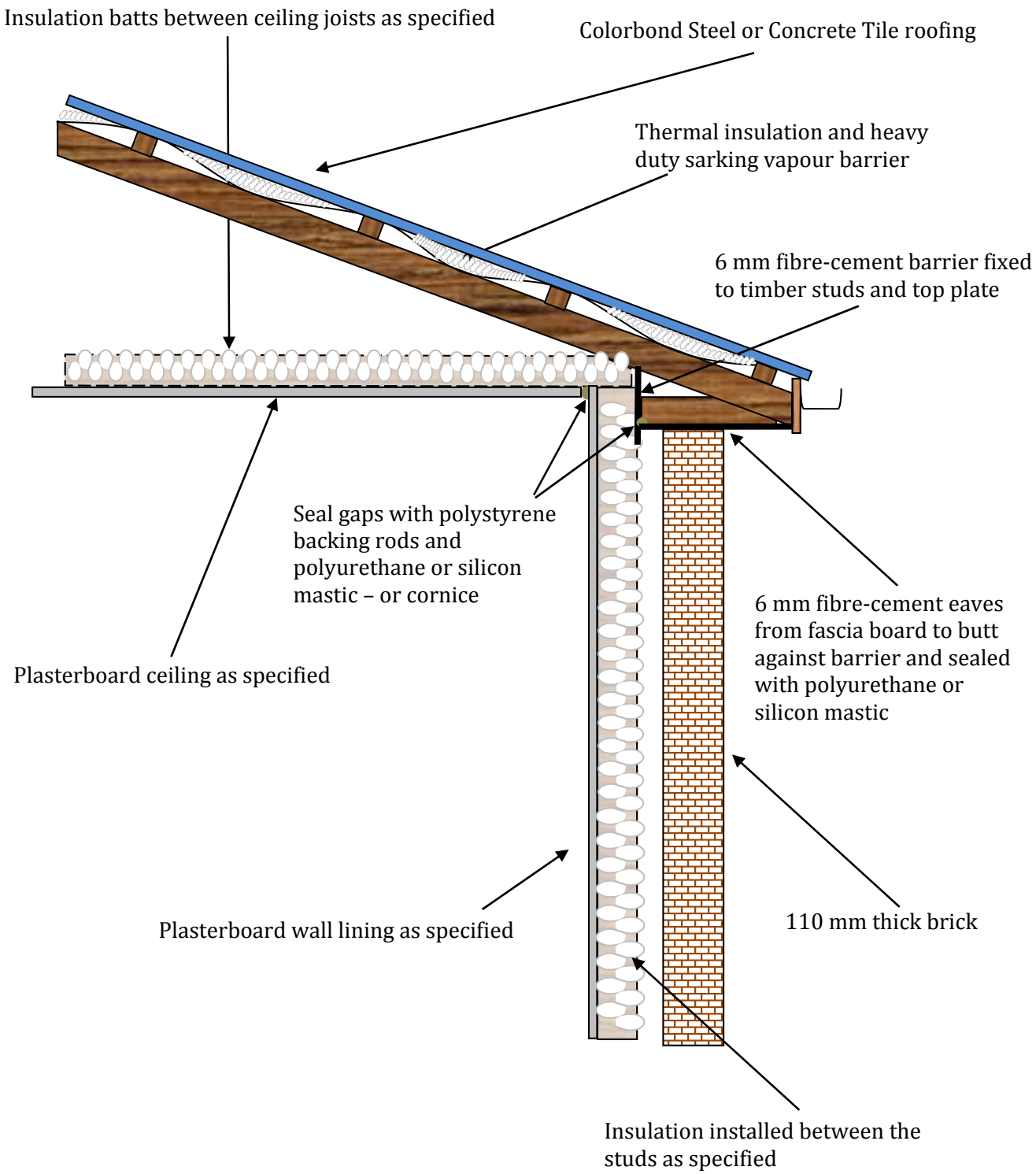
WEIGHTED SOUND REDUCTION INDEX, R_w – This is a single number rating of the airborne sound insulation of a wall, partition or ceiling. The sound reduction is normally measured over a frequency range of 100 to 3,150 Hertz and averaged in accordance with ISO standard weighting curves (Refer AS/NZS 1276.1:1999).

Internal partition wall $R_w + C$ ratings are frequency weighted to simulate insulation from human voice noise. The $R_w + C$ is always similar in value to the STC rating value. External walls, doors and windows may be $R_w + C_{tr}$ rated to simulate insulation from road traffic noise. This is normally a lower number than the STC rating value.

WHITE NOISE – White noise is broadband random noise whose spectral density is constant across its entire frequency range. The sound power is the same for equal bandwidths from low to high frequencies. Because the higher frequency octave bands cover a wider spectrum, white noise has more energy at the higher frequencies and sounds like a hiss.

