Proposed Development at 4 - 6 Bligh Street, Sydney

Potential Impacts of Proposed Development on Sydney Metro and CBD Rail Link Assets

Holdmark

Reference: 754-SYDGE308795AC-R1 (For SSDA)

5 December 2022

PROPOSED DEVELOPMENT AT 4 - 6 BLIGH STREET, SYDNEY

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QUALITY INFORMATION

Revision history

Revision	Description	Date	Author	Reviewer	Approver
01	First Issue (For SSDA)	05/12/2022	Helen Chow	Patrick Wong / Ching Dai	Ching Dai

Distribution

Report Status	No. of copies	Format	Distributed to	Date
Draft	1	<PDF>	Holdmark	05/12/2022

EXECUTIVE SUMMARY[1]

This Sydney Metro tunnel and CBD Rail Link impact assessment report have been prepared by Tetra Tech Coffey (Coffey) to accompany a detailed State Significant Development Application **(SSDA)** for the mixed-use redevelopment proposal at 4 – 6 Bligh Street, Sydney. The site is legally described as Lot 1 in Deposited Plan 1244245.

The study is based on the available tunnel alignment information from Sydney Metro and Transport NSW. It has been prepared to address item 22 (assess the impacts of the development on existing utility infrastructure and service provider assets surrounding the site) of the Secretary's Environmental Assessment Requirements **(SEARs)** issued for the project (SSD-48674209) and the additional assessment requirement from the SEARs Cover Letter - Possible impacts on the existing and future infrastructure (CBD Rail Link and Sydney Metro - City and Southwest and Sydney Metro - West). Also, the issues in geotechnical perspective as required by Sydney Metro Underground Corrpagidor Protection Technical Guidelines.

The assessment of the potential impact of the proposed development on the Sydney Metro tunnels and CBD Rail Link was carried out using a simplified 2-dimensional (2D) numerical analysis. The numerical modelling includes the new Sydney Metro (West Tunnel) and the CBD Rail Link (Southwest Tunnel). Based on the available information, the new West tunnel runs underneath the central core of the building and the Southwest tunnel (east tunnel) is located adjacent to the eastern corner of the building.

The assessment considered 5 basement level (B5) in which the footings are anticipated to be founded in Class II or better Sandstone, from geotechnical point of view, the assessment results satisfied the allowable limits of displacement and ultimate structural actions are within the tunnel liner capacity.

The assessment assumes the shape of the new Sydney Metro West tunnel is an oval shape as provided in the Sketchbook by WB with a curved excavated floor referring to the existing Southwest tunnel design. The results indicated that with the 5 levels of basement, the development does not significantly impact on the Sydney Metro Tunnel. However, assessment of displacement along the tunnel alignment is also required to satisfy the requirements as stated in the Sydney Metro Technical Guidelines, therefore a more in-depth detailed analysis (3D) Finite element analysis is recommended to assess the interaction between the infrastructures and the development.

[1] This executive summary must be read in the context of the full report and the attached limitations.

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1. INTRODUCTION

This report has been prepared to accompany an SSDA for the mixed-use redevelopment proposal at 4 – 6 Bligh Street, Sydney.

The Council of the City of Sydney, as delegate for the Minister for Planning and Public Spaces (the Minister), is the Consent Authority for the SSDA under an Instrument of Delegation issued by the Minister on 3 October 2019.

The application seeks consent for the construction of a 59-storey mixed-use hotel and commercial development. The purpose of the project is to revitalise the site and deliver new commercial floorspace and public realm improvements consistent with the City's vision to strengthen the role of Central Sydney as an international tourism and commercial destination.

A separate development consent (D/2018/892) relating to early works for the proposed application was granted for the site on 31 January 2020. Consent was granted for the demolition of the existing site structures, excavation and shoring of the site for three basement levels (to a depth of RL9.38m) to accommodate the proposed mixed-use hotel and commercial development. As such, this application does not seek consent for these components and instead seeks to rely upon and activate D/2018/892 for early works.

Specifically, development consent is sought for:

- Site establishment, including removal of two existing trees along the Bligh Street frontage and de-commissioning and removal of an existing substation (s2041) on the site.
- Construction of a 59-storey hotel and commercial office tower. The tower will have a maximum building height of RL225.88 (205m) and a total gross floor area (GFA) provision of 26,796sqm, and will include the following elements:
    - Five basement levels accommodating a substation, rainwater tank, hotel back of house, plant and services. A porte cochere and four service bays will be provided on basement level 1, in addition to 137 bicycle spaces and end of trip facilities on basement level 2.
    - A 12-storey podium accommodating hotel concierge and arrival at ground level, conference facilities, eight levels of commercial floor space and co-working facilities, and hotel amenities including a pool and gymnasium at level 12.
    - 42 tower levels of hotel facilities including 417 hotel keys comprising standard rooms, suites and a penthouse.
    - Two tower levels accommodating restaurant, bar, back of house and a landscaped terrace at level 57.
    - Plant, servicing and BMU at level 59 and rooftop.
- Increase to the width of the existing Bligh Street vehicular crossover to 4.25m and provision of an additional 4m vehicular crossover on Bligh Street to provide one-way access to the porte cochere and service bays on basement level 1.
- Landscaping and public domain improvements including:
    - Replacement planting of three street trees in the Bligh Street frontage,
    - Construction of a landscape pergola structure on the vertical façade of the north-eastern and south- eastern podium elevations,
    - Awning and podium planters, and
    - Provision of a feature tree at the level 57 terrace.

- Identification of two top of awning building identification signage zones with a maximum dimension of 1200mm x 300mm. Consent for detailed signage installation will form part of a separate development application.
- Utilities and service provision.
- Installation of public art on the site, indicatively located at ground level.

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (**SEARs**) dated 1 October 2022 and issued for the SSDA. Specifically, this report has been prepared to respond to the SEARs requirement issued below.

Item	Description of requirement	Section reference (this report)
22	• Infrastructure Requirements and Utilities ○ In consultation with relevant service providers – assess the impacts of the development on existing utility infrastructure and service provider assets surrounding the site.	Section 4 onwards

This report also addresses the requirements for the impact assessment and management of potential risks associated with the proposed development near existing Metro underground infrastructure, in accordance with Sydney Metro Underground Corridor Protection Technical Guidelines.

This report is to be provided to Sydney Metro as supporting document for the development application.

2. THE SITE

The site for the purposes of this SSDA is a single allotment identified as 4-6 Bligh Street, Sydney and known as Lot 1 in Deposited Plan 1244245. The site has an area of 1,218sqm, and is identified in Figure 1.

The site is relatively flat, with a slight slope ranging from 21m AHD in the north-western corner to 19.5m AHD in the south-western corner.

The site is located within the north-eastern part of Central Sydney in a block bound by Bligh Street to the west, Hunter Street to the south, Chifley Square/Phillip Street to the east, and Bent Street to the north. The surrounding buildings are generally characterised by a mix of commercial office and hotel uses with ground level retail, restaurant and café uses and are of varying heights, ages and styles, including a number of State and local listed heritage buildings.

The site is also located in proximity to a number of Sydney Metro City & Southwest (opening 2024) and Sydney Metro West (opening 2030) station sites.

Specifically, the site is located to the immediate east of the Sydney Metro Hunter Street station (east site), which is located on the corner of Hunter Street and Bligh Street, and approximately 350m east of the Sydney Metro Hunter Street station (west site). The Hunter Street station sites are part of the Sydney Metro West project. SEARs for the preparation of Concept SSDAs for the sites were issued in August 2022.

Approximately 150m to the south of the site is Sydney Metro Martin Place Station site, located to the south of Hunter Street between Castlereagh Street and Elizabeth Street. The Martin Place Station site is currently under construction and forms part of the Sydney Metro City & Southwest project.

The site is occupied by a vacant commercial office building with ground floor retail and basement car parking known as “Bligh House”. Completed in 1964, Bligh House is a 17-storey tower inclusive of a three-storey podium with the podium levels built to the Bligh Street alignment and the tower setback from the street frontage. The building was designed by Peddle Thorp and Walker and was constructed as part of the post-World War II development boom in the Sydney CBD. The podium overhang along the footpath provides continuous pedestrian protection. Vehicle access to the site is off Bligh Street via a single 2.6m wide driveway that is restricted by a security gate under one-lane, two-way access arrangements. The driveway provides access to the basement car park, containing 21 car parking spaces.

The site contains no vegetation; however, two existing street trees are located adjacent to the site boundary on Bligh Street.

Development consent for the demolition of the existing site structures, excavation and shoring of the site for three basement levels (to a depth of RL9.38m) was granted by City of Sydney on 31 January 2022 (D/2018/892).

It is understood that Holdmark is proposing to extend the excavation to five basement levels (to RL 3.38 m AHD).

Source: Urbis

Figure 1: Site Identification Plan

3. PREVIOUS ASSESSMENT

Coffey has previously undertaken an impact assessment of the proposed development on future Sydney Metro underground infrastructure. The assessment was carried out for the excavation of three basement level with the final bulk excavation level (BEL) at approximately RL 9.4 m AHD considering the Sydney Metro assets - the South-West Tunnel only. The findings of the assessment were documented in our report - Potential Impacts on Sydney Metro Assets: Development at 4 – 6 Bligh Street, Sydney (Ref: SYDGE205019-AE Rev. 2) dated 26 November 2019.

4. CURRENT ASSESSMENT

Coffey was advised by Holdmark that the new Sydney Metro West Tunnel will be constructed prior to the proposed development and the impact assessment is required to be updated to include both the new Sydney Metro West and Sydney Metro City and Southwest tunnels with the original 3 basement level (Level B3 at RL 9.38 m AHD) and new excavation scheme with 5 basement level (Level B5 at RL 3.38 m AHD). Pad footings are proposed as the foundation for the proposed development with thicknesses of 1 m and 3 m. The final bulk excavation level is approximately 3 m below the basement level. Based on the sketches provided by project structural engineer Mott MacDonald **(MM)**, the centre of the new West-East tunnel is located at approximately RL -17.1 m AHD and the centre of the West-South tunnels are located at RL -4.1 m AHD.

This assessment addresses the following issues in geotechnical perspective as required by Sydney Metro:

- Predicted displacement of existing or planned metro underground infrastructure due to proposed development at various stages.
- Predicted displacements, stresses and structural actions as imposed on the structural support of metro infrastructure structure at various stages of construction.
- Discussion on design assumptions, qualifications or limitations that have been applied.
- Recommendations regarding any planned preventive or remedial action that may be required to limit development induced impacts on metro infrastructure.

5. AVAILABLE INFORMATION

The following information were used in the current assessment:

1. 4 – 6 Bligh Street, Sydney - The Sketchbook Report by Woods Bagot **(WB)** dated 25 Oct 2022 (Appendix B)
2. Foundation sketches – Level B5 – Foundations by MM – Sketch No. MMD-SK-005 to 009 Rev. B dated 17 Oct 2022 (Appendix C)
3. Powerpoint slides showing the Sydney pagMetro West-East tunnel alignment and tunnel cross sections (Appendix D)
4. Transport for NSW - City & Southwest Alignment GA Plan and Longitudinal Section (Appendix D)
5. Geotechnical Investigation Report by Coffey Services Australia Pty Ltd (Ref: SYDGE205019-AD Rev 0) dated 16 November 2018
6. Planning Secretary's Environmental Assessment Requirements **(SEAR)**– Cultural, recreation and tourist facilities dated 1 October 2022

7. Sydney Metro Underground Corridor Protection Technical Guidelines (Ref: iCentral SM 20-00081444) April 2021
8. Technical Note – TN 004: 2015 – Buried service at turnouts and special trackwork dated 03 September 2015
9. Engineering Specification – SPC Track Monitoring Requirements for Undertrack Excavation – Version 1.5 dated 03 July 2019.

6. DESIGN CRITIERIA

With reference to Sydney Metro Underground Corridor Protection Technical Guidelines, the design criteria for the impact assessment relating to induced movement by the proposed development are as follows:

- For metro cast in-situ cavern and tunnel concrete linings
    - Allowable movement in any direction = 10 mm
    - Allowable differential movement in any plane = 10 mm or 1/2000, whichever is less
- If development activity has the potential to cause track displacement, monitoring requirement should comply with Engineering Specification - SPC 207 Track monitoring requirements for Undertrack Excavation.

7. LOCATION OF SYDNEY METRO TUNNELS AND CBD RAIL LINK

Based on the information provided by WB and MM, the locations of the of CBD Rail Link and Sydney Metro Tunnel Alignments are as follows and shown in Figure 2 and Figure 3:

- Sydney Metro West tunnels are running from west to east underneath the proposed development. The Eastbound tunnel is located underneath the central core of the development and the Westbound tunnel is located underneath the southern corner of the development as shown in Figure 3. Indicative cross section for tunnel sections are shown in Figure 4.The crown and centre of both tunnels are located at approximately RL -13.1 m AHD and RL -17.1 m AHD, respectively.
- City & Southwest tunnels are running from north to south. The eastern tunnel is located adjacent to the eastern corner and the western tunnel is located at approximately 14 m from the western corner of the development as shown in Figure 3. The eastern tunnel is circular in cross section with a diameter of 6 m. The crown and centre of the tunnel is located at approximately RL -1.1 m AHD and RL -4.1 m AHD, respectively.

Based on the Sydney Metro Underground Corridor Protection Technical Guidelines, the proposed development site is located within the 2nd Protective Reserve zone of the Sydney rail corridor and the basement excavation and footing will be intruded into the 2nd reserve zone.

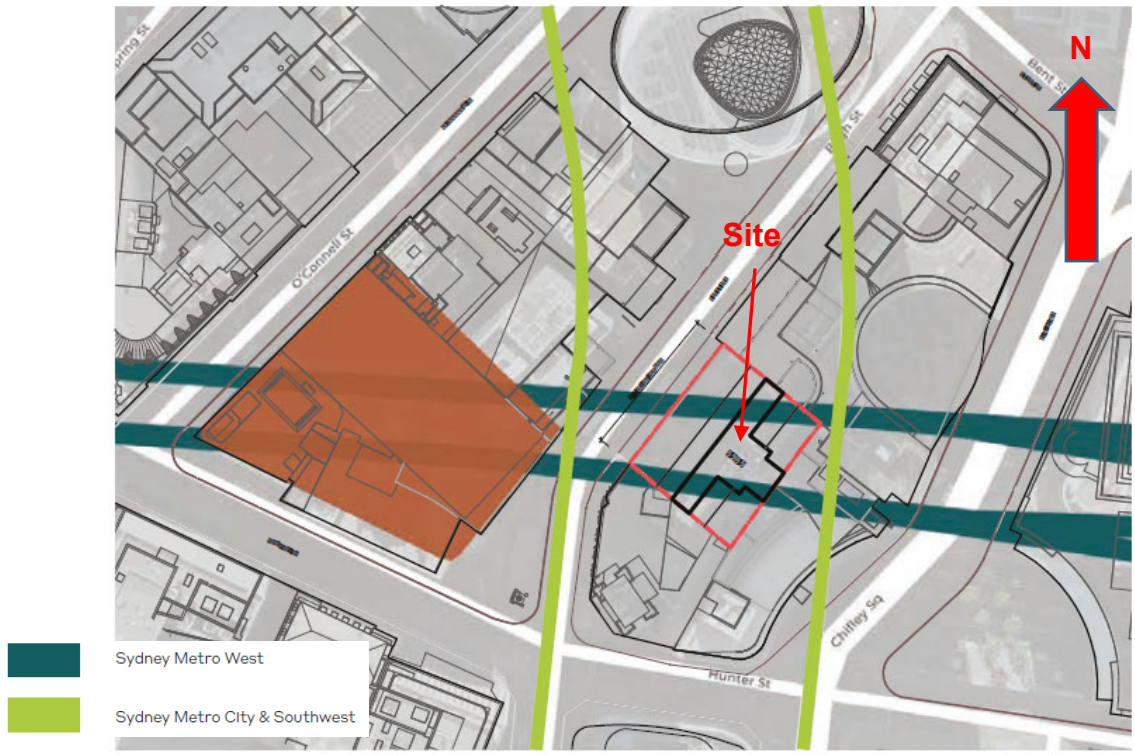


Figure 2: Location of CBD Rail Link Tunnels (extracted from Sketchbook by WB)

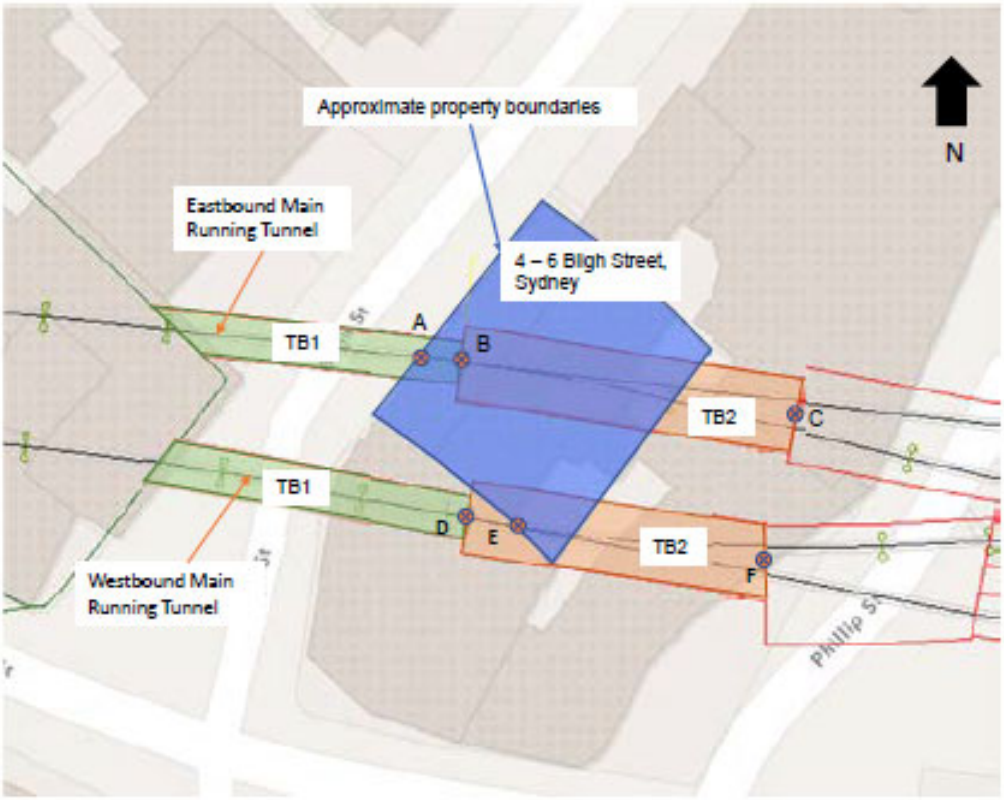


Figure 3: Location of Sydney Metro West Tunnels – Eastbound and Westbound Tunnels (extracted from Sketchbook by WB)

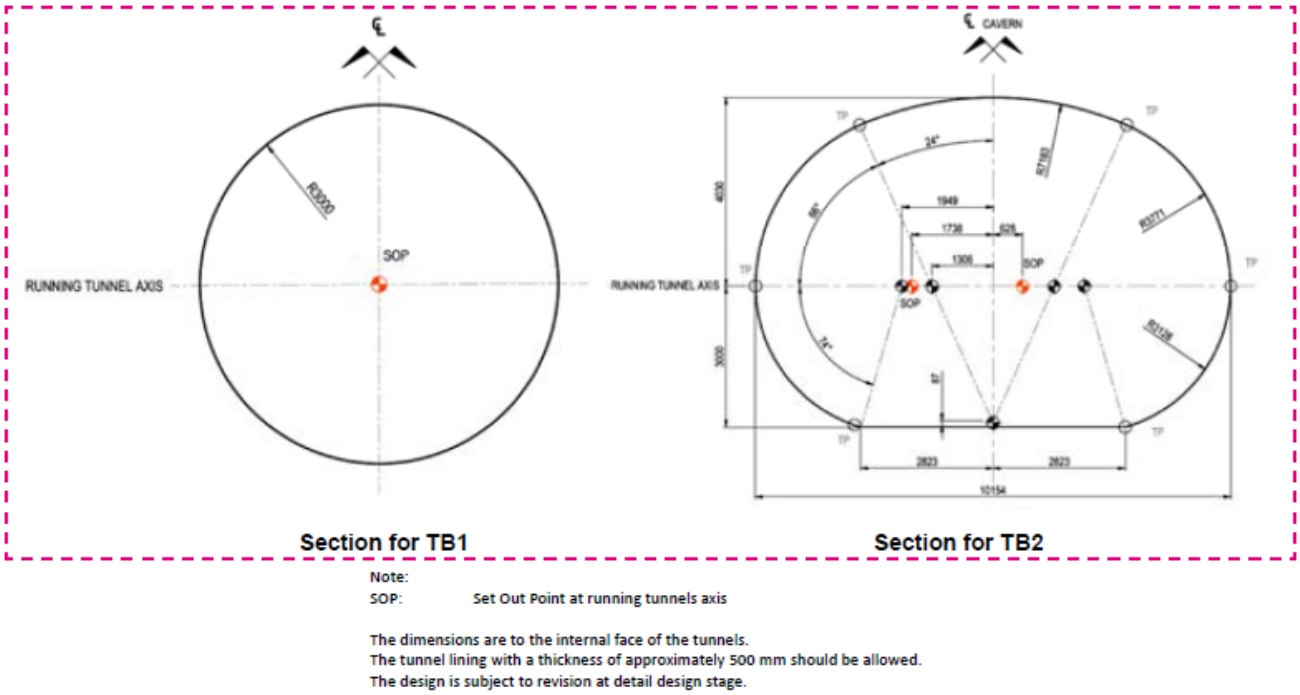


Figure 4: Indicative Cross Section for TB1 and TB2 (extracted from Sketchbook by WB)

8. DESIGN MODEL

8.1 GEOTECHNICAL MODEL

The geotechnical model adopted for the impact assessment is based on the model developed for basement excavation and foundation design presented in Section 6.2 of the geotechnical investigation report for the development prepared by Coffey (reference SYDGE205019-AD Rev0 dated 16 November 2018). It is assumed that readers of this impact assessment report also have access to the referenced geotechnical report. Table 1 below reproduces the geotechnical model from our geotechnical report.

Table 1 Geotechnical Model adopted for this impact assessment

Geotechnical Unit	Materials	Rock classification
Unit 0	Unobserved ground. Likely to comprise fill, concrete & asphalt pavements overlying residual soil grading to sandstone	Not applicable for soil strength materials. Sandstone could vary from Class V to Class II
Unit 1	Moderately weathered to fresh, medium and high strength sandstone	Class II and Class I Sandstone
Unit 2	Interbedded sandstone, shale & shale breccia, varies from highly to slightly weathered, and from low to high strength, fractured	Class III Shale based on defect patterns and variable strength
Unit 3	Fresh medium and high strength sandstone	Class II and Class I Sandstone

Note: Rock classification is based on the system presented in Pells P.J.N., Mostyn, G., Bertuzzi, R., and Wong, P. K. (2019), "Classification of Sandstones and Shales in the Sydney Region: A Forty Year Review", Australian Geomechanics Journal, Vol. 54 No.2 pp. 29 – 55, June 2019.

8.2 GEOTECHNICAL MODEL

The analytical model used for impact assessment is indicated in Table 2. The rock properties used for the modelling are based on the technical paper by Oliveira, D.A.F., (2014). The rock layers are modelled as equivale Mohr-Coulomb continuum, i.e. no explicit joints.

Table 2 Analytical model for tunnel impact assessment

Unit	Top of unit RL (m AHD)	Unit Thickness (m)	γ (kN/m^3)	ϕ (º)	c' (kPa)	σ_t (kPa)	Young's Modulus, E (MPa)	In-situ stress ratio#	
								In-plane direction, k_H	Out-plane direction, k_h
Fill material	20**	2	18	30	25	0	20	1	1
Class II and Class I Sandstone (upper)*	18	13.5	24	53	1000	300	2500	1	1
Class III Shale*	4.5**	1.5	23	30	360	25	300	1	1
Class II and Class I Sandstone (lower)*	3**	-	24	53	1000	300	2500	See Section 8.3	

Note: (*) Modelled as equivalent continuum, i.e. no explicit joints.
(**) Approximately RL around proposed site / Approximate RL in close proximity of rail tunnel
(#) k_H = horizontal stress $\sigma_{h\,(N\text{-}S)}$/ vertical stress σ_v and k_h = horizontal stress $\sigma_{h\,(E\text{-}W)}$ / vertical stress σ_v, refer to Section 8.3
γ = unit weight, c' = cohesion, ϕ = friction angle, σ_t = tensile strength

8.3 IN-SITU STRESSES

Based on the available stress data for Hawkesbury Sandstone in the Sydney CBD and CBD Metro projects, the following design horizontal stress regime is recommended for Sandstone below the excavation at this site:

$\sigma_1 = \sigma_{h(N\text{-}S)} = 1.5\text{MPa} + 2\sigma_v$

$\sigma_2 = \sigma_{h(E\text{-}W)} = 1.0\text{MPa} + 1.2\sigma_v$

The vertical pressure (σ_v) will be the overburden pressure plus the surcharge of adjacent buildings.

For the fill and rock layers above the basement level, the in-situ stress ratios in both in-plane and out of plane directions are assumed to be 1, to take into account the stress relaxation during excavation (i.e locked-in stress released).

8.4 TUNNEL LINER

According to the Sketchbook by WB, the liner of the Sydney Metro tunnels is conservatively assumed to be unreinforced concrete with a thickness of approximately 500 mm. The properties of the tunnel liner adopted in the assessment is given in Table 3.

Table 3: Parameters for concrete tunnel liner

Material Type	Reinforced Concrete
Concrete Thickness (m)	0.5
Concrete Young's Modulus (MPa)	30000
Concrete Poisson's ratio	0.15
Concrete Compressive Strength (MPa)	50
Concrete Flexural Tensile Strength (MPa)	4.2

9. METHODOLOGY

The assessment of potential impact of the proposed development on the Sydney Metro tunnels was carried out using a simplified 2-dimensional (2D) numerical analyses of two critical sections. A commercially available Finite Element (FE) program RS2 Version 11 by Roscience.

9.1 ANALYSIS ASSUMPTIONS

To simulate the condition of the tunnel (stress and displacement), the following assumptions were made:

- The building at 4-6 Bligh Street will be constructed after the rail tunnel
- Stress relaxation in rock material above BEL during excavation (i.e. in-situ stress ratios = 1) and the in-situ stresses for the rock material below excavation are assumed based on recommended values in Section 8.3.
- A surcharge load of 10 kPa on Bligh Street
- The groundwater table is assumed to be at RL 7.2 mAHD.
- The thickness of footings are 1 m and 3 m.
- Loads on existing buildings are as follows:
    - Wentworth Hotel = 200 kPa
    - 10 Bligh Street = 130 kPa
    - Chifley Square = 200 kPa
    - Existing building at 4 – 6 Bligh Street = 200 kPa
- The floor (invert) of the tunnel (TB2) is a curve as shown in Figure 5(b) with reference to the Southwest tunnels Figure 5(a)

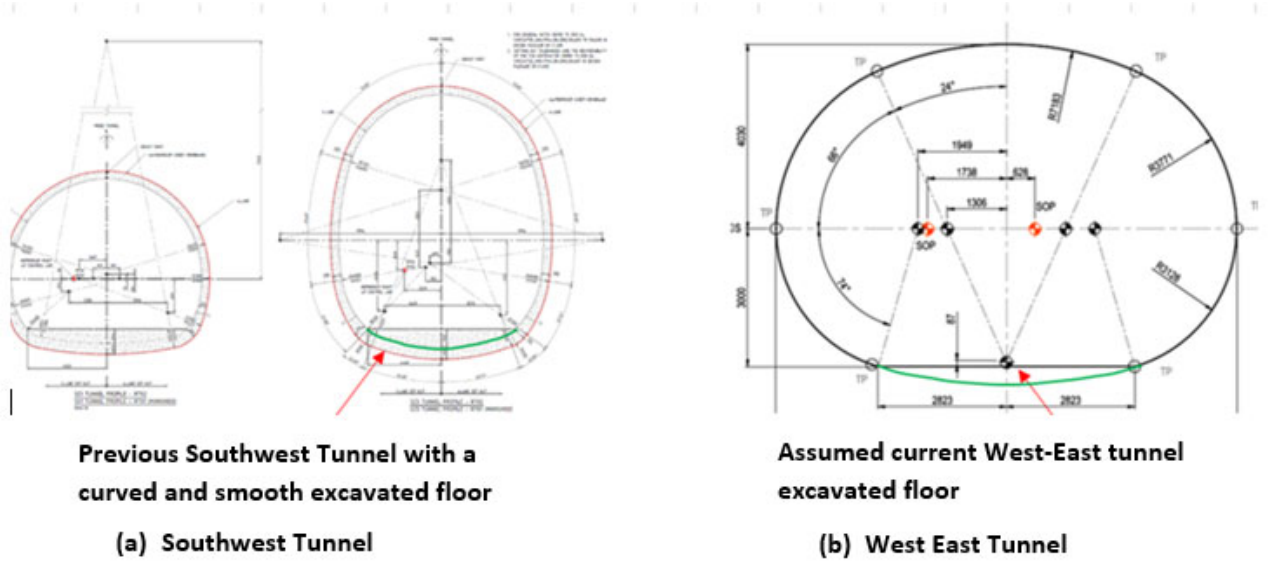


Figure 5: Assumed cross-section of Sydney Metro West tunnel

9.2 MODELLING STRUCTURAL LOADS

The structural loads of the building acting on the base of footings are provided by MM as attached in Appendices C and D. The following load cases are considered in the analysis:

- Service Load Conditions: SLS1 – 1 G + 0.4 Q
- Ultimate Load Conditions: ULS 1 – 1.2 G + 1.5 Q

where G = Dead Load and Q = Live Load

9.3 ANALYSED SECTIONS

Analyses have been carried out to the following critical sections nominated by MM:

- Section AA – From North to South, perpendicular to the new West tunnels – Eastbound (Tunnel A) and Westbound (Tunnel B)
- Section BB – From East to West, perpendicular to the SouthWest tunnel (Tunnel C) and parallel to Tunnel A

The location of the sections is shown in Figure 6. Analyses have been carried out considering 5 basement level. Cross-sections of the analysed cases are shown in Figure 7 and Figure 8. The analysed cases are summarised in Table 4.

Table 4: Summary of Analysed Cases

Case	Section	Load Case	Basement Level Option
1	AA	SLS1	B5
2	AA	ULS1	B5
3	BB	SLS1	B5
4	BB	ULS1	B5

For section BB, as Tunnel A is running parallel to the section, only Tunnel C can be modelled, this section can provide indication of the rock movement along the crown of Tunnel A.

