

105 MILLER STREET

PROPOSED DEVELOPMENT IMPACTS FROM SYDNEY METRO INFRASTRUCTURE STRUCTURAL REPORT

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PROPOSED DEVELOPMENT IMPACTS FROM SYDNEY METRO INFRASTRUCTURE - STRUCTURAL REPORT

PROJECT: 105 Miller Street

Project No: PS214031

Prepared for: Investa Property Group

Rev	Date	Purpose of Issue / Nature of Revision	Prepared by	Reviewed by	Issue Authorised by
A	02/07/2025	For Information	DS	TBB	TBB

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1 Executive Summary

WSP has been commissioned by Investa Property Group to act as the structural engineer for the proposed development at 105 Miller Street, North Sydney. This development is adjacent to a Sydney Metro Infrastructure asset, namely the Victoria Cross Station and the Sydney Metro City & Southwest Rail Line.

Following the development application submitted by Investa and subsequent review, Sydney Metro submitted an RFI (dated 25/05/2025) requesting clarification on several items in order to make a decision on granting concurrence. This report and the associated structural drawings address items a. (structural component), b. and c. of this RFI as referenced below:

Following this review, Sydney Metro advises that it is not in a position to make a decision on the granting of concurrence until the additional information outlined below is provided for Sydney Metro's further review:

- (a) *Geotechnical and structural reports/drawings that meet the Standards and requirements of Sydney Metro. The geotechnical report must be based on actual borehole testing conducted on the portion of the site that is closest to the rail corridor and include:*
 - i. *an analysis of the potential impact of demolition, excavation and operation of the development;*
 - ii. *demolition and excavation induced vibration impacts on the rail corridor and rail infrastructure; and*
 - iii. *potential loadings of the development on the rail corridor and rail infrastructure.*
- (b) *Structural design documentation for the development which demonstrates that:*
 - i. *the foundation design ensures that all loads from the development are transferred and have no adverse impacts on the rail corridor, rail infrastructure, rail easements, station assets or assets associated with integrated station development;*
 - ii. *any deformation induced by bulk excavation will not have adverse impacts on the rail corridor, rail infrastructure or rail easements.*
- (c) *Plan and cross sectional drawings showing:*
 - i. *the rail corridor*
 - ii. *Victoria Cross Metro Station and ISD assets*
 - iii. *sub soil profile*
 - iv. *proposed excavation, including drainage pits*
 - v. *proposed basement and/or foundation excavation, and*
 - vi. *structural design of the development's sub-ground support adjacent to the rail corridor.*

All other requirements forming part of the RFI are covered in other reports.

Specifically, and related to the structural system of the proposed development and the associated loads, the following reports form part of Investa's overall submission to Metro.

- Geotechnical assessment report (Douglas Partners)
- Structural assessment on Tunnel liner (WSP)
- Risk assessment report (WSP)

2 Building Overview

The address of the site is 105-153 Miller Street, North Sydney and is legally described as Lot 2 in DP 792740. The site sits in the heart of the North Sydney Central Business District (CBD), immediately south of the Victoria Cross Metro Station and in walking distance of the North Sydney Train Station.

The site has a total area of 6,640m², with three street frontages, to Miller Street, Brett Whiteley Plaza and Denison Street. The Miller Street frontage is occupied by a landscaped area, pedestrian walkway and retail frontage. The site has a highly visible interface with Brett Whiteley Plaza, which is identified as a key public open space in North Sydney. A range of retail occupancies are located on the Denison Street frontage of the site, set back under a low awning. **Figure 1** shows the site and its context.

The North Sydney MLC Centre and associated turfed public domain currently occupy the site. The existing building comprises a modular building mass with a 13-storey north-south oriented western wing, a central service core and a 6-storey eastern wing, setback from the southern boundary.

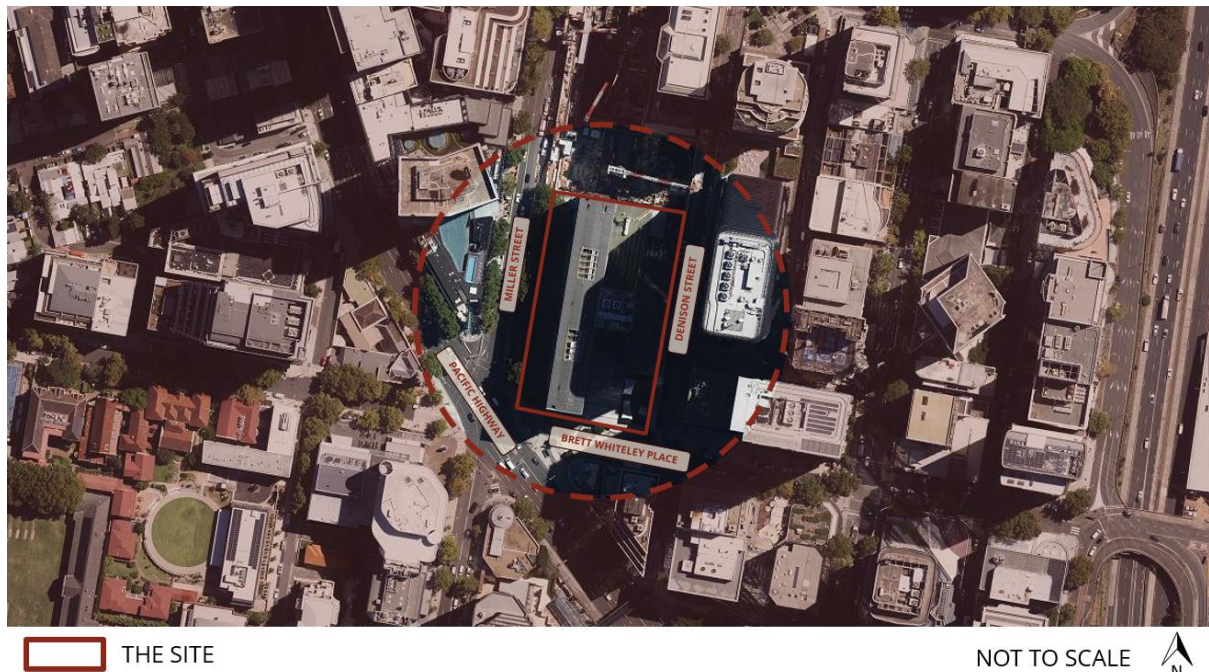


Figure 1 Aerial view of the site

The proposed re-development is to be proposed to accommodate either commercial or educational areas and is to be extended vertically for the extent of the Denison Wing and the Central core to 22 storeys (including plant). The Miller Wing is to remain at its current height.

3 Existing Development

3.1 Basement

The existing development features two basement levels – one partial basement (used primarily for car parking) which extends a basement level below Miller Street to the west (See **Figure 2** for a section view), extending through to Denison Street on the east at grade due to the fall across the site, and another basement (used primarily for plant and storage) which extends a basement level below Denison Street (See **Figure 3** below for plan view).

The existing basement has perimeter walls around its footprint which constitute the permanent retention system.

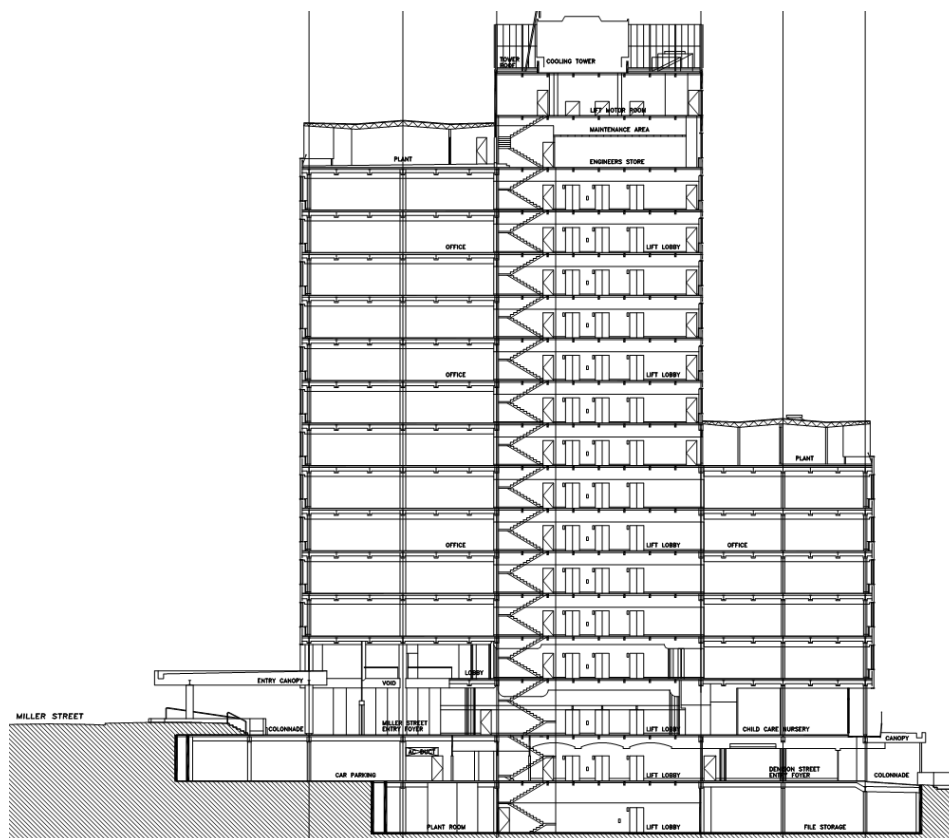


Figure 2 - Section (East/West) through existing development structure

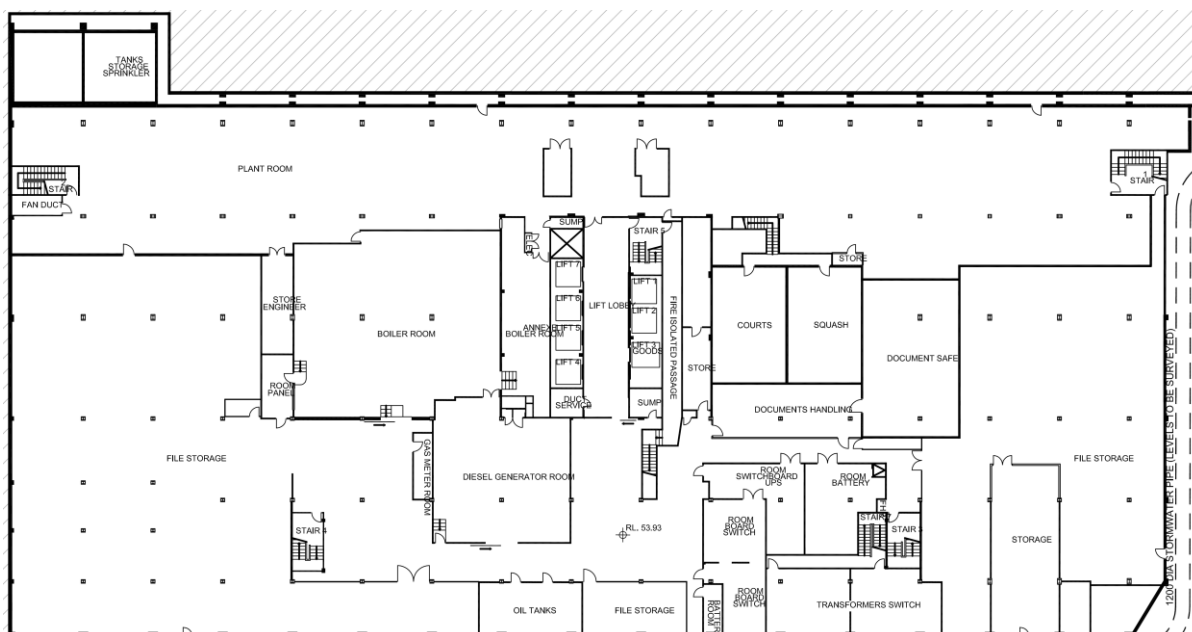


Figure 3 - Existing development basement below Denison Street

3.2 Foundations

The existing building tower columns are founded on high level pad foundations themselves founded on rock. The perimeter retaining walls are founded on high level strip footing constructed within the site and founding on rock. The lowest basement slab is an on-grade slab structure.

3.3 Superstructure

The existing building is a steel framed structure with all concrete walls designed to be non-load bearing

The basement floorplates consist of concrete slabs supported by concrete encased steel beams. The floorplates also provide lateral support to the perimeter retaining walls.

The tower floors are a lightweight system consisting of a 63mm slabs placed atop a 100mm light gage metal deck, itself supported by steel beams. The column grid is approximately 6m by 9m and the core is located centrally between the two wings. Lateral capacity is assumed to be provided by the steel frame action of the columns and floor beams.

5 Proposed Structural System

For both scheme (Educational and Commercial) DA applications, a report has been prepared describing the proposed structural system. This proposed system is also summarized below.

In addition to the structural reports, refer to the *Site Metro Protection Zones* drawing set prepared by WSP for drawings and details showing the proposed system in its relation to Metro assets, refer Appendix C.

The only difference of structural significance between the two schemes is a larger structural core and raft footing extent for the Educational scheme (associated with a larger load). This difference is reflected on the Metro Protection Zones drawing as this is the critical case with the larger loading.

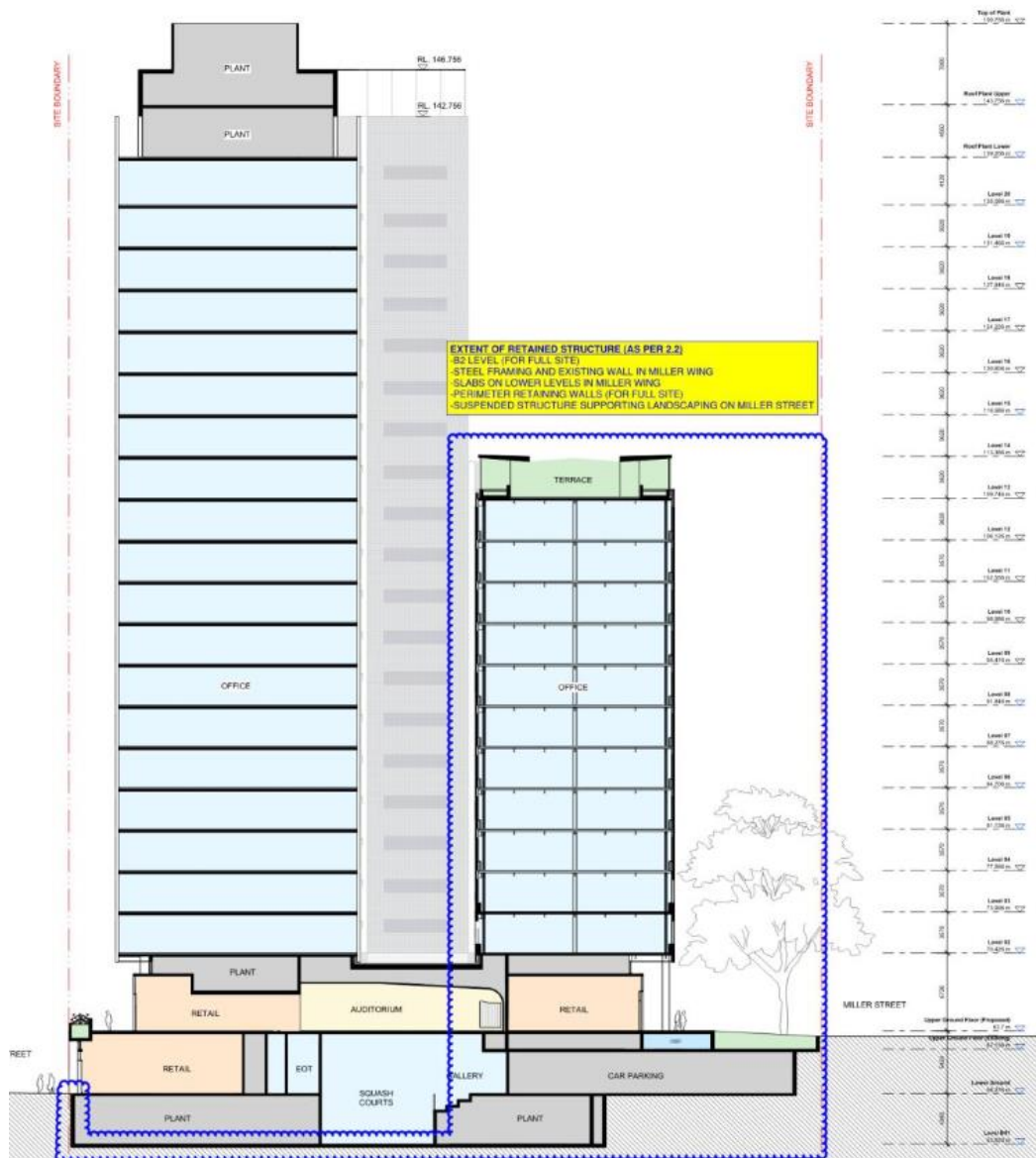


Figure 5 Section Through Proposed Building

5.1 Miller Street Wing:

- **Lower Levels – Retained Concrete-Encased Columns, Beams, and Slabs:** On the lower levels, the existing structural columns and beams are concrete-encased, providing the required 2-hour fire rating and structural strength. At these levels, the existing 125mm-thick slab will be retained.
- **Upper Levels – Slab Replacement:** For the upper levels of the Miller Street wing, existing slabs will be replaced with a profiled 150mm-thick concrete slab on a metal deck to meet load bearing, fire safety, and durability requirements. This change will lead to increase in load on the existing superstructure and foundations.
- **Existing Non-load Bearing walls:** The existing non-load bearing walls at the North and South ends and around the existing stairwells are constructed out of concrete or masonry and are to be retained.
- **All levels - Retention of existing steel structure.** The steel structure is to be entirely retained throughout the building. Structurally, the beams, columns and have been shown to have additional capacity and can sustain the increase in loading with the exception of the ground floor columns (now double height) which will need to be strengthened.