External Wall, Roof and Ceiling Acoustical Detail – Brick Veneer

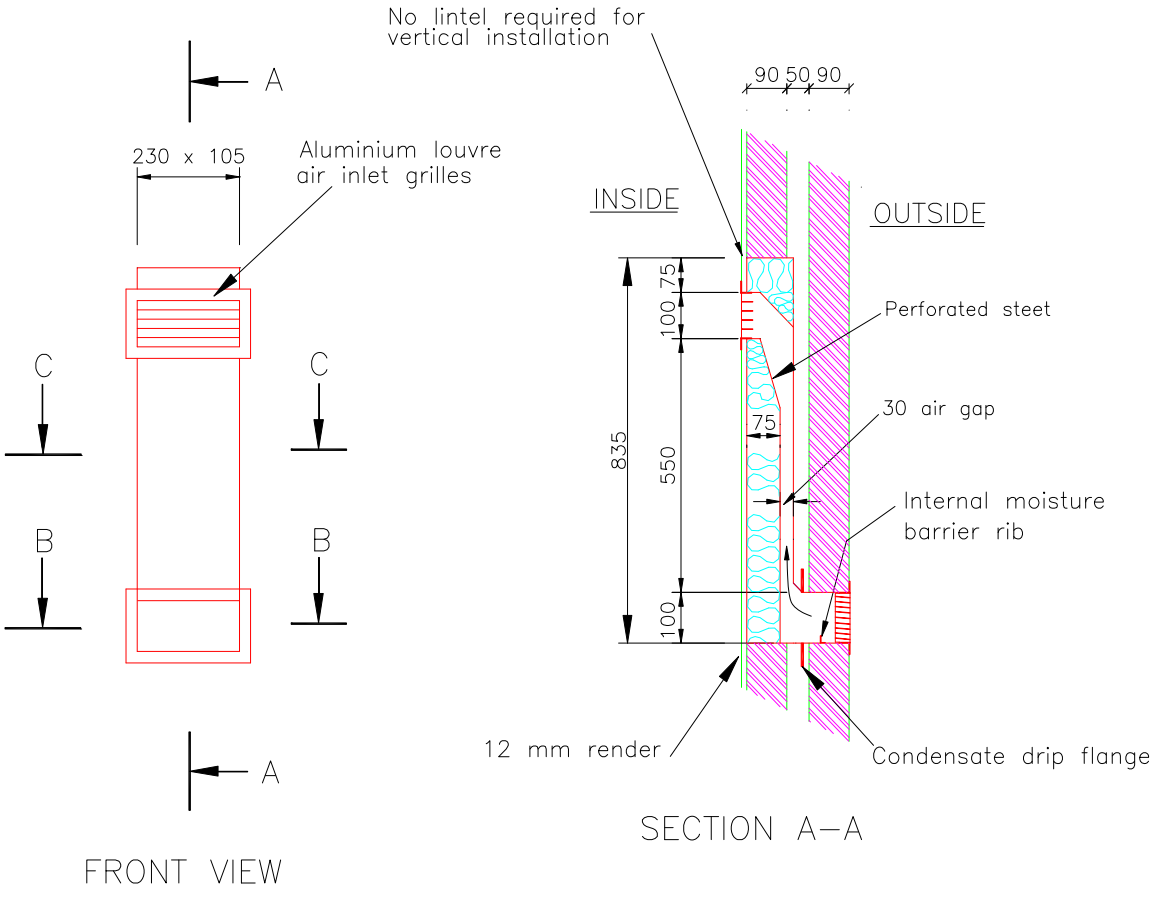
AC806-MH

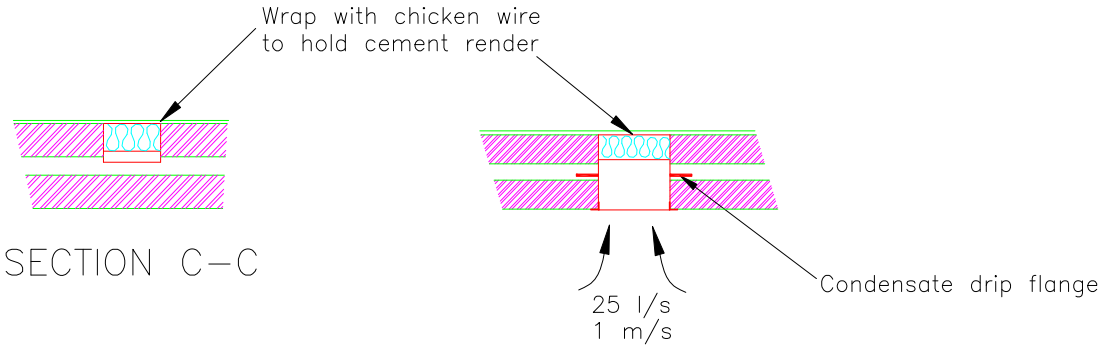


Date: 17 April 2014
Drawn by: MH

SILENCED AIR RELIEF INTAKE
AIR DUCT SINGLE OUTLET

AC810-6B





NOTES

1. Air Intake Silencer 1.6mm galv. steel casing Not less than 32kg/m^3 density 75mm fibreglass wool insulation faced with 0.6mm 25% open area perforated galv. steel.
2. Duct to built into wall with no air gaps between bricks and duct.
3. Duct may be mounted vertically or horizontally