Figure 9 to Figure 10 illustrated the finite element meshes for the analyses of Sections AA and BB. The modelling sequence is given in Section 9.4.

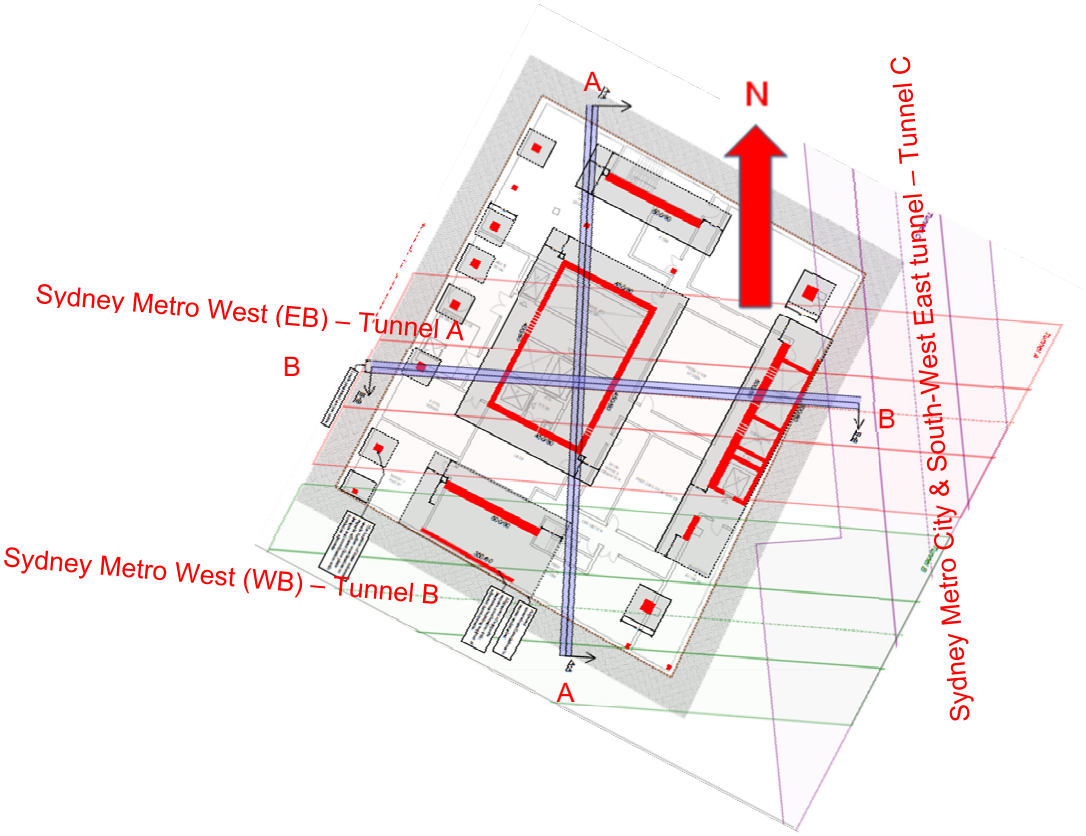


Figure 6: Location of analysed critical sections

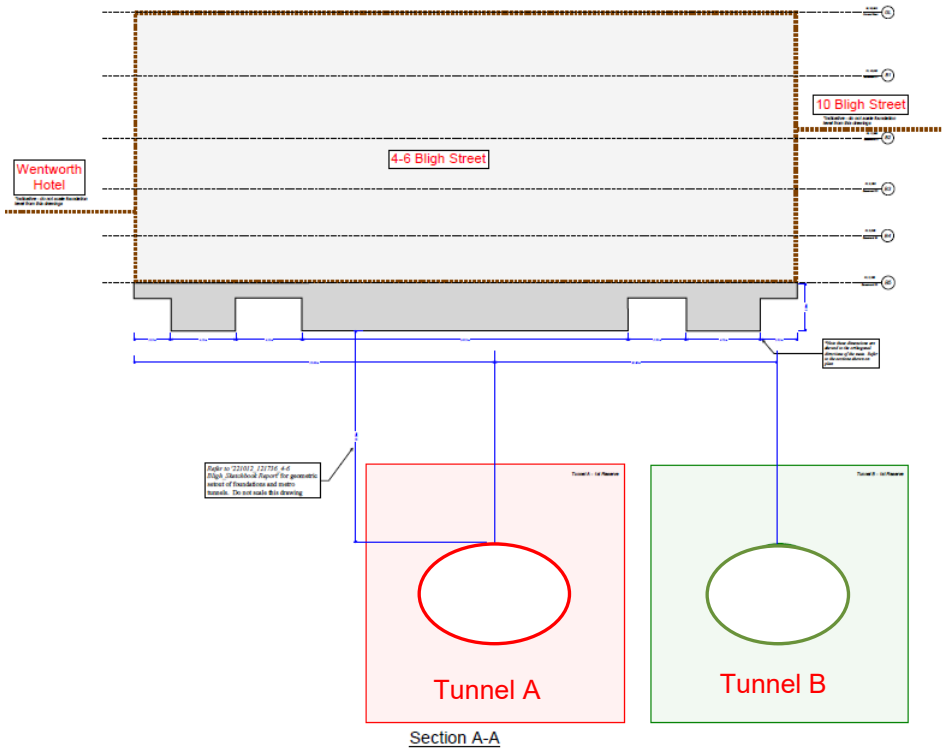


Figure 7: Cross-section AA – B5 basement level

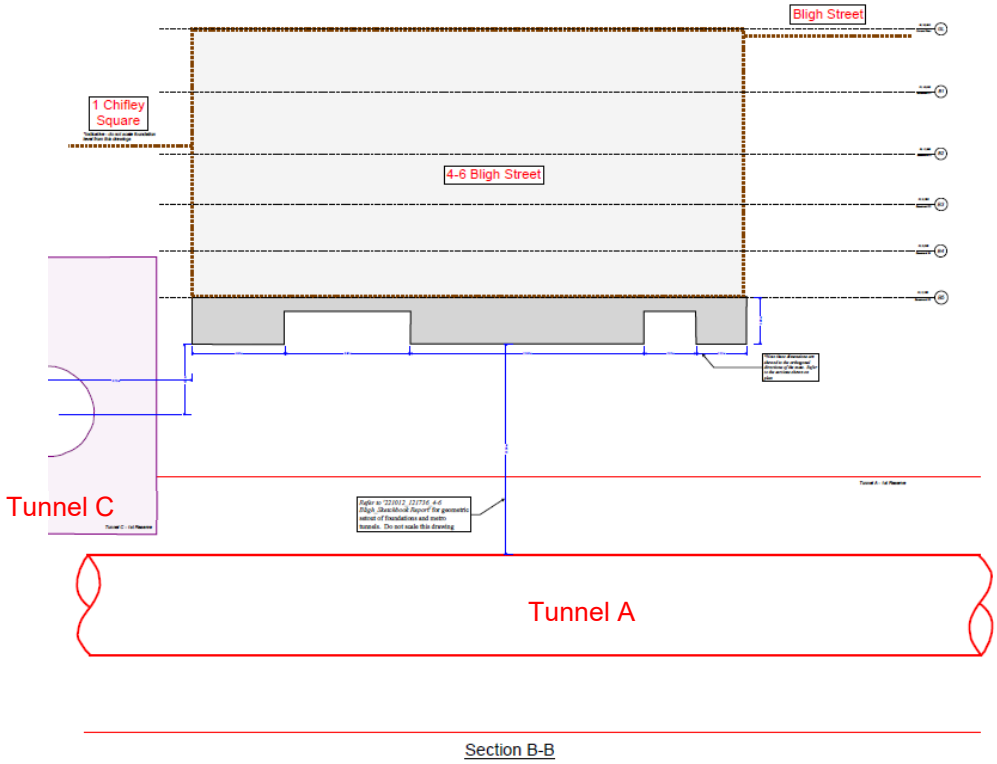
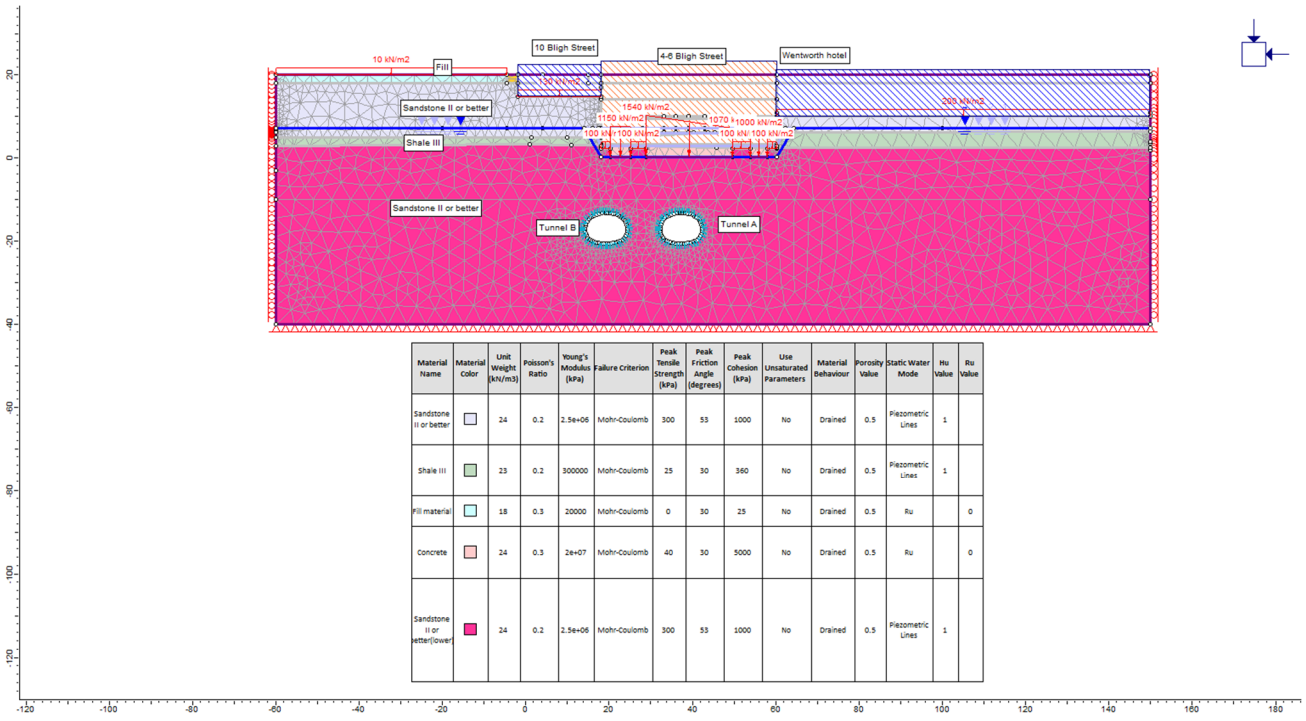
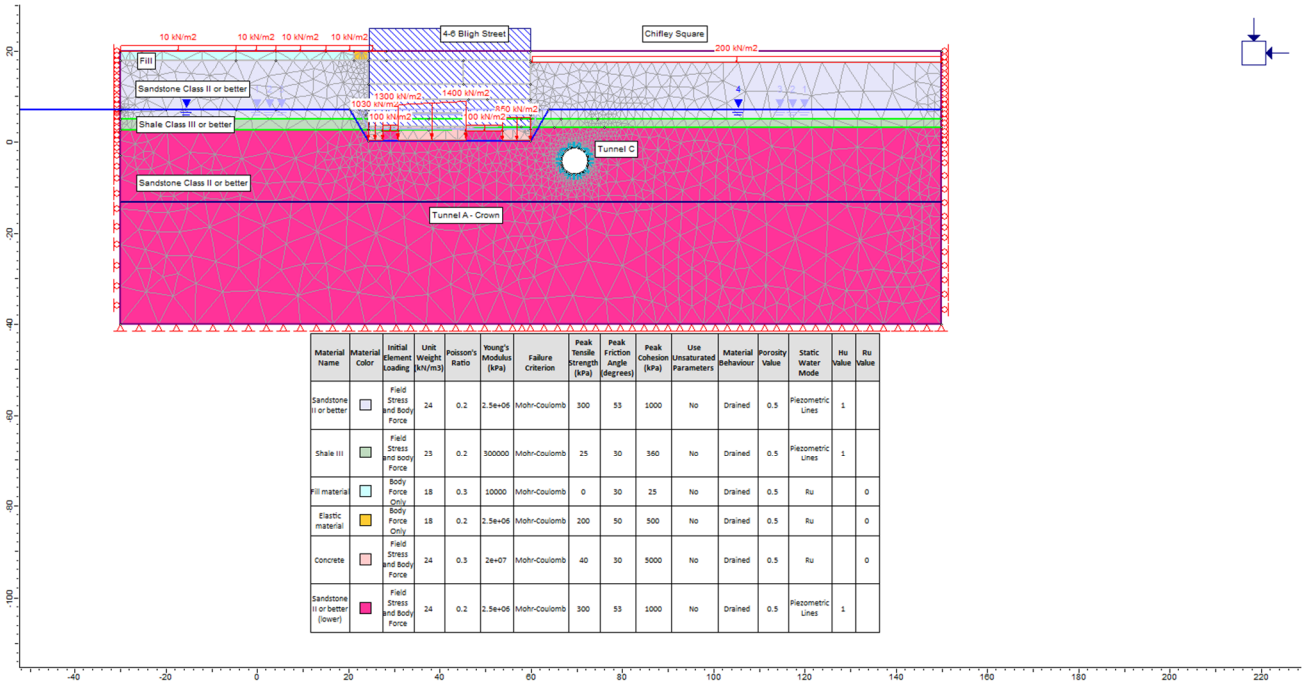


Figure 8: Cross-section BB – B5 basement level



Material Name	Material Color	Unit Weight (kN/m3)	Poisson's Ratio	Young's Modulus (kPa)	Failure Criterion	Peak Tensile Strength (kPa)	Peak Friction Angle (degrees)	Peak Cohesion (kPa)	Use Unsaturated Parameters	Material Behaviour	Porosity Value	Static Water Mode	Hu Value	Ru Value
Sandstone II or better		24	0.2	2.5e+06	Mohr-Coulomb	300	53	1000	No	Drained	0.5	Piezometric Lines	1	
Shale III		23	0.2	300000	Mohr-Coulomb	25	30	360	No	Drained	0.5	Piezometric Lines	1	
Fill material		18	0.3	20000	Mohr-Coulomb	0	30	25	No	Drained	0.5	Ru		0
Concrete		24	0.3	2e+07	Mohr-Coulomb	40	30	5000	No	Drained	0.5	Ru		0
Sandstone II or better(lower)		24	0.2	2.5e+06	Mohr-Coulomb	300	53	1000	No	Drained	0.5	Piezometric Lines	1	

Figure 9: Finite Element Mesh for Case 1 – Section AA – B5 level



Material Name	Material Color	Initial Element Loading	Unit Weight (kN/m3)	Poisson's Ratio	Young's Modulus (kPa)	Failure Criterion	Peak Tensile Strength (kPa)	Peak Friction Angle (degrees)	Peak Cohesion (kPa)	Use Unsaturated Parameters	Material Behaviour	Porosity Value	Static Water Mode	Hu Value	Ru Value
Sandstone II or better		Field Stress and Body Force	24	0.2	2.5e+06	Mohr-Coulomb	300	53	1000	No	Drained	0.5	Piezometric Lines	1	
Shale III		Field Stress and body Force	23	0.2	300000	Mohr-Coulomb	25	30	360	No	Drained	0.5	Piezometric Lines	1	
Fill material		Body Force Only	18	0.3	10000	Mohr-Coulomb	0	30	25	No	Drained	0.5	Ru		0
Elastic material		Body Force Only	18	0.2	2.5e+06	Mohr-Coulomb	200	50	500	No	Drained	0.5	Ru		0
Concrete		Field Stress and Body Force	24	0.3	2e+07	Mohr-Coulomb	40	30	5000	No	Drained	0.5	Ru		0
Sandstone II or better (lower)		Field Stress and Body Force	24	0.2	2.5e+06	Mohr-Coulomb	300	53	1000	No	Drained	0.5	Piezometric Lines	1	

Figure 10: Finite Element Mesh for Case 3 – Section BB – B5 level

9.4 MODELLING SEQUENCE

The following calculation stages have been assumed for the RS2 finite element analysis:

1. Initialize insitu ground stresses in layered rock
2. Apply surcharge load of existing buildings at current basement levels and apply 10 kPa uniform distributed surface traffic load for Bligh Street. Excavate tunnels with equivalent loads such that stresses at tunnel-rock boundary are unchanged.
3. Allow stresses at tunnel-rock boundary to relax by 80%.
4. Simulate installation of unreinforced concrete tunnel liner.
5. Allow stresses at tunnel-rock boundary to relax by 100% (rock loads taken by liner)
6. Reset displacement to zero
7. Remove existing building load (demolition)
8. Basement stage 2 excavation.
9. Basement stage 3 excavation.
10. Lower Groundwater level (GWL) to underside of B4 level
11. Basement stage 4 excavation
12. Lower GWL to underside of B5 level
13. Basement stage 5 excavation
14. Lower GWL to underside of footings
15. Construct footings
16. Apply proposed structural loads.

Stage 5 represents the model before demolition of existing buildings within site. Stages 8 to 15 represents progressive excavation of the basement and footing construction. Stage 16 represents the completion of construction.

10. GEOTECHNICAL ASSESSMENT RESULTS

The results of RS2 finite element analysis are presented in the following figures:

10.1 CASE 1 – SECTION AA WITH BASEMENT AT B5 LEVEL – SLS1

- Figure 11 to Figure 13 show the induced total, vertical and horizontal displacement contours after loading of proposed building (Stage 16).
- Figure 14 and Figure 15 show the induced total and differential displacement of Tunnel A liner after loading of proposed building (Stage 16)
- Figure 16 and Figure 17 show the induced total and differential displacement of Tunnel B liner after loading of proposed building (Stage 16)

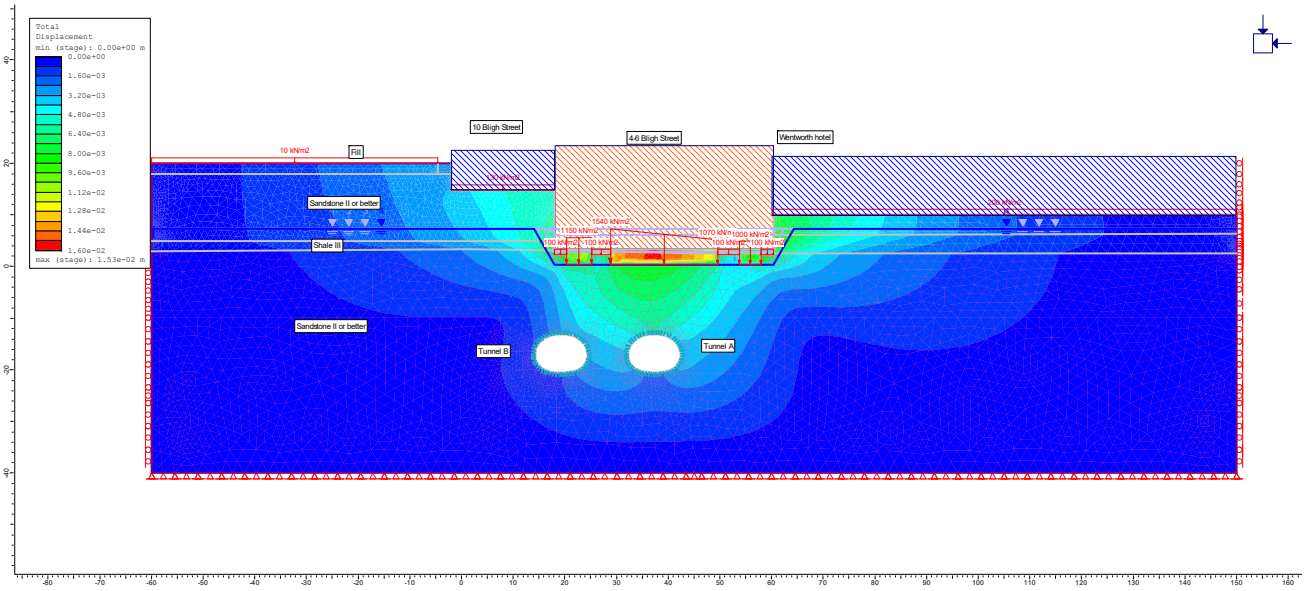


Figure 11: Induced Total Displacement contours after loading of proposed building (Stage 16) for Case 1

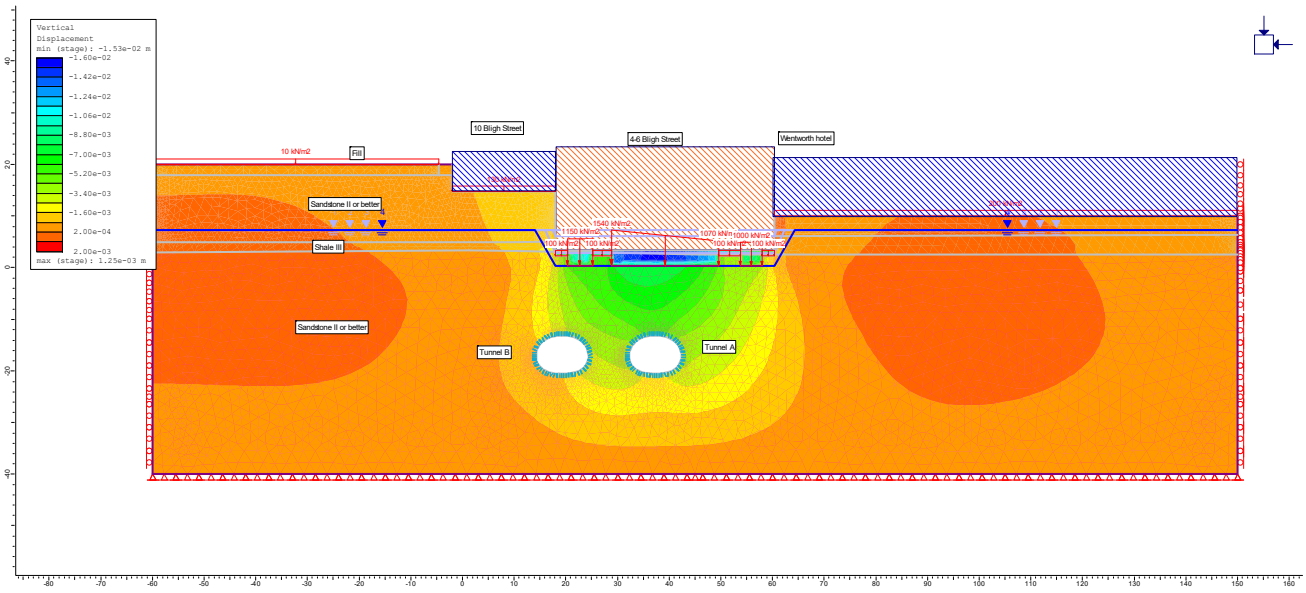


Figure 12: Induced Vertical Displacement contours after loading of proposed building (Stage 16) for Case 1

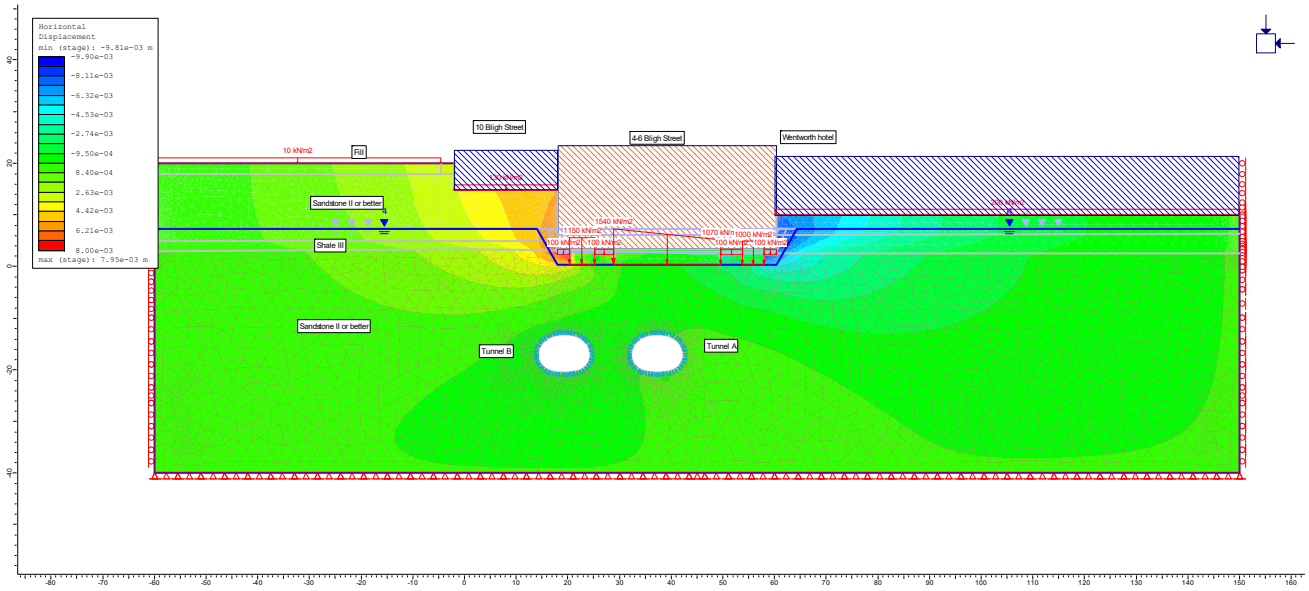


Figure 13: Induced Horizontal Displacement contours after loading of proposed building (Stage 16) for Case 1

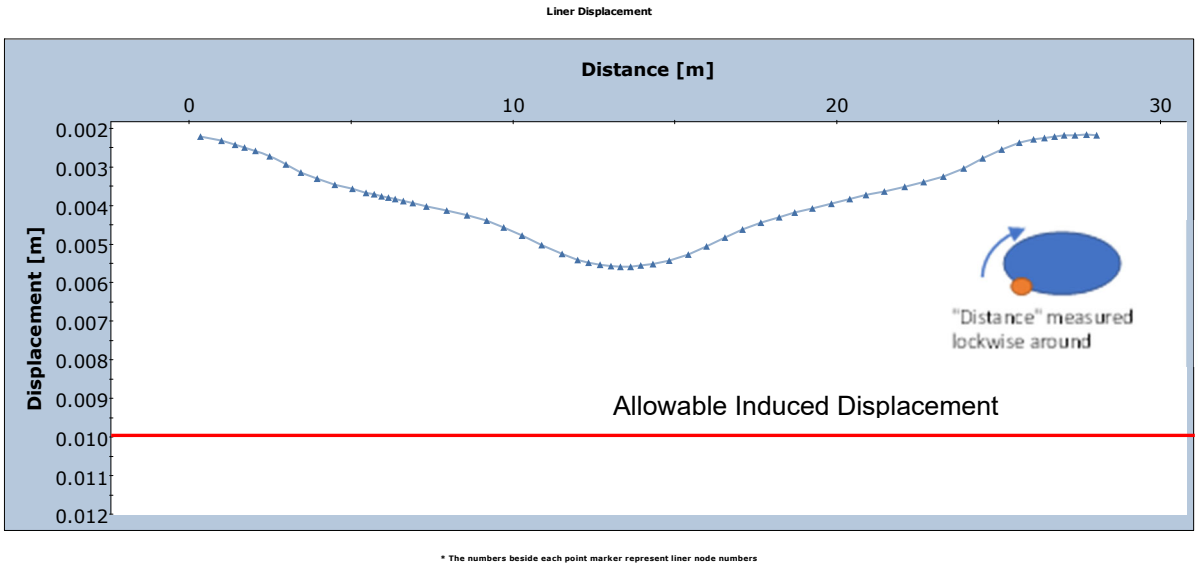


Figure 14: Tunnel A liner Induced displacement after loading of proposed building (Stage 16) for Case 1

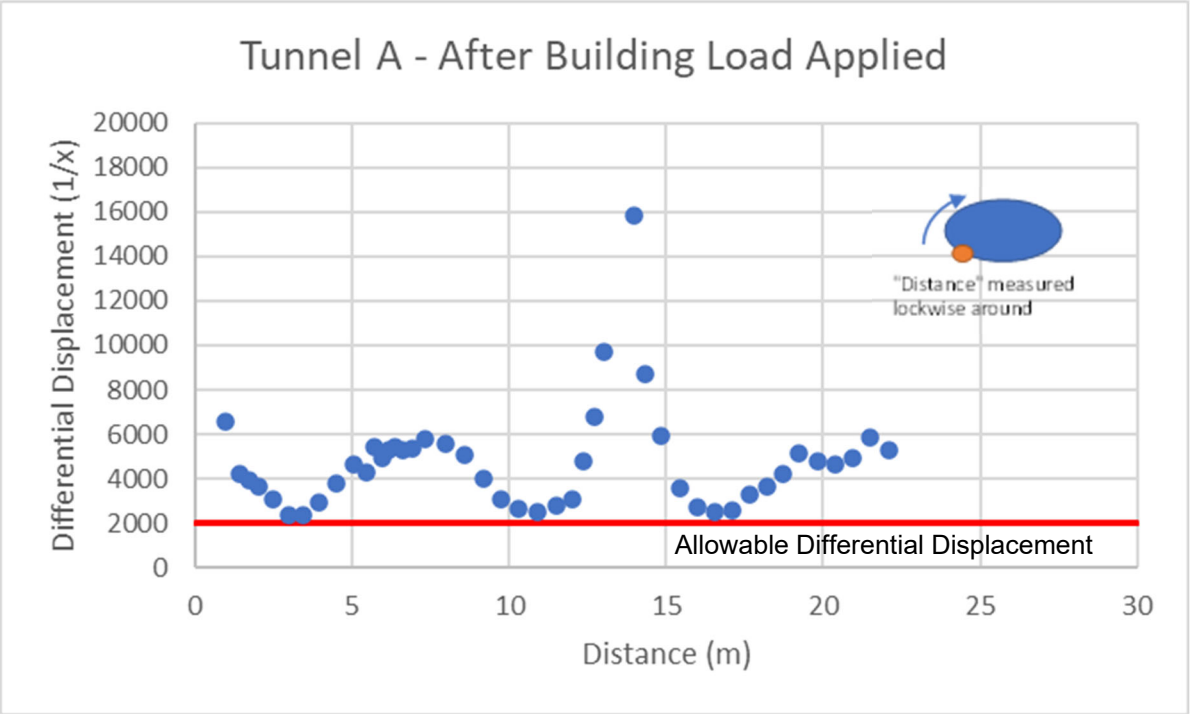


Figure 15: Tunnel A liner Induced differential displacement after loading of proposed building (Stage 16) for Case 1