The footings of the Miller Street Wing are for the most part within the 2nd Reserve, the changes to this area will lead to an increase in load the existing superstructure and foundations of up to 25%.

5.2 Denison Street Wing and Podium

- **Complete Re-build with New Concrete Structure:** The existing structure will be fully replaced with a reinforced concrete system to support the building's expanded height and load-bearing needs.
- **Floorplate Design for Podium and Typical Levels:** The podium levels will feature a post-tensioned (PT) banded beam system, while the typical levels will have a 200mm-thick PT flat plate system. Levels 21 and 22 are proposed to support plant loading and will be required to be approximately 300 thick flat plate.

3No Tower column footings as well several podium footings to the North of the Floorplate are within the 2nd reserve. This area will see an increase in loading when compared to the existing condition.

5.3 Central Core

The central core will be entirely rebuilt with 250mm-thick concrete walls to provide critical lateral stability and support increased vertical loads. Extending through the full height of the building, this core will serve as the primary stability system for both wings, ensuring compliance with seismic and wind load standards. Floor plates within the central core are typically 200 thick.

The new Core will see a significant increase in vertical and lateral loading when compared to the current condition, however, the core and it's footing are entirely outside of the 2nd reserve.

5.4 Foundations and excavation

- The basement bulk excavation arrangement is to remain unchanged, ie no further bulk excavation is proposed.
 - No excavation other than those required for the construction of new footings and sewer pits are proposed.
 - All footings are to be shallow footings (pads and rafts). Refer to *Site Metro Protection Structural Drawings* in Appendix C for RLs, depths and extents.
 - Ground anchors are proposed to be embedded in the rock layer below the core raft to develop tension forces generated by lateral loads.
-

5.5 Retention System

With the site sloping downwards between Miller Street and Denison Street, the extent below ground varies between 2 levels and 1 level. On the South, East and West edges of the building, the perimeter walls retain soil and are proposed to be retained and provided with temporary ground anchors during construction of the B1 and Ground floor levels.

5.6 Slab on Ground

The existing slab on ground at B2 level is over 300mm thick and is adequate to support the plant loads proposed in this area.

6 Impacts of development on Metro assets

The impacts of the new development on structural loading at founding level and on existing building structures are outlined below and shown on the *Site Metro Protection Zones* drawing set issued by WSP, refer Appendix C.

6.1 Load increase

- Existing footings supporting the Miller Street Wing will experience an increase in loading. Most footings of this wing are within the 2nd reserve. Some of the footings to the North are also within the Metro easements.
 - New footings supporting the Denison Street Wing and podium levels will see an increase in loads from that currently applied by the existing structure. Several of these footings on the Northern side of the site are within the 2nd reserve. Some of these footings are also within the existing easement
 - The vertical and lateral loads on the structural core will see an increase those currently applied by the existing structure. However, the core and its raft are entirely outside of the 2nd reserve.
-

6.2 Extent of Works Within the 2nd Reserve

- Proposed excavations within the 2nd Reserve consist of:
 - Temporary, local, excavation to validate adequacy of existing footings within the 2nd reserve only.
 - Temporary excavation to form and build new footings (no lower than existing footings) within the 2nd reserve only.
 - Temporary excavation within easements adjacent to Victoria Cross (no lower than existing footings). As shown on the existing Structural drawings (Appendix A and B), the ground anchors within the easement are lower than the existing footings and would not clash with the new footings. Care will need to be taken by the contractor to not over-excavate during construction.
 - 1 No permanent small excavation to build a sewer bit is required within the 2nd Reserve only.
- Temporary ground anchors to restrain the top of the existing retaining walls on the East, West and South boundaries are proposed within the second reserve.

- Permanent ground anchors to resist tension forces due to lateral loads under the core raft are entirely outside of the 2nd reserve.
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6.3 Impact on Victoria Cross Station

- **Structural retaining wall**

- The structural retaining wall described in section 4.1 is impacted by the surcharge load from 3No footings on the Northern edge of the Miller Street Wing. All other footings are located far enough from the wall to not have any adverse impact on it.
- While the actual load on these footings will increase with the proposed development, the column loads assumed for the design of this wall are less than those calculated for the retrofitted building. The existing structural wall is therefore adequate for the proposed development. Refer to Appendix A for the assumed loading of the Miller Wing columns used for the design of this retaining wall (columns C8,C9,C10); and to the *Site Metro Protection Zones* drawings for the proposed loads calculated by WSP (CL4a and CL13).

- **Ground Anchor/bolt underpinning system**

The impact of the proposed development on the existing underpinning and retaining system present at the Southern Boundary of the Victoria Cross station is assessed in a separate report prepared by Douglas Partners. Their assessment is based on the unloading (during construction) and re-loading (new/upgraded building) sequence shown on the *Site Metro Protection Zones* drawings issued by WSP. It has been advised to WSP by Douglas Partners that the analysis has found the following in regard to the Southern Boundary of the Victoria Cross station:

- Very minor / negligible pressure increases on permanent walls under increased loading.
 - Very minor / negligible increases in permanent bolt axial forces under increased loading.
 - Negligible permanent wall movements – and as a result, negligible induced slab forces.
 - Negligible movements of existing footings under increased loading.
-

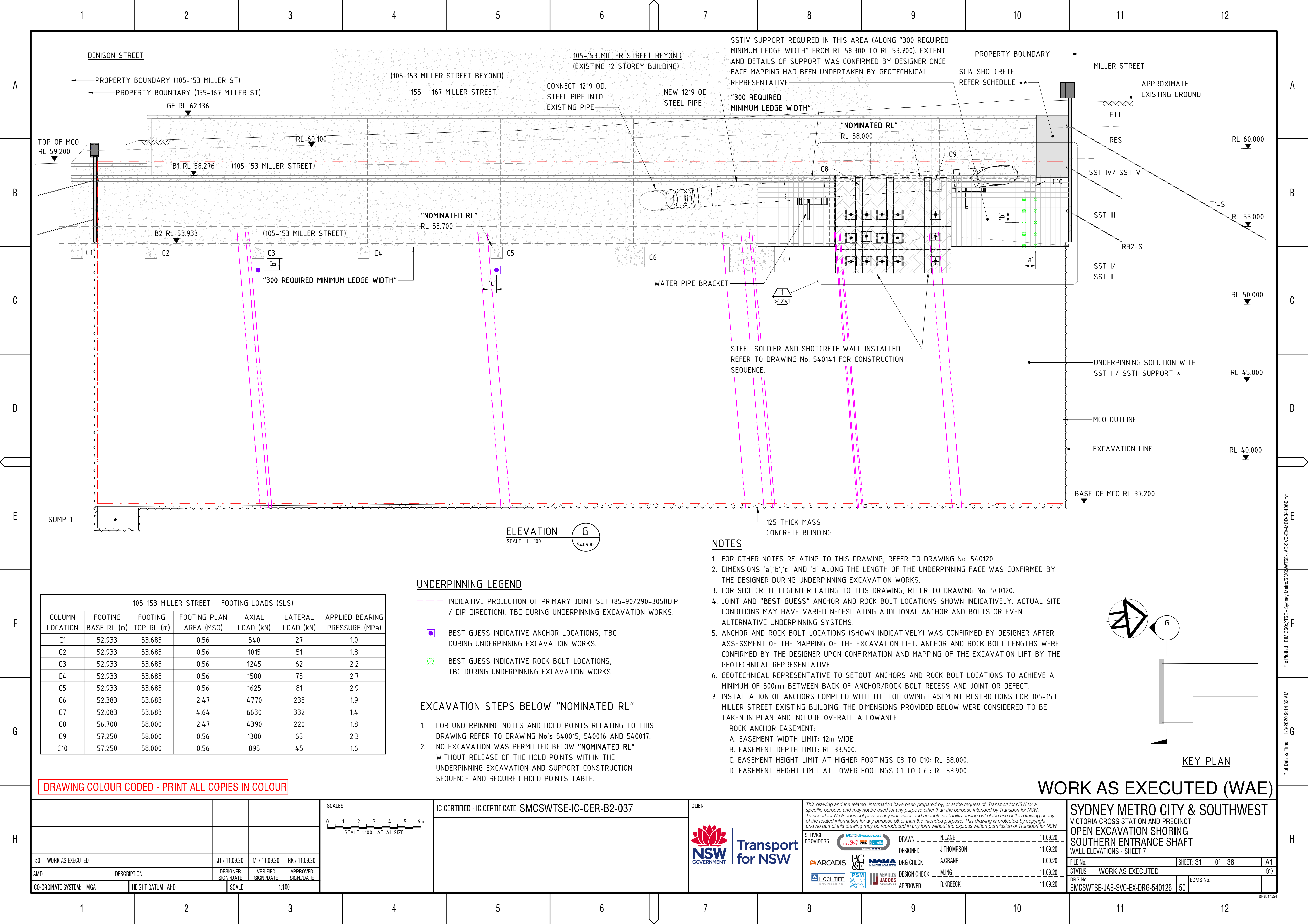
6.4 Impact on Sydney Metro – City & South-West rail corridor

- A geotechnical and a tunnel assessment structural report have been prepared separately by Douglas Partners and WSP to assess the impact of the proposed

structure on the rail corridor based on the loading conditions calculated by WSP and provided on the *Site Metro Protection Zones* drawings.

7 Appendices

7.1 Appendix A - Structural elevation of Victoria Cross Southern retaining system



7.2 Appendix B – Detailing of Ground Anchors at Victoria Cross Southern retaining system

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ANCHOR SCHEDULE SOUTHERN SHAFT

ANCHOR ID	ANCHOR/BOLT TYPE	FOUNDING MATERIAL	ANCHOR LOAD (kN)			INCLINATION (DEGREES)	LENGTH (m)		NUMBER OF STRANDS 15.2mm DIAMETER	HOLE DIAMETER
			WORKING	LOCK OFF	ULTIMATE		MINIMUM FREE	MINIMUM BOND		
RB1-S	22 DIA. HIGH STRENGTH	SANDSTONE III	38	-	57	30	-	4	-	75
RB2-S	22 DIA. HIGH STRENGTH	SANDSTONE III	11	-	17	30	-	4	-	75
RB3-S	22 DIA. HIGH STRENGTH	SANDSTONE III	20	-	55	50	2	3	-	75
RB4-S	TYPE 3	SANDSTONE III	203	-	305	40	-	4	-	75
RB5-S	22 DIA. HIGH STRENGTH	SANDSTONE II	3	-	5	40	-	4	-	75
RB6-S	22 DIA. HIGH STRENGTH	SANDSTONE III	9	-	14	30	-	4	-	75
RB7-S	22 DIA. HIGH STRENGTH	SANDSTONE III	38	-	57	30	-	4	-	75
RB8-S	22 DIA. HIGH STRENGTH	SANDSTONE III	12	-	18	30	-	4	-	75
RB9-S	22 DIA. HIGH STRENGTH	SANDSTONE III	85	-	128	30	-	4	-	75
RB10-S	22 DIA. HIGH STRENGTH	SANDSTONE IV	48	-	72	15	-	4	-	75
RB12-S	22 DIA. HIGH STRENGTH	SANDSTONE IV	45	-	68	15	-	6	-	75
RB13-S	ROCK ANCHOR (100 YEARS DESIGN LIFE) #	SANDSTONE I/II	80	-	120	15*	-	5	-	100
RB14-S	ROCK ANCHOR (100 YEARS DESIGN LIFE) #	SANDSTONE I/II	80	-	120	5	-	4	-	100
RB15-S	TYPE 3B PERMANENT BOLT	SANDSTONE IV	135	-	203	30	-	3	-	130
RB16-S	TYPE 3B PERMANENT BOLT	SANDSTONE III	275	-	413	35	-	3.5	-	100
RB17-S	TYPE 3B PERMANENT BOLT	SANDSTONE IV	165	-	248	35	-	3.5	-	130
RB18-S	TYPE 3B PERMANENT BOLT	SANDSTONE III	305	-	458	35	-	3.5	-	100
T1-S	TYPE A	SANDSTONE II	421	433	649	30	13	3	5	75
T2-S	TYPE A	SANDSTONE II	401	428	642	50	7	3	5	75
T3-S	TYPE A	SANDSTONE III	220	226	339	30	9	3	3	75
T3A-S	TYPE A	SANDSTONE III	249	252	406	40	9	6	3	75
T4-S	TYPE A	SANDSTONE III	208	223	335	30	5.5	3	3	75
T5-S	ROCK ANCHOR (100 YEARS DESIGN LIFE) #	SANDSTONE I/II	445	467	665	15	7	3	5	100

22 DIAMETER HIGH STRENGTH BOLTS - NOMINAL DIAMETER = 22mm, MINIMUM TENSILE STRENGTH = 205kN
REFER TO PROJECT WIDE DETAILS, DRAWING No. SMCSWTSE-JAB-TPW-EX-DRG-500062 TYPE 2, FOR ROCK BOLT DETAILS ADOPTED
* VERTICAL ANGLE WAS ADJUSTED WHERE NECESSARY. REFER TO ELEVATION FOR ADJUSTED VERTICAL ANGLE.
PERMANENT BOLTS. REFER DRAWING No. 540017 FOR FURTHER DETAILS.

TYPE 3B PERMANENT BOLT

NOMINAL DIAMETER = 32mm
MINIMUM TENSILE STRENGTH = 844kN
100 YEAR DESIGN LIFE

SECTION 2

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SECTION 3

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NOTES

1. FOR NOTES RELATING TO THIS DRAWING, REFER TO DRAWING No 540010.
2. FOR TEMPORARY ANCHOR DETAILS REFER TO DRAWING No SMCSWTSE-JAB-TPW-EX-DRG-500060.
3. FOR TYPE 3 ROCK BOLT DETAILS REFER TO DRAWING No SMCSWTSE-JAB-TPW-EX-DRG-500062.

REQUIRED MINIMUM PILE FOUNDATION

UNLESS NOTED OTHERWISE ON THE DRAWING, PILES WAS FOUNDEN IN SANDSTONE CLASS II NOMINAL 1000mm EMBEDMENT. IF THE TOP OF THE FOUNDING MATERIAL WAS MORE THAN 500mm HIGHER OR LOWER THAN SHOWN ON THE DRAWINGS, THE DESIGNER WAS NOTIFIED AND OBTAINED DIRECTIONS BEFORE PROCEEDING.

TEMPORARY SUPPORT SHOWN WAS PREDICTED. ACTUAL SUPPORT AND DIMENSIONS INSTALLED MAY HAVE VARIED. SEE QUALITY RECORDS.

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0 0.2 0.4 0.6 0.8 1.0 1.2m

SCALE 1:20 AT A1 SIZE

IC CERTIFIED - IC CERTIFICATE SMCSWTSE-IC-CER-B2-037

CLIENT

NSW GOVERNMENT

Transport for NSW

50

WORK AS EXECUTED

JT / 11.09.20

MI / 11.09.20

RK / 11.09.20

AMD

DESCRIPTION

DESIGNER SIGN / DATE

VERIFIED SIGN / DATE

APPROVED SIGN / DATE

CO-ORDINATE SYSTEM: MGA

HEIGHT DATUM: AHD

SCALE:

NTS

SCALES

0 0.2 0.4 0.6 0.8 1.0 1.2m

SCALE 1:20 AT A1 SIZE

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NTS

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SCALES

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SCALE 1:20 AT A1 SIZE

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SCALES

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SCALES

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SCALE 1:20 AT A1 SIZE

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SCALE 1:20 AT A1 SIZE

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CLIENT

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DESCRIPTION

DESIGNER SIGN / DATE

VERIFIED SIGN / DATE

APPROVED SIGN / DATE

CO-ORDINATE SYSTEM: MGA

HEIGHT DATUM: AHD

SCALE:

NTS

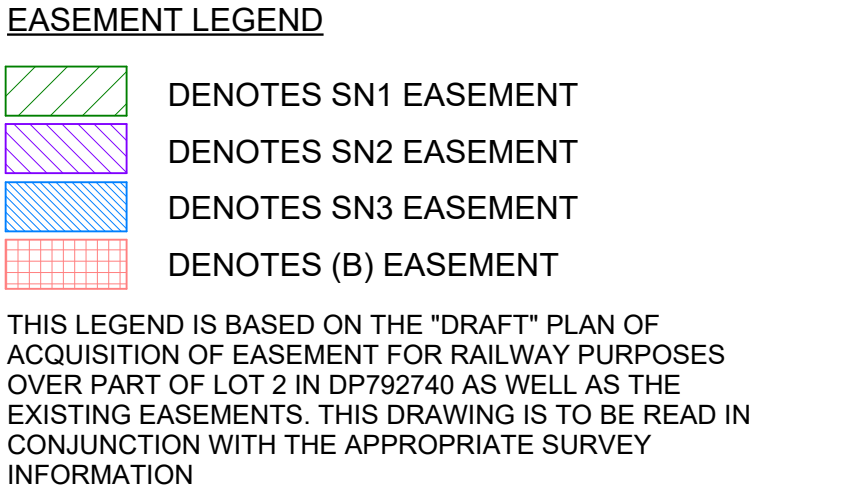
SCALES

0 0.2 0.4 0.6 0.8 1.0 1.2m

SCALE 1:20 AT A1 SIZE

IC CERTIFIED - IC CERTIFICATE SMCSWTSE

7.3 Appendix C – Site Metro Protection Zones



Existing Columns Vertical Loads onto Foundations		
Column Label	Unfactored Dead Load (kN)	Unfactored Live Load (kN)
CL1	3200	1350
CL2	2000	800
CL2a	1500	700
CL3	3450	800
CL4	2350	450
CL4a	2150	400
CL5	2450	1300
CL6	3250	1300
CL7	3250	1100
CL8	1800	600
CL8a	1150	350
CL9	2000	450
CL10	1150	400
CL11	1150	350
CL11a	950	250
CL12	1000	300
CL13	450	150
CL14	750	200

- NOTES:
- THIS DRAWING IS A COMPILATION OF THE METRO PROTECTION ZONES AS PER RPS SURVEYORS DRAWING "PR145326-002-C-Metro Protection Zones-105" AND EXPLANATORY NOTES ON THE NOMINATED DRAWINGS SHOULD BE READ IN CONJUNCTION. WE NOTE THE BELOW SUPPLIED METRO DRAWINGS ARE "FOR CONSTRUCTION" ONLY
 - ADOPTED DIAMETER OF METRO TUNNEL 6.69M
 - UPLINE TUNNEL MODELED BETWEEN CHAINAGE 10KM+ 650 AND 10KM+849.349
 - SMCSWTSE-JAB-TPW-AL-DRG-505121 (FILE NAME SMCSWTSE-JCG-1NL-DM-DWG-000053.01.01.PDF)
 - SMCSWTSE-JAB-TPW-AL-DRG-505011 (FILE NAME SMCSWTSE-JCG-1NL-DM-DWG-000024.03.AFC.03.01.PDF)
 - SMCSWTSE-JAB-TPW-AL-DRG-505014 (FILE NAME SMCSWTSE-JCG-1NL-DM-DWG-000027.03.AFC.03.01.PDF)
 - SMCSWTSE-JHO-TPW-DN-DRG-9 (FILE NAME SMCSWTSE-JCG-TPW-DM-DWG-000514.00.AFC.00.01.PDF)
 - THIS DRAWING ALSO SHOWS THE "DRAFT" PLAN OF ACQUISITION OF EASEMENT FOR RAILWAY PURPOSES OVER PART OF LOT 2 IN DP792740 AS WELL AS THE EXISTING EASEMENTS. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE APPROPRIATE SURVEY INFORMATION
 - EXISTING BASEMENT B1 LEVEL EXTENTS IS TO BE CONFIRMED BY A REGISTERED SURVEYOR.
 - DO NOT SCALE THIS DRAWING. PLEASE REFER TO ARCHITECTURAL DRAWINGS FOR MORE INFORMATION.
 - PAD FOOTINGS SIZES AND POSITIONS ARE INDICATIVE ONLY
 - SITE RETENTION ASSUMED TO BE TEMPORARY ANCHORED INTO 2ND RESERVE ONLY USING GROUND ANCHORS SHOWN INDICATIVELY IN THE PERMANENT CASE THIS IS TO BE RESTRAINED BY THE NEW FLOOR PLATE STRUCTURE

EASEMENT LEGEND

- DENOTES SN1 EASEMENT
- DENOTES SN2 EASEMENT
- DENOTES SN3 EASEMENT
- DENOTES (B) EASEMENT

THIS LEGEND IS BASED ON THE "DRAFT" PLAN OF ACQUISITION OF EASEMENT FOR RAILWAY PURPOSES OVER PART OF LOT 2 IN DP792740 AS WELL AS THE EXISTING EASEMENTS. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE APPROPRIATE SURVEY INFORMATION

(A) EASEMEN FOR CRANE ACCESS

4
001-24

5
001-24

6a
001-25

6b
001-25

VICTORIA CROSS STATION SOUTHERN ENTRANCE

(A) EASEMENT FOR CRANE ACCESS

1 03.07.25 FOR APPROVAL

Rev. Date Description
STRUCTURAL / CIVIL CONSULTANT



680 George st, Sydney NSW 2000 Australia
9272 5100

http://www.wsp.com

CLIENT

BUILDER

PROJECT NAME
105 MILLER STREET

PROJECT NUMBER: 214031

DRAWING TITLE
SITE METRO PROTECTION ZONES - CONSTRUCTION STAGE PLAN

SCALE AT A1: 1 : 200
DRAWN BY: J.D.B.
CHECKED BY: T.B.B.

DRAWING STATUS

FOR INFORMATION

DRAWING NUMBER
ST-001-06

REV.
1

Existing Columns Vertical Loads onto Foundations During Construction Stage		
Column Label	Unfactored Dead Load (kN)	Unfactored Live Load (kN)
CL1	350	0
CL2	350	0
CL2a	650	0
CL3	2050	0
CL4	1350	0
CL4a	1200	0
CL13	350	0
CL14	50	0

90
DP 1231644 BELOW

5
DP 814848

MILLER STREET

RT01 UP MNW CENTRELINE

SYDNEY METRO SUBSTRATUM
1ST RESERVE

PACIFIC HWY

2ND RESERVE

BRETT WHUTELEY PLACE

DENISON STREET

SITE METRO PROTECTION ZONES -
CONSTRUCTION STAGE PLAN

SCALE: 1 : 200

- NOTES:
- THIS DRAWING IS A COMPILATION OF THE METRO PROTECTION ZONES AS PER RPS SURVEYORS DRAWING "PR145326-002-C-Metro Protection Zones-105" AND EXPLANATORY NOTES ON THE NOMINATED DRAWINGS SHOULD BE READ IN CONJUNCTION. WE NOTE THE BELOW SUPPLIED METRO DRAWINGS ARE "FOR CONSTRUCTION" ONLY
 - ADOPTED DIAMETER OF METRO TUNNEL 6.69M
 - UPLINE TUNNEL MODELED BETWEEN CHAINAGE 10KM+ 650 AND 10KM+849.349
 - SMCSWTSE-JAB-TPW-AL-DRG-505121 (FILE NAME SMCSWTSE-JCG-1NL-DM-DWG-000053.01.01.PDF)
 - SMCSWTSE-JAB-TPW-AL-DRG-505011 (FILE NAME SMCSWTSE-JCG-1NL-DM-DWG-000024.03.AFC.03.01.PDF)
 - SMCSWTSE-JAB-TPW-AL-DRG-505014 (FILE NAME SMCSWTSE-JCG-1NL-DM-DWG-000027.03.AFC.03.01.PDF)
 - SMCSWTSE-JHO-TPW-DN-DRG-9 (FILE NAME SMCSWTSE-JCG-TPW-DM-DWG-000514.00.AFC.00.01.PDF)
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 - EXISTING BASEMENT B1 LEVEL EXTENTS IS TO BE CONFIRMED BY A REGISTERED SURVEYOR.
 - ALL INFORMATION CONTAINED ON THIS DRAWING RELATES TO THE ARCHITECTURAL SET OF DRAWINGS ISSUED BY BATES SMART ON 27/11/2024. ANY CHANGES TO ARCHITECTURAL DRAWINGS OR THE BUILDING STRUCTURE, INCLUDING BUT NOT LIMITED TO FLOOR SLAB EXTENTS, FLOOR LOADING/USAGE AND COLUMN/WALL POSITIONS WILL DIRECTLY CHANGE/INFLUENCE ALL INFORMATION SHOWN ON THIS DRAWING. WHILST EVERY EFFORT HAS BEEN MADE BY ENSTRUCT TO ACCOUNT FOR ANY LIKELY CHANGES, THE ACCURACY AND VALIDITY OF THIS DRAWING CANNOT BE GUARANTEED AS THE DESIGN OF THE BUILDING PROGRESSES.
 - DO NOT SCALE THIS DRAWING. PLEASE REFER TO ARCHITECTURAL DRAWINGS FOR MORE INFORMATION.
 - ALL PAD FOOTINGS HAVE BEEN DESIGNED FOR AN ALLOWABLE BEARING PRESSURE OF 6000kPa.
 - PAD FOOTING SIZES AND POSITIONS ARE INDICATIVE ONLY
 - SITE RETENTION ASSUMED TO BE TEMPORARY ANCHORED INTO 2ND RESERVE ONLY USING GROUND ANCHORS SHOWN INDICATIVELY IN THE PERMANENT CASE THIS IS TO BE RESTRAINED BY THE NEW FLOOR PLATE STRUCTURE

- EASEMENT LEGEND
- DENOTES SN1 EASEMENT
 - DENOTES SN2 EASEMENT
 - DENOTES SN3 EASEMENT
 - DENOTES (B) EASEMENT

THIS LEGEND IS BASED ON THE "DRAFT" PLAN OF ACQUISITION OF EASEMENT FOR RAILWAY PURPOSES OVER PART OF LOT 2 IN DP792740 AS WELL AS THE EXISTING EASEMENTS. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE APPROPRIATE SURVEY INFORMATION

1 03.07.25 FOR APPROVAL
Rev. Date Description
STRUCTURAL / CIVIL CONSULTANT



680 George st, Sydney NSW 2000 Australia
9272 5100
http://www.wsp.com

CLIENT

BUILDER

PROJECT NAME
105 MILLER STREET

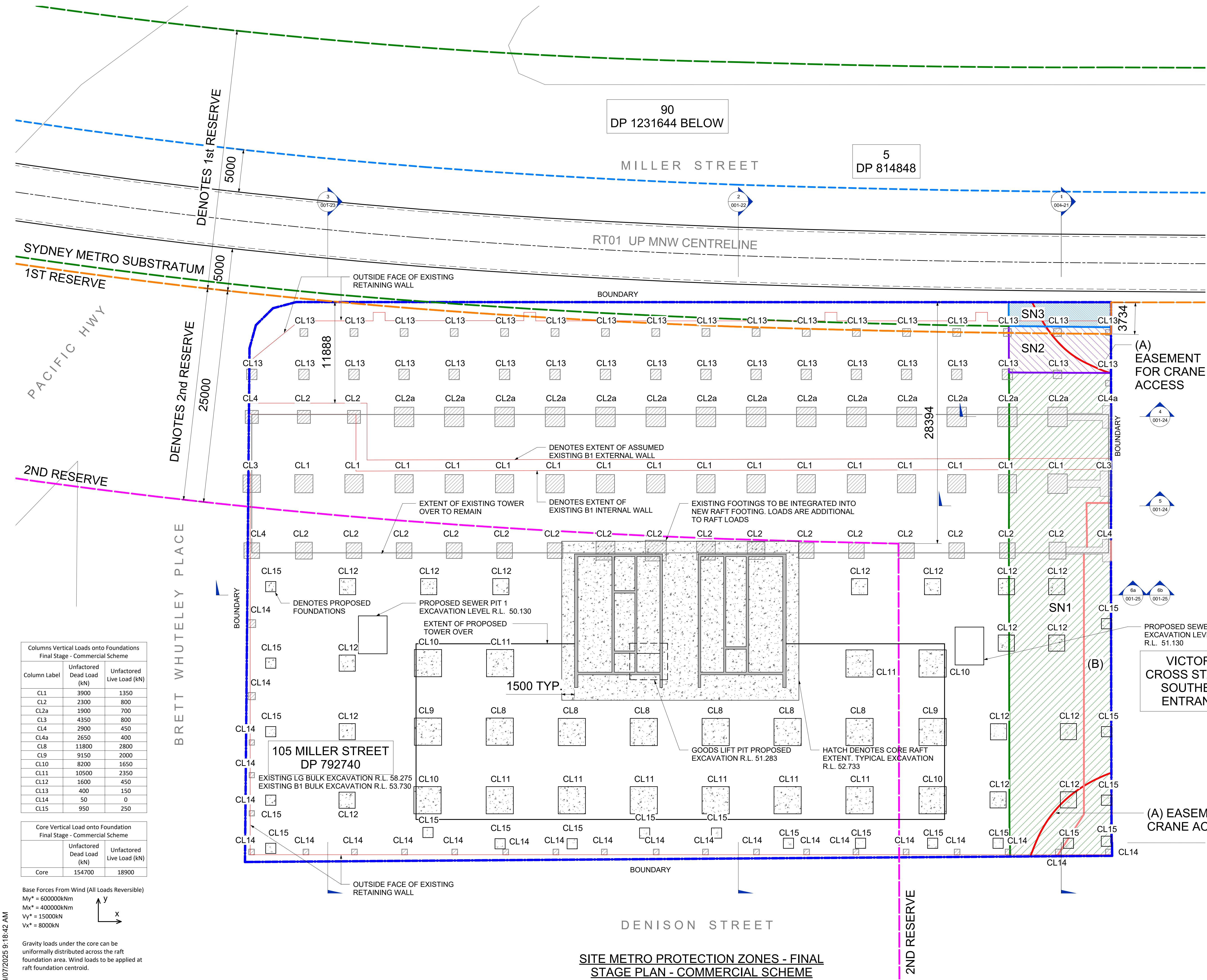
PROJECT NUMBER: 214031

DRAWING TITLE
SITE METRO PROTECTION ZONES - FINAL STAGE PLAN - COMMERCIAL SCHEME

SCALE AT A1: 1 : 200
DRAWN BY: J.D.B.
CHECKED BY: T.B.B.
DRAWING STATUS

FOR INFORMATION

DRAWING NUMBER REV.
ST-001-07 1



Columns Vertical Loads onto Foundations Final Stage - Commercial Scheme		
Column Label	Unfactored Dead Load (kN)	Unfactored Live Load (kN)
CL1	3900	1350
CL2	2300	800
CL2a	1900	700
CL3	4350	800
CL4	2900	450
CL4a	2650	400
CL8	11800	2800
CL9	9150	2000
CL10	8200	1650
CL11	10500	2350
CL12	1600	450
CL13	400	150
CL14	50	0
CL15	950	250

Core Vertical Load onto Foundation Final Stage - Commercial Scheme		
	Unfactored Dead Load (kN)	Unfactored Live Load (kN)
Core	154700	18900

Base Forces From Wind (All Loads Reversible)
My* = 60000kNm
Mx* = 400000kNm
Vy* = 15000kN
Vx* = 8000kN

Gravity loads under the core can be uniformly distributed across the raft foundation area. Wind loads to be applied at raft foundation centroid.

SITE METRO PROTECTION ZONES - FINAL STAGE PLAN - COMMERCIAL SCHEME

SCALE: 1 : 200

- NOTES:
- THIS DRAWING IS A COMPILATION OF THE METRO PROTECTION ZONES AS PER RPS SURVEYORS DRAWING "PR145326-002-C-Metro Protection Zones-105" AND EXPLANATORY NOTES ON THE NOMINATED DRAWINGS SHOULD BE READ IN CONJUNCTION. WE NOTE THE BELOW SUPPLIED METRO DRAWINGS ARE "FOR CONSTRUCTION" ONLY
 - ADOPTED DIAMETER OF METRO TUNNEL 6.69M
 - UPLINE TUNNEL MODELED BETWEEN CHAINAGE 10KM+ 650 AND 10KM+849.349
 - SMCSWTSE-JAB-TPW-AL-DRG-505121 (FILE NAME SMCSWTSE-JCG-1NL-DM-DWG-000053.01.01.PDF)
 - SMCSWTSE-JAB-TPW-AL-DRG-505011 (FILE NAME SMCSWTSE-JCG-1NL-DM-DWG-000024.03.AFC.03.01.PDF)
 - SMCSWTSE-JAB-TPW-AL-DRG-505014 (FILE NAME SMCSWTSE-JCG-1NL-DM-DWG-000027.03.AFC.03.01.PDF)
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 - THIS DRAWING ALSO SHOWS THE "DRAFT" PLAN OF ACQUISITION OF EASEMENT FOR RAILWAY PURPOSES OVER PART OF LOT 2 IN DP792740 AS WELL AS THE EXISTING EASEMENTS. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE APPROPRIATE SURVEY INFORMATION
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 - ALL INFORMATION CONTAINED ON THIS DRAWING RELATES TO THE ARCHITECTURAL SET OF DRAWINGS ISSUED BY FJCSSTUDIO ON 01/04/2025. ANY CHANGES TO ARCHITECTURAL DRAWINGS OR THE BUILDING STRUCTURE, INCLUDING BUT NOT LIMITED TO FLOOR SLAB EXTENTS, FLOOR LOADING/USAGE AND COLUMN/WALL POSITIONS WILL DIRECTLY CHANGE/INFLUENCE ALL INFORMATION SHOWN ON THIS DRAWING. WHILST EVERY EFFORT HAS BEEN MADE BY ENSTRUCT TO ACCOUNT FOR ANY LIKELY CHANGES, THE ACCURACY AND VALIDITY OF THIS DRAWING CANNOT BE GUARANTEED AS THE DESIGN OF THE BUILDING PROGRESSES.
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- DENOTES SN1 EASEMENT
 - DENOTES SN2 EASEMENT
 - DENOTES SN3 EASEMENT
 - DENOTES (B) EASEMENT

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1 03.07.25 FOR APPROVAL

Rev. Date Description

STRUCTURAL / CIVIL CONSULTANT



680 George st, Sydney NSW 2000 Australia

9272 5100

<http://www.wsp.com>

CLIENT

BUILDER

PROJECT NAME

105 MILLER STREET

PROJECT NUMBER: 214031

DRAWING TITLE

SITE METRO PROTECTION ZONES - FINAL STAGE PLAN - EDUCATIONAL SCHEME

SCALE AT A1: 1 : 200

DRAWN BY: J.D.B.

CHECKED BY: T.B.B.