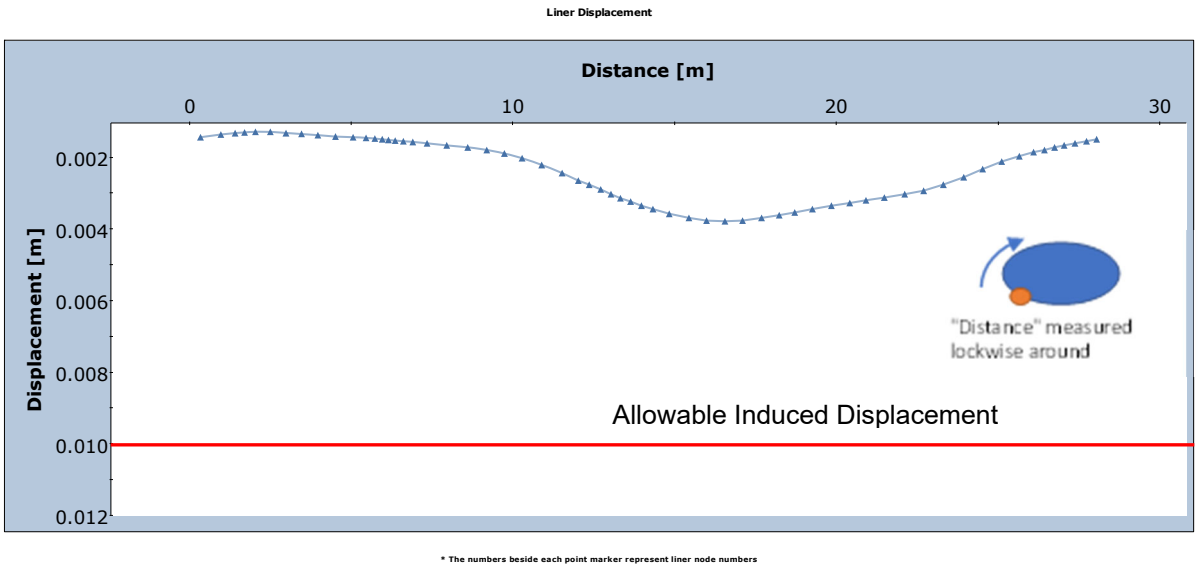


Figure 16: Tunnel B liner induced displacement after loading of proposed building (Stage 16) for Case 1

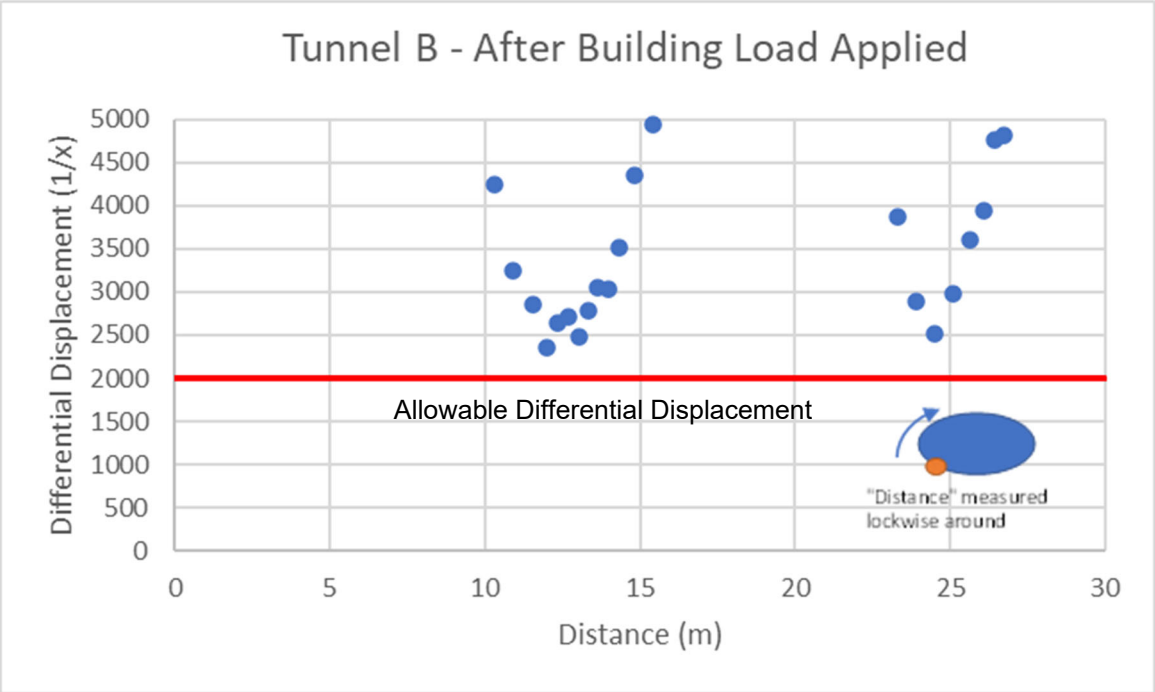


Figure 17: Tunnel B liner Induced differential displacement after loading of proposed building (Stage16) for Case 1

10.2 CASE 2 – SECTION AA WITH BASEMENT AT B5 LEVEL – ULS1

- Figure 18 and Figure 19 show the changes in horizontal and vertical total stress in the rock around tunnel A after loading of proposed building (Stage 16).
- Figure 20 to Figure 22 show the axial force, bending moment and shear of Tunnel A liner after loading of proposed building (Stage 16)
- Figure 23 shows the support capacity for Tunnel A liner after loading of proposed building (Stage 16) with various FOS
- Figure 24 and Figure 25 show the changes in horizontal and vertical total stress in the rock around tunnel B after loading of proposed building (Stage 16)
- Figure 26 to Figure 28 show the axial force, bending moment and shear of Tunnel B liner after loading of proposed building (Stage 16)
- Figure 29 shows the support capacity for Tunnel B liner after loading of proposed building (Stage 16) with various FOS

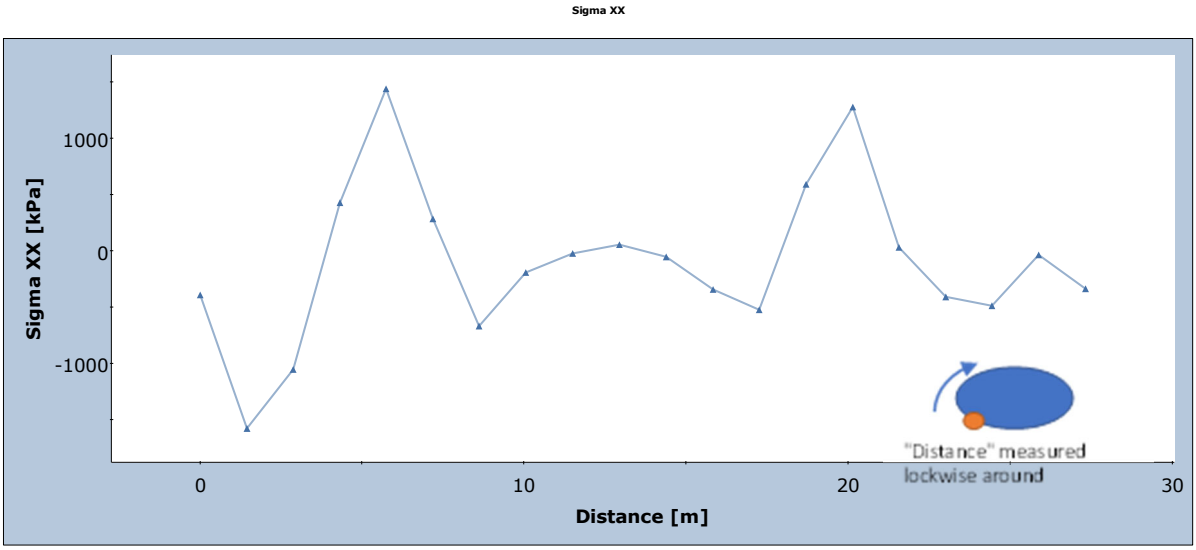


Figure 18: Changes in horizontal total stress on rock around Tunnel A after loading of proposed building (Stage 16) for Case 2

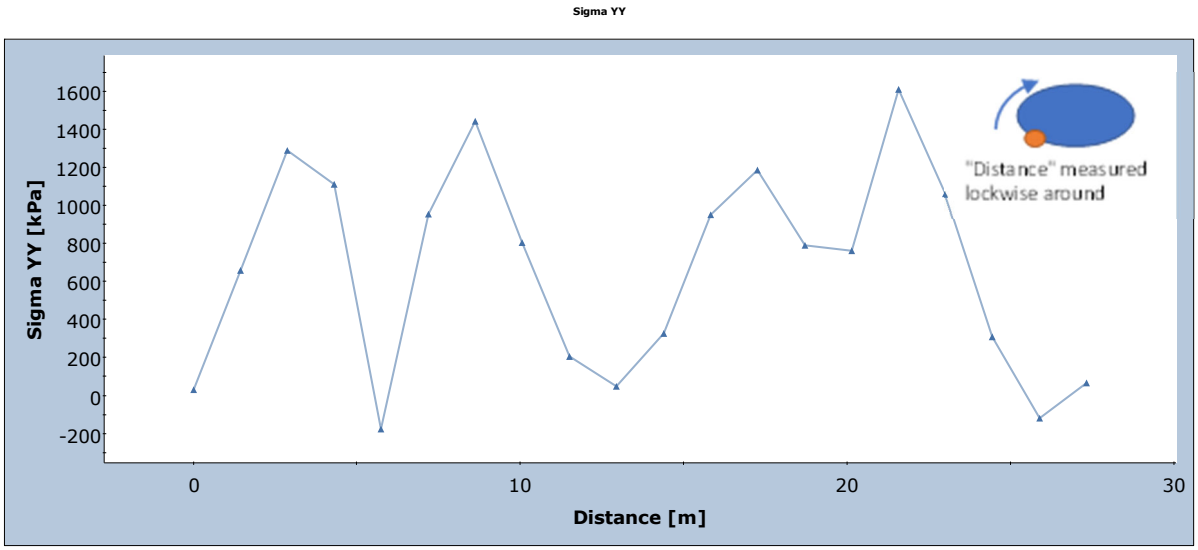


Figure 19: Changes in vertical total stress on rock around Tunnel A after loading of proposed building (Stage 16) Case 2

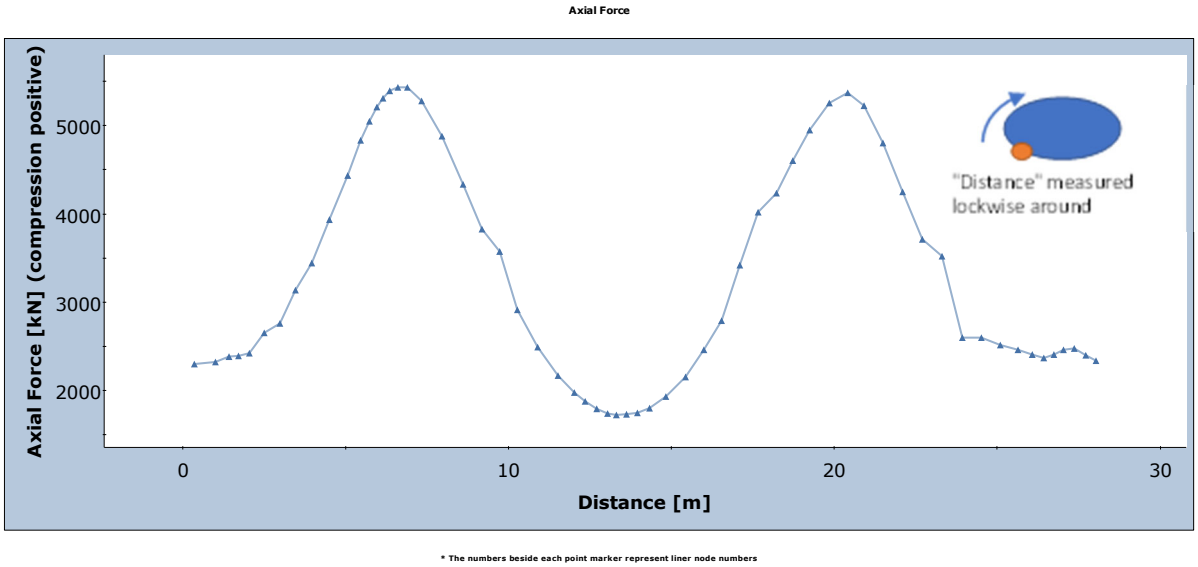


Figure 20: Axial force in Tunnel A liner after loading of proposed building (Stage 16) for Case 2

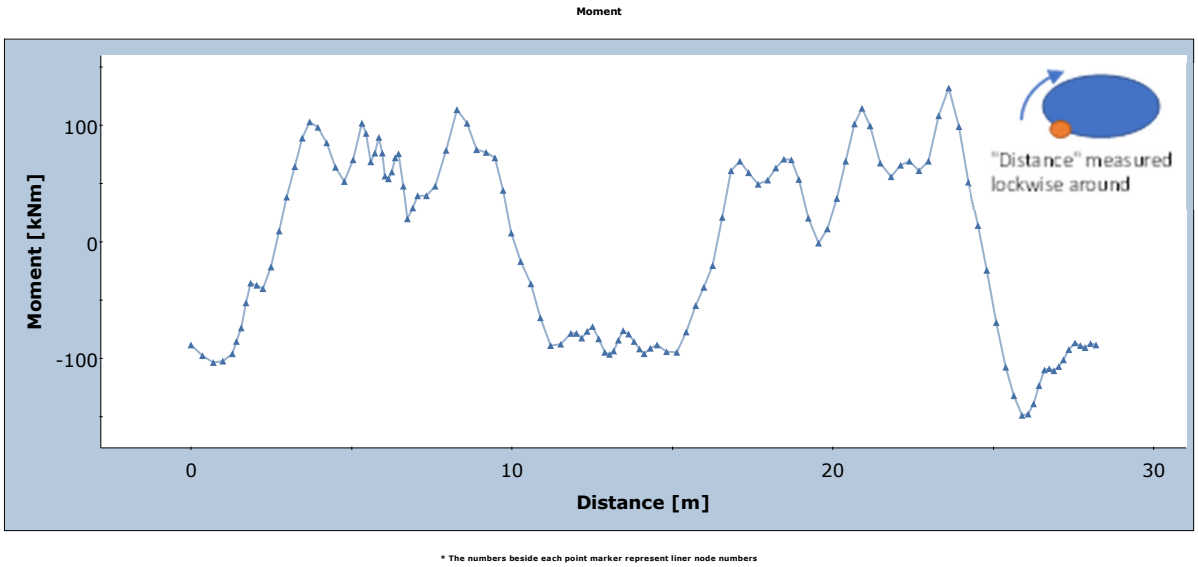


Figure 21: Bending Moment in Tunnel A liner after loading of proposed building (Stage 16) for Case 2

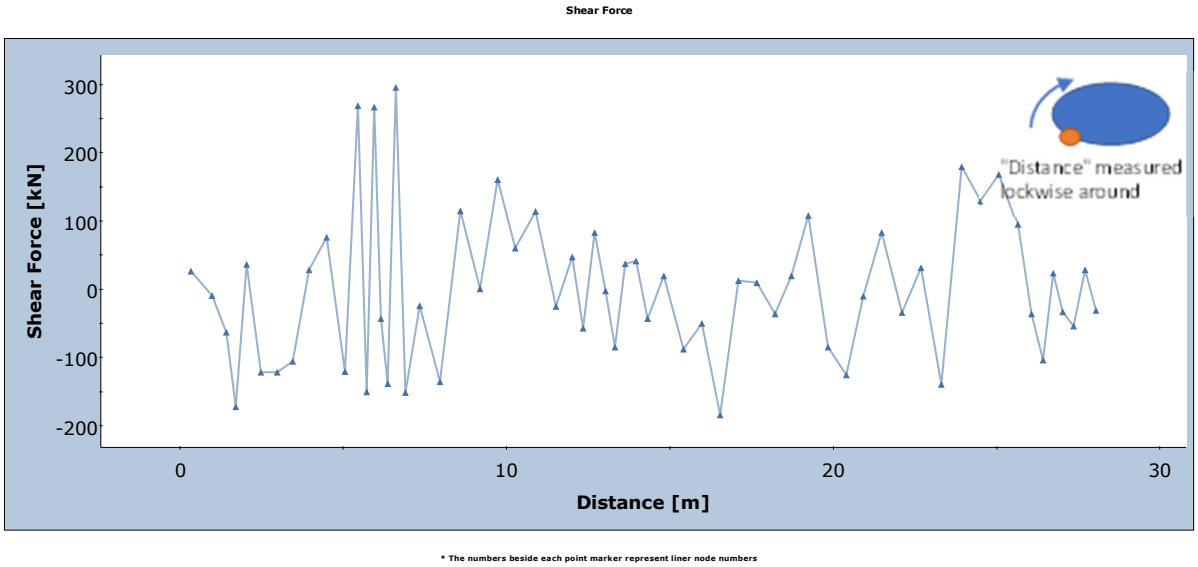


Figure 22: Shear Force in Tunnel A liner for after loading of proposed building (Stage 16) for Case 2

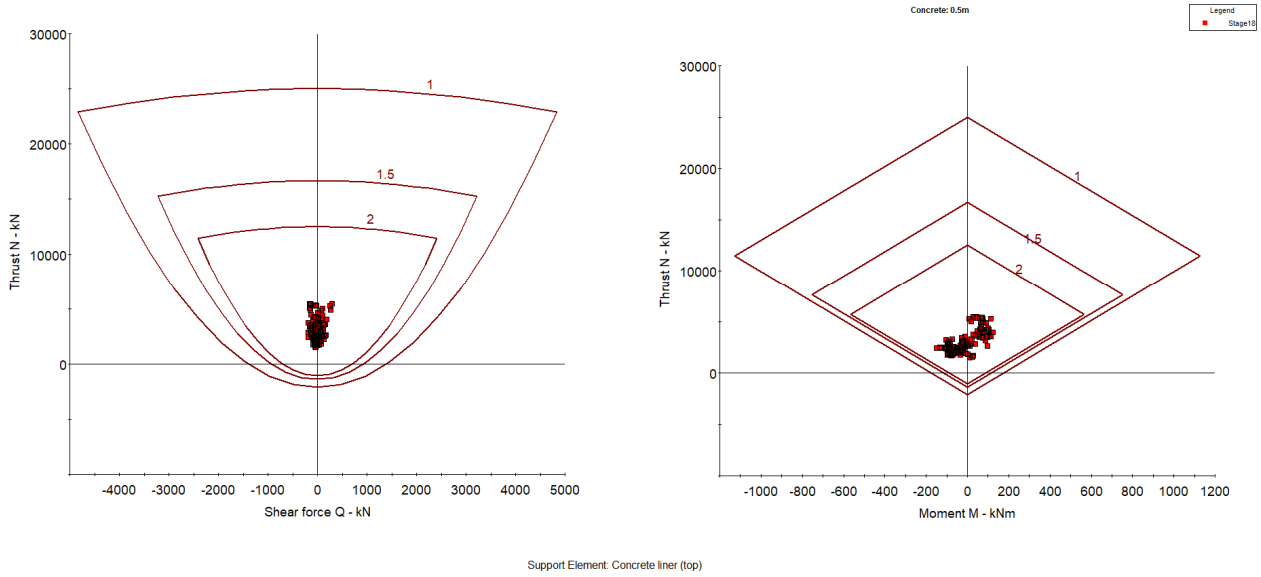


Figure 23: Tunnel A liner support capacity after loading of proposed building (Stage 16) with various FOS for Case 2

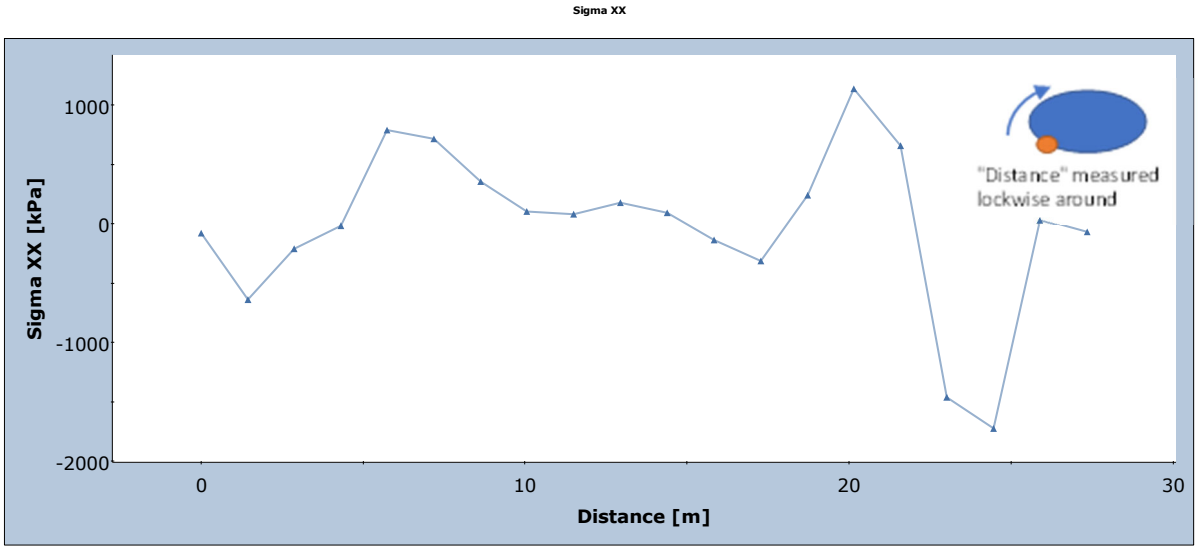


Figure 24: Changes in horizontal total stress on rock around Tunnel B after loading of proposed building (Stage 16) for Case 2

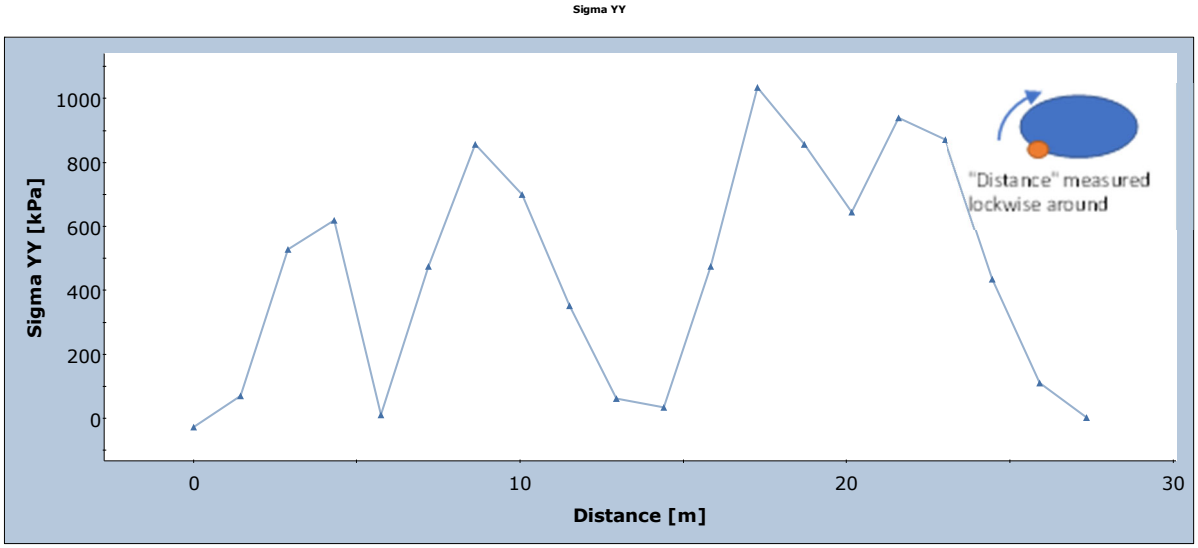


Figure 25: Changes in vertical total stress on rock around Tunnel B after loading of proposed building (Stage 16) for Case 2

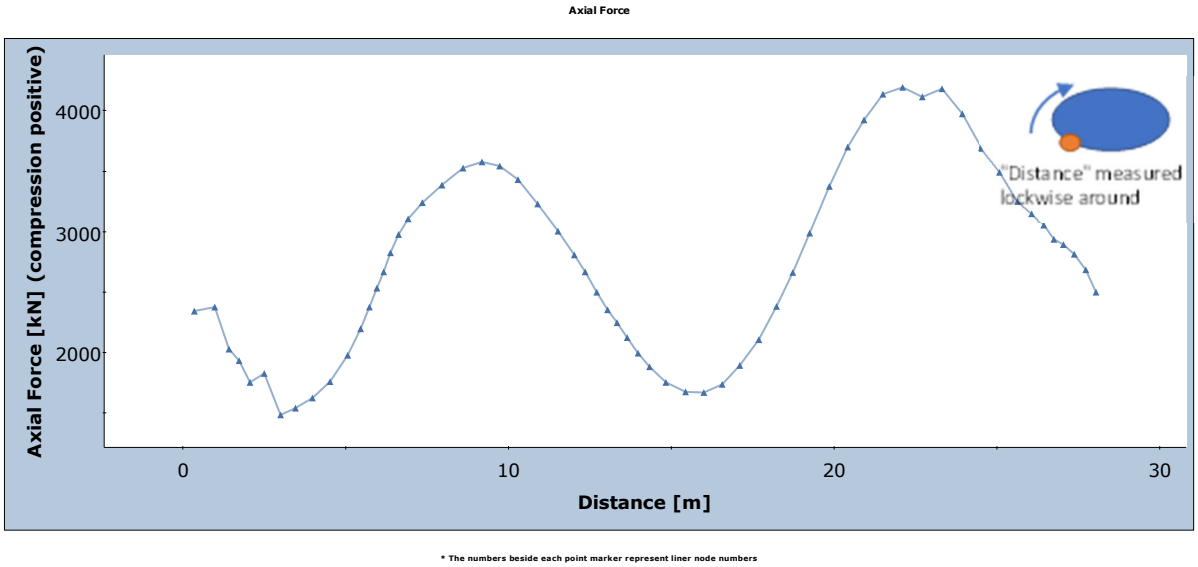


Figure 26: Axial force in Tunnel liner B after loading of proposed building (Stage 16) for Case 2

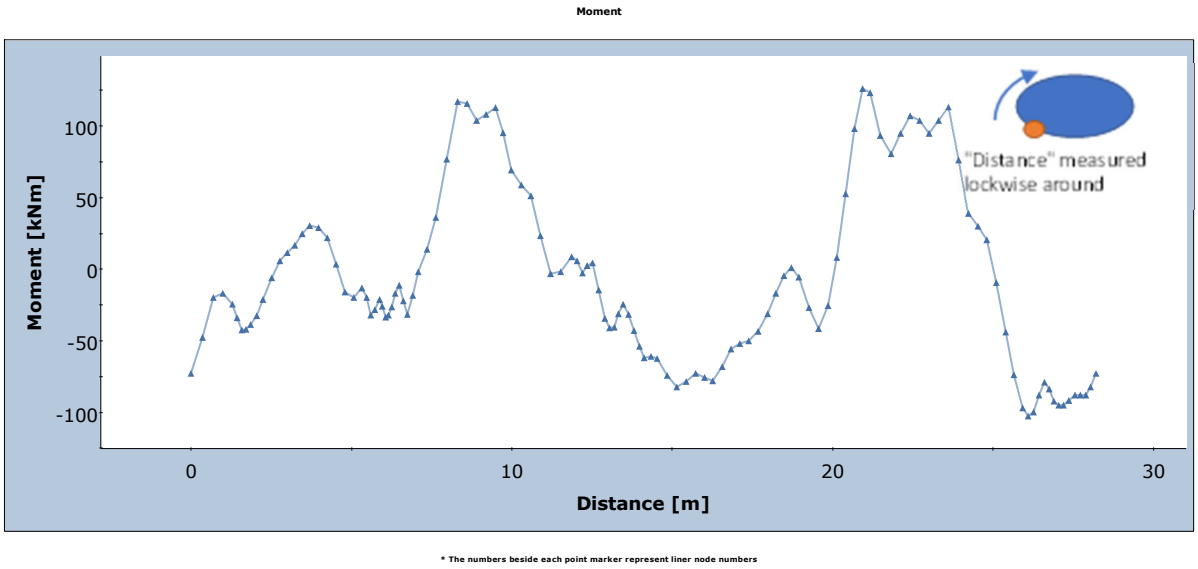


Figure 27: Bending Moment in Tunnel B liner after loading of proposed building (Stage 16) for Case 2

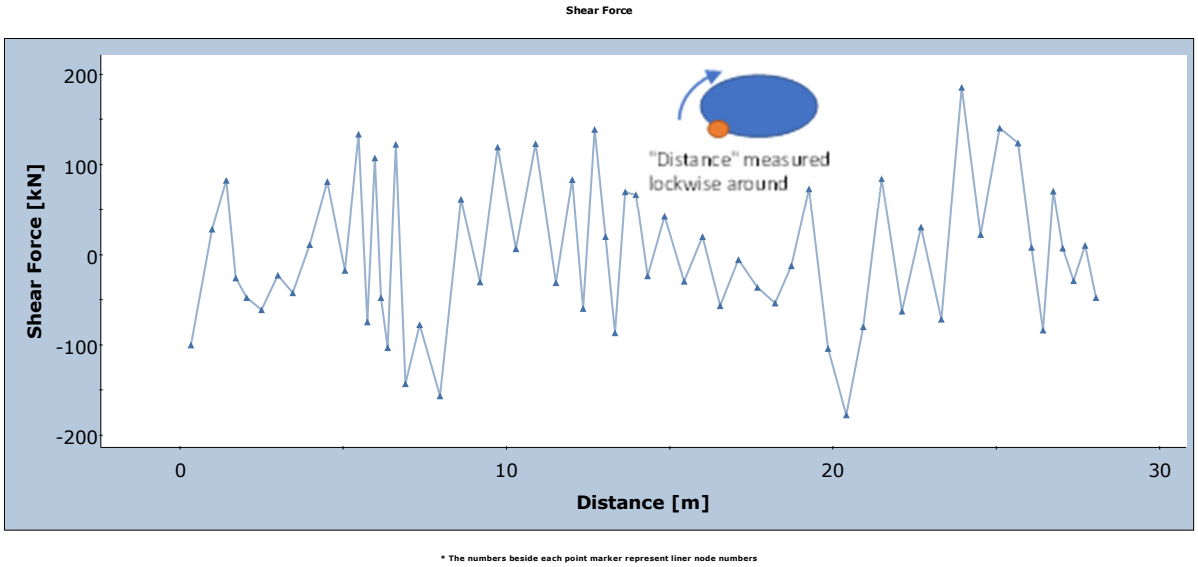


Figure 28: Shear Force in Tunnel B liner after loading of proposed building (Stage 16) for Case 2

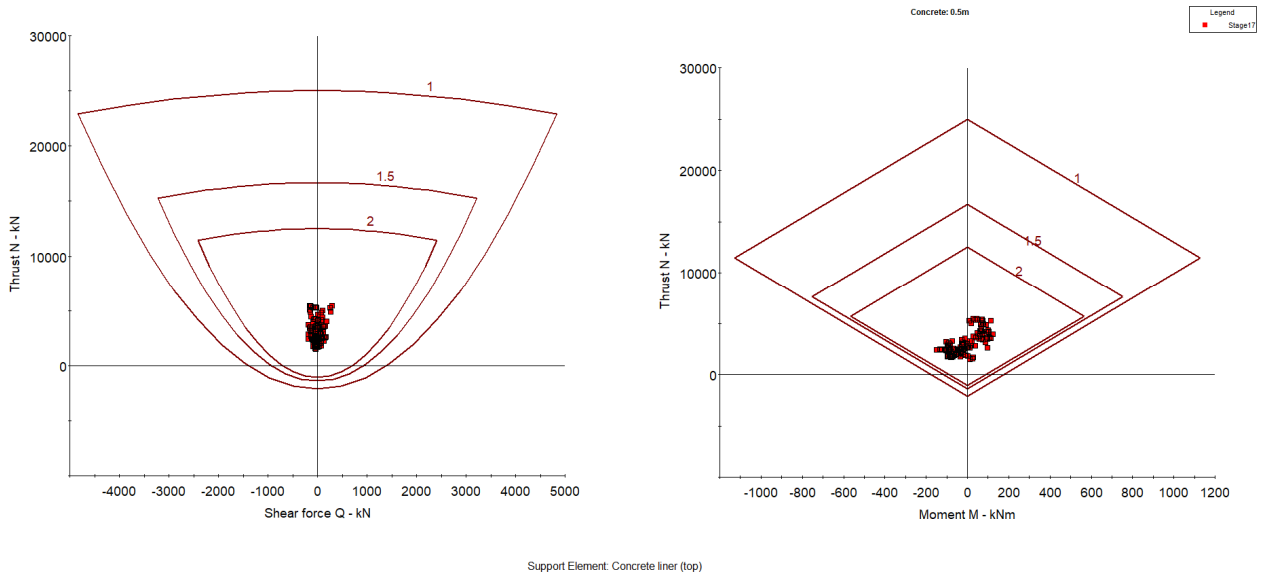


Figure 29: Tunnel B liner support capacity after loading of proposed building (Stage 16) with various FOS for Case 2

10.3 CASE 3 – SECTION BB WITH BASEMENT AT B5 LEVEL – SLS1

- Figure 30 to Figure 32 show the induced total, vertical and horizontal displacement contours after loading of proposed building (Stage 16).
- Figure 33 and Figure 34 show the induced total and differential displacement of Tunnel C liner

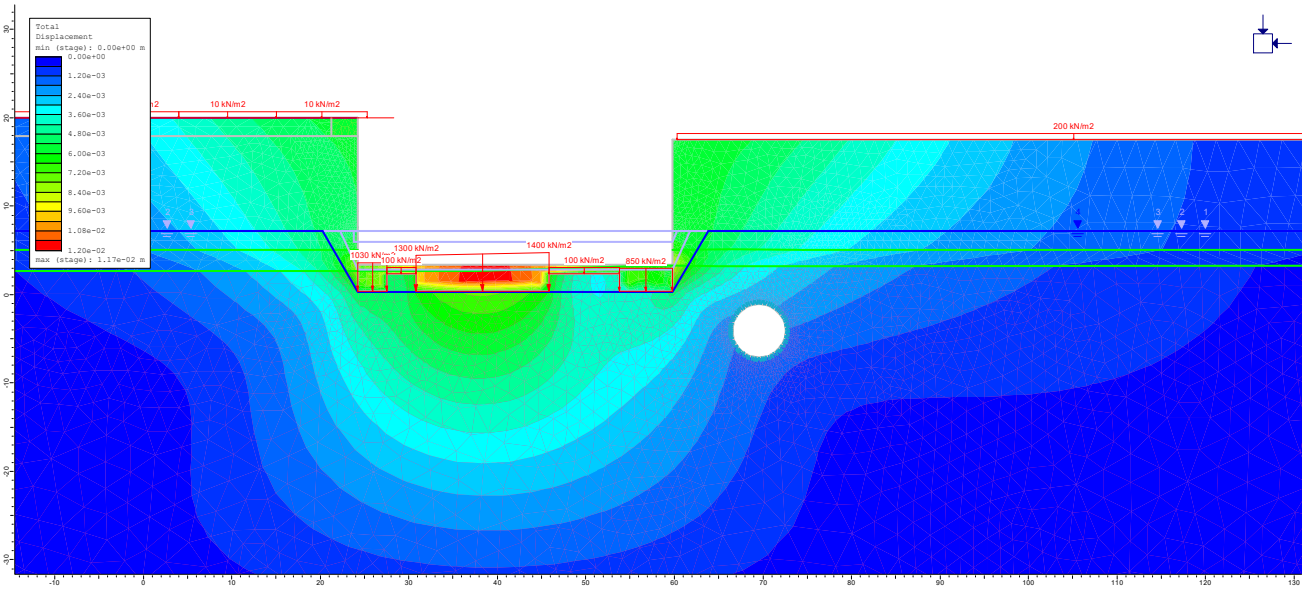


Figure 30: Induced Total Displacement contours after loading of proposed building (Stage 16) for Case 3

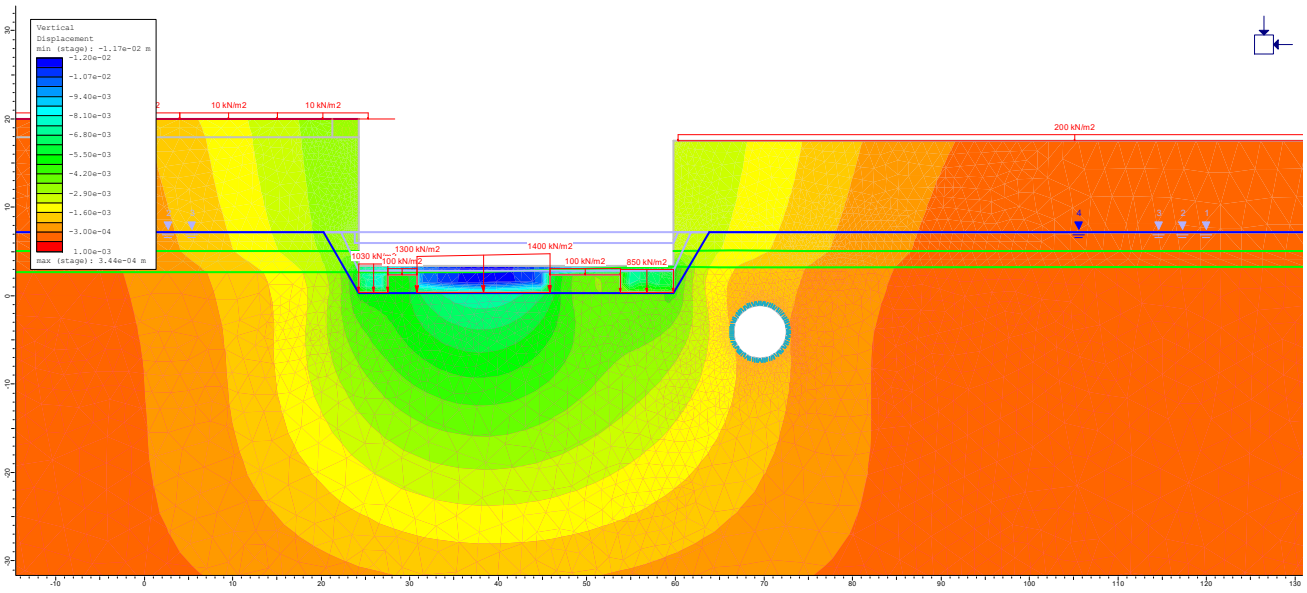


Figure 31: Induced Vertical Displacement contours after loading of proposed building (Stage 16) for Case 3

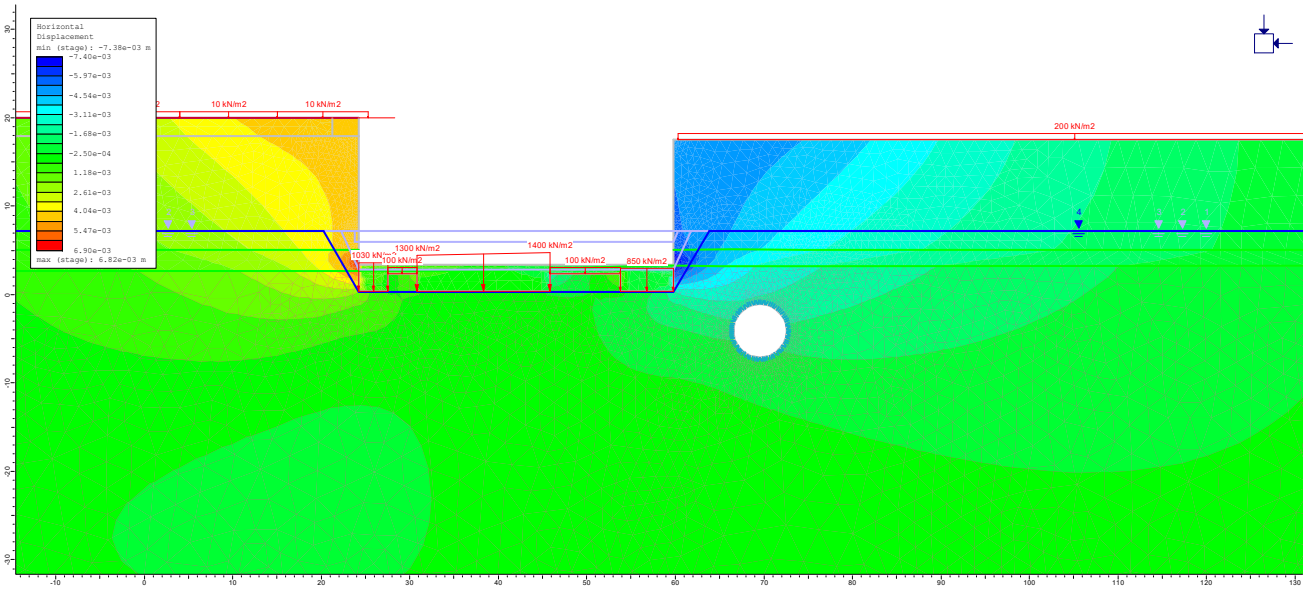


Figure 32: Induced Horizontal Displacement contours after loading of proposed building (Stage 16) for Case 3

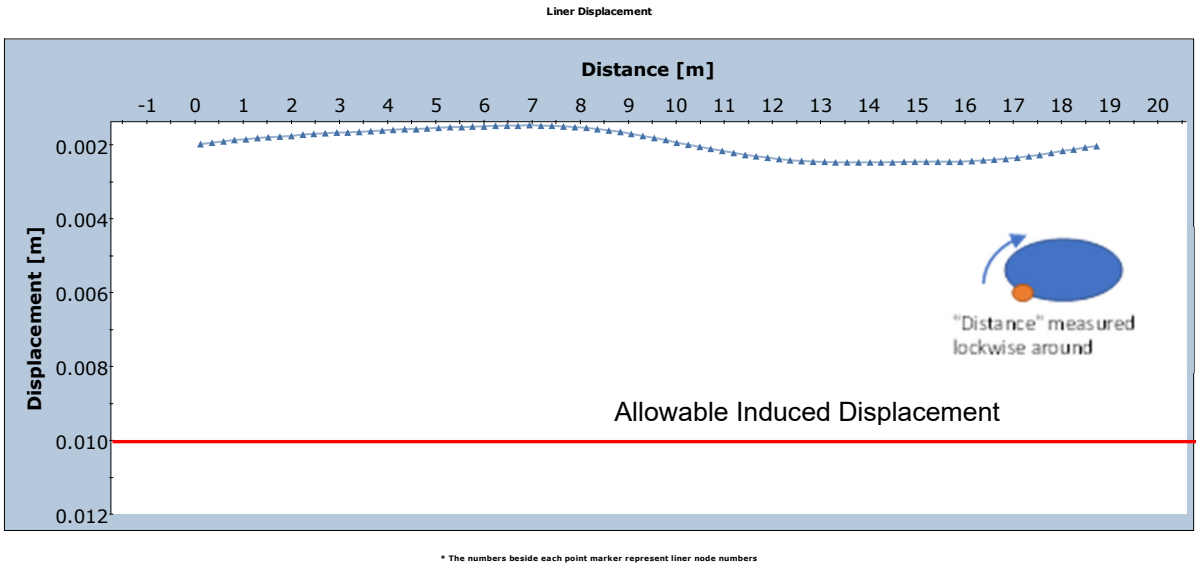


Figure 33: Tunnel C (South-West Tunnel) liner induced displacement after loading of proposed building (Stage 16) for Case 3

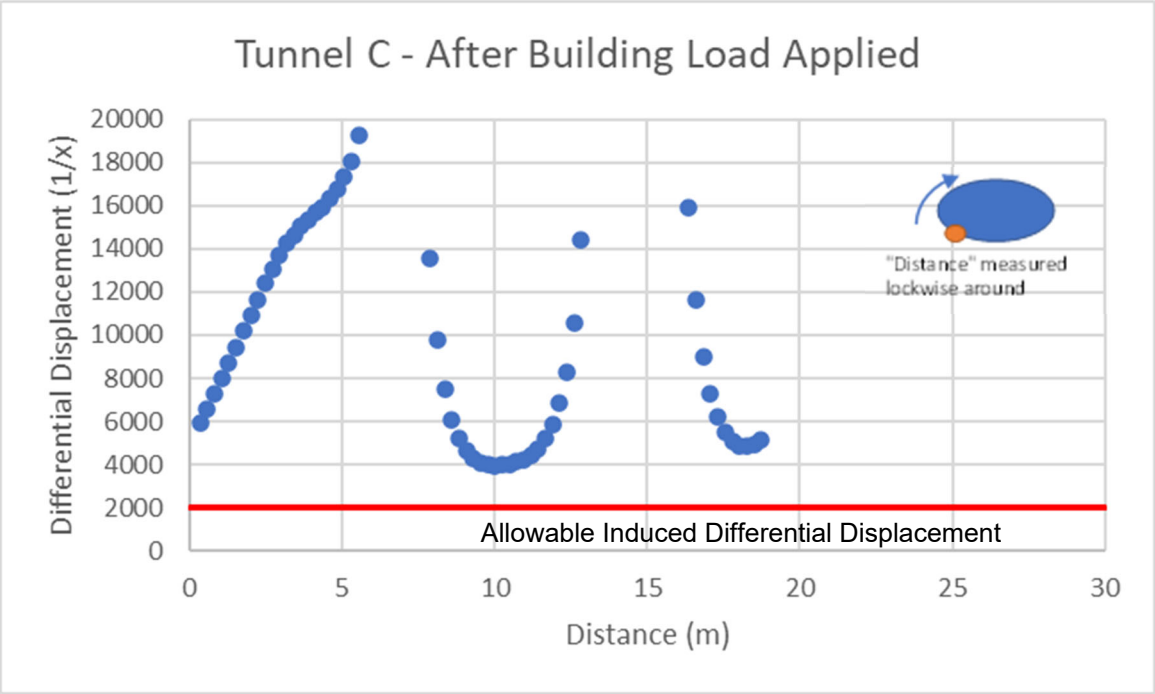


Figure 34: Tunnel C (South-West Tunnel) liner induced differential displacement after loading of proposed building (Stage 16) for Case 3

10.4 CASE 4 – SECTION BB WITH BASEMENT AT B5 LEVEL – ULS1

- Figure 35 and Figure 36 show the changes in horizontal and vertical total stress in the rock around tunnel A after loading of proposed building.
- Figure 37 and Figure 39 show the axial force, bending moment and shear of Tunnel C liner
- Figure 40 shows the support capacity for Tunnel C liner for Stage 16 with various FOS

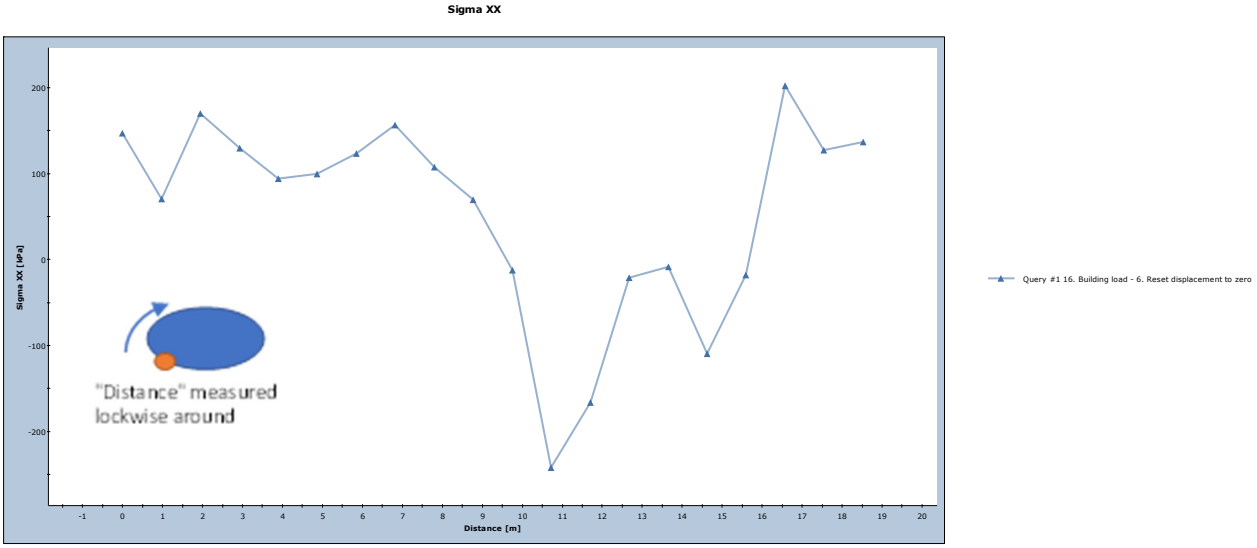


Figure 35: Changes in horizontal total stress on rock around Tunnel C (South-West Tunnel) after loading of proposed building (Stage 16) for Case 4

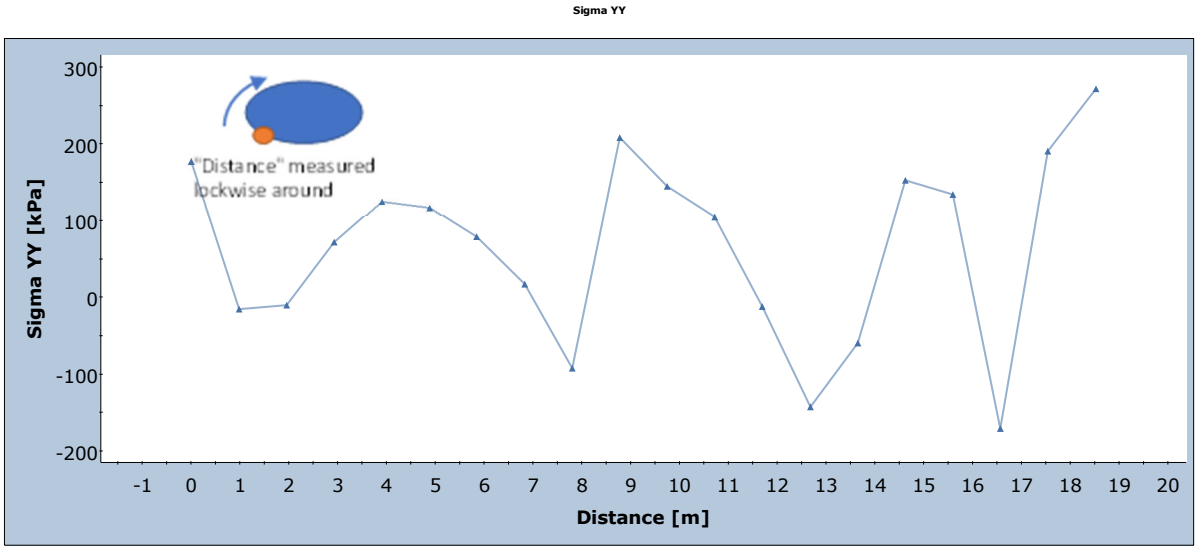


Figure 36: Changes in vertical total stress on rock around Tunnel C (South-West Tunnel) after loading of proposed building (Stage 16) Case 4

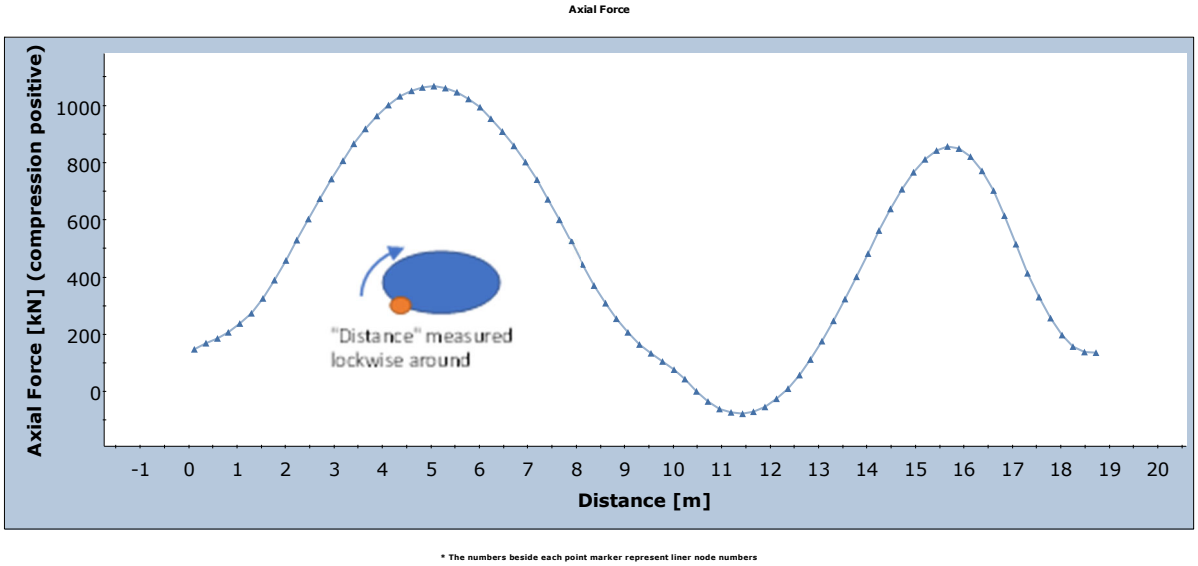


Figure 37: Axial force in Tunnel C liner (South-West Tunnel) after loading of proposed building (Stage 16) for Case 4

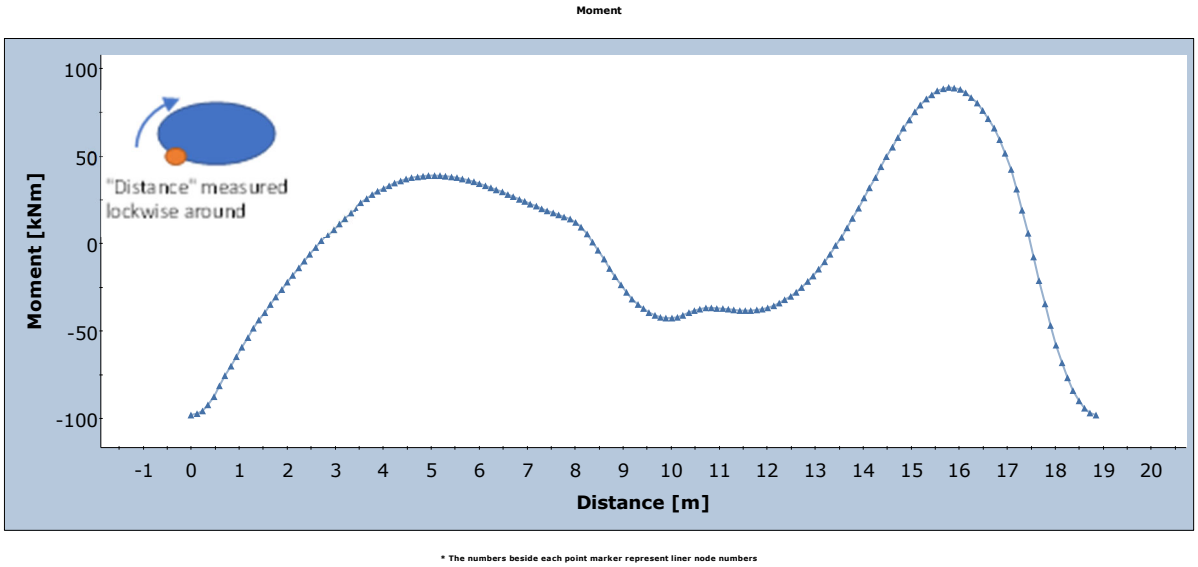


Figure 38: Bending Moment in Tunnel C liner (South-West Tunnel) after loading of proposed building (Stage 16) for Case 4

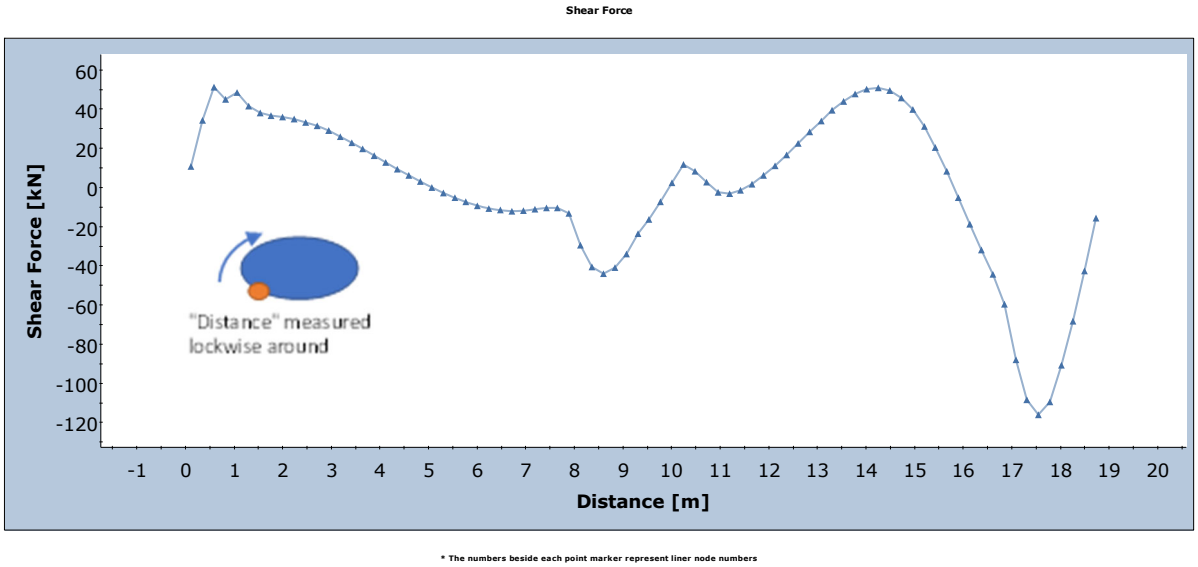


Figure 39: Shear Force in Tunnel C liner (South-West Tunnel) after loading of proposed building (Stage 16) for Case 4

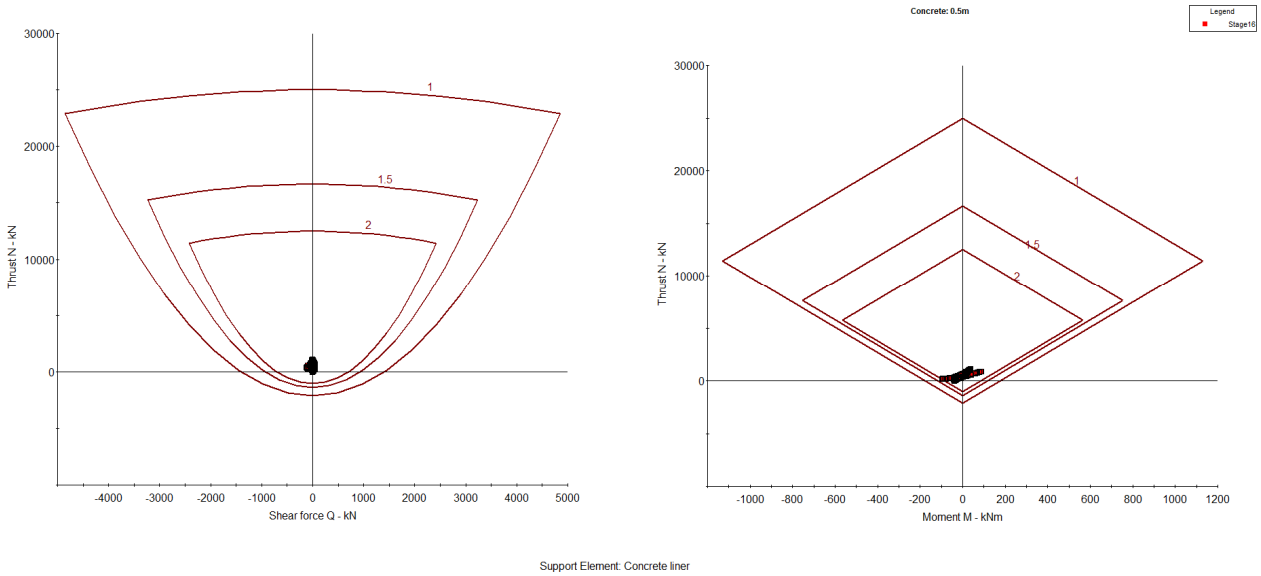


Figure 40: Tunnel C liner (South-West Tunnel) support capacity after loading of proposed building (Stage 16) with various FOS for Case 4

Table 5 and Table 6 summarises the structural actions on the tunnel liner after the completion of building construction for the cases analysed. The assessed structural actions are within the cracking envelope of the tunnel liner capacity (assumed unreinforced liner) considering FOS of 1, 1.5 and 2.0.