DRAWING STATUS

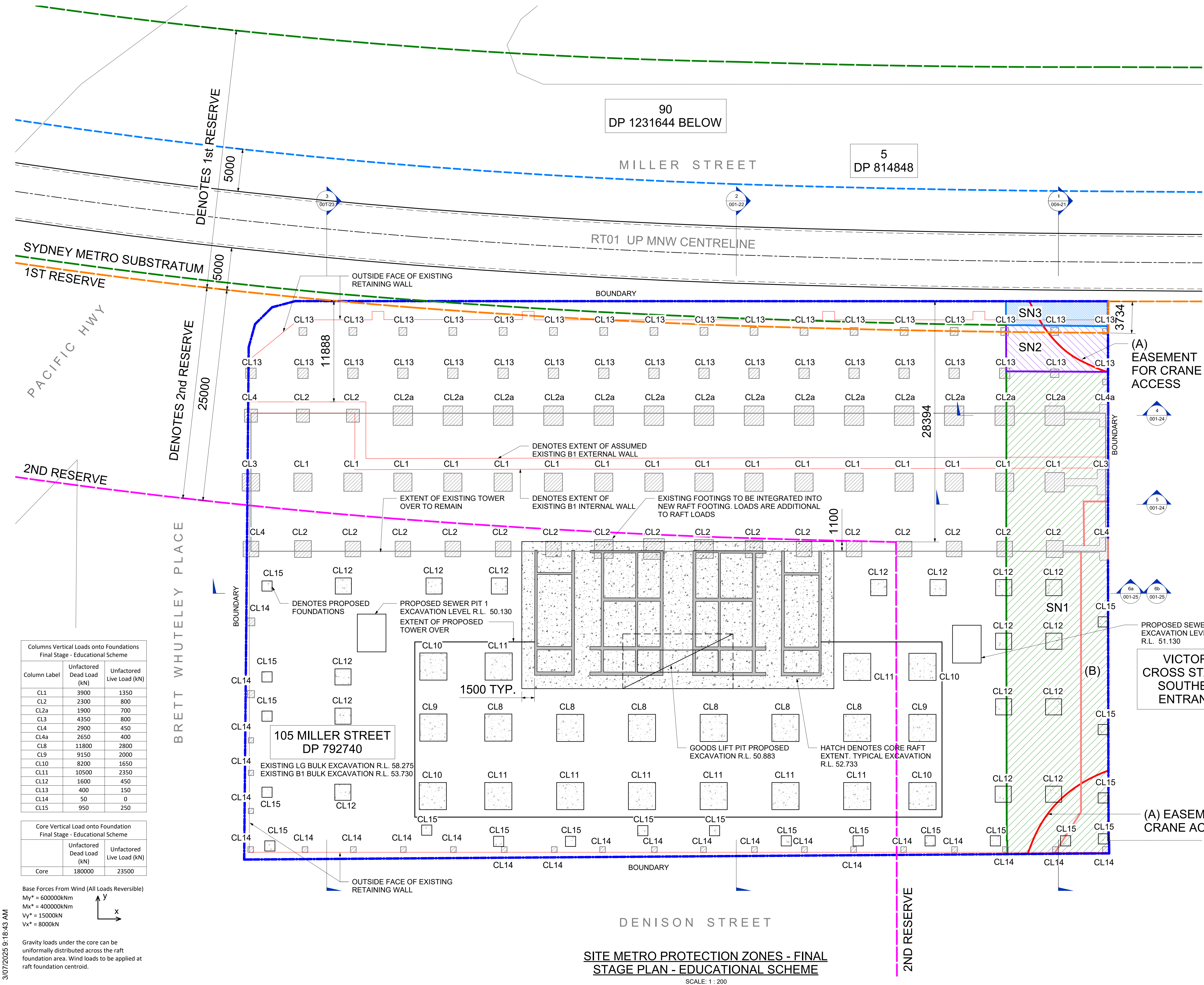
FOR INFORMATION

DRAWING NUMBER

ST-001-08

REV.

1



Columns Vertical Loads onto Foundations Final Stage - Educational Scheme		
Column Label	Unfactored Dead Load (kN)	Unfactored Live Load (kN)
CL1	3900	1350
CL2	2300	800
CL2a	1900	700
CL3	4350	800
CL4	2900	450
CL4a	2650	400
CL8	11800	2800
CL9	9150	2000
CL10	8200	1650
CL11	10500	2350
CL12	1600	450
CL13	400	150
CL14	50	0
CL15	950	250

Core Vertical Load onto Foundation Final Stage - Educational Scheme		
	Unfactored Dead Load (kN)	Unfactored Live Load (kN)
Core	180000	23500

Base Forces From Wind (All Loads Reversible)

$M_y^* = 600000\text{kNm}$

$M_x^* = 400000\text{kNm}$

$V_y^* = 15000\text{kN}$

$V_x^* = 8000\text{kN}$

Gravity loads under the core can be uniformly distributed across the raft foundation area. Wind loads to be applied at raft foundation centroid.

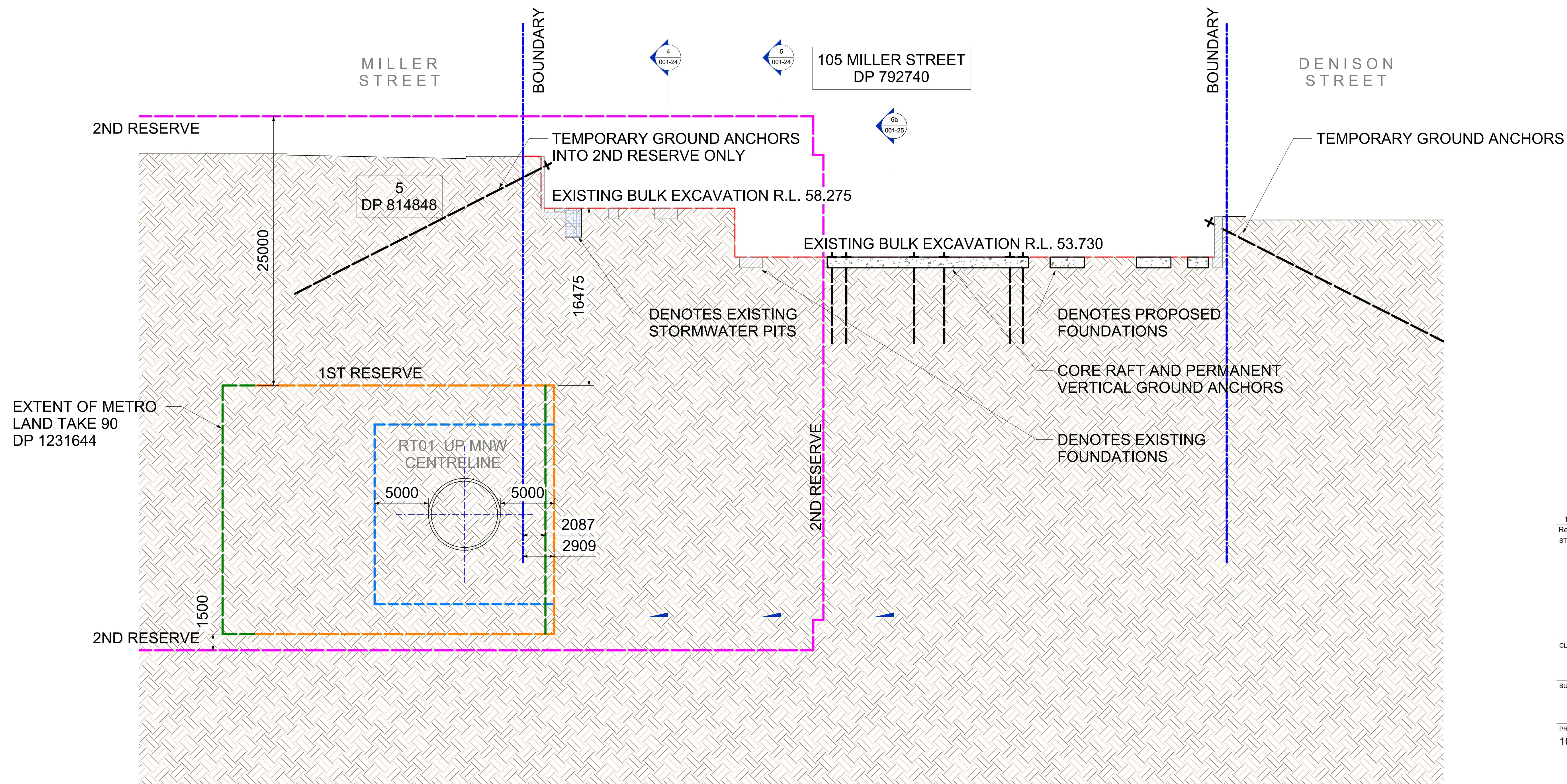
SITE METRO PROTECTION ZONES - FINAL STAGE PLAN - EDUCATIONAL SCHEME

SCALE: 1 : 200

3/07/2025 9:18:44 AM

-  DENOTES SN1 EASEMENT
 DENOTES SN2 EASEMENT
 DENOTES SN3 EASEMENT
 DENOTES (B) EASEMENT

THIS LEGEND IS BASED ON THE "DRAFT" PLAN OF ACQUISITION OF EASEMENT FOR RAILWAY PURPOSES OVER PART OF LOT 2 IN DP792740 AS WELL AS THE EXISTING EASEMENTS. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE APPROPRIATE SURVEY INFORMATION



SECTION 2
1 : 200 001-05

NOTE:
EXISTING AND PROPOSED STRUCTURE ABOVE THE
EXCAVATION LEVELS NOT SHOWN

1 03.07.25 FOR APPROVAL
 Rev. Date Description
 STRUCTURAL / CIVIL CONSULTANT



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9272 5100
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CLIENT

BUILDER

PROJECT NAME
105 MILLER STREET

PROJECT NUMBER: 214031

DRAWING TITLE

**SITE METRO PROTECTION
ZONES - SECTIONS SHEET 2**

SCALE AT A1: 1 : 200

SCALE AT AT: 1 : 200
DRAWN BY: J.D.B.
CHECKED BY: T.B.B.

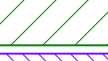
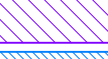
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FOR INFORMATION

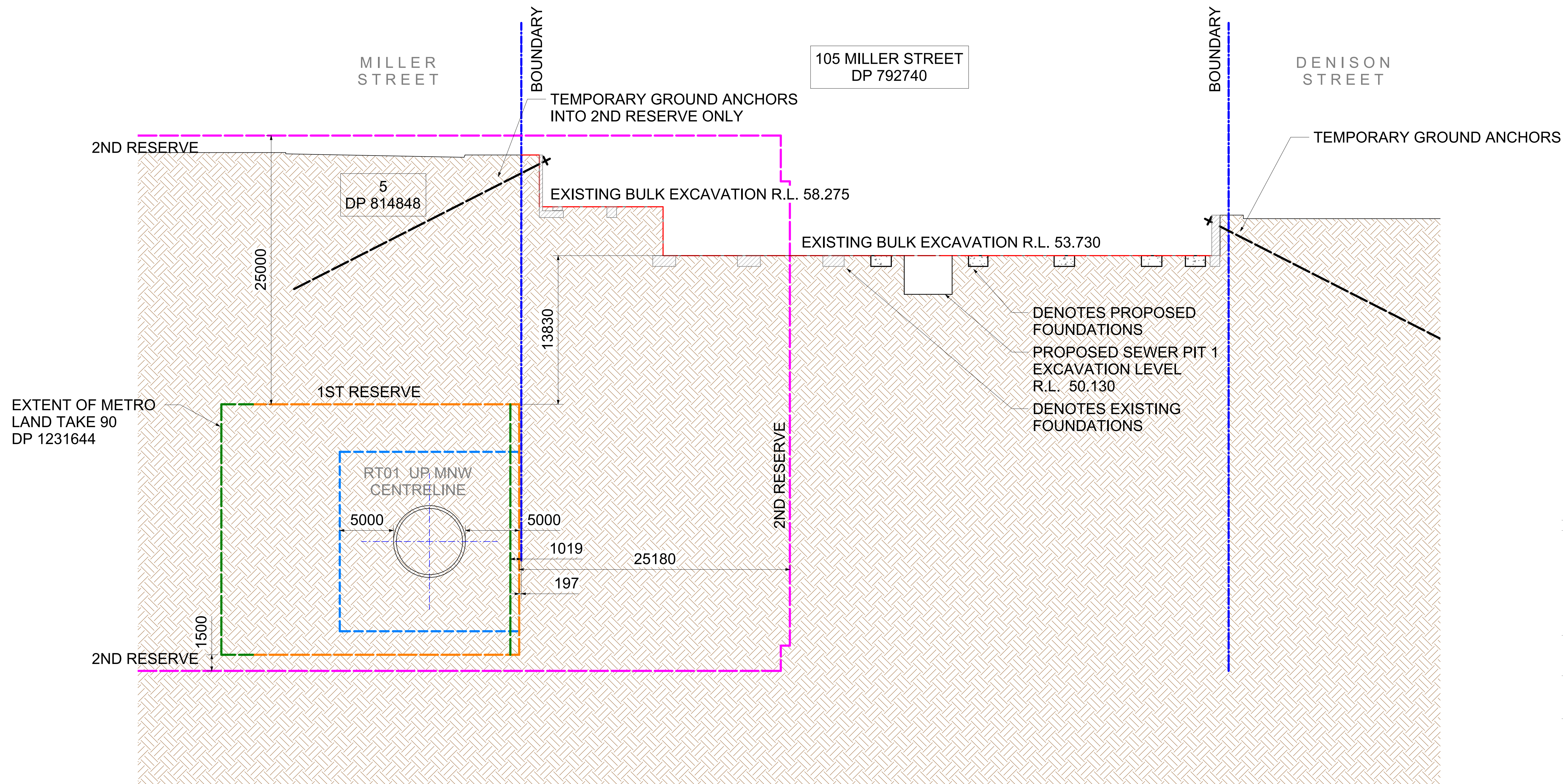
DRAWING NUMBER
ST-001-22

REV.
1

EASEMENT LEGEND

-  DENOTES SN1 EASEMENT
 DENOTES SN2 EASEMENT
 DENOTES SN3 EASEMENT
 DENOTES (B) EASEMENT

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SECTION 3
1 : 200

NOTE:
EXISTING AND PROPOSED STRUCTURE ABOVE THE
EXCAVATION LEVELS NOT SHOWN

1 03.07.25 FOR APPROVAL

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BUILDER

PROJECT NAME

105 MILLER STREET

PROJECT NUMBER: 214031

DRAWING TITLE

SITE METRO PROTECTION
ZONES - SECTIONS SHEET 3

SCALE AT A1: 1 : 200

DRAWN BY: J.D.B.

CHECKED BY: T.B.B.

DRAWING STATUS

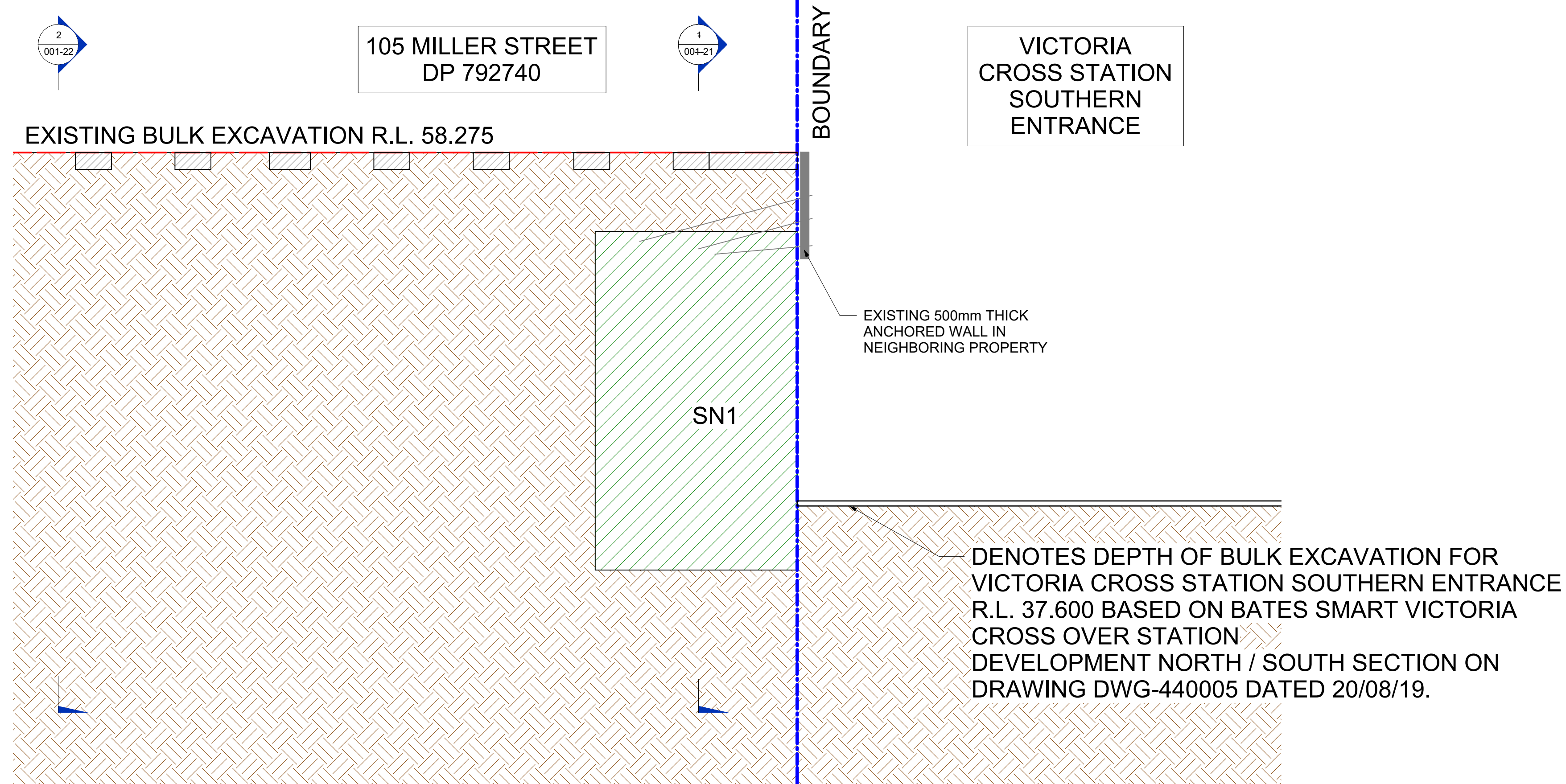
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DRAWING NUMBER

ST-001-23

REV.