Table 5: Summary of liner induced displacement for tunnels subjected to SLS cases

Tunnel	Liner Displacement (mm)			Max. Differential displacement in transverse direction (1/X)			Within allowable limit
	A	B	C	A	B	C	
Basement level B5	5.5	4	2.5	2326	2356	4000	Y

Table 6: Summary of structural actions for tunnels subjected to ULS cases

Basement level	Tunnel	Max. Axial Force (kN)	Max. Bending Moment (kNm)	Max. Shear Force (kN)	Within Tunnel Liner Capacity
B5	A	5500	150	300	Y
	B	4200	125	200	Y
	C	1200	90	120	Y

11. CONCLUSIONS

Based on the assessment presented above, the analyses show that for the 5 basement level (B5 level) in which the footings are anticipated to be founded in Class II or better Sandstone, from geotechnical point of

view, the assessment results satisfied the allowable limits of displacement and ultimate structural actions are within the tunnel liner capacity.

The assessment assumes the shape of the new Sydney Metro West tunnel is an oval shape with a curved excavated floor instead of the cross-section as provided in the Sketchbook by WB. The assessment indicated that the tunnel with a flat floor could cause localised stress concentration at the transition zone from the curve wall to the flat floor. This assumption of the curved floor is based on the cross section for the Sydney Metro Southwest tunnels. The shape of the tunnels needs to be confirmed by Sydney Metro.

The current 2D analysis results indicate that with the 5 level basement, the development does not significantly impact on the Sydney Metro Tunnel. However, assessment of longitudinal differential displacement of the tunnel liner is also required to satisfy the requirements as stated in the Sydney Metro Technical Guidelines, this would require more in-depth detailed analysis.

12. FURTHER ANALYSIS

The detailed 3D requirements of the Sydney Metro Underground Corridor Protection Technical Guidelines are:

Induced movement:

- For metro cast in-situ cavern and tunnel concrete linings, the allowable total movement **in any direction** is 10 mm and differential movement in any plane is 10 mm or 1:2000, whichever is less.
- For metro running tunnels that are supported by a precast concrete segmental lining, the allowable total movement **in any direction** is 10 mm and differential movement in any plane is 10 mm or 1:2000 whichever is less. The main purpose of these limits is to ensure that the watertightness of the lining through joints is not compromised as consequence of gasket decompression and/or damage.
- Any development activity, whether beneath or adjacent to contained metro tracks, that has the potential to cause track displacement must comply with the requirements of SPC 207 Track Monitoring Requirements for Undertrack Excavation. SPC 207 has specifical requirements for the **track long and short twist deformation** analysis.

For the completeness of the impact assessment, a full three-dimensional (3D) Finite Element Analysis will be required to assess the potential impact on the tunnels (as the tunnels are located at different levels and directions) and the interaction between infrastructures and buildings.

13. CLOSURE

The attached document entitled “Important information about your Tetra Tech Coffey report” provides additional information on the uses and limitations of this report.

14. REFERENCES

Oliveira, D. A. F., 2014, “An Alternative view on Geotechnical Parameters for Tunnel Design in Sydney”, Australian Geomechanics, Vol. 49(3), September 2014.

Pells et al (2019), “Classification of Sandstones and Shales in the Sydney Region: A Forty Year Review”, Australian Geomechanics Journal, Vol. 64: No. 2 June 2019

APPENDIX A: LIMITATIONS

IMPORTANT INFORMATION ABOUT YOUR TETRA TECH COFFEY REPORT

As a client of Tetra Tech Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Tetra Tech Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Tetra Tech Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Tetra Tech Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Tetra Tech Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Tetra Tech Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Tetra Tech Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Tetra Tech Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Tetra Tech Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Tetra Tech Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Tetra Tech Coffey to work with other project design professionals who are affected by the report. Have Tetra Tech Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Tetra Tech Coffey for information relating to geoenvironmental issues.

Rely on Tetra Tech Coffey for additional assistance

Tetra Tech Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Tetra Tech Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Tetra Tech Coffey to other parties but are included to identify where Tetra Tech Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Tetra Tech Coffey closely and do not hesitate to ask any questions you may have.

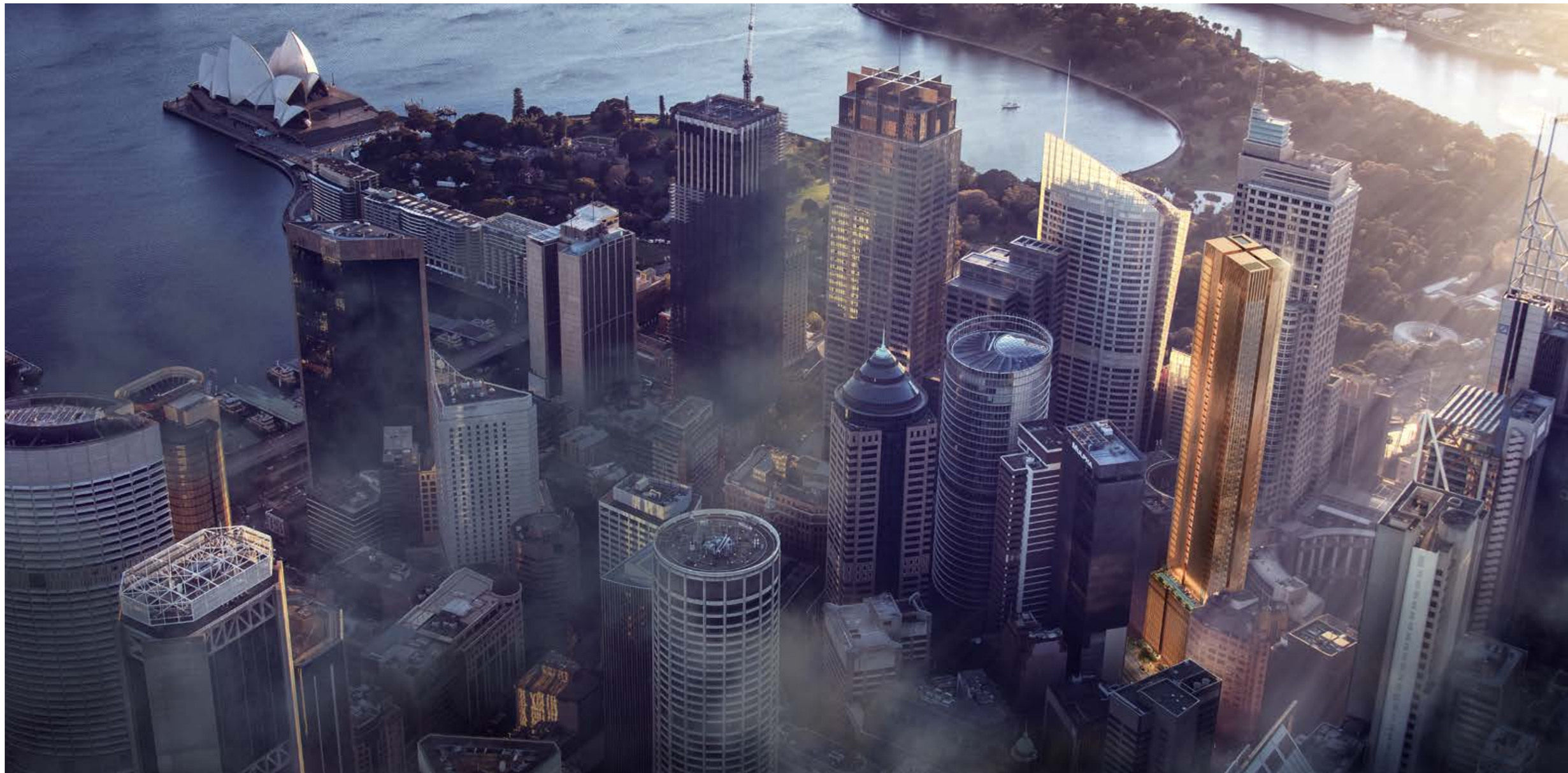
APPENDIX B: SKETCHBOOK REPORT BY WB

W—B
WOODS BAGOT

25.10.22

SKETCHBOOK REPORT

4-6 Bligh Street
Holdmark



Contacts

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Ian.Lomas@woodsbagot.com

Tim Davies
Tim.Davies@woodsbagot.com

John Norman
John.Norman@woodsbagot.com

Woods Bagot acknowledges the Traditional Owners of the land, sky and waters. We pay our respects to Elders past, present, and to the future leaders of our community.

We honour the ongoing deep spiritual connection that the Traditional Owners have with this country. With respect, we tread gently to help reconcile and pave the way for a united and harmonious future for all people.

Image above:
4-6 Bligh St Hotel Lobby
Sydney, Australia
Cover image:
4-6 Bligh St Aerial
Sydney, Australia

Contents

01

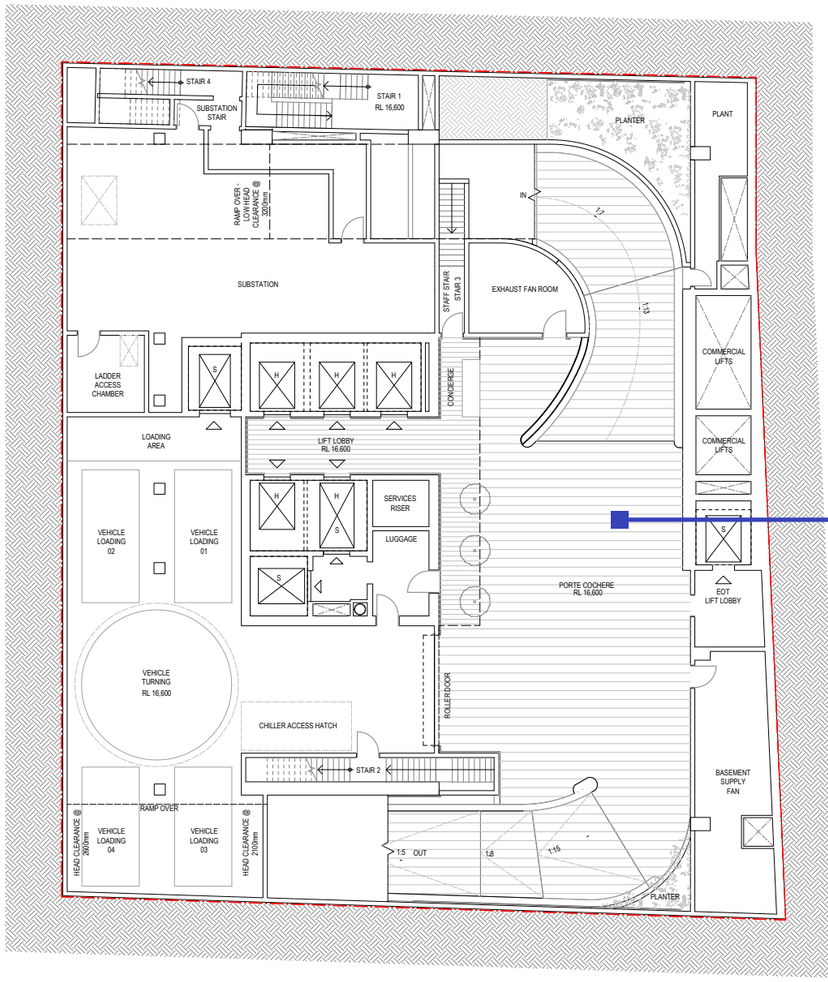
Development Constraints

Current Design Levels

Existing Excavation DA

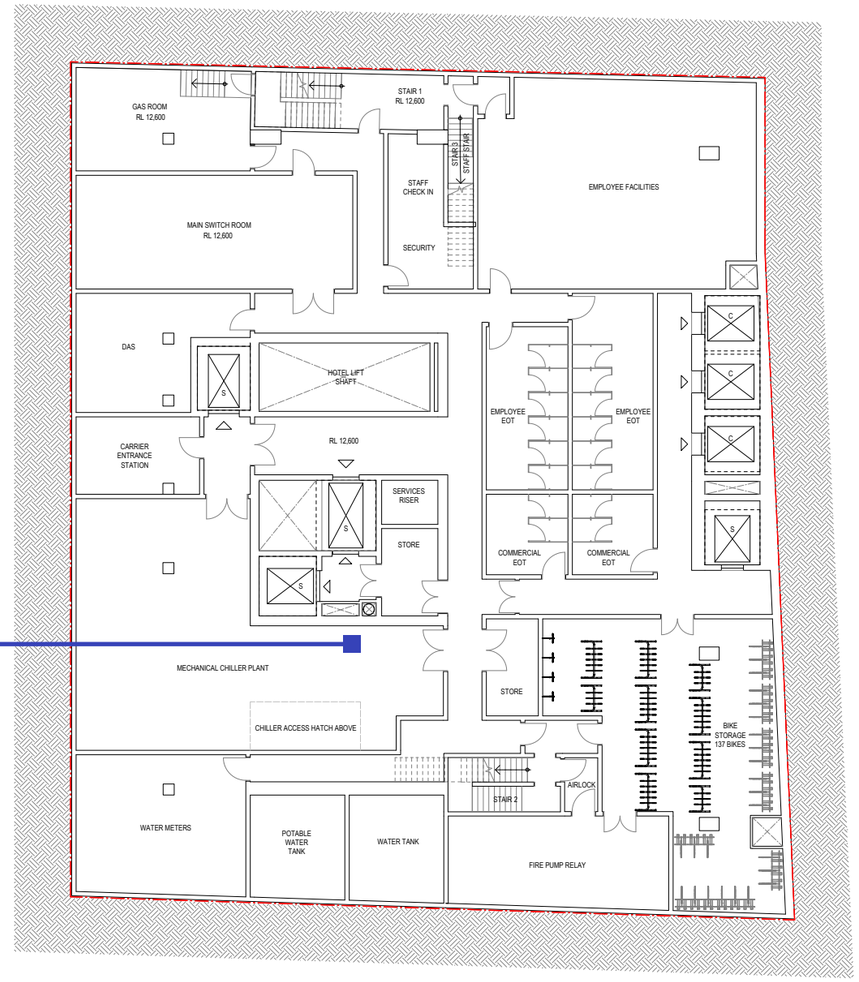
Sydney Metro Alignments

01.1 Current Design Levels



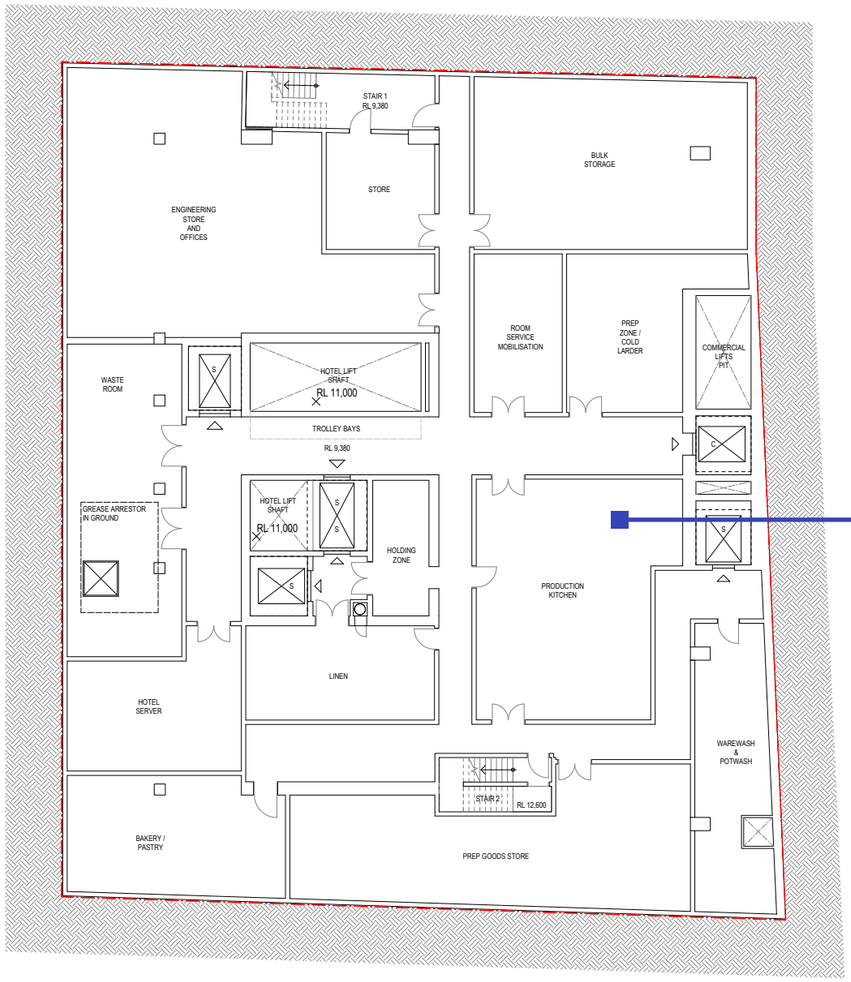
RL 16.6

RL 12.6



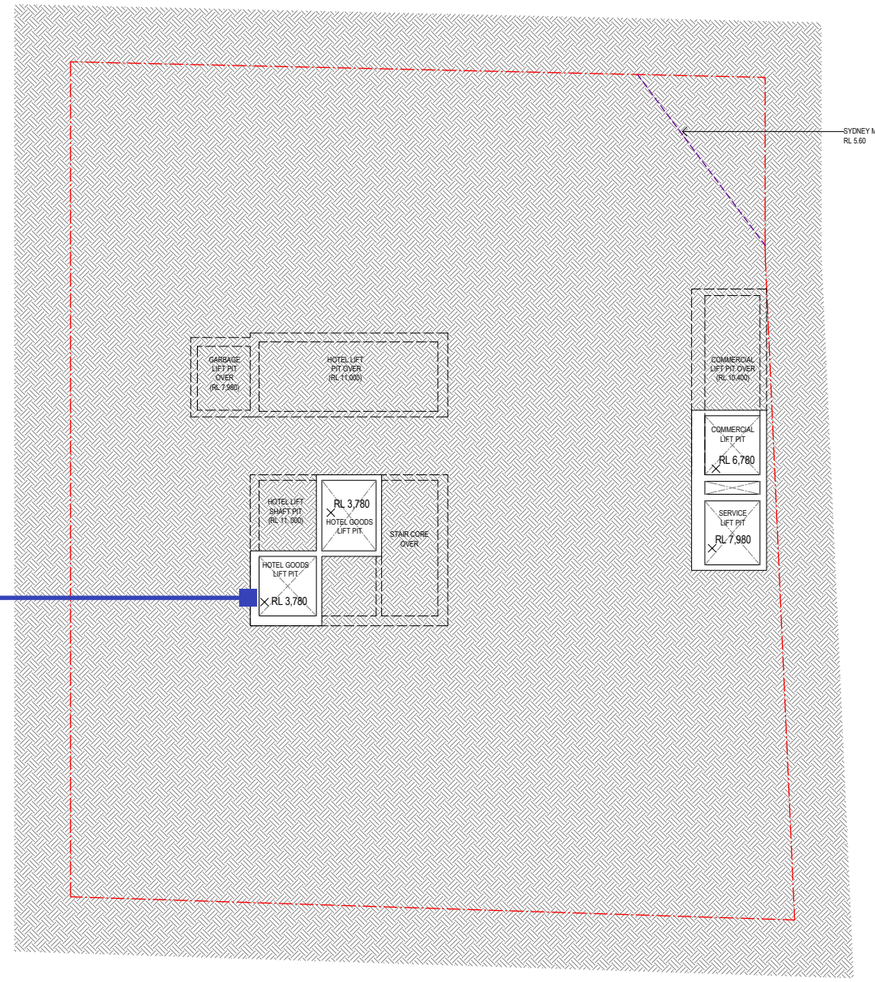
Basement Level 01 Floor Plan

Basement Level 02 Floor Plan



RL 9.38

RL 3.78



Basement Level 03 Floor Plan

Basement Level 04 Floor Plan

01.2 Existing Excavation DA

LEGEND

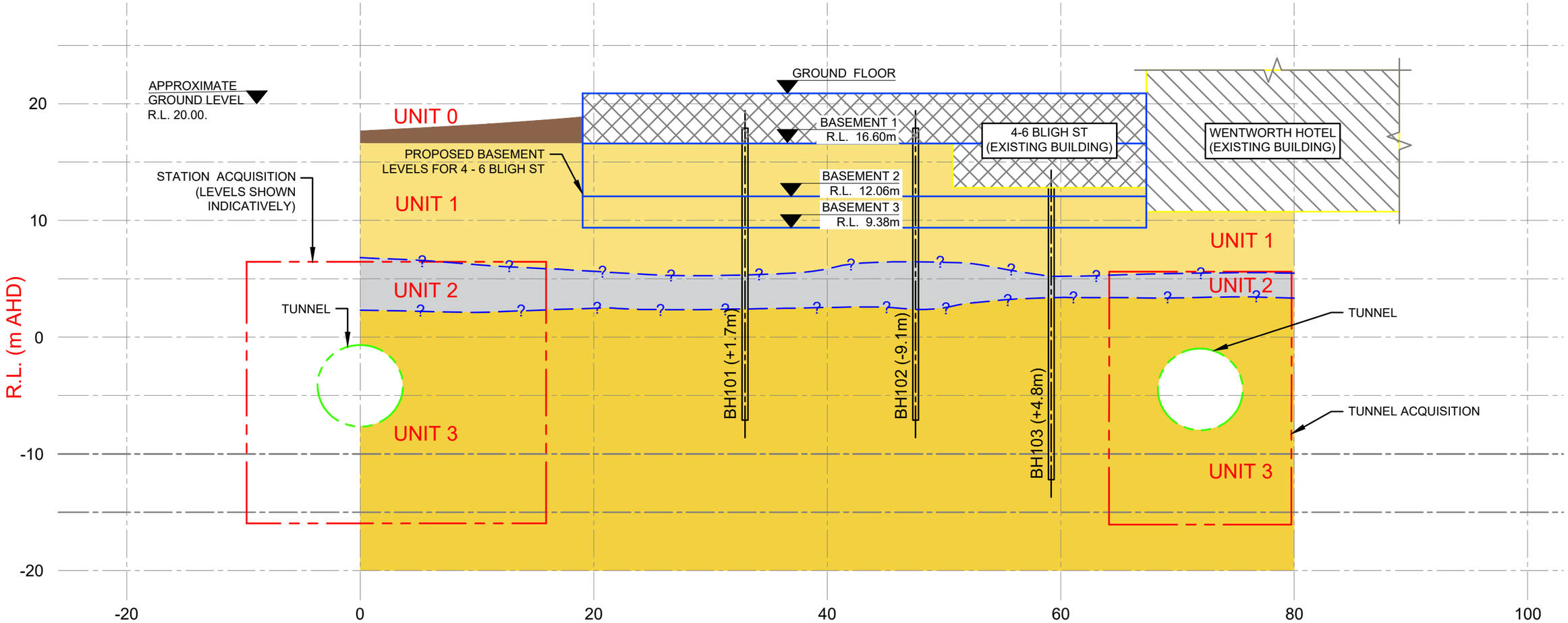
UNIT 0 - UNOBSERVED GROUND, LIKELY FILL, RESIDUAL SOIL TO SANDSTONE (CLASS V TO II)

UNIT 1 - MODERATELY WEATHERED TO FRESH CLASS II AND CLASS I SANDSTONE

UNIT 2 - CLASS III SHALE

UNIT 3 - FRESH CLASS II AND CLASS I SANDSTONE

INFERRED GEOLOGICAL BOUNDARY

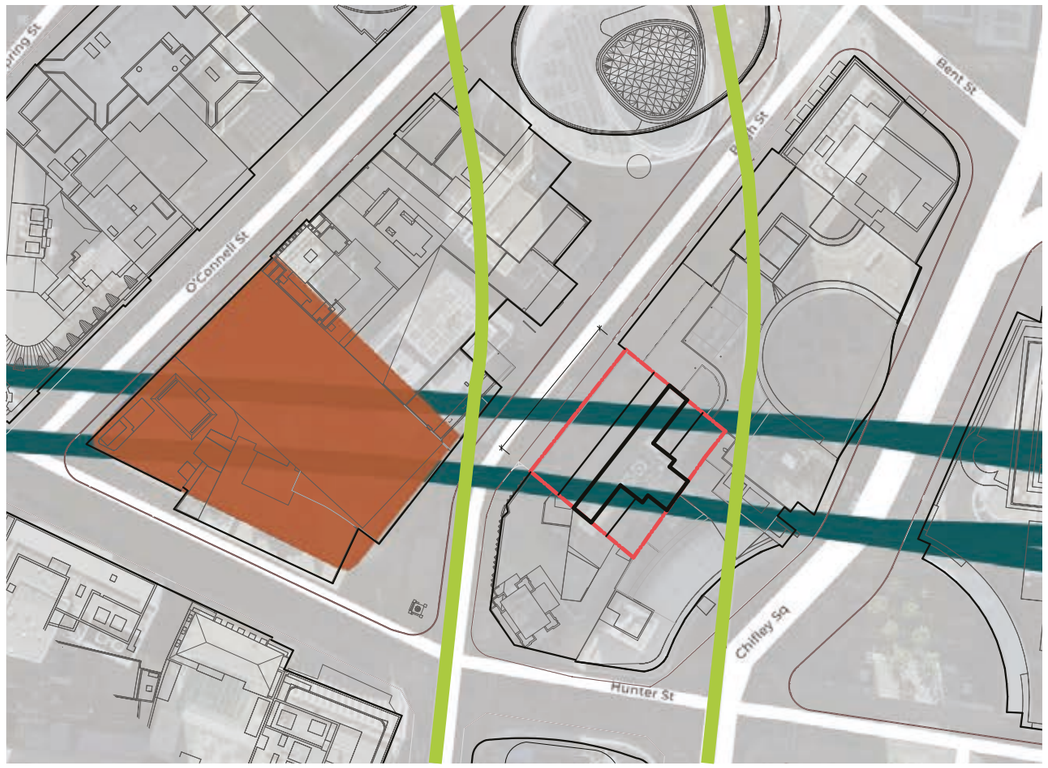


DETAIL A

SCALE 1:500 FIGURE A1

01.3 Sydney Metro and CBD Rail Link Alignments

Metro Interactive Map

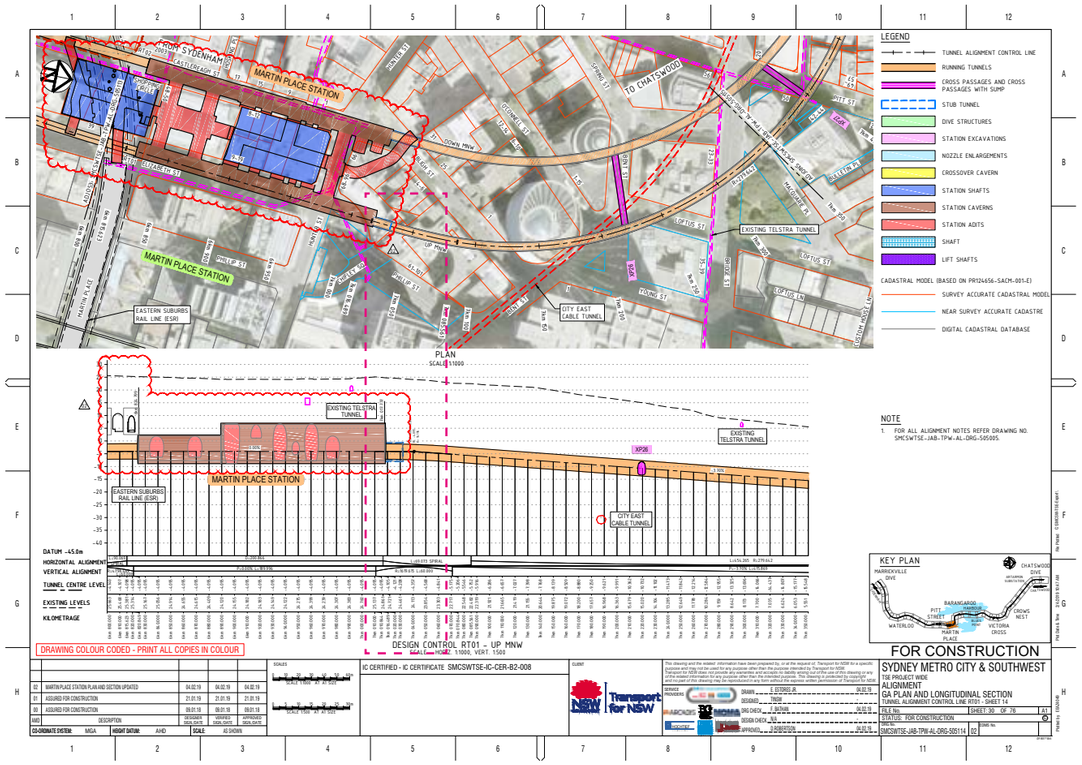


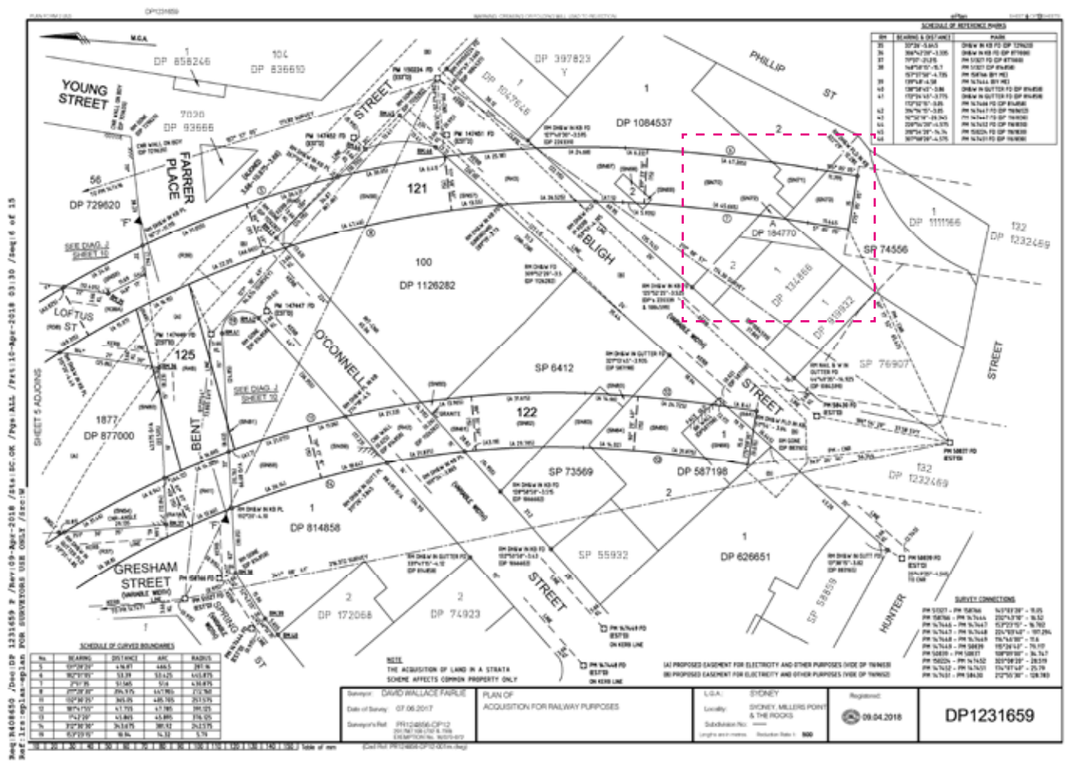
Overlay with site plan drawing

Sydney Metro West

CBD Rail Link

City & Southwest (CBD Rail Link) - Reference Drawings





Drawing Reference

Title: Tunnel Alignment Control Line RT01 - Sheet 14

Drawing No: SMCSWTSE-JAB-TPW-AL-DRG-505114

Date issued: 04.02.2019

Drawing Reference

Title: Plan Of Acquisition For Rail Purposes

Drawing No: DP12 the Rocks DP1231659.pdf - Page7

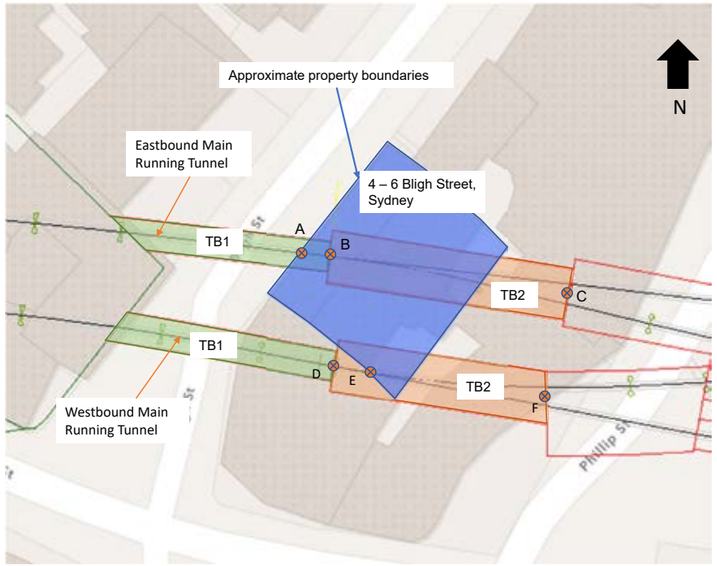
Date issued: 07.06.2017

Sydney Metro West - Reference Drawings

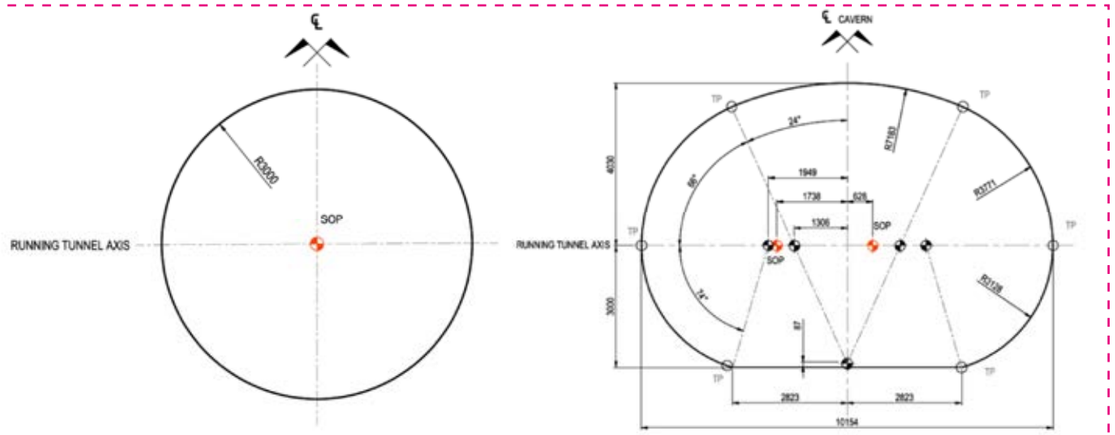
4 – 6 Bligh Street, Sydney
Overlay of SMW Alignment rev5.7

POINT	EASTING (MGA 56 2020)	NORTHING (MGA 56 2020)	RL (mAHD)
A	334461.4	6251293.1	-17.1
B	334464.3	6251292.9	-17.1
C	334511.8	6251286.5	-17.8
D	334465.6	6251271.3	-17.1
E	334466.6	6251271.1	-17.2
F	334507.7	6251265.6	-17.8

Note:
RLs are taken at tunnel centreline
Points A, B and C are on Eastbound Alignment (UP)
Points D, E and F are on Westbound Alignment (DOWN)



Indicative Cross Section for TB1 and TB2



Section for TB1 **Section for TB2**

Note:
SOP: Set Out Point at running tunnels axis

The dimensions are to the internal face of the tunnels.
The tunnel lining with a thickness of approximately 500 mm should be allowed.
The design is subject to revision at detail design stage.

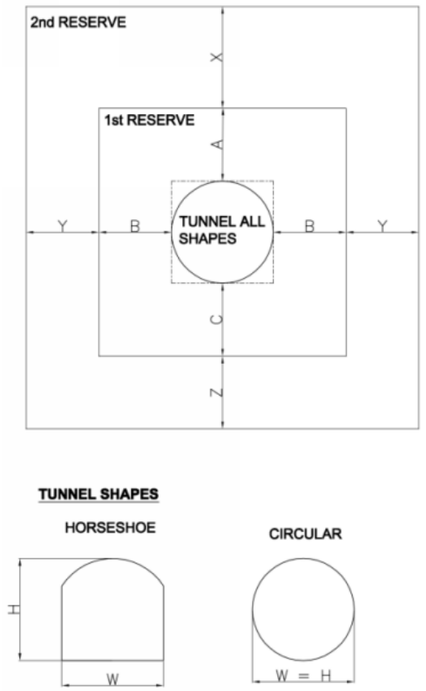
Drawing Reference

Title: 4-6 Bligh Street, Sydney Overlay of SMW Alignment rev5.7

Drawing No: 4-6 Bligh ST Sydney 221020.pptx

Date issued: 20.10.2022

Sydney Metro Guidelines



	First reserve dimensions (m)
Top (A)	The greater of the following: • 5 m from the crown of tunnel or cavern or • Support zone based on 1/3* tunnel width plus 1 metre (1/3*W+1) or • Extent of Sydney Metro substratum above crown
Side (B)	The greater of the following: • 5 m from side wall of tunnel or cavern or • Lateral extent of Sydney Metro substratum
Bottom (C)	The greater of the following: • 5 m below the invert of the tunnel or cavern or • Extent of Sydney Metro substratum below invert

	Second reserve dimensions (m)
Top (A+X)	The greater of the following: • 1.5 x (W+H) or • A + 25 or • Where 'W' and 'H' are width and height of the existing rail tunnel
Side (B+Y)	The greater of the following: • W or • B + 25
Bottom (C+Z)	C + 1.5 x (W_n + H_n) Where 'W_n' and 'H_n' are width and height of new tunnel under the existing metro tunnel or cavern

Note: all dimensions are taken from the excavated profile of tunnels and caverns

Figure 4.1 Protection reserves for metro tunnels and caverns

Drawing Reference

Title: Sydney Metro Underground Corridor Protection Technical Guidelines

Drawing No: Protection reserve diagram Fg.4.1 (Page 8)

Date issued: April 2021

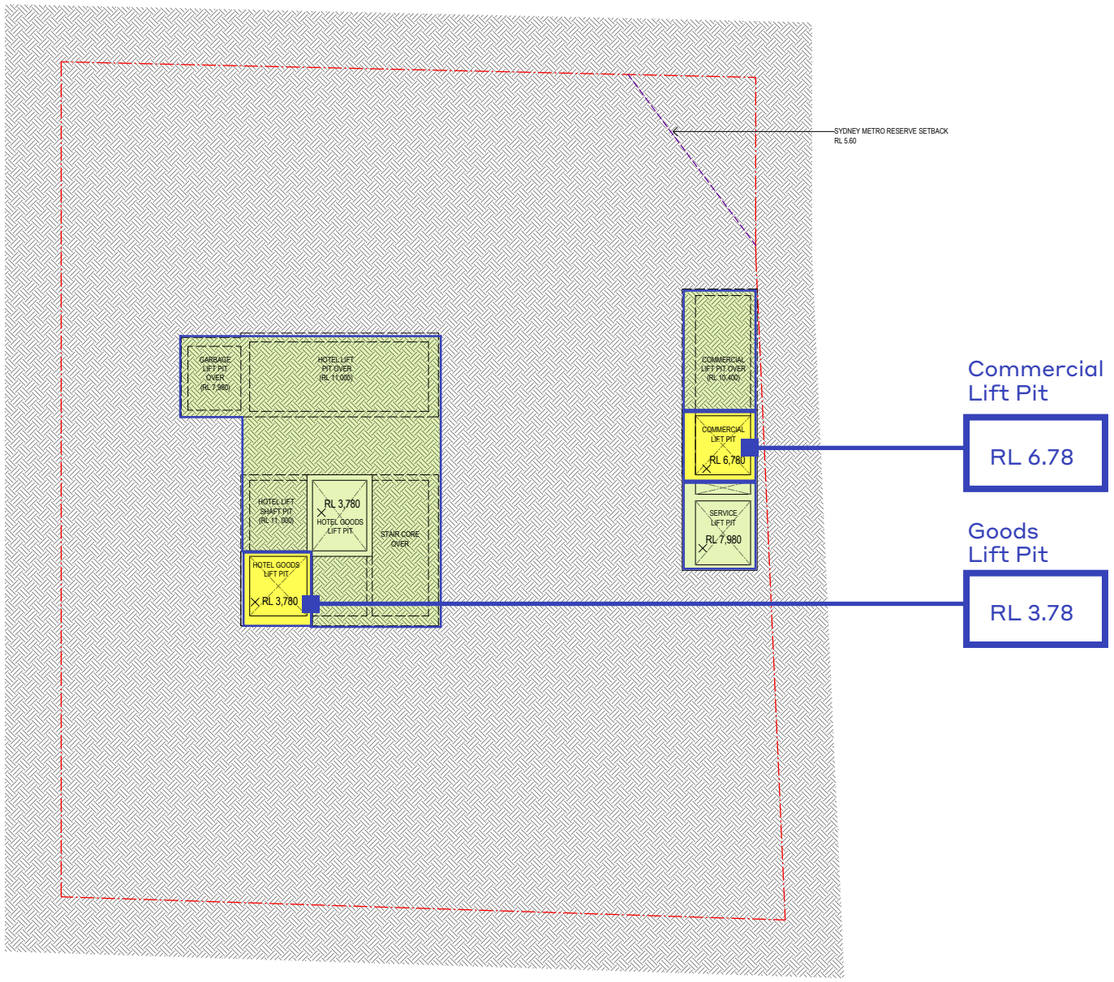
02

Additional Basements Study

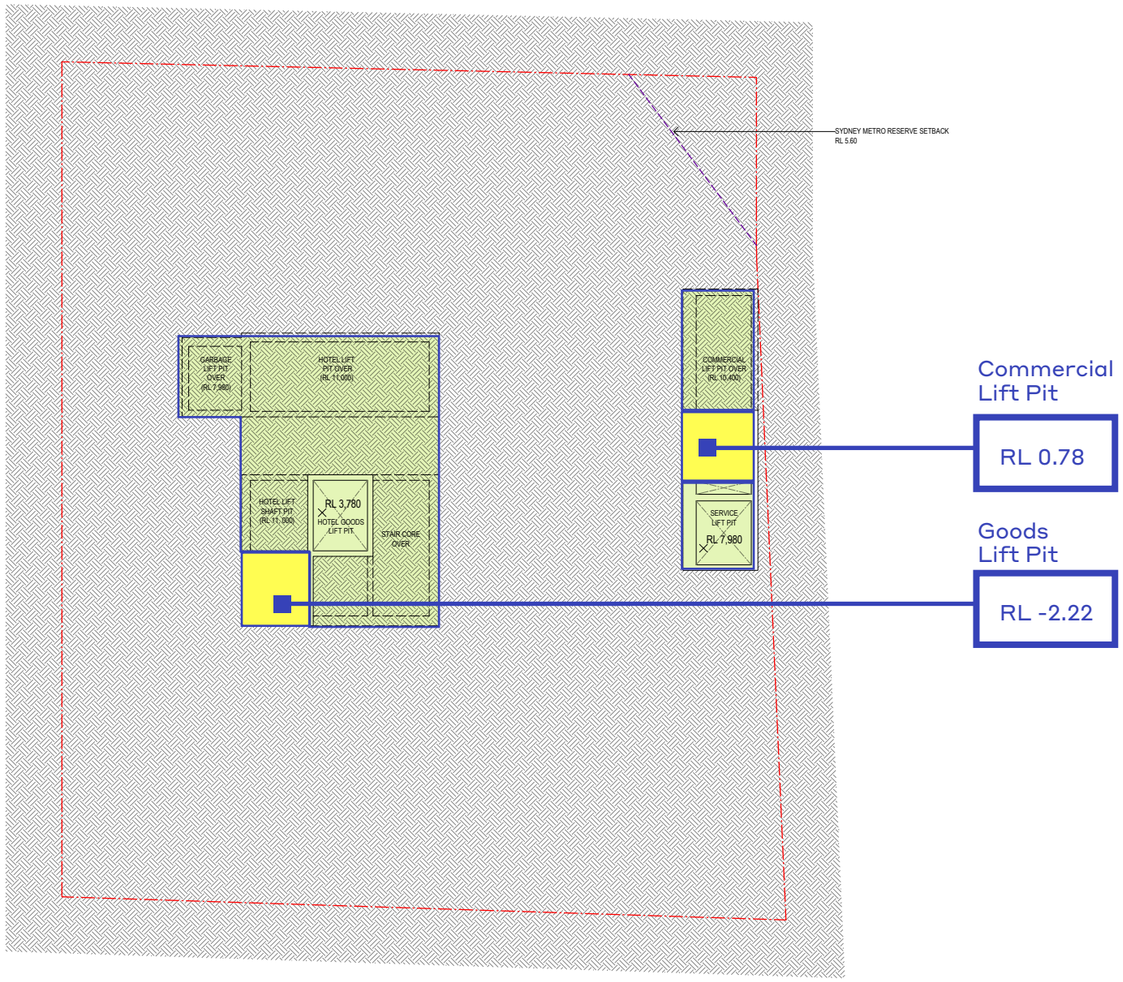
Lift Pit Strategy

Sydney Metro Tunnels Overlay

02.1 Lift Pit Strategy



Basement Level 04 Floor Plan - Current lift pit levels



Basement Level 04 Floor Plan - Proposed lift pit levels

02.2 Sydney Metro and CBD Rail Link Tunnels Overlay

Legend

Sydney Metro West:

- Cavern
- Tunnel

City & Southwest Metro:

- Tunnel
- Acquisition Boundary
- Cores

Note:
Coordinates highlighted in **red** as per Sydney Metro West Alignment.
Refer to ***'Sydney Metro West - Reference Drawings'***

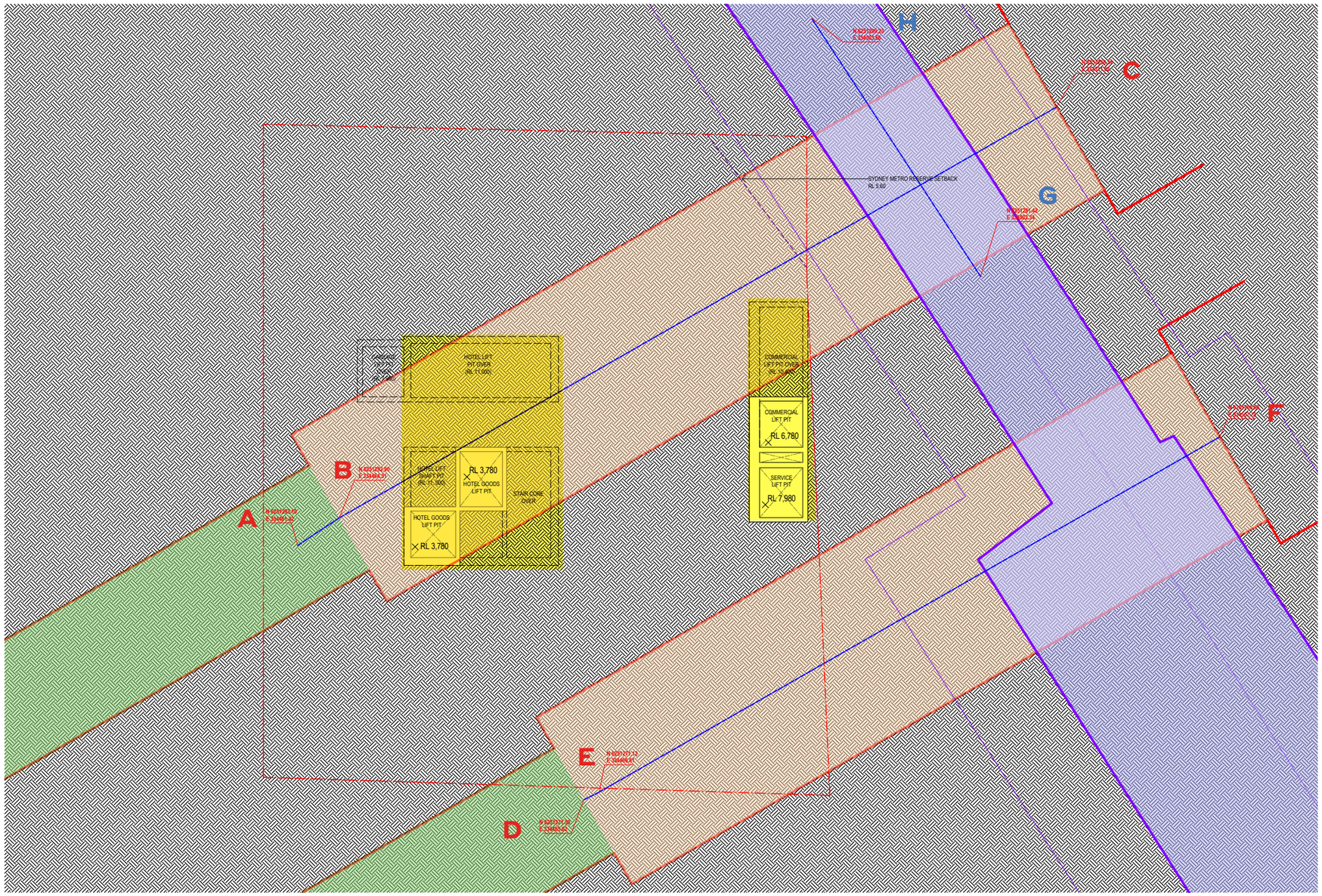
Centreline of Tunnels:

A) -17.1
B) -17.1
C) -17.8
D) -17.1
E) -17.2
F) -17.8

Coordinates highlighted in **blue** as per Tunnel Alignment Control Line RT01 - Sheet 14.
Refer to ***'Sydney Metro City & Southwest - Reference Drawings'***

Centreline of Tunnels:

G) -4.105
H) -4.357



Ground Floor Plan

Legend

Sydney Metro West:

- Cavern
- Tunnel

City & Southwest Metro:

- Tunnel
- Acquisition Boundary
- Cores

Note:
Coordinates highlighted in **red** as per Sydney Metro West Alignment.
Refer to ***'Sydney Metro West - Reference Drawings'***

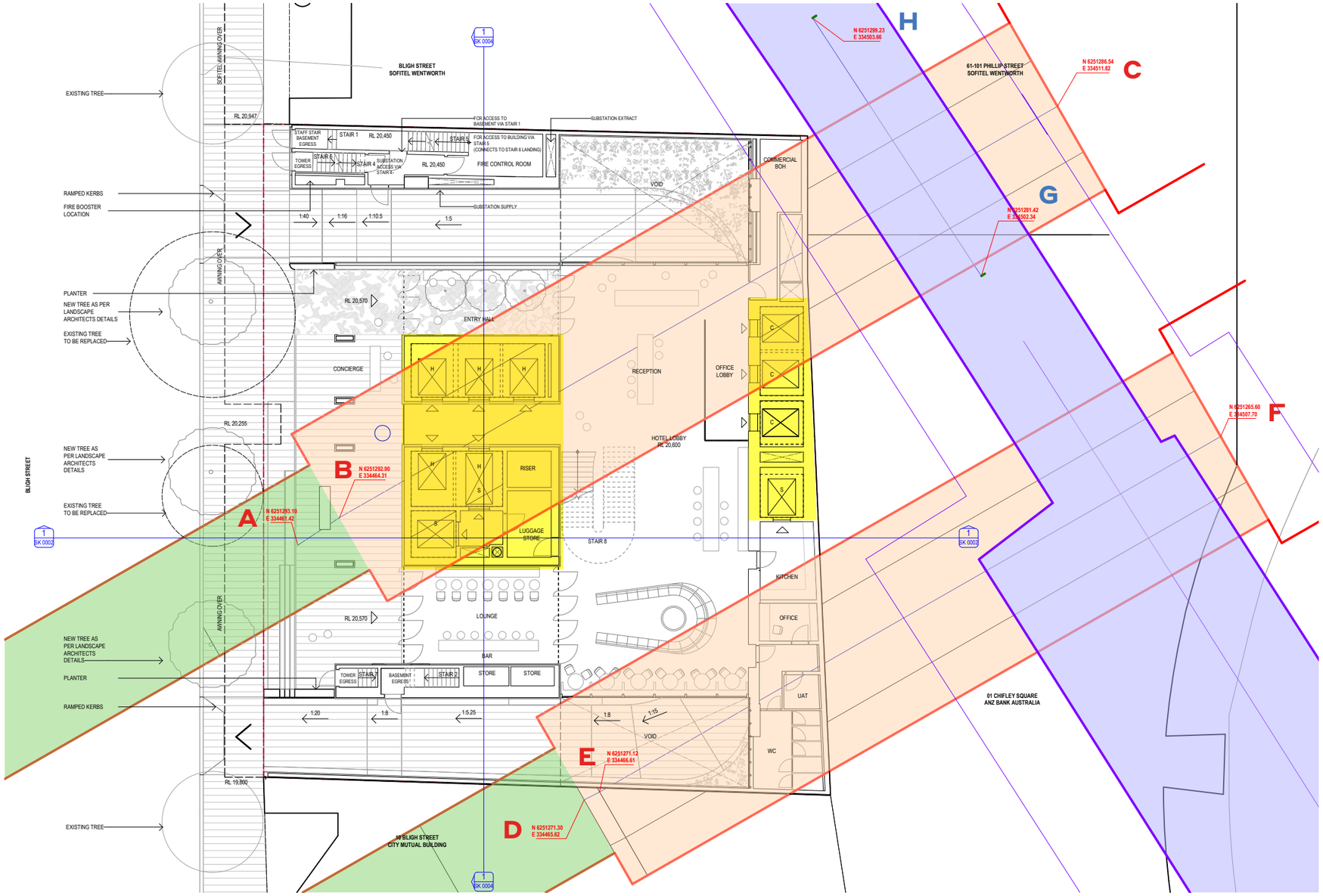
Centreline of Tunnels:

A) -17.1
B) -17.1
C) -17.8
D) -17.1
E) -17.2
F) -17.8

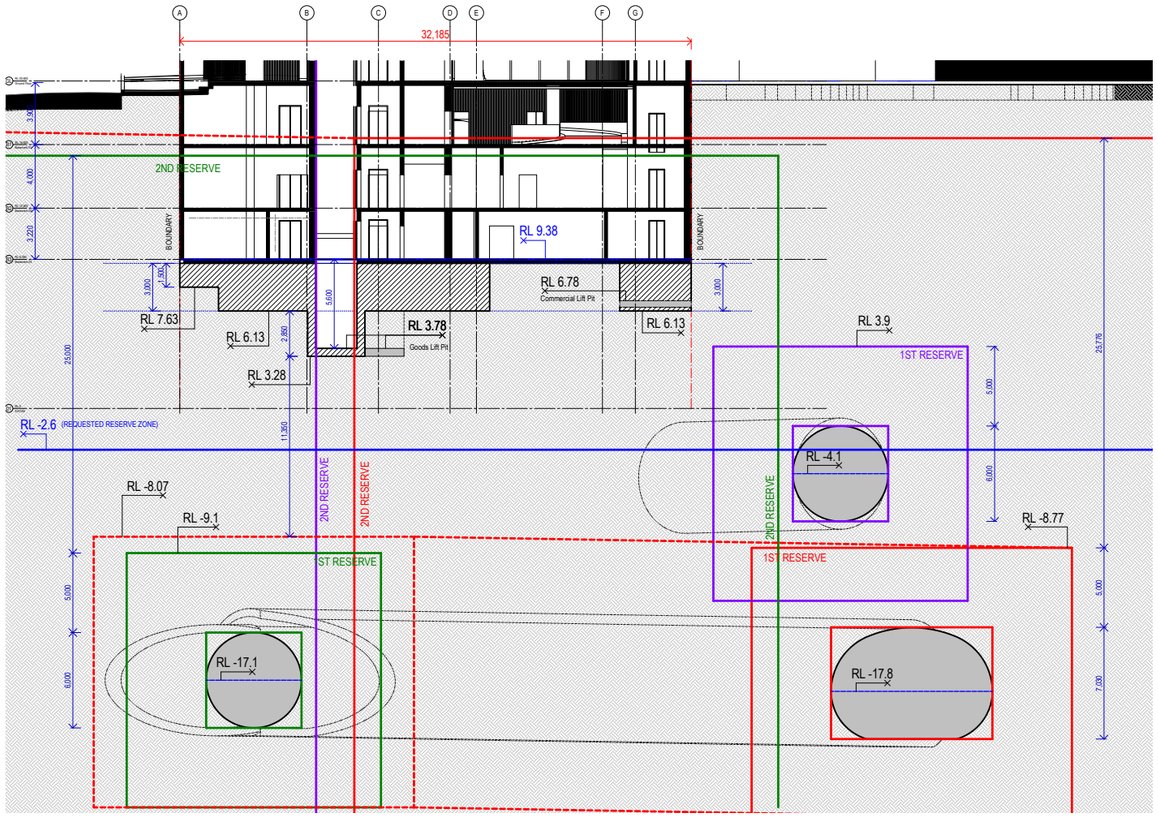
Coordinates highlighted in **blue** as per Tunnel Alignment Control Line RT01 - Sheet 14.
Refer to ***'Sydney Metro City & Southwest - Reference Drawings'***

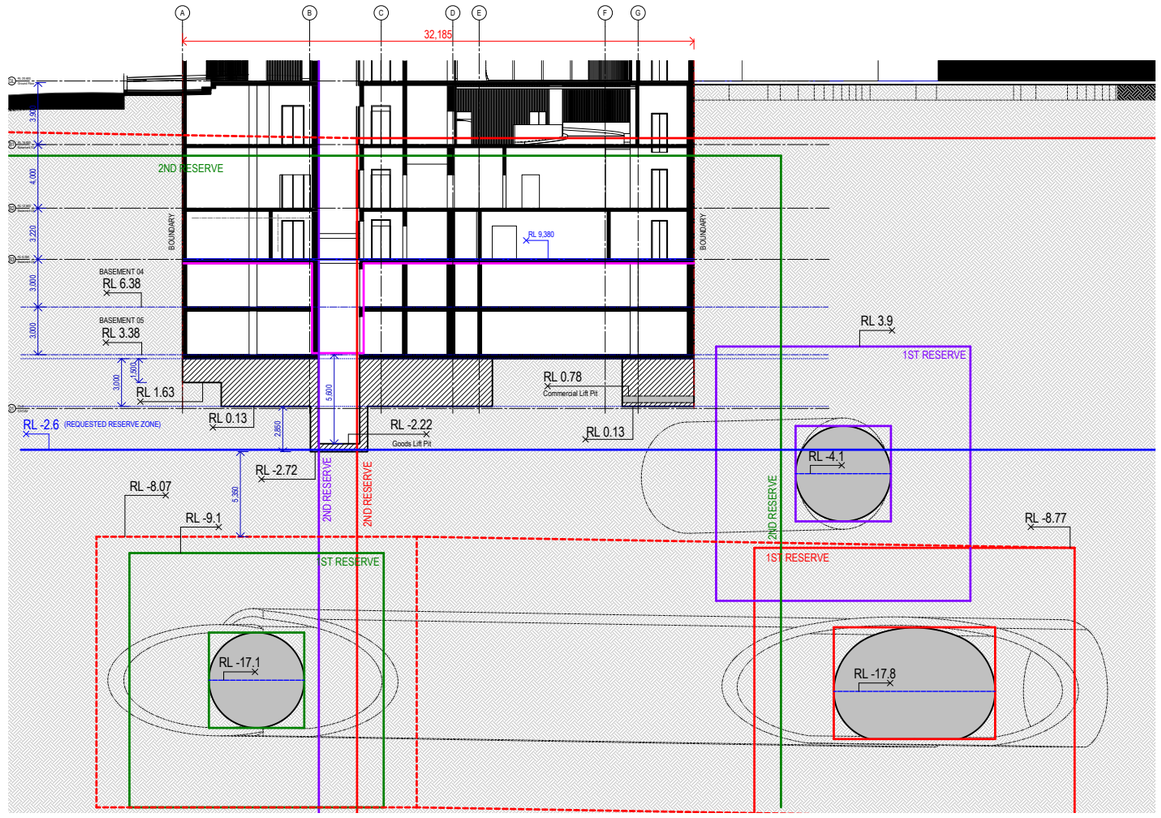
Centreline of Tunnels:

G) -4.105
H) -4.357



Cross Section - West / East





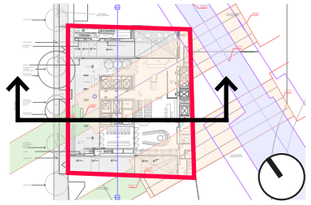
Cross Section - Current levels

Note: Tunnel centreline levels shown are relative to section line location.