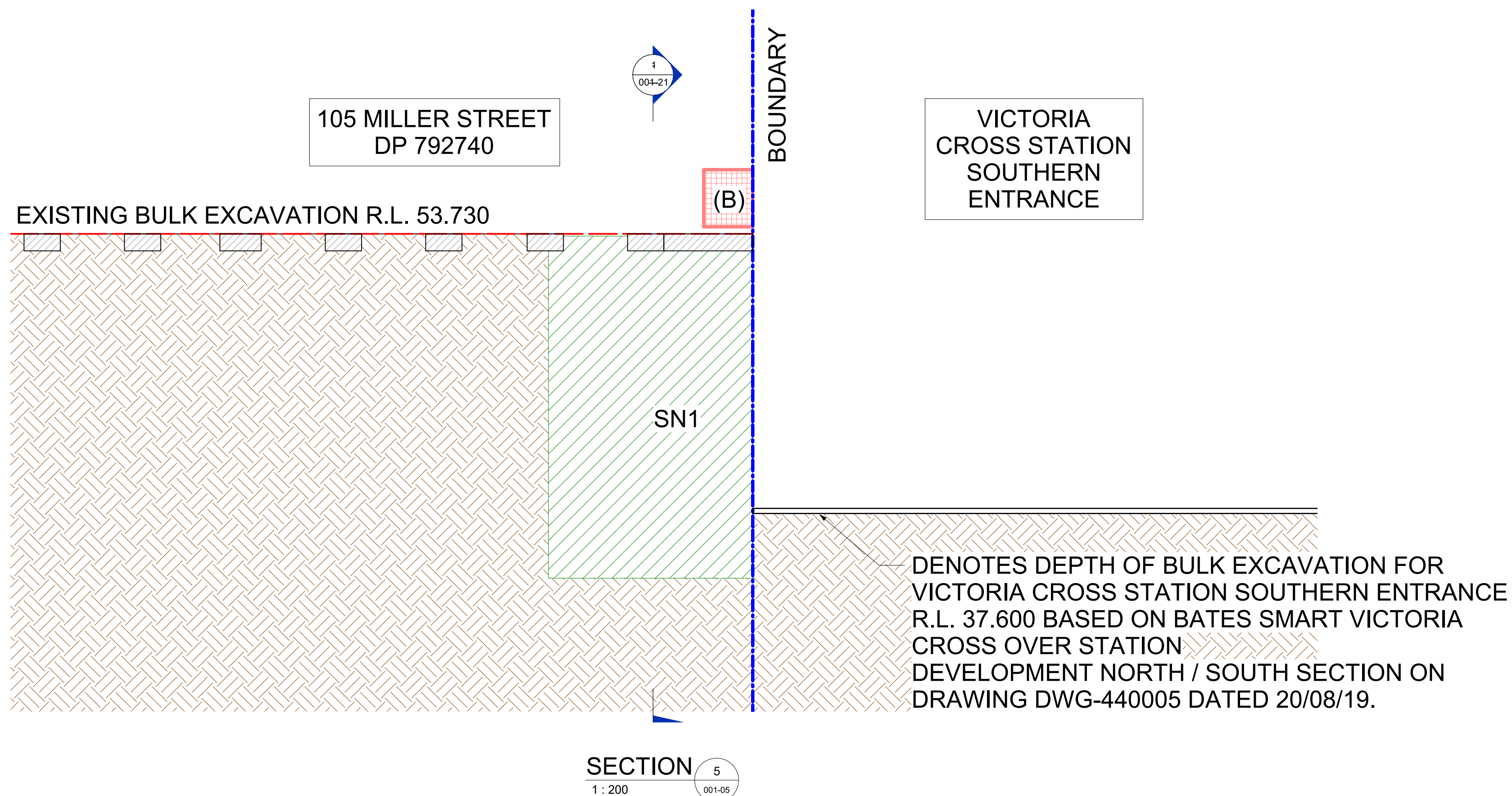
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EASEMENT LEGEND

- DENOTES SN1 EASEMENT
- DENOTES SN2 EASEMENT
- DENOTES SN3 EASEMENT
- DENOTES (B) EASEMENT

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CLIENT

BUILDER

PROJECT NAME
105 MILLER STREET

PROJECT NUMBER: 214031

DRAWING TITLE
SITE METRO PROTECTION
ZONES - SECTIONS SHEET 4

SCALE AT A1: 1 : 200

DRAWN BY: LDT

CHECKED BY: T.B.B.

DRAWING STATUS

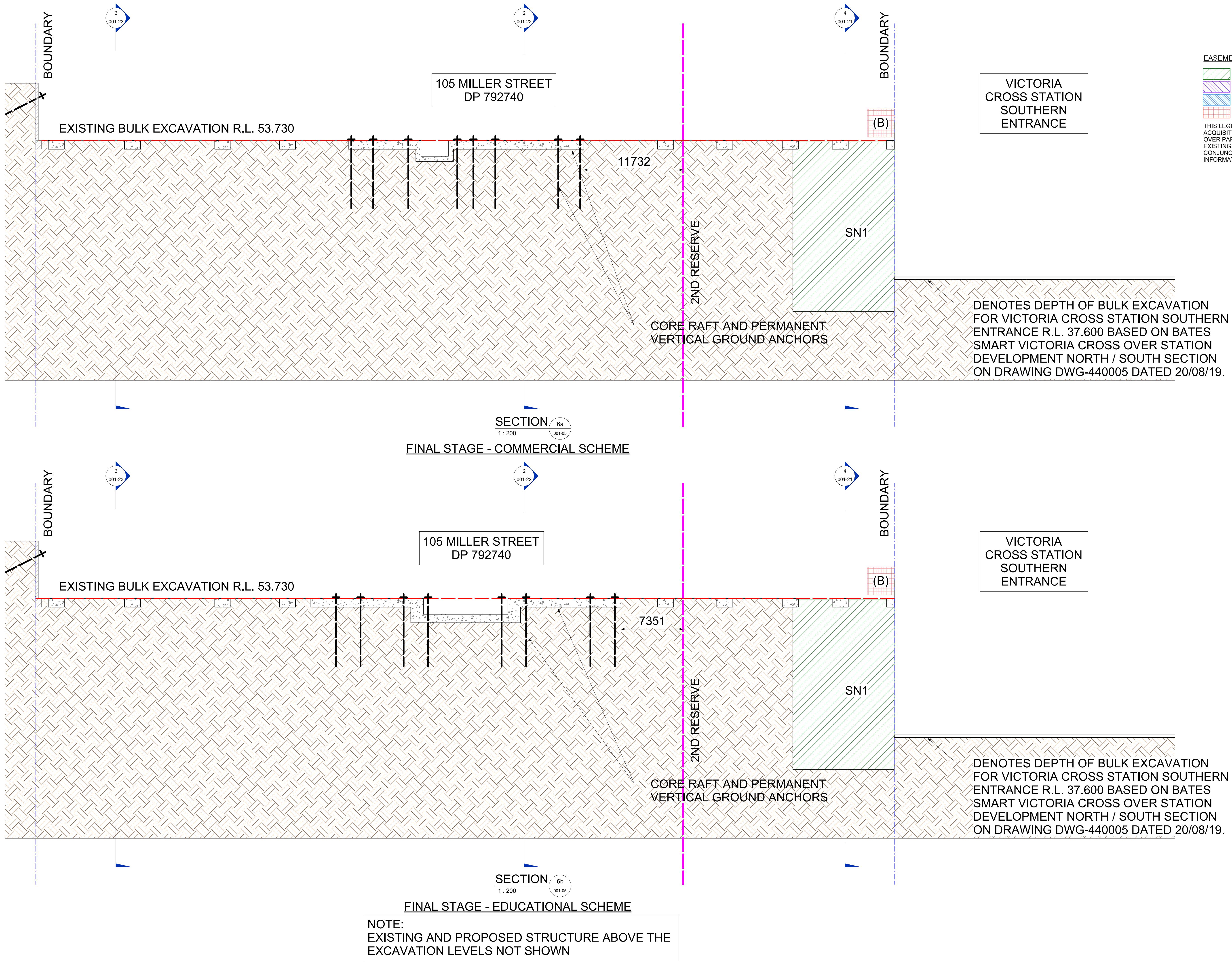
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DRAWING NUMBER

ST-001-24

REV.

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1 03.07.25 FOR APPROVAL

Rev. Date Description

STRUCTURAL / CIVIL CONSULTANT



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CLIENT

BUILDER

PROJECT NAME

105 MILLER STREET

PROJECT NUMBER: 214031

DRAWING TITLE

SITE METRO PROTECTION
ZONES - SECTIONS SHEET 5

SCALE AT A1: 1 : 200

DRAWN BY: LDT

CHECKED BY: T.B.B.

DRAWING STATUS

FOR INFORMATION

DRAWING NUMBER

ST-001-25

REV.

1

105 Miller Street

DA Submission Structural Report



Prepared for: Investa
By: **enstruct** group pty ltd
Revision: 1
November 2024

105 Miller Street

DA Submission Structural Report

ISSUE AUTHORISATION

PROJECT: 105 Miller Street

Project No: PS214031

Rev	Date	Purpose of Issue / Nature of Revision	Prepared by	Reviewed by	Issue Authorise by
0	29/11/2024	DA Submission	DS	TB	TB



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1 **Executive Summary**

In the spirit of reconciliation, Enstruct acknowledges the Traditional Custodians across all the lands on which we work and their enduring connections to land, sea, and community. We pay our respect to Elders past and present and extend that respect to all First Nations peoples today.

This structural schematic report is submitted to North Sydney Council on behalf of our client, Investa Custodian (2) Pty Ltd as Trustee for 105 Miller Street North Sydney Trust (Investa) to support a Development Application (DA) for the redevelopment and adaptive reuse of an existing State Heritage listed building at 105 Miller Street, North Sydney (the site) as a new commercial office building.

Specifically, the proposed works include the following:

- Adaptive reuse and restoration of the Miller Street wing;
- Demolition of the Denison Street wing and construction of a new 22 storey building;
- Alterations to the ground level to deliver a significantly enhance public domain;
- Construction of an almost double height ground floor retail and the delivery of a new public open space along Miller Street; and
- Basement carparking and loading dock accessed from a relocated entry off Denison Street.

For a detailed site and project description, refer to the Statement of Environmental Effects prepared by Beam Planning and the Architectural Drawings prepared by Bates Smart.

The existing structure includes a six-storey Denison Wing and a 13-storey Miller Wing. The redevelopment project aims to extend the Denison Wing and central core to 22 (including plant) stories, while the Miller Wing retains its current height.

The building's structural strategy emphasizes retaining existing components wherever possible to optimize cost and sustainability, including full retention of the B2 slab on ground and perimeter retention walls and partial retention of the steel framing and lower-level concrete slabs. However, key areas require demolition and rebuilding to support the increased height, updated architectural intent and compliance with modern standards. For example, the Denison Wing and central core must be demolished to provide the necessary structural capacity for the extended levels, as well as to meet modern seismic load, wind load, and fire safety standards.

Structural adjustments include upgrading floor thicknesses, revising slab designs, enhancing lateral stability systems, and replacing existing suspended floors with 150mm-thick profiled slabs to meet fire resistance and load requirements. Additionally, the ground floor slab in the Miller Wing will be raised to mitigate flood risk, while retaining much of its original structure.

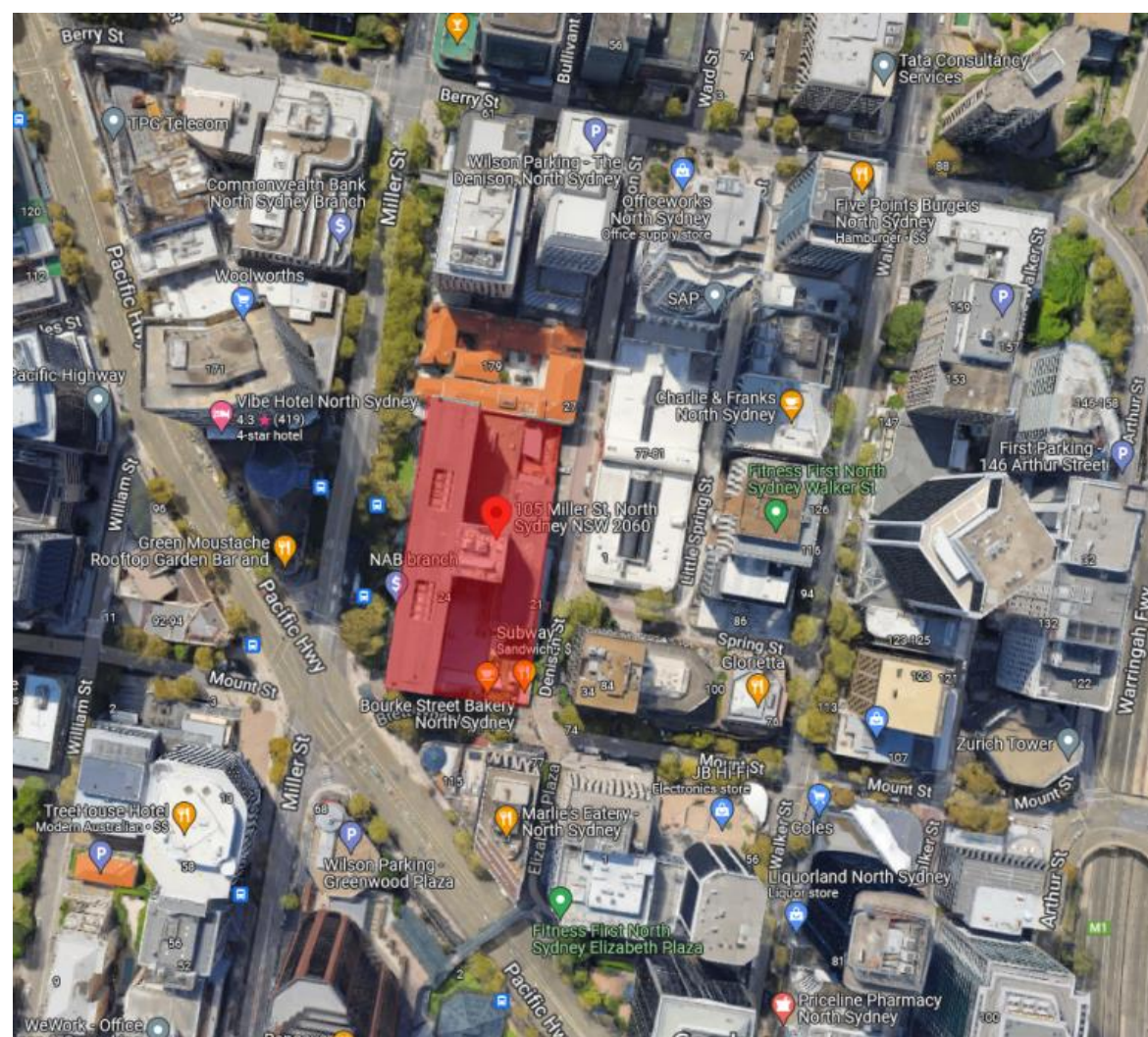
The design and material standards outlined comply with the relevant Australian standards to ensure the building's safety, durability, and environmental efficiency. The selected load assumptions,

durability classifications, reinforcement grades, and seismic requirements are outlined in detail, with careful attention to design life, vibration control, and crack resistance.

2 Building Overview

2.1 Description

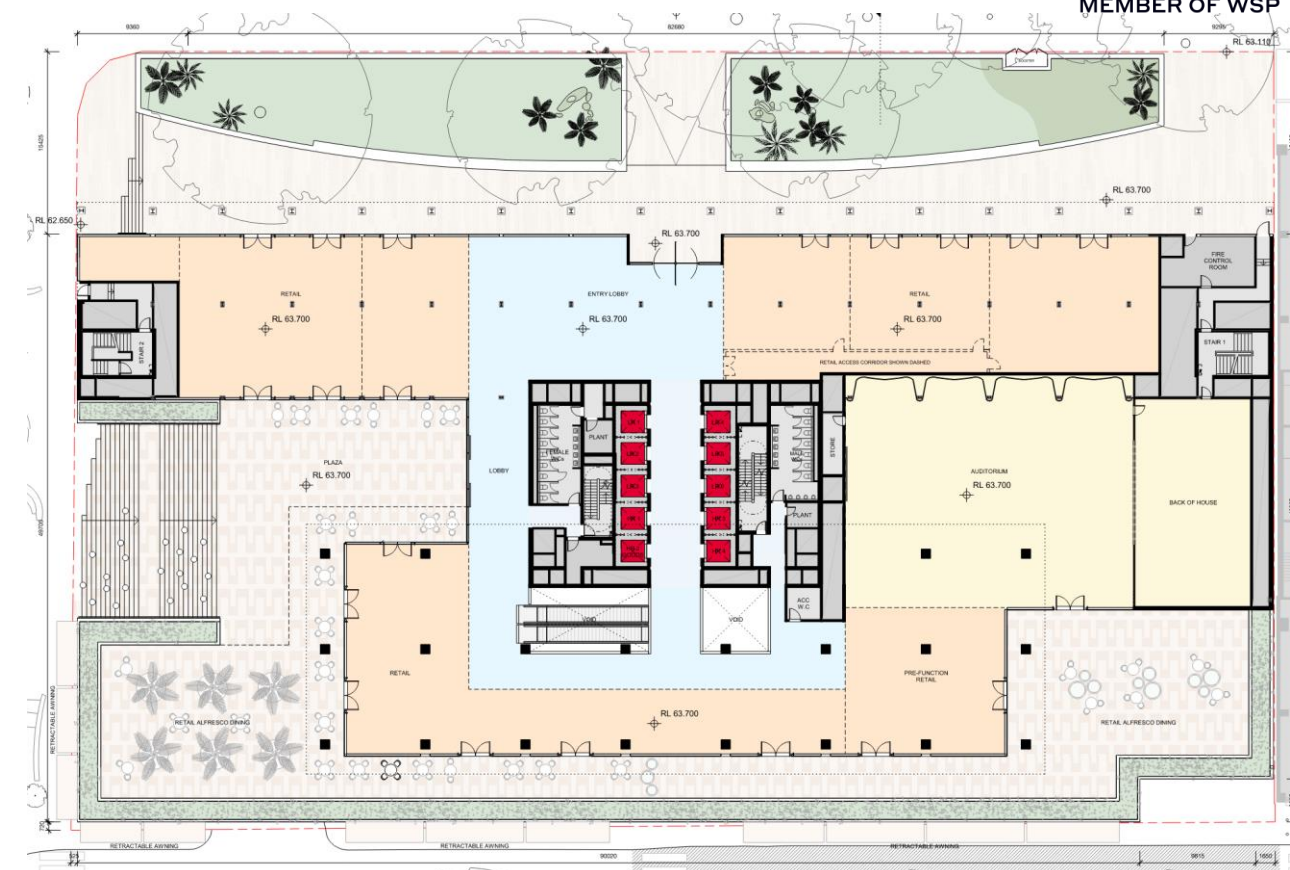
The 105 Miller St building is a commercial office building in North Sydney. The site is bound by Miller Street to the west, Denison Street to the east, and Brett Whitely Plaza to the south. It is located adjacent to the intersection of Miller Street and Pacific highway and is immediately adjacent to the Victoria Cross Metro Station to the North, refer site image below.