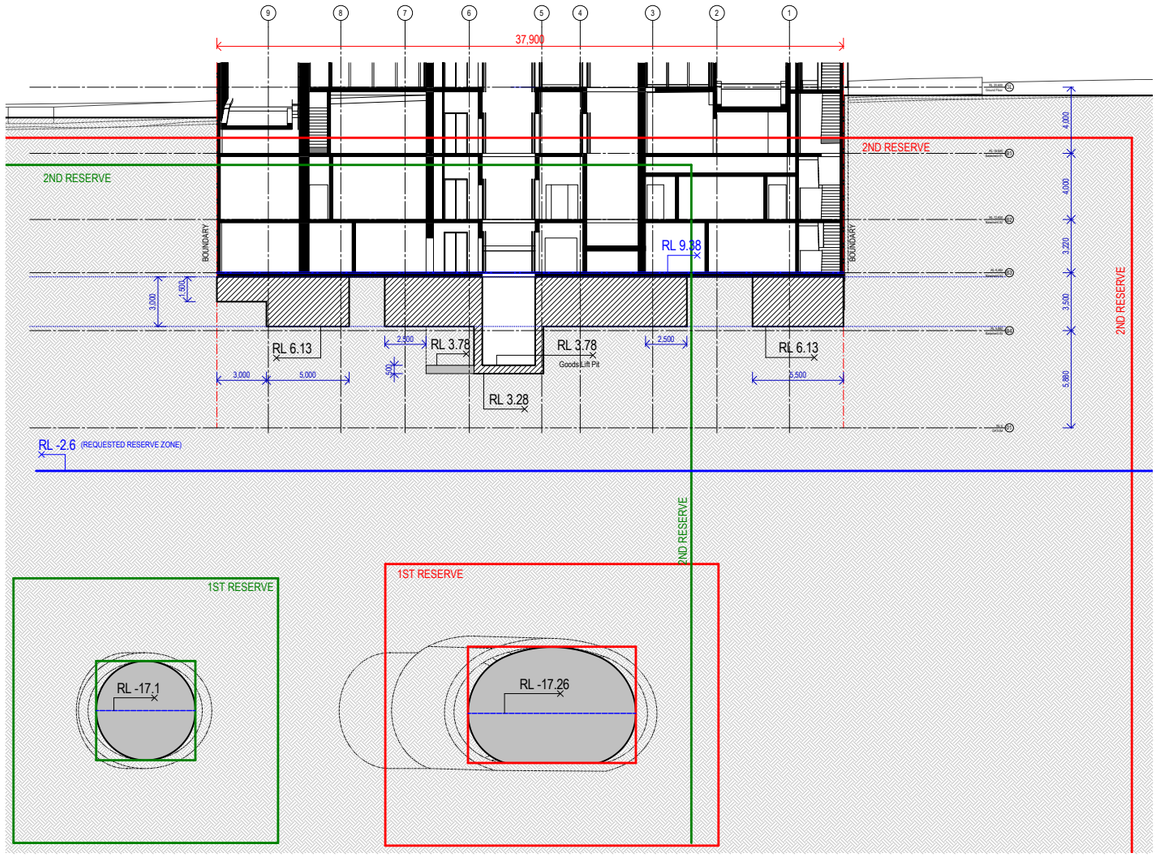
Cross Section - Proposed

Outline of current levels

RI 9.38 Approved Early Works DA

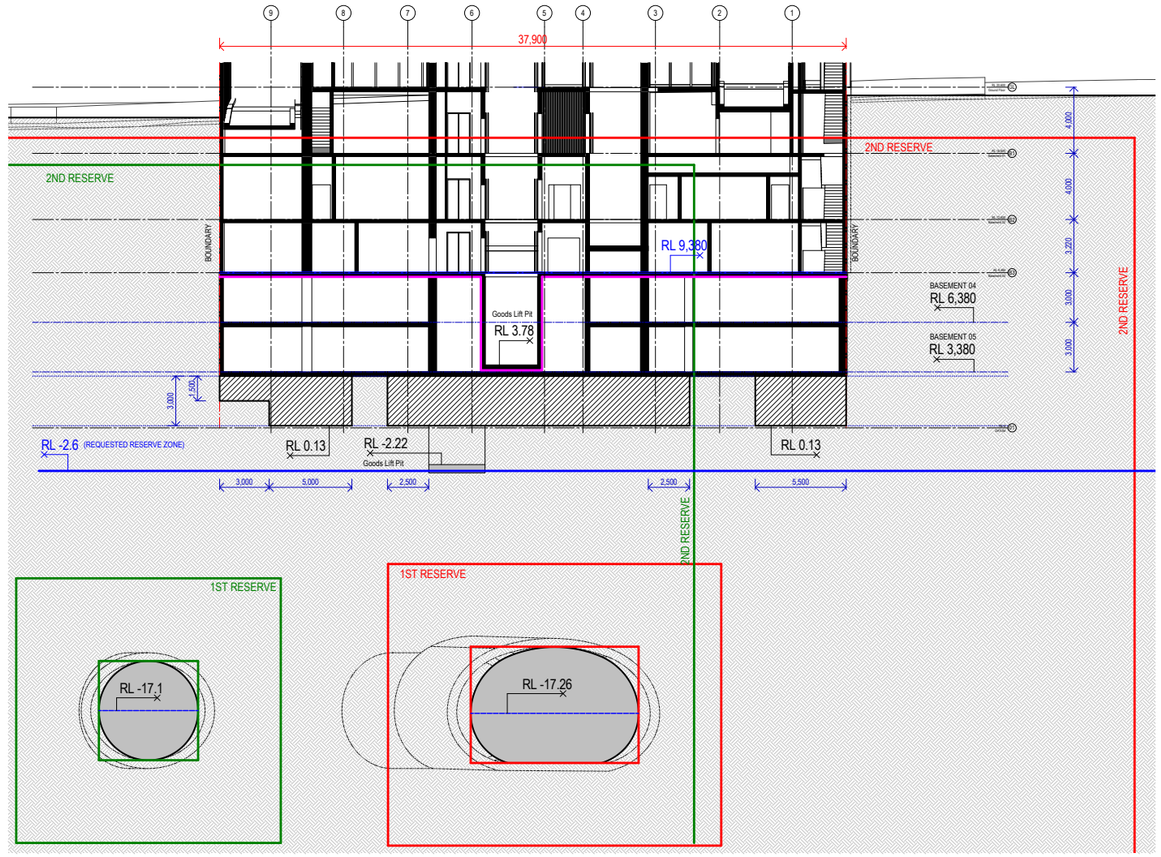


Long Section - North / South



Long Section - Current levels

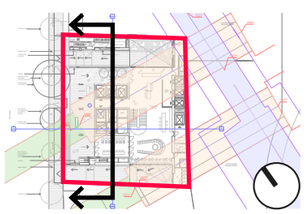
Note: Tunnel centreline levels shown are relative to section line location.



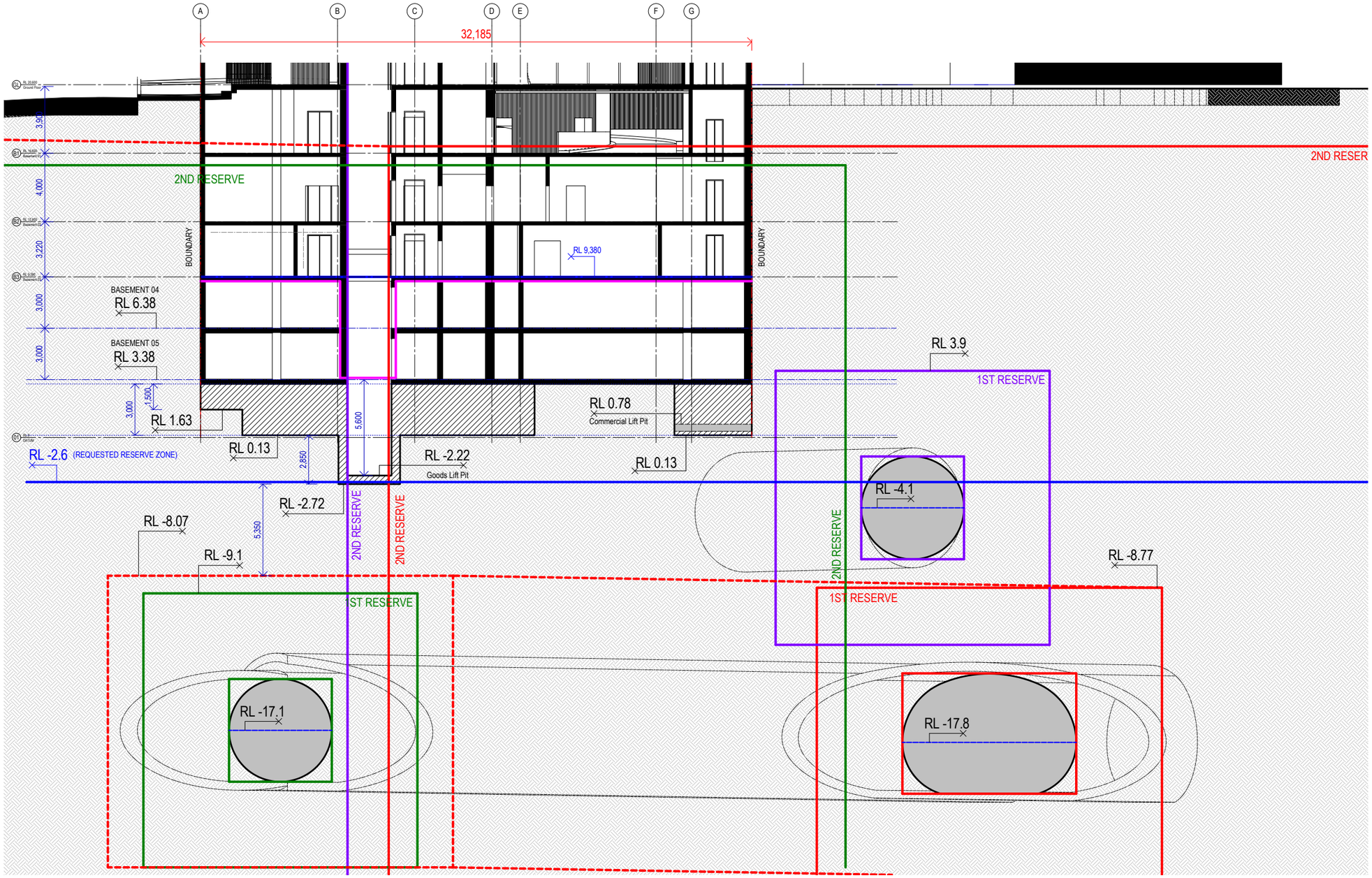
Long Section - Proposed

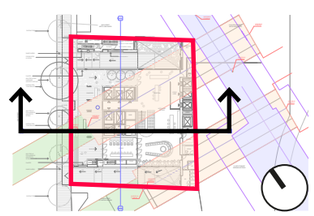
Outline of current levels

RI 9.38 Approved Early Works DA

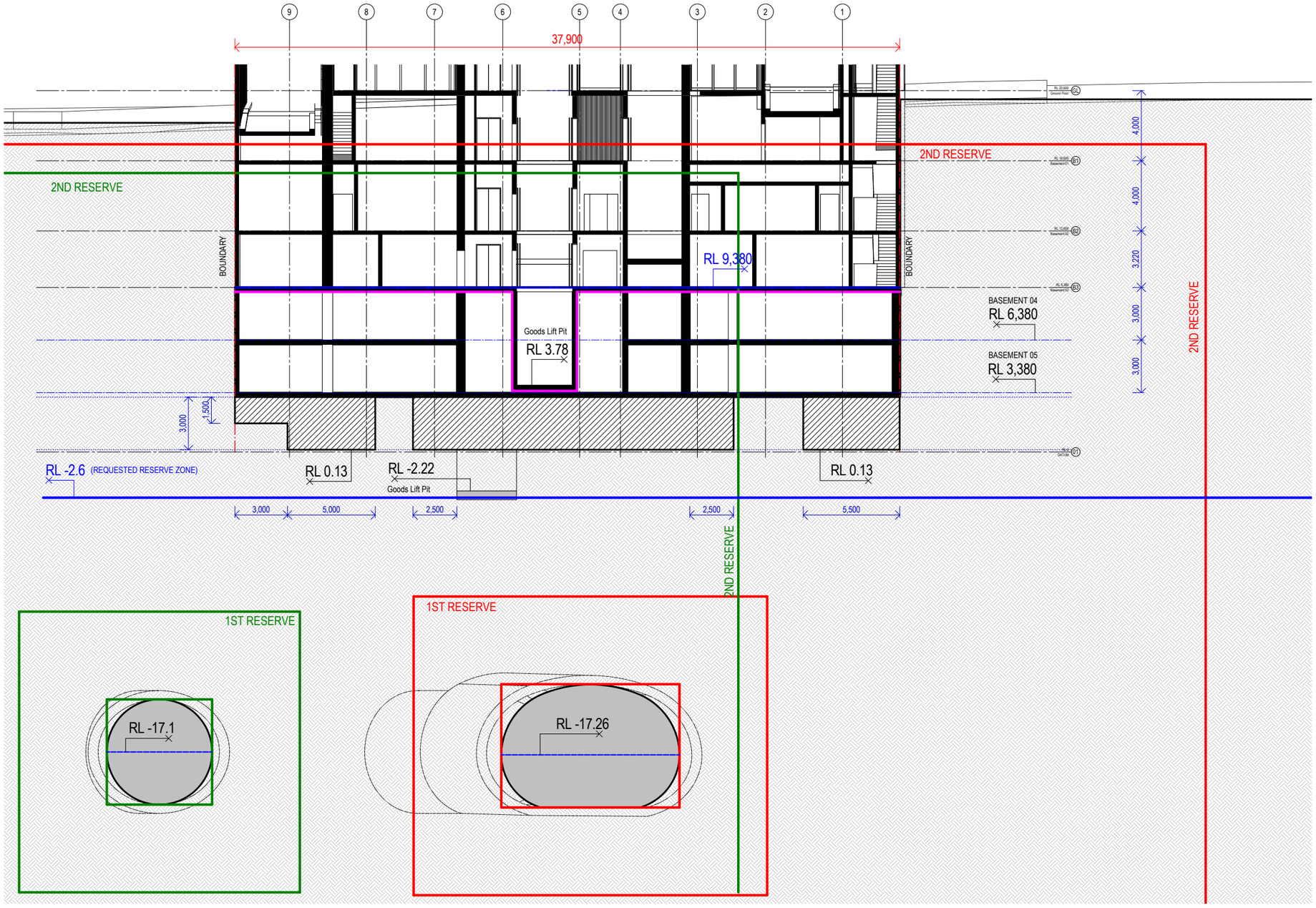


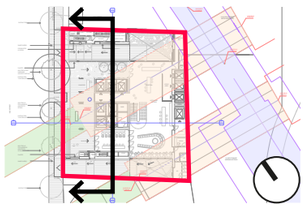
Cross Section - West / East [Proposed]



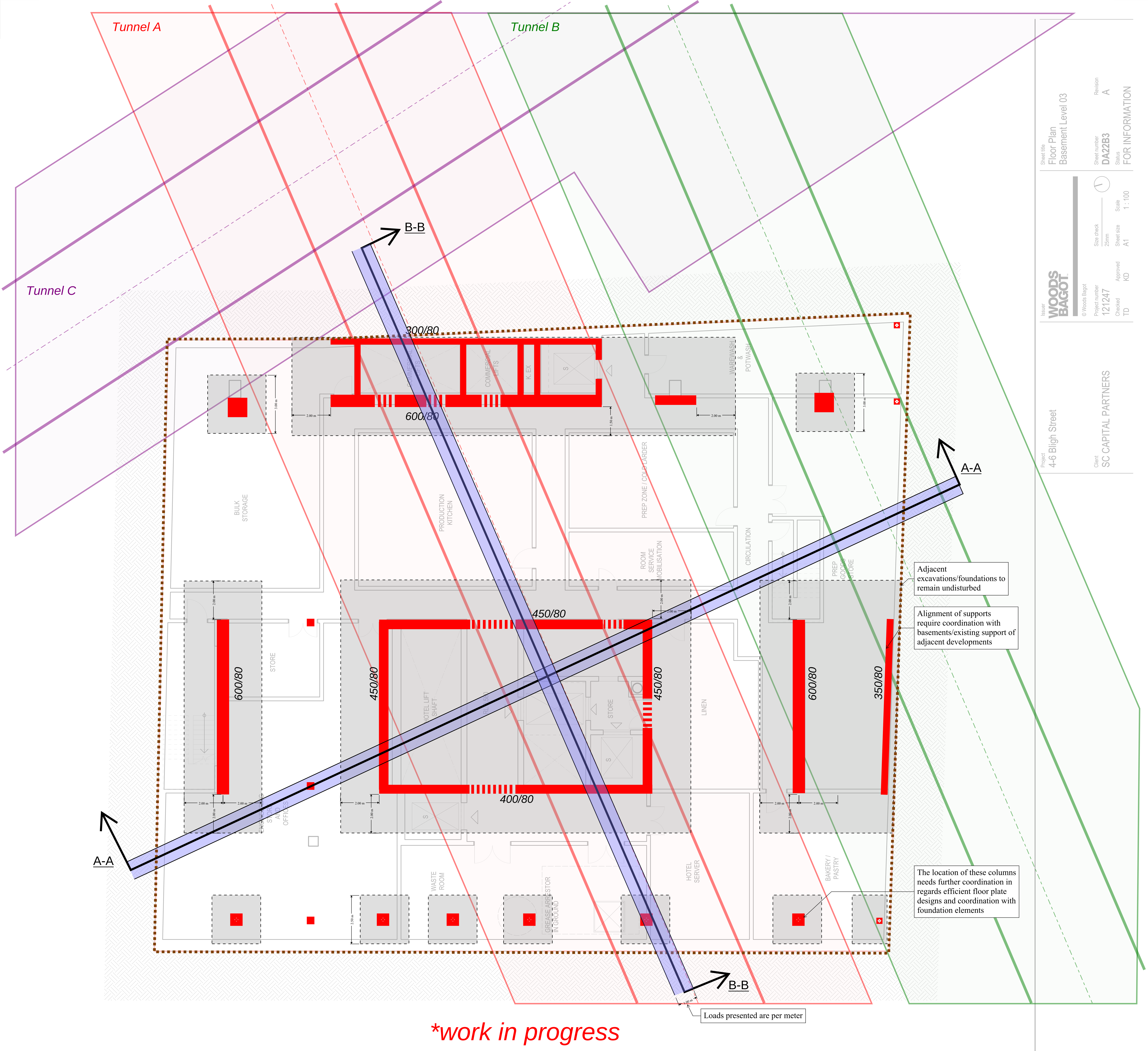


Long Section - North / South [Proposed]





APPENDIX C: FOUNDATION SKETCHES (LEVEL B5) BY MM



Tunnel A
Tunnel B
Tunnel C
B-B
A-A
300/80
600/80
450/80
400/80
600/80
450/80
450/80
600/80
350/80
BULK STORAGE
PRODUCTION KITCHEN
COMMERCIAL LIFTS
COMMERCIAL LIFTS
K. EX
WAREWASH & POTWASH
PREP ZONE / COLD LARDER
ROOM SERVICE MOBILISATION
CIRCULATION
PREP GOODS STORE
STORE
HOTEL LIFT SHAFT
STORE
LINEN
WASTE ROOM
GREASE ARRESTOR IN GROUND
HOTEL SERVER
BAKERY / PASTRY
2.00 m
3.00 m
1.50 m
2.50 m
1.00 m
Adjacent excavations/foundations to remain undisturbed
Alignment of supports require coordination with basements/existing support of adjacent developments
The location of these columns needs further coordination in regards efficient floor plate designs and coordination with foundation elements
Loads presented are per meter
Sheet title
Floor Plan
Basement Level 03
Sheet number
DA22B3
Revision
A
Status
FOR INFORMATION
WOODS BAGOT
© Woods Bagot
Size check
25mm
Scale
1 : 100
Sheet size
A1
Project number
121247
Checked
TD
Approved
KD
Project
4-6 Bligh Street
Client
SC CAPITAL PARTNERS

*work in progress

NOTES:

1) Shallow foundation solution shown is a work in progress based on a snapshot in time at the SSDA stage. Future coordination and completion of detailed design may call for adjustments to the designs.

2) The foundations presented in these sketches are based on tower stress distribution only and have not been assessed in terms of geotechnical aspects (ie different settlements etc)

3) Primary foundation elements are shown in this sketch - secondary elements for support of smaller loads requires further work and coordination with the remainder of the floorplates - but should not have an appreciable impact on the tunnel stresses.

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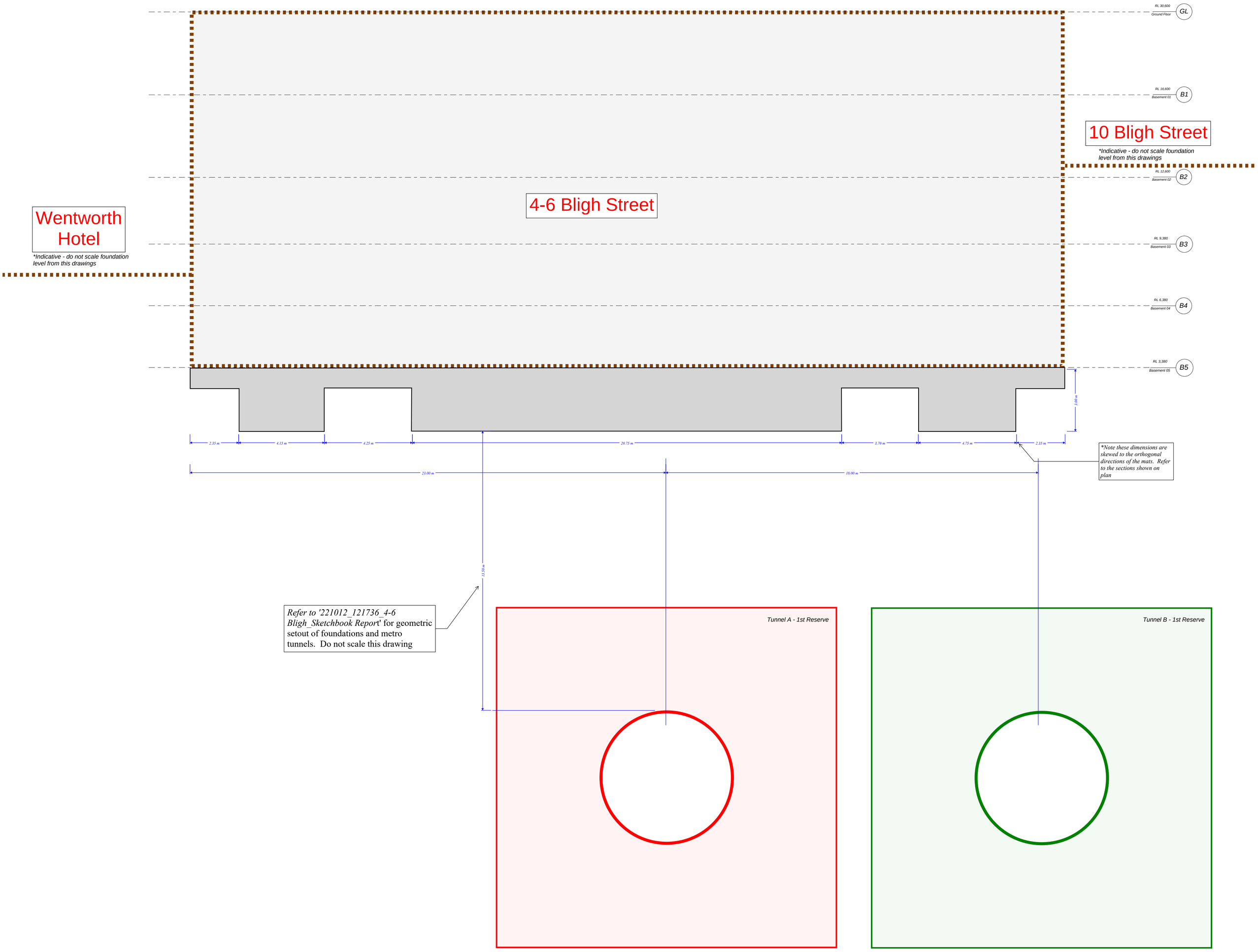
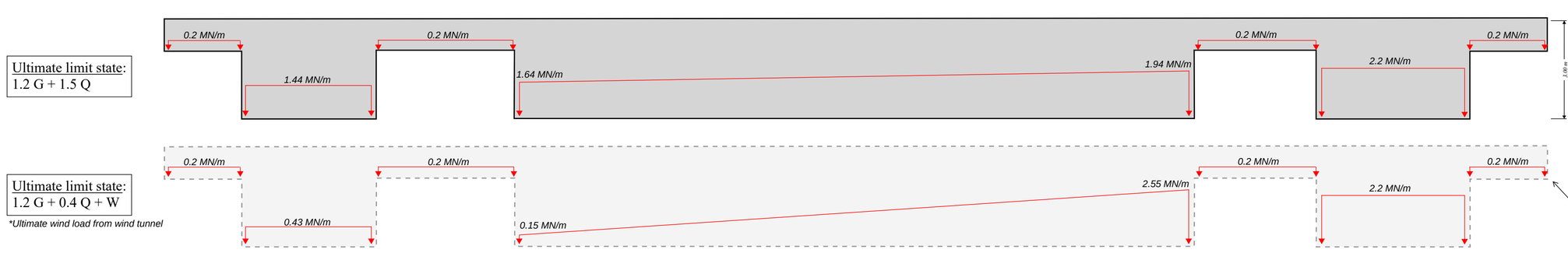
4-6 BLIGH STREET	409096
LEVEL B5 - FOUNDATIONS	J.O. / J.O. / G.D.
	17/10/2022
MMD-SK-005	B



Section A-A

Ultimate Load Conditions



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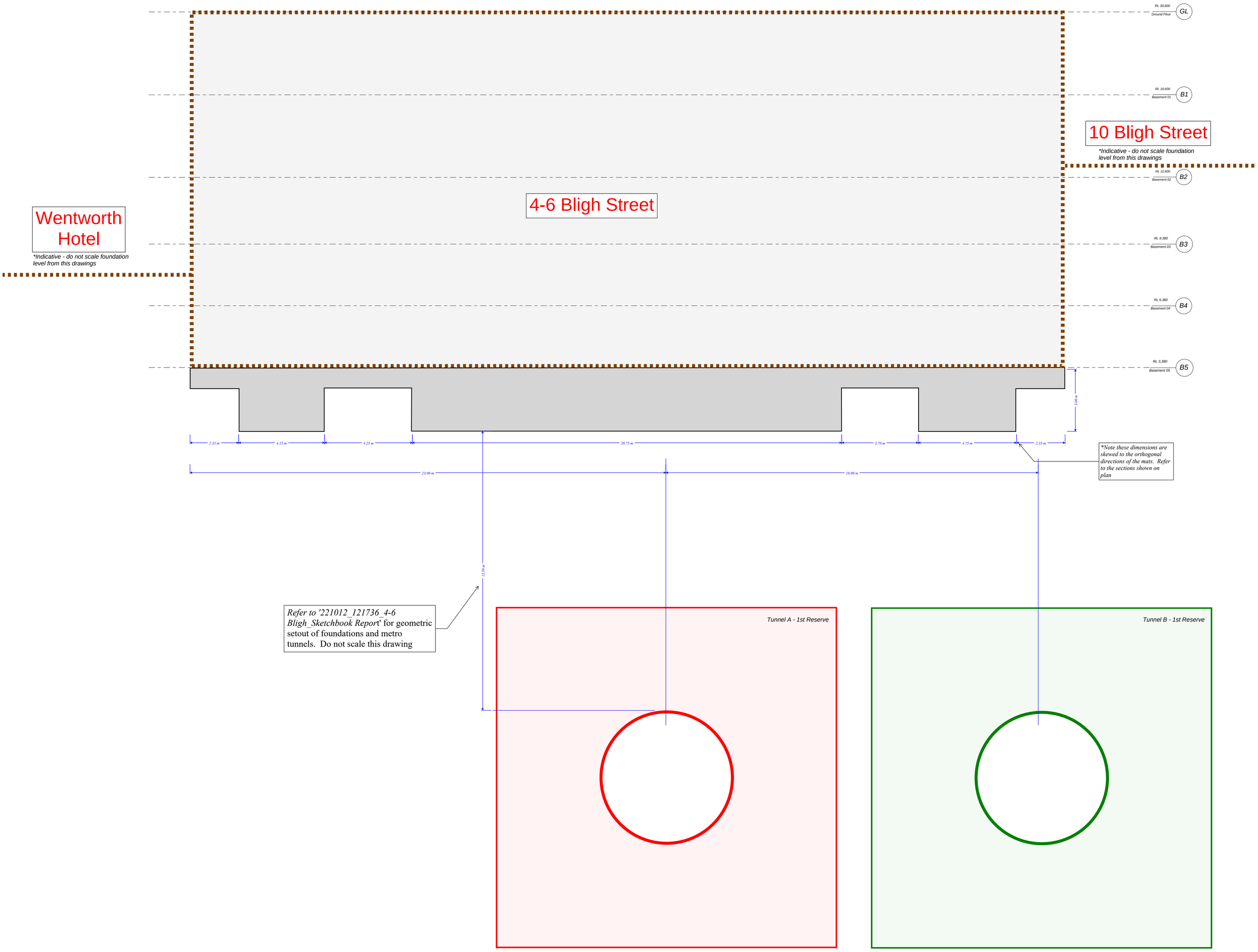
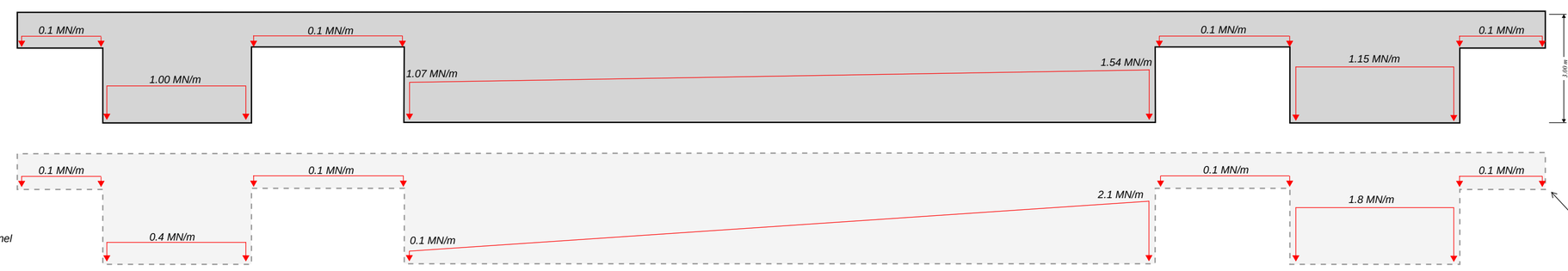
4-6 BLIGH STREET		409096
TUNNEL SECTION 1 - ULTIMATE	Dr J.O. / C J.O. / G.D.	
	D 17/10/2022	
MMD-SK-006		B



Section A-A

Service Load Conditions

Service limit state:
1.0 G + 0.4 Q



Service limit state:
1.0 G + 0.4 Q + W

*Service wind load from wind tunnel

NOTES:

1) Shallow foundation solution shown is a work in progress based on a snapshot in time at the SSDA stage. Future coordination and completion of detailed design may call for adjustments to the designs.