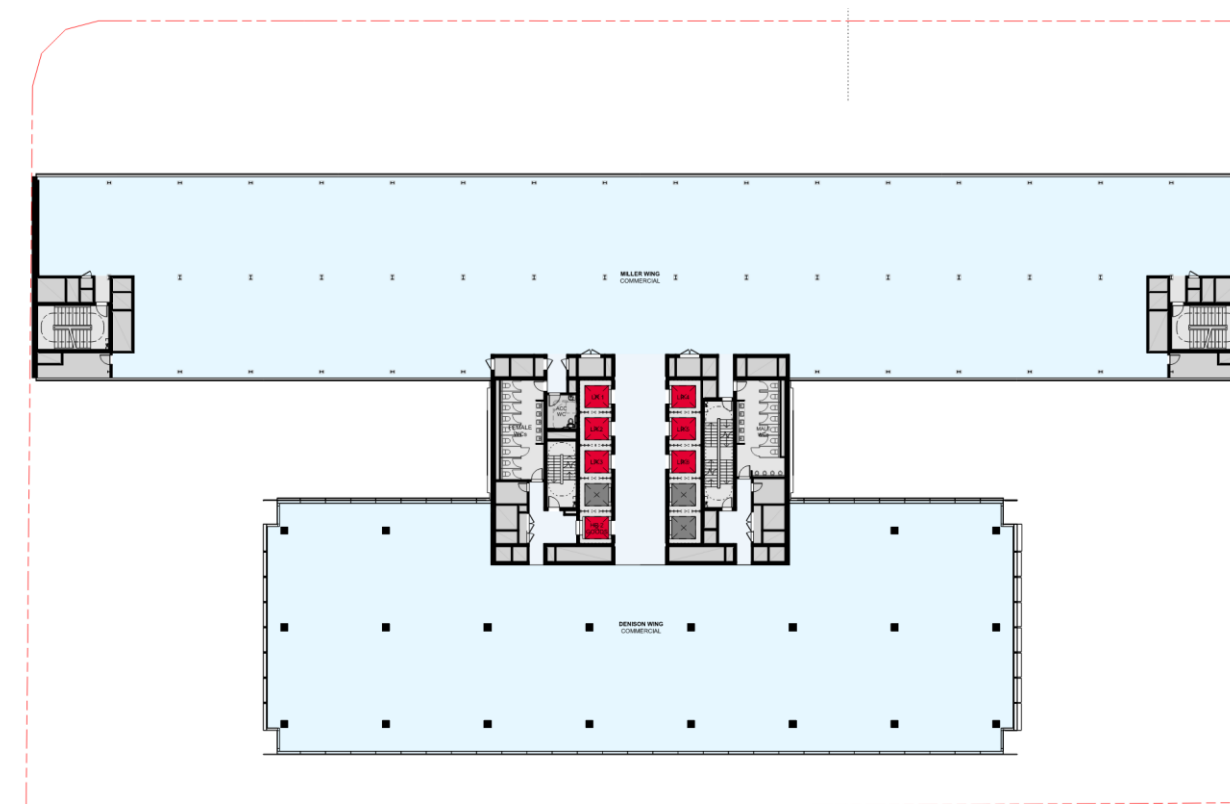
1 Site Location

The existing building consists of 2 basement levels, with one of these basement levels being Lower Ground that is a partial basement level due to the slope of the site and aligns with Denison St. Above ground there are 6 stories at the eastern wing and 13 stories at the western wing.

The proposed re-development is to be designed to accommodate commercial offices and is to extend vertically for the extent of the Denison Wing and the Central core to 22 storeys (including plant), with the Miller Wing to remain at its current height.



2 Proposed Ground Floor Layout



3 Proposed Typical Level Layout

Wherever possible, the structural intent has been to retain the existing structure to limit cost and improve sustainability. However, in order to achieve the new extent, comply with current standards and achieve architectural intent, a number of areas need to be demolished and re-built.

2.2 Extent of Retained Structure

- **B2 Level:** The existing B2 slab is proposed to be entirely retained except for local demolition where required to accommodate new footings.
- **Steel framing and existing walls in Miller Wing:** Existing steel columns and beams as well as non-load-bearing walls are to be preserved.
- **Slabs on lower levels in Miller Wing:** B1 and Ground Floor slabs are proposed to be retained within the extent of the Miller Wing along with the steel structure which is concrete encased on those levels.
- **Perimeter retaining walls**
- **Suspended structure supporting landscaping on Miller Street**

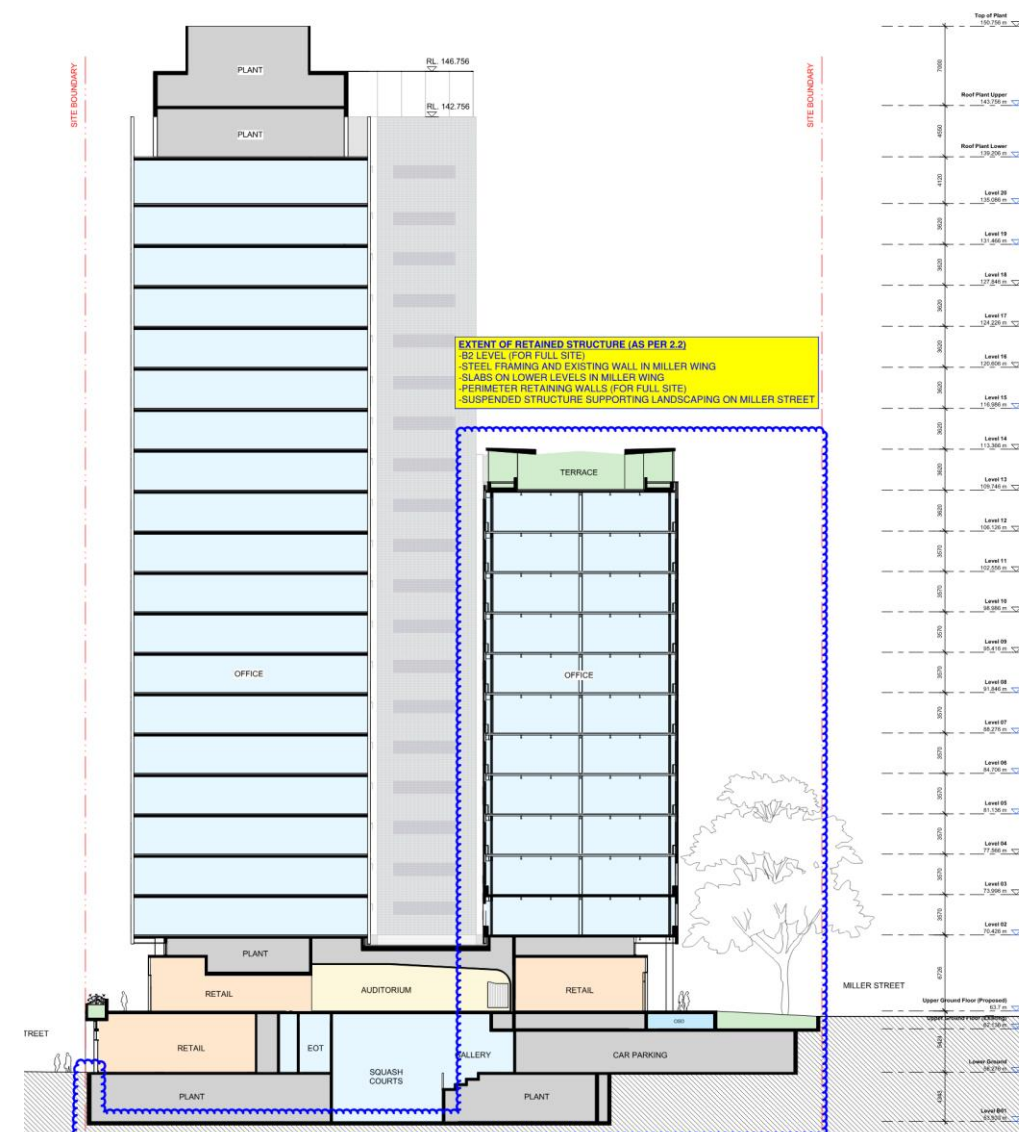
2.3 Extent of Demolition and Rebuild

- **Denison Wing:** This Denison Wing is to be entirely rebuilt and extended 22 storeys (including plant) along with a slight change in footprint.
- **Miller Wing slabs:** The Miller Wing concrete slab for all levels above ground level is to be replaced with 150mm thick profiled slab on metal deck.
- **Central Core:** The central core is to be entirely rebuilt and extended 22 storeys
- **B1 and Ground floor outside of the Miller Wing footprint.**

2.4 Justification for Demolition requirements

- **Monolithic Floor Design and Lateral Impact:** The existing monolithic floor plate design binds the Denison and Miller Street wings into a unified lateral system. Modifying either wing to support additional floors requires strengthening of the lateral system. Extending the Denison Street wing to 20 storeys, in particular, requires updates to meet current standards for structural stability.
- **Inadequate Slab Thickness in Miller Street Wing:** Suspended slabs in the Miller Street wing, at 63mm on a 100mm metal deck with minimal reinforcement, do not meet the 2-hour fire rating (requiring 120mm per AS3600) or the tension capacity for AS3600 and AS1170.4 in-plane diaphragm forces under seismic loading. Replacing these slabs with thicker, reinforced concrete will ensure compliance with fire and seismic codes.

- **Load-Bearing Limitations in Denison Street Wing:** Originally designed to support only six storeys, the Denison Street wing cannot handle the weight of the proposed 20-storey expansion. Consequently, it must be demolished and replaced to provide the necessary load-bearing capacity for the new structure.
- **Inadequate Stability System:** The current stability system of the building is not compliant to current standards and needs to be augmented/replaced. The current core in the “Central Tower” located in between the two wings, provides little more than nominal capacity. The existing core is therefore also required to be demolished and rebuilt with sufficient capacity for lateral and vertical loads.
- **Floor height constraints:** Outside the extent of the Miller Street wing, the podium levels are proposed to be demolished and rebuilt to allow for the floor height constraints set by the clearance requirements for retail, common areas, substation and loading dock access.



4 Section Through Proposed Building

3 Proposed Structural System

3.1 Miller Street Wing:

- **Lower Levels – Retained Concrete-Encased Columns, Beams, and Slabs:** On the lower levels, the existing structural columns and beams are concrete-encased, providing the required 2-hour fire rating and structural strength. At these levels, the existing 125mm-thick slab will be retained.
- **Upper Levels – Slab Replacement:** For the upper levels of the Miller Street wing, existing slabs will be replaced with a profiled 150mm-thick concrete slab on a metal deck to meet load bearing, fire safety, and durability requirements. Adequate fire rating to the existing framing is to be provided to achieve the required 2hr fire rating.
- **Ground Floor Flood Mitigation and double height space:** The ground floor slab in the Miller Street wing is to be raised as part of the flood mitigation strategy while retaining the original slab structure. This will be achieved by constructing 140mm blockwork dwarf walls at 2.5-meter intervals, on top of which a 120mm-thick slab on metal decking is to be installed. Additionally, Level 1 will be demolished in the Miller Street wing, allowing for an almost double-height space on the ground floor across both wings. Existing columns within the double height space are to be strengthened to accommodate the increased buckling length.
- **Existing Non-load Bearing walls:** The existing non-load bearing walls at the North and South ends and around the existing stairwells are constructed out of concrete or masonry and are to be retained. They will be required to be restrained and/or structurally isolated from the stability system to ensure they do not fail under seismic loads and lead to a risk for public safety or egress. For the perimeter walls, the terracotta cladding they support is proposed to be replaced due to their poor condition. Structural works on these walls may be done concurrently if required.

3.2 Denison Street Wing:

- **Complete Reconstruction with New Concrete Structure:** The existing structure will be fully replaced with a reinforced concrete system to support the building's expanded height and load-bearing needs.
- **Floorplate Design for Podium and Typical Levels:** The podium levels will feature a post-tensioned (PT) banded beam system, while the typical levels will have a 200mm-thick PT flat plate system. Levels 21 and 22 are proposed to support plant loading and will be required to be approximately 300 thick flat plate.

3.3 Central Core:

The central core will be rebuilt with 250mm-thick concrete walls to provide critical lateral stability and support increased vertical loads. Extending through the full height of the building, this core will

serve as the primary stability system for both wings, ensuring compliance with seismic and wind load standards. Floor plates within the central core are typically 200 thick.

3.4 Foundation System

The proposed foundation system consists of shallow footings, with pad footings provided to support columns and a raft provided to support the core. Ground anchors are to be provided to overcome tension forces generated by lateral loads.

3.5 Retention System

With the site sloping downwards between Miller Street and Denison Street, the extent below ground varies between 2 levels and 1 level. On the South, East and West edges of the building, the perimeter walls retain soil and are proposed to be retained and provided with temporary ground anchors during construction of the B1 and Ground floor levels.

3.6 Slab on Ground.

The existing slab on ground at B2 level is over 300mm thick and is adequate to support the plant loads proposed in this area.

4 Design Standards

The Structural Design components will be designed and detailed in accordance with the relevant Australian standards listed below –

AS/NZS 1170.0-2002 -	Structural Design Actions – General Principles
AS/NZS 1170.1-2002 -	Structural Design Actions – Permanent, Imposed and Other Actions
AS/NZS 1170.2-2021 -	Structural Design Actions – Wind Actions
AS/NZS 1170.4-2007 -	Structural Design Actions – Earthquake Actions in Australia
AS 3600-2018 -	Concrete Structures
AS 3700-2001 -	Masonry Standards
AS 4100-2020 -	Steel Structures
AS 4671.1-2001 -	Steel Reinforcing Materials AS
2159-2009 -	Piling Design and Installation
AS 4678-2002 -	Earth Retaining Structures
AS 2670.2-1990 -	Evaluation of Human Exposure to Whole Body Vibration Continuous and Induced Vibration in Buildings

5 Design loads

Design loads for the buildings are to comply with Australian Standards, the Building Code of Australia and any additional loading requirements that arise following the review of the loading assumptions. Please refer below for loading assumptions of the main building usages:

5.1 Floor loads

The design load specifications for various areas in the building are as follows:

- **Carpark (Basement)**
 - Superimposed Dead Load: 0.5 kPa
 - Live Load (vehicles not exceeding 2500kg gross mass): 2.50 kPa
- **Loading Dock**
 - Superimposed Dead Load: 0.50 kPa
 - Final Live Load (TBC, dependent on truck requirements): 10.0 kPa
- **Retail Spaces**
 - Superimposed Dead Load: 2kPa
 - Reducible Live Load: 5.00 kPa
- **General Office**
 - Superimposed Dead Load:
 - Services/Ceiling: 0.50 kPa
 - Floor Finishes: 0.50 kPa

- Raised access floor: 0.50 kPa
 - Total SDL: 1.5 kPa
 - Live Load: 3.00 kPa
- **Compactus Zone**
 - Superimposed Dead Load:
 - Services/Ceiling: 0.50 kPa
 - Floor Finishes: 0.50 kPa
 - Raised access floor: 0.50 kPa
 - Total Dead Load: 1.50 kPa
 - Live Load: 7.50 kPa
 - Note: Applies to 5% of office area.
- **Terrace**
 - Superimposed Dead Load:
 - Services/Ceiling: 0.50 kPa
 - Floor Finishes (100mm Zone): 2.50 kPa
 - Total SDL: 3.00 kPa
 - Live Load: 4.00 kPa
- **Terrace Landscaping at Ground level (Localised Planters)**
 - Superimposed Dead Load (100mm Zone for Finishes): 2.50 kPa
 - Planter Zones (600mm Soil TBC): 12.00 kPa
 - Live Load: 0.5 kPa
- **Lift Motor Room**
 - Superimposed Dead Load: 2.50 kPa
 - Live Load: 7.50 kPa
- **Lift Overrun**
 - Superimposed Dead Load: 2.50 kPa
 - Live Load: 5.00 kPa
- **Plant Room**
 - Superimposed Dead Load (Plinths and Partitions): 3.00 kPa
 - Live Load: 5.00 kPa
- **Amenities**
 - Superimposed Dead Load: 2.00 kPa
 - Live Load: 5.00 kPa
- **Corridors & Lobbies**
 - Superimposed Dead Load: 2.00 kPa
 - Live Load: 4.00 kPa
- **Fire Stairs**

- Superimposed Dead Load: 0.5 kPa
- Live Load: 4.00 kPa

- **Façade**

- Glazed facade: 1kPa (~4 kN/m)

5.2 Earthquake Loads

The structure is assumed to be designed in accordance with AS1170.4 for the following criteria –

- Hazard Factor Z – 0.08;
- Site Sub-Soil Class – Be;
- Importance Factor – 3;
- Design Working Life – 50 Years;
- Earthquake Design Category – III;
- Earthquake Loading Return Period – 1 in 1000; and
- Probability Factor Kp – 1.3.

5.3 Wind Loads

The proposed wind loading in determining a suitable structural scheme will be based on the following factors in accordance with AS1170.2 unless more extensive wind studies are performed –

Wind Region	A2
Terrain Category	3
Ultimate Wind	1 in 1000, Velocity = 46 m/s
Serviceability Wind	1 in 25, Velocity = 37 m/s
Terrain Height Multiplier, Mz,cat	Refer AS1170.2
Damping Ratio (Ultimate)	3.0% of Critical Damping (TBC)
Damping Ratio (Serviceability)	1.0% of Critical Damping (TBC)

6 Design Criteria

6.1 Design Life

As a minimum standard, the concrete structure will be assumed to be designed to have a design life of 50 years in accordance with Cl.4.1 of AS3600-2018.

6.2 Tall building Acceleration

Peak building acceleration must be limited to the following for a 10-year return wind event –

ISO 10137-2007 Equation was extended by Melbourne and Cheung from R = 1 year to

any R, for office buildings the equation expressed as peak acceleration in milli-g is:

$[Exp (-2.81-0.445 \ln (n))/0.68] \times [0.68 + \ln R / 5] \times [1000/9.81]$ (Melbourne and Cheung)

6.3 Robustness

Building robustness has a minimum lateral resistance equivalent to 1.5% of the characteristic dead load. This approach is commonly adopted in the industry.

6.4 Suspended Floor Slab Deflection

Suspended floor deflections are to be limited to ensure the floor space is suitable for the proposed usage. Deflections are also limited by the requirements of the façade system, sensitive internal partitions or other non-structural items.

- Floor members with span less than or equal to 12.5m –
 - With non-structural items insensitive to movement:

▪ Total Deflection	=	Span/250	or	25mm
▪ Incremental Deflection	=	Span/360		
 - With brittle non-structural items:

▪ Total Deflection	=	Span/250	or	25mm
▪ Incremental Deflection	=	Span/500		
- Floor members with span greater than 12.5m:
 - With non-structural items insensitive to movement:

▪ Total Deflection	=	Span/250	or	30mm
▪ Incremental Deflection	=	Span/360		
 - With brittle non-structural items:

▪ Total Deflection	=	Span/250	or	30mm
▪ Incremental Deflection	=	Span/500		

6.5 Impact on adjacent buildings and Metro tunnel

The structural design will ensure that the building and its foundations do not have an adverse effect on the metro tunnel to the west of the site and the adjacent buildings (in particular the metro station to the north of the site). As part of this process, coordination with Metro Sydney will be undertaken during the DA approval process. Considering the Miller Street wing columns and associated footings to the West of the site are proposed to remain in their current state and that the Main Denison Wing footings are located at least 20 metres away from any adjacent building structure, this consideration is not expected to warrant extensive works.

- Transfer members:
 - Total Deflection = Span/1000 or 10mm
 - Incremental Deflection = Span/1000
- Cantilever members:
 - Total Deflection = Span/125 or 25mm
 - Incremental Deflection = Span/250

6.6 Suspended Floor Shrinkage Crack Control

Suspended floor structures will be designed for a “Minor Degree of Crack Control” to AS 3600 - 2018 as a minimum. Certain elements such as roofs, balconies, areas with the concrete slab exposed (no floors coverings), terraces etc. will be designed for a “High Degree of Crack Control”. Tiled areas will be designed to a “Moderate Degree of crack control”

6.7 Vibration Limit

The office floors must meet standard vibration acceptance criteria specified for walking excitation.

Acceptance levels due to floor vibrations vary based on occupancy use.

The acceptance criteria nominated below is based on criteria as recommended by Australian Standard AS2670.2 – Evaluation of Human Exposure to whole body vibration Part 2: Continuous and shock induced vibration in buildings which is identical to the International Standards Organisation Standard ISO 2631-2, 1989.

For office floors, Peak acceleration in frequency range 4-8 Hz NOT to exceed 0.5%g.

Criteria above apply to footfall-induced vibrations. The same criterion values apply to mechanical disturbances at a single frequency or at a number of widely separated frequencies. For disturbances at multiple, closely spaced frequencies, the criterion apply to disturbances observed in one-third-octave bands. Typically vibration generated by plant or equipment is controlled by vibration isolation mounts below the item or isolating the equipment from the main structural frame using a floating slab.

7 Materials

7.1 Concrete

The minimum concrete strengths for individual structural elements are shown on the structural drawings together with additional information regarding to their mix design.

The minimum strength required is the minimum 28-day strength of the concrete.

7.2 Concrete Durability

The building is to have adequate durability to achieve as a minimum the design life without requiring undue maintenance. Durability is to be incorporated into the structure through

materials with properties complying with the recommendations for durability specified in the relevant Australian Standard, concrete mix design, appropriate protective coatings, attention of design details and good construction practice.

Concrete durability is in accordance with AS 3600 - 2018 Section 4 “Design for Durability”.

Element	Classification
Exterior Concrete	B1
Interior Concrete	A2

For exposure classification refer to AS 3600 - 2018: Section 4.3 - 4.6 Exposure Classification.

7.3 Reinforcement

- Reinforcing bars to AS 4671-2001
- Deformed bars with $f_{sy} = 500$ MPa
- Welded wire to BS 4483 – 2005

7.4 Structural Steel

- Structural Steel to AS 4100-2020
- Steel decking to Grade G440

7.5 Tendons

All post-tensioned tendons to consist of 12.7mm or 15.2mm diameter strands, with a total jacking force of 156kN and 212kN respectively.

8 Design Software

- RAM Concept by Bentley - Suspended reinforced and post-tensioned concrete member design
- RAPT by PCDC - Reinforced and post-tensioned concrete design package
- ETABS by CSI – Finite element analysis and design package for building structures
- Space Gass by Space Gass Pty Ltd. – Beam and frame analysis package
- Structural Toolkit by Space Gass Pty Ltd. – Multi purpose design tool

9 *References*

Geotechnical report - 86964.03.R.001.Rev1

105 Miller Street

SSDA Submission Structural Report (Education Scheme)



Prepared for: Investa
By: **enstruct** group pty ltd
Revision: 1
April 2024

105 Miller Street

SSDA Submission Structural Report (Education Scheme)

ISSUE AUTHORISATION

PROJECT: 105 Miller Street

Project No: PS214031

Rev	Date	Purpose of Issue / Nature of Revision	Prepared by	Reviewed by	Issue Authorise by
0	02/04/2025	SSDA Submission	DS	TB	TB



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1 **Executive Summary**

In the spirit of reconciliation, Enstruct acknowledges the Traditional Custodians across all the lands on which we work and their enduring connections to land, sea, and community. We pay our respect to Elders past and present and extend that respect to all First Nations peoples today.

This structural schematic report is submitted to the Department of Planning, Housing and Infrastructure (DPHI) on behalf of our client, Investa Custodian (2) Pty Ltd as Trustee for 105 Miller Street North Sydney Trust (Investa) to support a State Significant Development Application (SSDA) for the redevelopment and adaptive reuse of an existing state heritage building at 105 Miller Street, North Sydney (the site) as an education institution.

Specifically, the proposed works include the following:

- Adaptive reuse and restoration of the Miller Street wing;
- Demolition of the Denison Street wing, central core structure and pavilion on the northwestern corner of Miller Street;
- Construction of a new Denison Street wing, comprising ground level retail and educational establishment uses above;
- Construction of a new central core structure, comprising the lift core and building services;
- Alterations to the ground level to deliver a significantly enhanced public domain;
- Construction of an almost double height ground floor retail and the delivery of a new public open space along Miller Street; and
- Basement carparking and loading dock accessed from a relocated entry off Denison Street.

For a detailed project description, refer to the Environmental Impact Statement prepared by Beam Planning and the Architectural Drawings prepared by FJC.

The existing structure includes a six-storey Denison Wing and a 13-storey Miller Wing. The redevelopment project aims to extend the Denison Wing and central core to 22 (including plant) stories, while the Miller Wing retains its current height.

The building's structural strategy emphasizes retaining existing components wherever possible to preserve heritage elements and ensure sustainability, including full retention of the B2 slab on ground and perimeter retention walls and partial retention of the steel framing and lower-level concrete slabs. However, key areas require demolition and rebuilding to achieve compliance with modern standards. For example, the Denison Wing and central core must be demolished to provide the necessary structural capacity to meet modern seismic load, wind load, and fire safety standards.

Structural adjustments include upgrading floor thicknesses, revising slab designs, enhancing lateral stability systems, and replacing existing suspended floors with 150mm-thick profiled slabs to meet fire resistance and load requirements. Additionally, the ground floor slab in the Miller Wing will be raised to mitigate flood risk, while retaining much of its original structure.

The design and material standards outlined comply with the relevant Australian standards to ensure the building's safety, durability, and environmental efficiency. The selected load assumptions, durability classifications, reinforcement grades, and seismic requirements are outlined in detail, with careful attention to design life, vibration control, and crack resistance.

2 Building Overview

2.1 Description

The address of the site is 105-153 Miller Street, North Sydney and is legally described as Lot 2 in DP 792740. The site sits in the heart of the North Sydney Central Business District (CBD), immediately south of the Victoria Cross Metro Station and in walking distance of the North Sydney Train Station.

The site has a total area of 6,640m², with three street frontages, to Miller Street, Brett Whiteley Plaza and Denison Street. The Miller Street frontage is occupied by a landscaped area, pedestrian walkway and retail frontage. The site has a highly visible interface with Brett Whiteley Plaza, which is identified as a key public open space in North Sydney. A range of retail occupancies are located on the Denison Street frontage of the site, set back under a low awning. **Figure 1** shows the site and its context.

The North Sydney MLC Centre and associated turfed public domain currently occupy the site. The existing building comprises a modular building mass with a 13-storey north-south oriented western wing, a central service core and a 6-storey eastern wing, setback from the southern boundary.

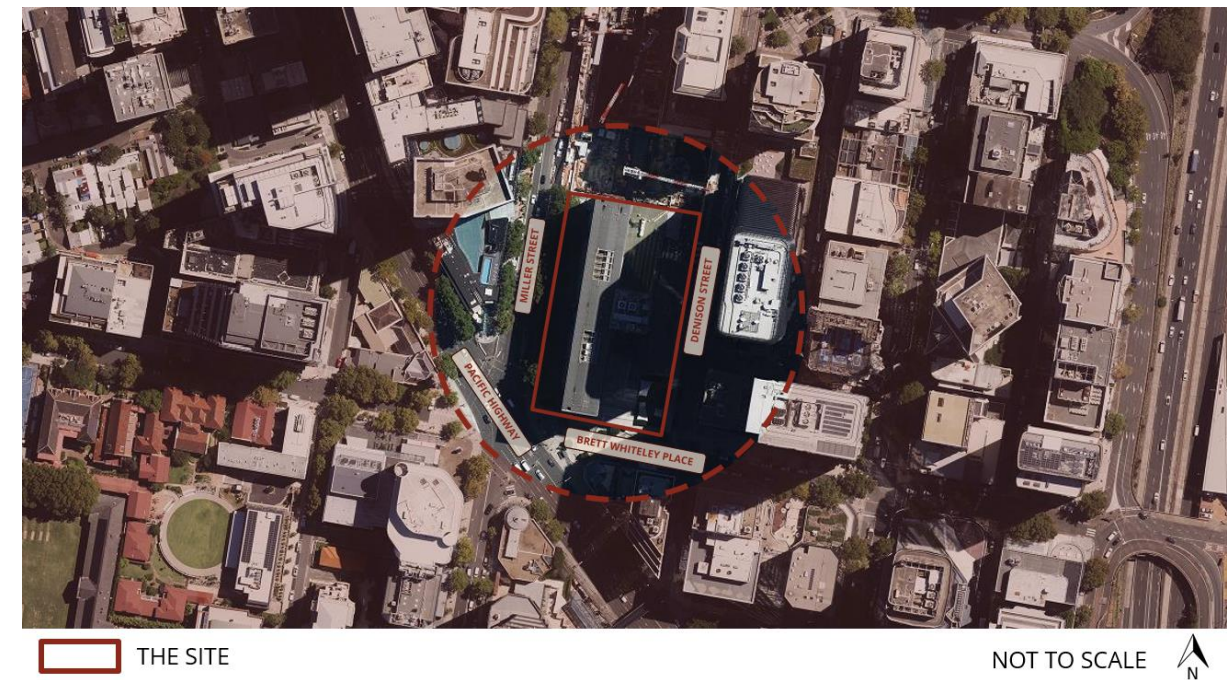


Figure 1 Aerial view of the site

The proposed re-development is to be designed to accommodate educational areas and is to extend vertically for the extent of the Denison Wing and the Central core to 22 storeys (including plant), with the Miller Wing to remain at its current height.

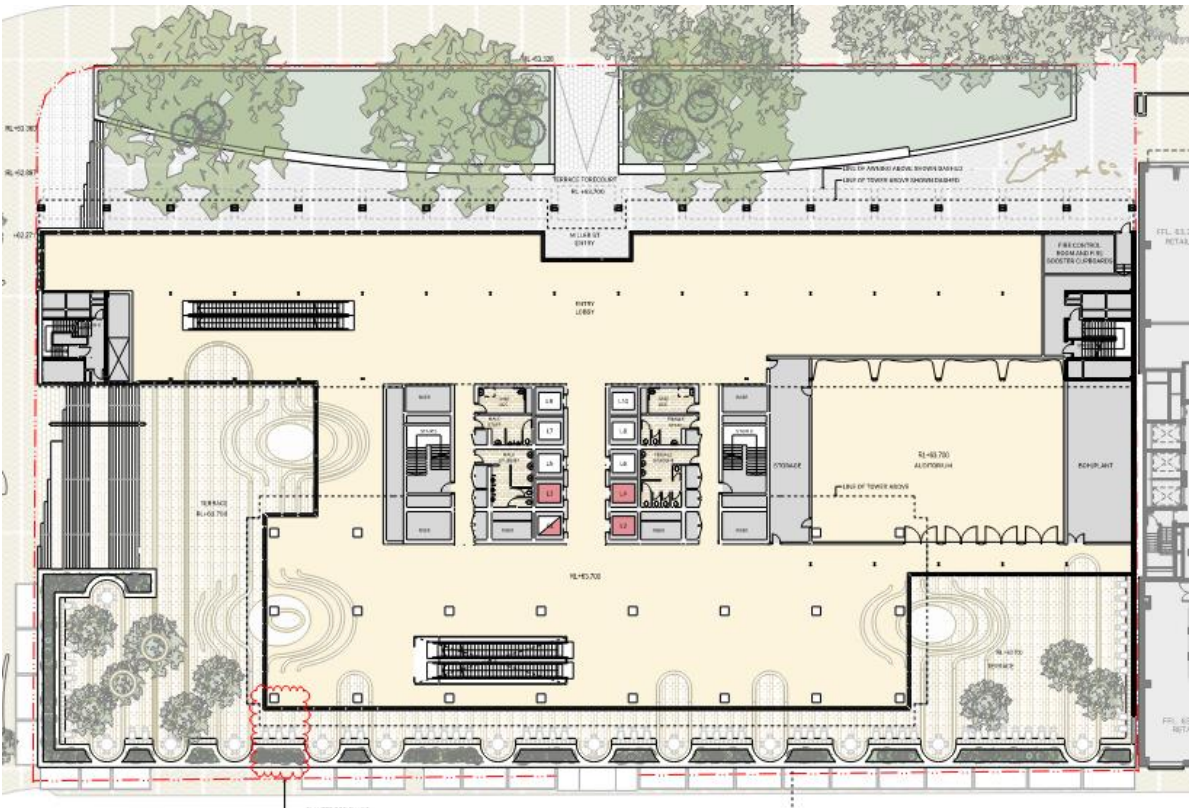


Figure 2 Proposed Ground Floor Layout

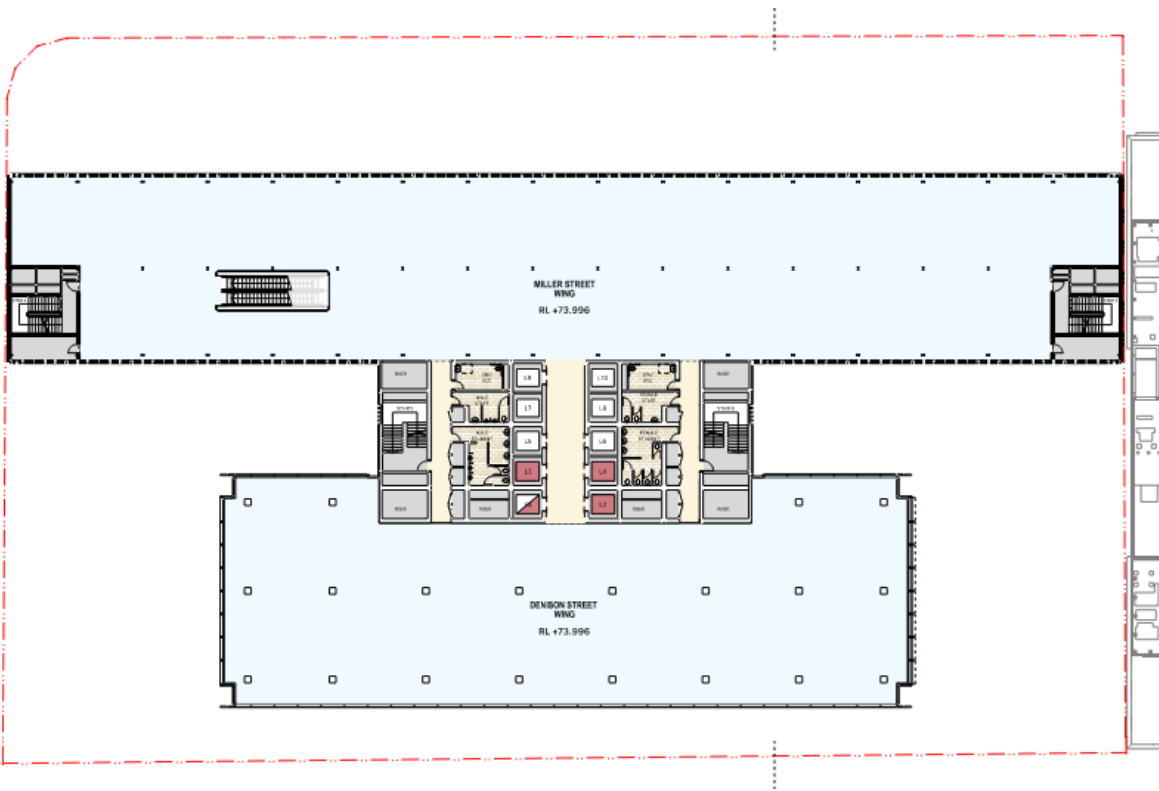


Figure 3 Proposed Typical Level Layout

Wherever possible, the structural intent has been to retain the existing structure to preserve heritage elements and improve sustainability. However, in order to achieve the new extent, comply with current standards and achieve architectural intent, a number of areas need to be demolished and re-built.

2.2 *Extent of Retained Structure*

- **B2 Level:** The existing B2 slab is proposed to be entirely retained except for local demolition where required to accommodate new footings.
- **Steel framing and existing walls in Miller Wing:** Existing steel columns and beams as well as non-load-bearing walls are to be preserved.
- **Slabs on lower levels in Miller Wing:** B1 and Ground Floor slabs are proposed to be retained within the extent of the Miller Wing along with the steel structure which is concrete encased on those levels.
- **Perimeter retaining walls**
- **Suspended structure supporting landscaping on Miller Street**

2.3 *Extent of Demolition and Rebuild*

- **Denison Wing:** This Denison Wing is to be entirely rebuilt and extended 22 storeys (including plant) along with a slight change in footprint.
- **Miller Wing slabs:** The Miller Wing concrete slab for all levels above ground level is to be replaced with 150mm thick profiled slab on metal deck.
- **Central Core:** The central core is to be entirely rebuilt and extended 22 storeys
- **B1 and Ground floor outside of the Miller Wing footprint.**

2.4 *Justification for Demolition requirements*

- **Monolithic Floor Design and Lateral Impact:** The existing monolithic floor plate design binds the Denison and Miller Street wings into a unified lateral system. Modifying either wing triggers the requirement for an upgrade under the Building Code of Australia. This coupled with the proposed additional floors requires strengthening of the lateral system.
- **Inadequate Slab Thickness in Miller Street Wing:** Suspended slabs in the Miller Street wing, at 63mm on a 100mm metal deck with minimal reinforcement, do not meet the 2-hour fire rating (requiring 120mm per AS3600) or the tension capacity for AS3600 and AS1170.4 in-plane diaphragm

forces under seismic loading. Replacing these slabs with thicker, reinforced concrete will ensure compliance with fire and seismic codes.

- **Load-Bearing Limitations in Denison Street Wing:** Originally designed to support only six storeys, the Denison Street wing cannot handle the weight of the proposed 22-storey expansion. Consequently, it must be demolished and replaced to provide the necessary load-bearing capacity for the new structure.

Inadequate Stability System: The current stability system of the building is not compliant to current standards and needs to be augmented/replaced. The current core in the “Central Tower” located in between the two wings, provides little more than nominal capacity. The existing core is therefore also required to be demolished and rebuilt with sufficient capacity for lateral and vertical loads.

- **Floor height constraints:** Outside the extent of the Miller Street wing, the podium levels are proposed to be demolished and rebuilt to allow for the floor height constraints set by the clearance requirements for retail, common areas, substation and loading dock access.

3 *Proposed Structural System*

3.1 *Miller Street Wing:*

- **Lower Levels – Retained Concrete-Encased Columns, Beams, and Slabs:** On the lower levels, the existing structural columns and beams are concrete-encased, providing the required 2-hour fire rating and structural strength. At these levels, the existing 125mm-thick slab will be retained.
- **Upper Levels – Slab Replacement:** For the upper levels of the Miller Street wing, existing slabs will be replaced with a profiled 150mm-thick concrete slab on a metal deck to meet load bearing, fire safety, and durability requirements. Adequate fire rating to the existing framing is to be provided to achieve the required 2hr fire rating.
- **Ground Floor Flood Mitigation and double height space:** The ground floor slab in the Miller Street wing is to be raised as part of the flood mitigation strategy while retaining the original slab structure. This will be achieved by constructing 140mm blockwork dwarf walls at 2.5-meter intervals, on top of which a 120mm-thick slab on metal decking is to be installed. Additionally, Level 1 will be demolished in the Miller Street wing, allowing for an almost double-height space on the ground floor across both wings. Existing columns within the double height space are to be strengthened to accommodate the increased buckling length.
- **Existing Non-load Bearing walls:** The existing non-load bearing walls at the North and South ends and around the existing stairwells are constructed out of concrete or masonry and are to be retained. They will be required to be restrained and/or structurally isolated from the stability system to ensure they do not fail under seismic loads and lead to a risk for public safety or egress. For the perimeter walls, the terracotta cladding they support is proposed to be replaced due to their poor condition. Structural works on these walls may be done concurrently if required.

3.2 Denison Street Wing:

- **Complete Reconstruction with New Concrete Structure:** The existing structure will be fully replaced with a reinforced concrete system to support the building's expanded height and load-bearing needs.
- **Floorplate Design for Podium and Typical Levels:** The podium levels will feature a post-tensioned (PT) banded beam system, while the typical levels will have a 200mm-thick PT flat plate system. Levels 21 and 22 are proposed to support plant loading and will be required to be approximately 300 thick flat plate.

3.3 Central Core:

The central core will be rebuilt with 250mm-thick concrete walls to provide critical lateral stability and support increased vertical loads. Extending through the full height of the building, this core will serve as the primary stability system for both wings, ensuring compliance with seismic and wind load standards. Floor plates within the central core are typically 200 thick.

3.4 Foundation System

The proposed foundation system consists of shallow footings, with pad footings provided to support columns and a raft provided to support the core. Ground anchors are to be provided to overcome tension forces generated by lateral loads.

3.5 Retention System

With the site sloping downwards between Miller Street and Denison Street, the extent below ground varies between 2 levels and 1 level. On the South, East and West edges of the building, the perimeter walls retain soil and are proposed to be retained and provided with temporary ground anchors during construction of the B1 and Ground floor levels.

3.6 Slab on Ground.

The existing slab on ground at B2 level is over 300mm thick and is adequate to support the plant loads proposed in this area.

4 Design Standards

The Structural Design components will be designed and detailed in accordance with the relevant Australian standards listed below –

AS/NZS 1170.0-2002	-	Structural Design Actions – General Principles
AS/NZS 1170.1-2002	-	Structural Design Actions – Permanent, Imposed and Other Actions
AS/NZS 1170.2-2021	-	Structural Design Actions – Wind Actions
AS/NZS 1170.4-2007	-	Structural Design Actions – Earthquake Actions in Australia AS
3600-2018	-	Concrete Structures
AS 3700-2001	-	Masonry Standards AS
4100-2020	-	Steel Structures
AS 4671.1-2001	-	Steel Reinforcing Materials AS
2159-2009	-	Piling Design and Installation AS
4678-2002	-	Earth Retaining Structures
AS 2670.2-1990	-	Evaluation of Human Exposure to Whole Body Vibration Continuous and Induced Vibration in Buildings

5 Design loads

Design loads for the buildings are to comply with Australian Standards, the Building Code of Australia and any additional loading requirements that arise following the review of the loading assumptions. Please refer below for loading assumptions of the main building usages:

5.1 Floor loads

The design load specifications for various areas in the building are as follows:

- **Carpark (Basement)**
 - Superimposed Dead Load: 0.5 kPa
 - Live Load (vehicles not exceeding 2500kg gross mass): 2.50 kPa
- **Loading Dock**
 - Superimposed Dead Load: 0.50 kPa
 - Final Live Load (TBC, dependent on truck requirements): 10.0 kPa
- **Retail Spaces**
 - Superimposed Dead Load: 2kPa
 - Reducible Live Load: 5.00 kPa
- **General Education**
 - Superimposed Dead Load:
 - Services/Ceiling: 0.50 kPa
 - Floor Finishes: 0.50 kPa

- Raised access floor: 0.50 kPa
 - Total SDL: 1.5 kPa
 - Live Load: 3.00 kPa
- **Compactus Zone**
 - Superimposed Dead Load:
 - Services/Ceiling: 0.50 kPa
 - Floor Finishes: 0.50 kPa
 - Raised access floor: 0.50 kPa
 - Total Dead Load: 1.50 kPa
 - Live Load: 7.50 kPa
 - Note: Applies to 5% of office area.
- **Terrace**
 - Superimposed Dead Load:
 - Services/Ceiling: 0.50 kPa
 - Floor Finishes (100mm Zone): 2.50 kPa
 - Total SDL: 3.00 kPa
 - Live Load: 4.00 kPa
- **Terrace Landscaping at Ground level (Localised Planters)**
 - Superimposed Dead Load (100mm Zone for Finishes): 2.50 kPa
 - Planter Zones (600mm Soil TBC): 12.00 kPa
 - Live Load: 0.5 kPa
- **Lift Motor Room**
 - Superimposed Dead Load: 2.50 kPa
 - Live Load: 7.50 kPa
- **Lift Overrun**
 - Superimposed Dead Load: 2.50 kPa
 - Live Load: 5.00 kPa
- **Plant Room**
 - Superimposed Dead Load (Plinths and Partitions): 3.00 kPa
 - Live Load: 5.00 kPa
- **Amenities**
 - Superimposed Dead Load: 2.00 kPa
 - Live Load: 5.00 kPa
- **Corridors & Lobbies**
 - Superimposed Dead Load: 2.00 kPa
 - Live Load: 4.00 kPa
- **Fire Stairs**

- Superimposed Dead Load: 0.5 kPa
 - Live Load: 4.00 kPa
- **Façade**
 - Glazed facade: 1kPa (~4 kN/m)

5.2 Earthquake Loads

The structure is assumed to be designed in accordance with AS1170.4 for the following criteria –

- Hazard Factor Z – 0.08;
- Site Sub-Soil Class – Be;
- Importance Factor – 3;
- Design Working Life – 50 Years;
- Earthquake Design Category – III;
- Earthquake Loading Return Period – 1 in 1000; and
- Probability Factor Kp – 1.3.

5.3 Wind Loads

The proposed wind loading in determining a suitable structural scheme will be based on the following factors in accordance with AS1170.2 unless more extensive wind studies are performed –

Wind Region	A2
Terrain Category	3
Ultimate Wind	1 in 1000, Velocity = 46 m/s
Serviceability Wind	1 in 25, Velocity = 37 m/s
Terrain Height Multiplier, Mz,cat	Refer AS1170.2
Damping Ratio (Ultimate)	3.0% of Critical Damping (TBC) Damping
Ratio (Serviceability)	1.0% of Critical Damping (TBC)

6 Design Criteria

6.1 Design Life

As a minimum standard, the concrete structure will be assumed to be designed to have a design life of 50 years in accordance with Cl.4.1 of AS3600-2018.

6.2 Tall building Acceleration

Peak building acceleration must be limited to the following for a 10-year return wind event –

ISO 10137-2007 Equation was extended by Melbourne and Cheung from R = 1 year to any R, for office buildings the equation expressed as peak acceleration in milli-g is:

$$[Exp (-2.81-0.445 \ln (n))/0.68] \times [0.68 + \ln R / 5] \times [1000/9.81] \quad (\text{Melbourne and Cheung})$$

6.3 Robustness

Building robustness has a minimum lateral resistance equivalent to 1.5% of the characteristic dead load. This approach is commonly adopted in the industry.

6.4 Suspended Floor Slab Deflection

Suspended floor deflections are to be limited to ensure the floor space is suitable for the proposed usage. Deflections are also limited by the requirements of the façade system, sensitive internal partitions or other non-structural items.

- Floor members with span less than or equal to 12.5m –
 - With non-structural items insensitive to movement:
 - Total Deflection = Span/250 or 25mm
 - Incremental Deflection = Span/360
 - With brittle non-structural items:
 - Total Deflection = Span/250 or 25mm
 - Incremental Deflection = Span/500
- Floor members with span greater than 12.5m:
 - With non-structural items insensitive to movement:
 - Total Deflection = Span/250 or 30mm
 - Incremental Deflection = Span/360
 - With brittle non-structural items:
 - Total Deflection = Span/250 or 30mm
 - Incremental Deflection = Span/500
- Transfer members:
 - Total Deflection = Span/1000 or 10mm
 - Incremental Deflection = Span/1000
- Cantilever members:
 - Total Deflection = Span/125 or 25mm
 - Incremental Deflection = Span/250

6.5 Suspended Floor Shrinkage Crack Control

Suspended floor structures will be designed for a “Minor Degree of Crack Control” to AS 3600 - 2018 as a minimum. Certain elements such as roofs, balconies, areas with the concrete slab exposed (no floors coverings), terraces etc. will be designed for a “High Degree of Crack Control”. Tiled areas will be designed to a “Moderate Degree of crack control”

6.6 Vibration Limit

The education floors must meet standard vibration acceptance criteria specified for walking excitation.

Acceptance levels due to floor vibrations vary based on occupancy use.

The acceptance criteria nominated below is based on criteria as recommended by Australian Standard AS2670.2 – Evaluation of Human Exposure to whole body vibration Part 2: Continuous and shock induced vibration in buildings which is identical to the International Standards Organisation Standard ISO 2631-2, 1989.

For Educational space floors, Peak acceleration in frequency range 4-8 Hz NOT to exceed 0.5%g.

Criteria above apply to footfall-induced vibrations. The same criterion values apply to mechanical disturbances at a single frequency or at a number of widely separated frequencies. For disturbances at multiple, closely spaced frequencies, the criterion apply to disturbances observed in one-third-octave bands. Typically vibration generated by plant or equipment is controlled by vibration isolation mounts below the item or isolating the equipment from the main structural frame using a floating slab.

6.7 Impact on adjacent buildings and Metro tunnel

The structural design will ensure that the building and its foundations do not have an adverse effect on the metro tunnel to the west of the site and the adjacent buildings (in particular the metro station to the north of the site).

Considering the Miller Street wing columns and associated footings to the West of the site are proposed to remain in their current state and that the Main Denison Wing footings are located at least 20 metres away from any adjacent building structure, the impact of the development on the surrounding buildings is not expected to warrant extensive works.

Regarding the effect on the Metro Tunnel, coordination with Metro Sydney has started and will be further undertaken during the DA approval process. Our understanding is that the DA should be referred under both s2.98 and s2.99 as our development is adjacent to the rail corridor and we will be modifying the loading in the second reserve. We note that:

- The proposed foundation system consists of shallow footings with ground anchors below core (no piles required throughout site).
- Localised excavations may be required to repair or replace the existing footings however they will be to a depth of less than 2m.
- We are currently undertaking studies on the likely depth on the stormwater drainage and will provide a further update once the final depths are resolved, however these are likely to not sit within either the first or second reserve of the Metro.
- The expected foundation levels will be less than 2m below the existing basement FFLs.

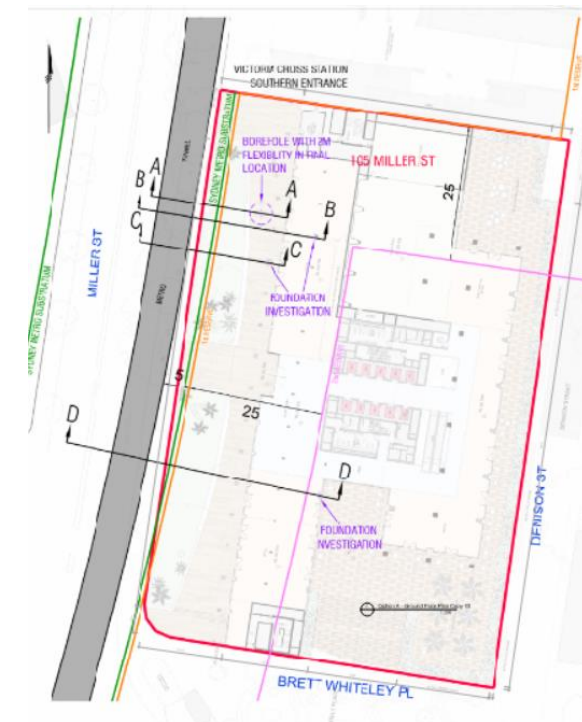


Figure 4 Impact on Metro - Plan



Figure 5 Impact on Metro – Section

7 **Materials**

7.1 **Concrete**

The minimum concrete strengths for individual structural elements are shown on the structural drawings together with additional information regarding to their mix design.

The minimum strength required is the minimum 28-day strength of the concrete.

7.2 **Concrete Durability**

The building is to have adequate durability to achieve as a minimum the design life without requiring undue maintenance. Durability is to be incorporated into the structure through materials with properties complying with the recommendations for durability specified in the relevant Australian Standard, concrete mix design, appropriate protective coatings, attention of design details and good construction practice.

Concrete durability is in accordance with AS 3600 - 2018 Section 4 “Design for Durability”.

Element	Classification
Exterior Concrete	B1
Interior Concrete	A2

For exposure classification refer to AS 3600 - 2018: Section 4.3 - 4.6 Exposure Classification.

7.3 **Reinforcement**

- Reinforcing bars to AS 4671-2001
- Deformed bars with $f_{sy} = 500 \text{ MPa}$
- Welded wire to BS 4483 – 2005

7.4 **Structural Steel**

- Structural Steel to AS 4100-2020
- Steel decking to Grade G440

7.5 **Tendons**

All post-tensioned tendons to consist of 12.7mm or 15.2mm diameter strands, with a total jacking force of 156kN and 212kN respectively.

8 **Design Software**

- RAM Concept by Bentley - Suspended reinforced and post-tensioned concrete member design
- RAPT by PCDC - Reinforced and post-tensioned concrete design package
- ETABS by CSI – Finite element analysis and design package for building structures
- Space Gass by Space Gass Pty Ltd. – Beam and frame analysis package
- Structural Toolkit by Space Gass Pty Ltd. – Multi purpose design tool

9 **References**

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