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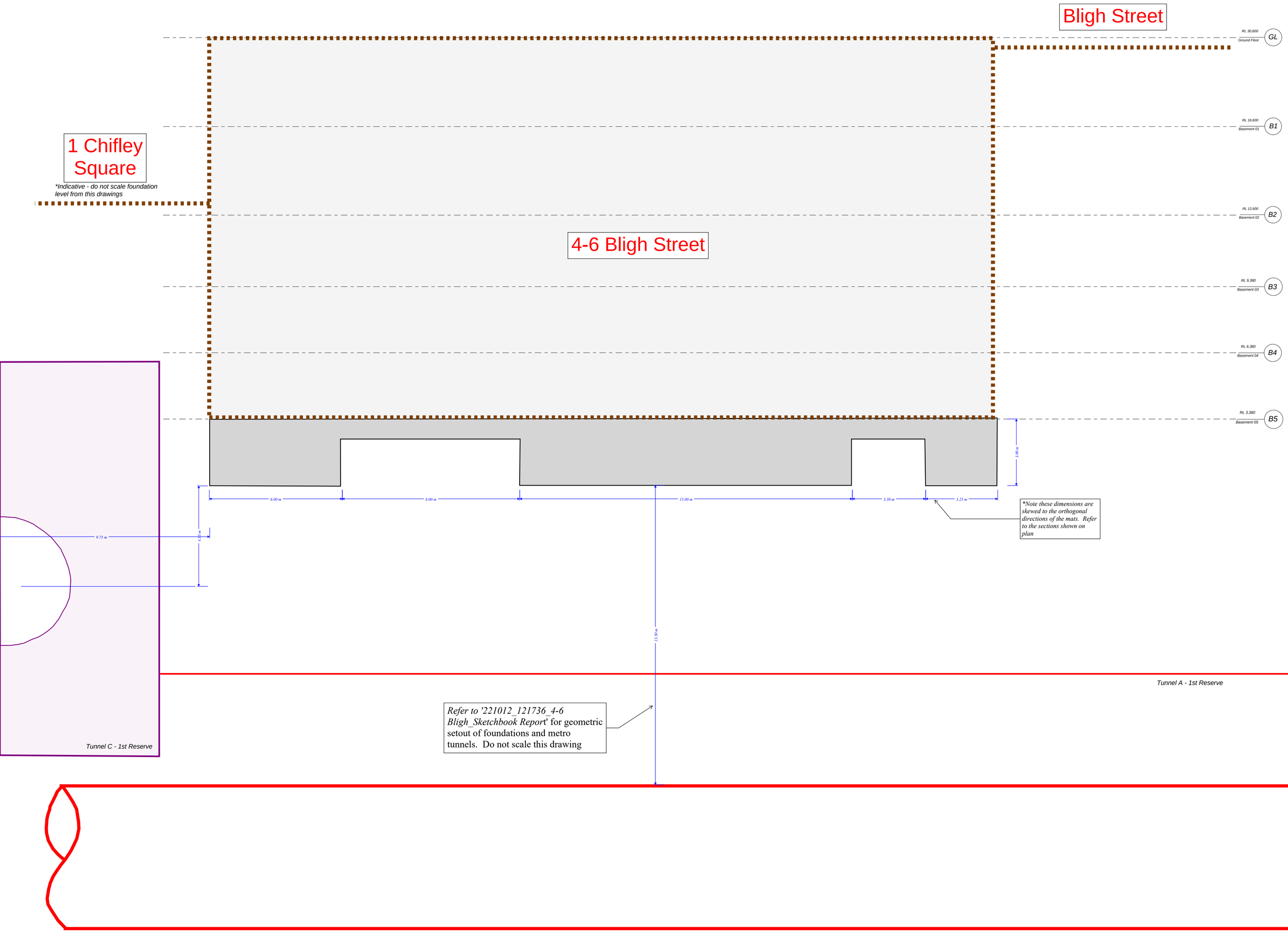
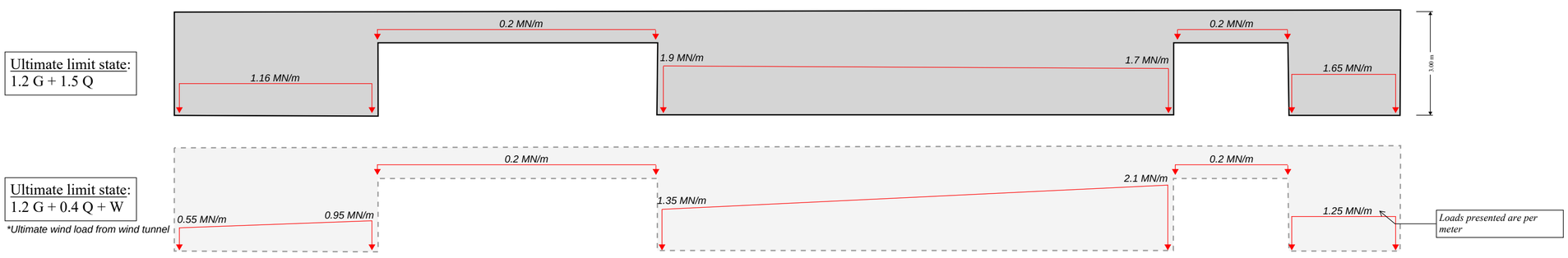
□r□□□□□	□r□□□□□N□	409096
4-6 BLIGH STREET	S□□□□	
S□□□□□ T□□□	Dr□□ □ C□□□□□d □□□r□□□d	
TUNNEL SECTION 1 - SERVICE	J.O. J.O. G.D.	
	D□□□	17/10/2022
S□□□□□ N□□ □□r	S□□□□□	R□□
MMD-SK-007		B



Section B-B

Ultimate Load Conditions



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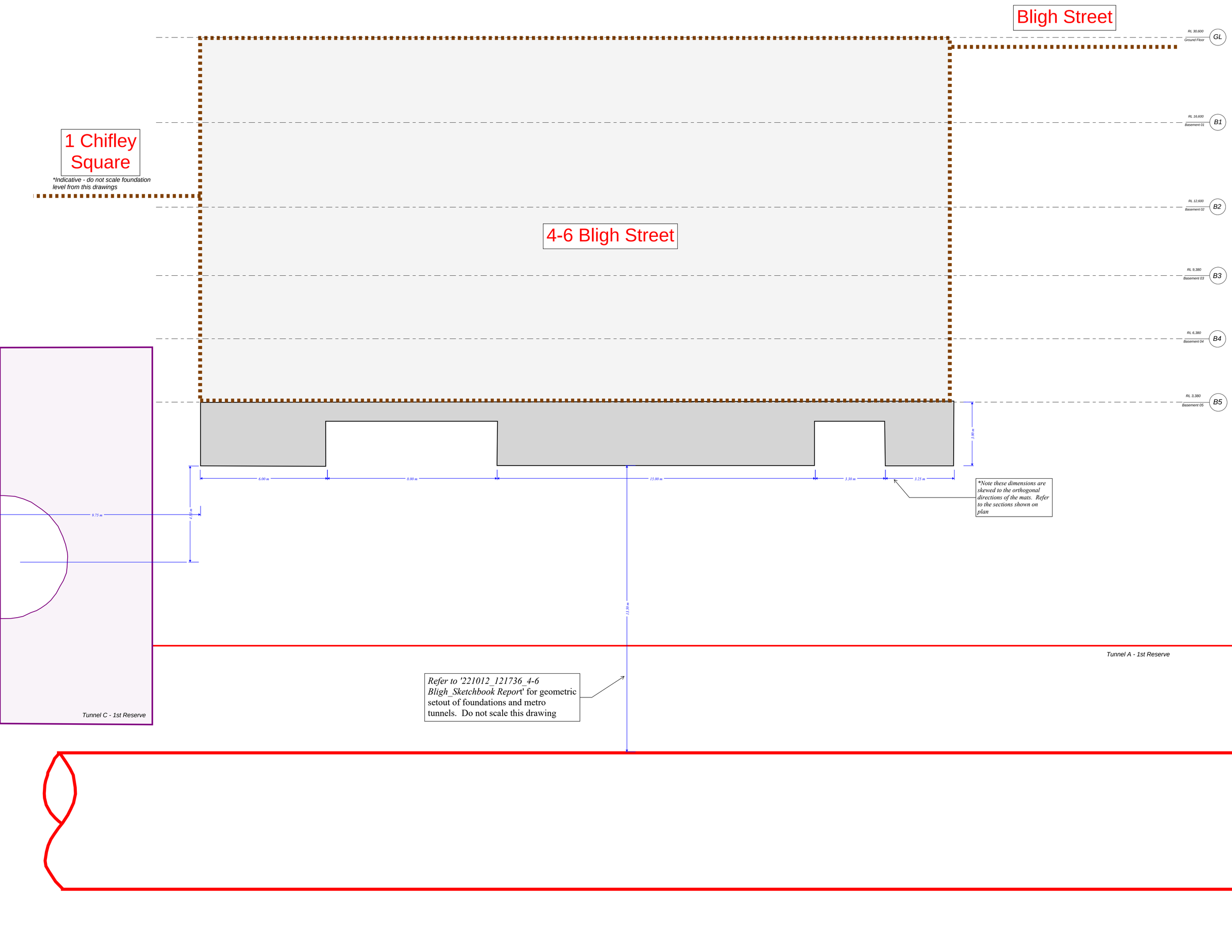
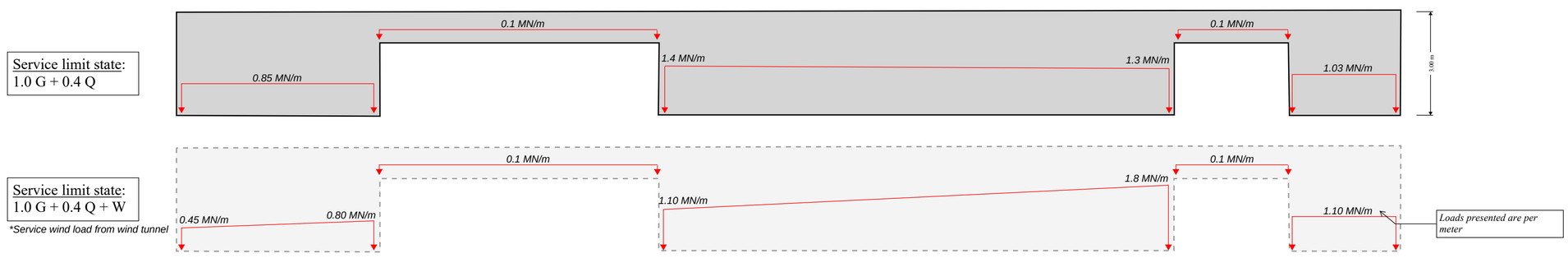
□r□□□□ 4-6 BLIGH STREET	□r□□□□N□	409096
	S□□□□	
S□□□□□ T□□□ TUNNEL SECTION 2 - ULTIMATE	Dr□□ □ J.O. / C□□□□□d J.O. / □□□r□□□d G.D.	
	D□□□	17/10/2022
S□□□□□ N□□ □□r MMD-SK-008	S□□□□□	R□□ B



Section B-B

Service Load Conditions



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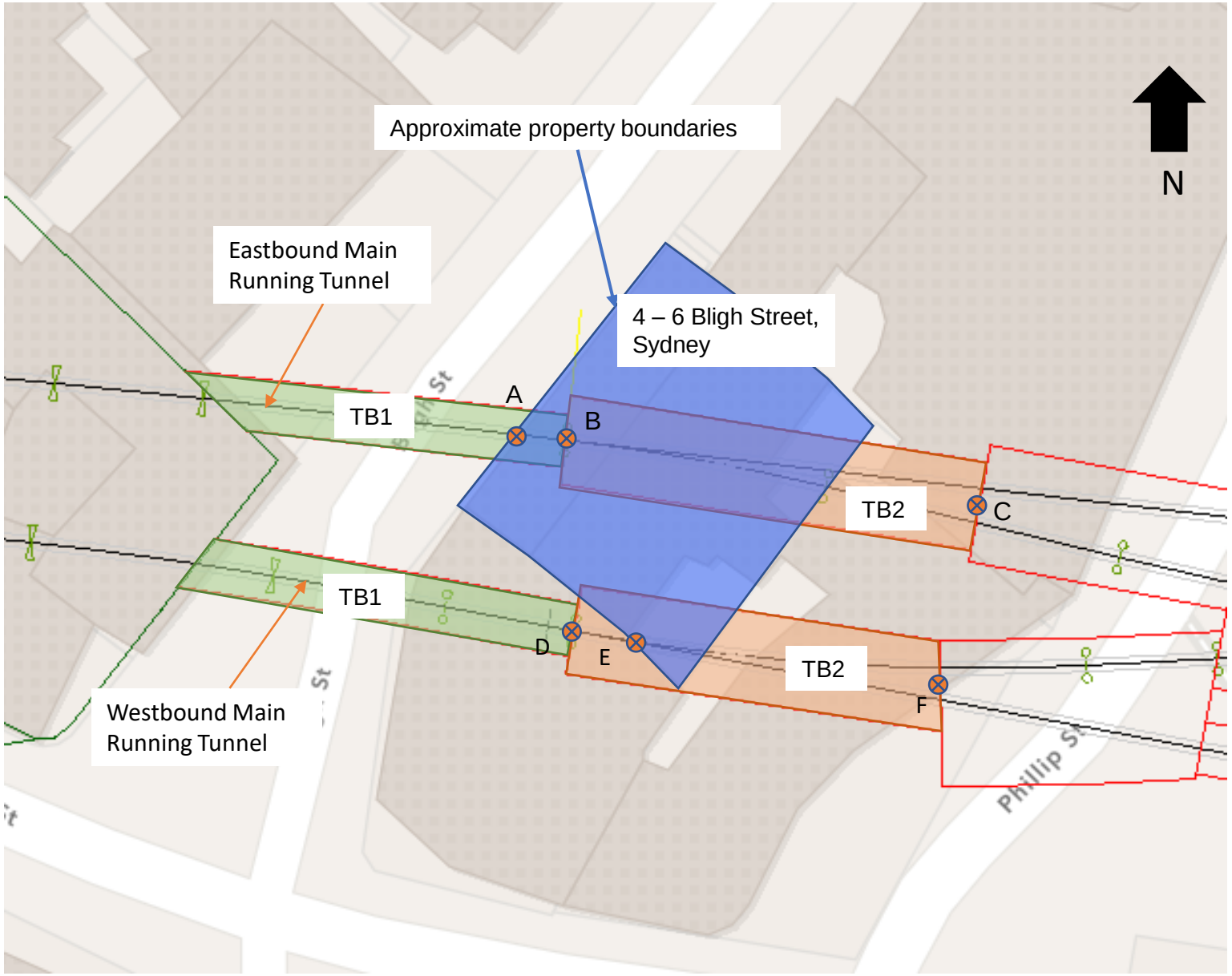
□r□□□□ 4-6 BLIGH STREET	□r□□□□N□	409096
	S□□□□	
S□□□□□ T□□□ TUNNEL SECTION 2 - SERVICE	Dr□□ □ J.O. / C□□□□□d J.O. / □□□r□□□d G.D.	
	D□□□	17/10/2022
S□□□□□ N□□ □□r MMD-SK-009	S□□□□□	R□□ B

APPENDIX D: SYDNEY METRO WEST AND CBD RAIL LINK ALIGNMENT

4 – 6 Bligh Street, Sydney
Overlay of SMW Alignment rev5.7

POINT	EASTING (MGA 56 2020)	NORTHING (MGA 56 2020)	RL (mAHD)
A	334461.4	6251293.1	-17.1
B	334464.3	6251292.9	-17.1
C	334511.8	6251286.5	-17.8
D	334465.6	6251271.3	-17.1
E	334466.6	6251271.1	-17.2
F	334507.7	6251265.6	-17.8

Note:
RLs are taken at tunnel centreline
Points A, B and C are on Eastbound Alignment (UP)
Points D, E and F are on Westbound Alignment (DOWN)



NSW GOVERNMENT
Department of Planning

State Environmental Planning Policy (Infrastructure) 2007

Interim Rail Corridor
CBD Rail Link & CBD Metro
Map 6 of 9

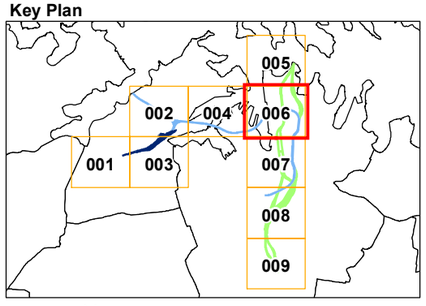
- CBD Rail Link (Zone B - Tunnel)
- CBD Metro (Zone A - Above Ground Including Cut & Cover Tunnel)
- CBD Metro (Zone B - Tunnel)
- CBD Station Extent
- LGA Boundary
- Land Title Boundary 20/07/08 © Dept of Lands

The CBD Metro is stage 1 of the Sydney Metro Network

Minister for Planning

Date: ----------

Key Plan



N

0 50 100 Metres

Scale: 1:5,000 @ A3

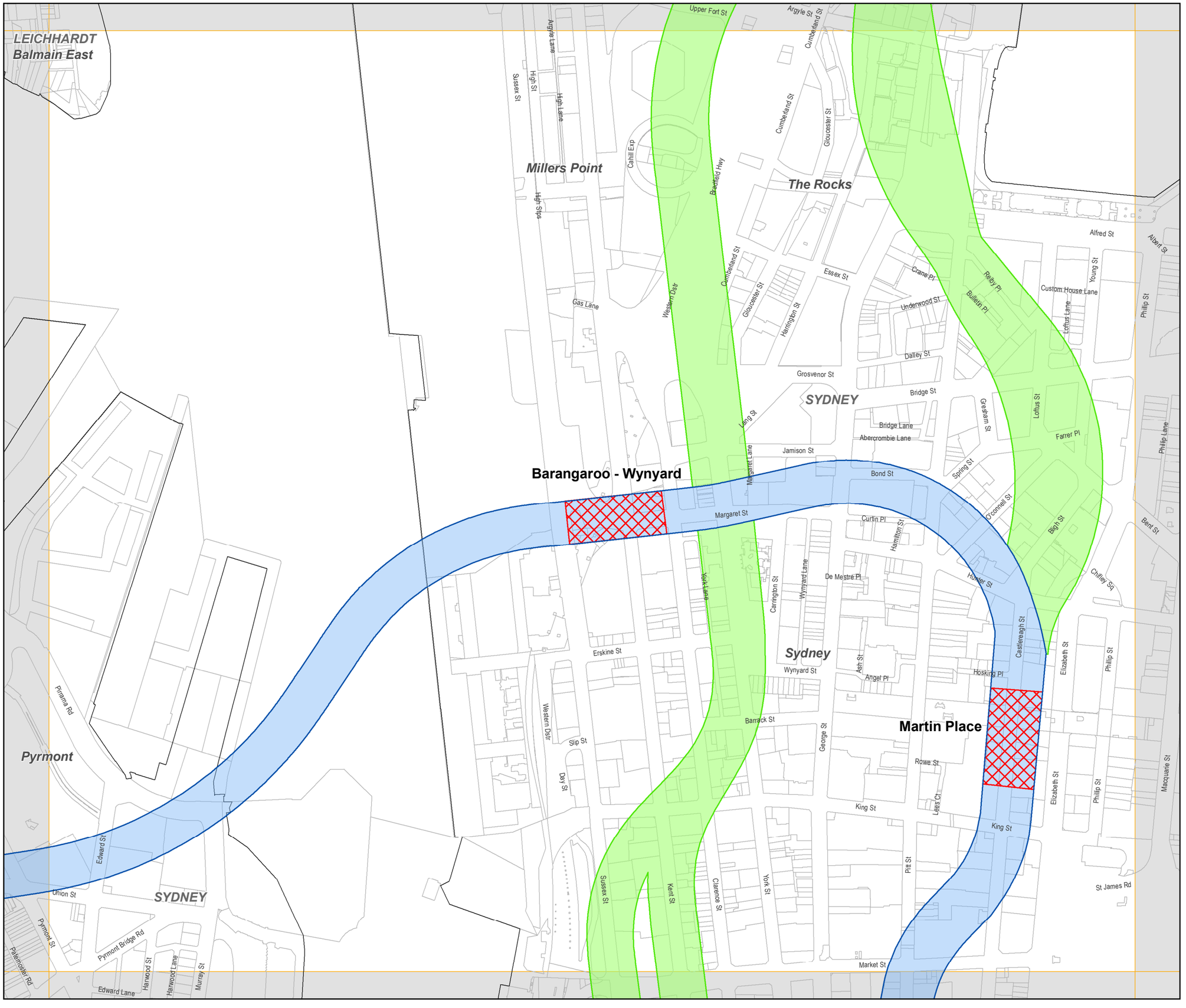
Projection: GDA 1994
MGA Zone 56

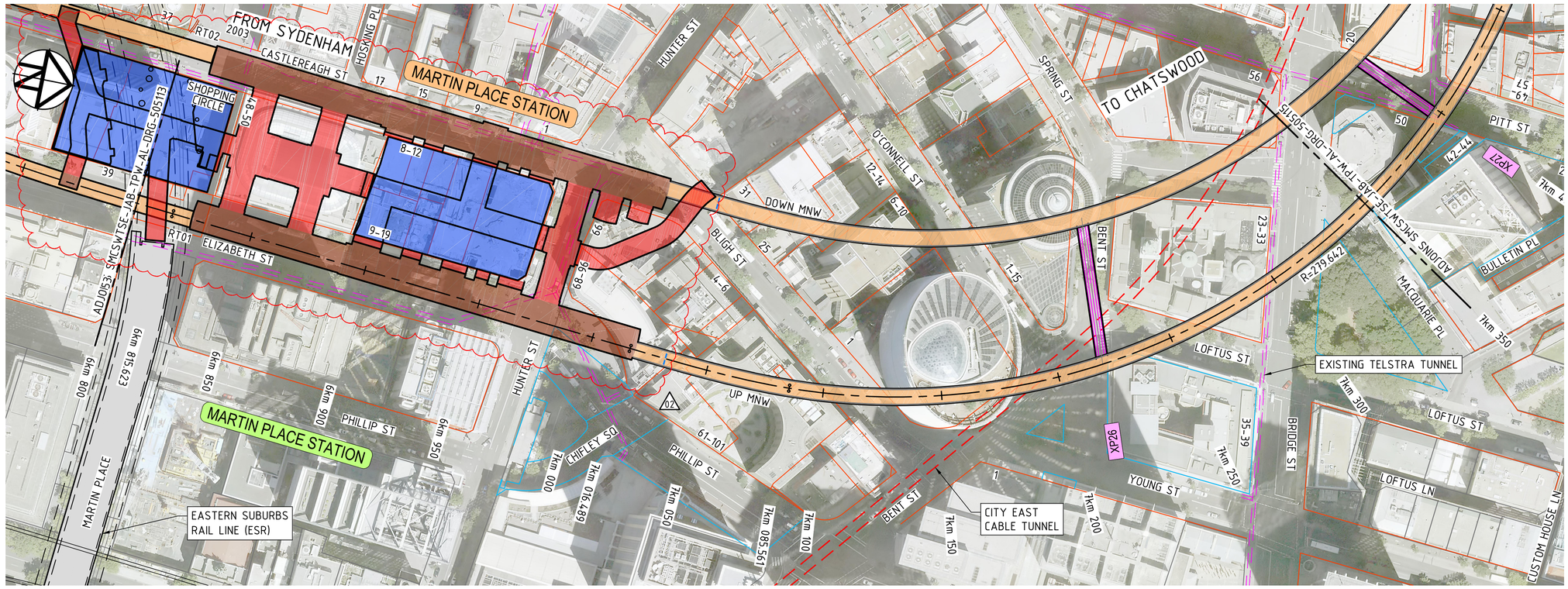
CERTIFIED BY:

SydneyMetro

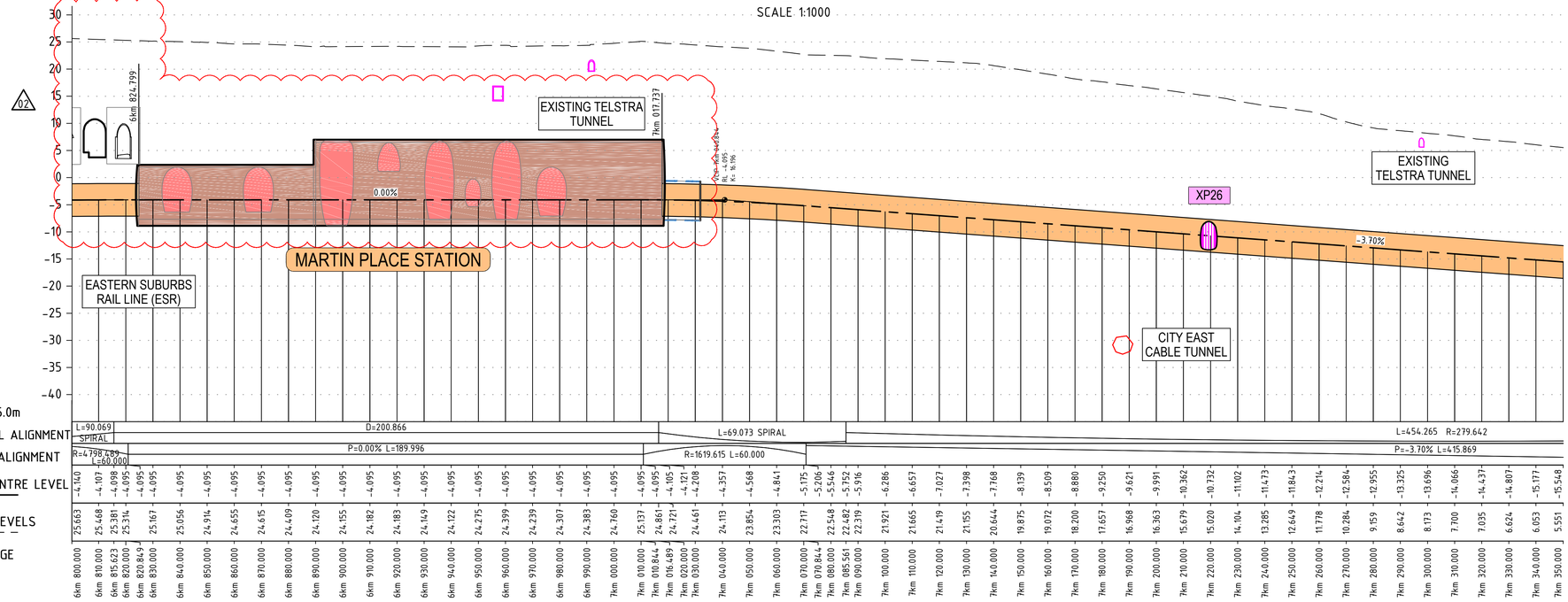
Date: ----------

Map identification number:
CBDMetroSMA_006_005_20090627.mxd





PLAN
SCALE 1:1000

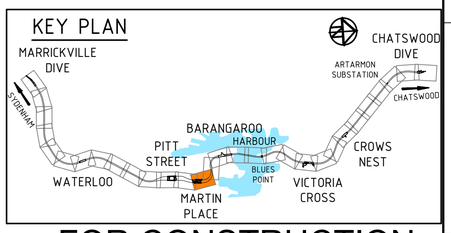


DESIGN CONTROL RT01 - UP MNW
SCALE - HORIZ. 1:1000, VERT. 1:500

NOTE

1. FOR ALL ALIGNMENT NOTES REFER DRAWING NO. SMCSWTSE-JAB-TPW-AL-DRG-505005.

KEY PLAN



LEGEND

- TUNNEL ALIGNMENT CONTROL LINE
- RUNNING TUNNELS
- CROSS PASSAGES AND CROSS PASSAGES WITH SUMP
- STUB TUNNEL
- DIVE STRUCTURES
- STATION EXCAVATIONS
- NOZZLE ENLARGEMENTS
- CROSSOVER CAVERN
- STATION SHAFTS
- STATION CAVERNS
- STATION ADITS
- SHAFT
- LIFT SHAFTS

CADASTRAL MODEL (BASED ON PR124656-SACM-001-E)

- SURVEY ACCURATE CADASTRAL MODEL
- NEAR SURVEY ACCURATE CADASTRE
- DIGITAL CADASTRAL DATABASE

DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

FOR CONSTRUCTION

AMD	DESCRIPTION	DESIGNER SIGN./DATE	VERIFIED SIGN./DATE	APPROVED SIGN./DATE
02	MARTIN PLACE STATION PLAN AND SECTION UPDATED	04.02.19	04.02.19	04.02.19
01	ASSURED FOR CONSTRUCTION	21.01.19	21.01.19	21.01.19
00	ASSURED FOR CONSTRUCTION	09.01.18	09.01.18	09.01.18

CO-ORDINATE SYSTEM: MGA | HEIGHT DATUM: AHD | SCALE: AS SHOWN

SCALES
0 10 20 30 40 50 60m
SCALE 1:1000 AT A1 SIZE
0 5 10 15 20 25 30m
SCALE 1:500 AT A1 SIZE

IC CERTIFIED - IC CERTIFICATE SMCSWTSE-IC-CER-B2-008

CLIENT
NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS: Metro | city & southwest; John Holland; CPB; Ghella; ARCADIS; BG&E; NOMA CONSULTING; HOCHTIEF; PSM; McMillen Jacobs Associates

DRAWN	E. ESTORES JR.	04.02.19
DESIGNED	TINSW	-
DRG CHECK	F. BATHAN	04.02.19
DESIGN CHECK	N/A	-
APPROVED	D.ROBERTSON	04.02.19

SYDNEY METRO CITY & SOUTHWEST

TSE PROJECT WIDE
ALIGNMENT
GA PLAN AND LONGITUDINAL SECTION
TUNNEL ALIGNMENT CONTROL LINE RT01 - SHEET 14

FILE No.	SHEET: 30 OF 76	A1
STATUS: FOR CONSTRUCTION		©
DRG No. SMCSWTSE-JAB-TPW-AL-DRG-505114	02	EDMS No.

DF 801*554

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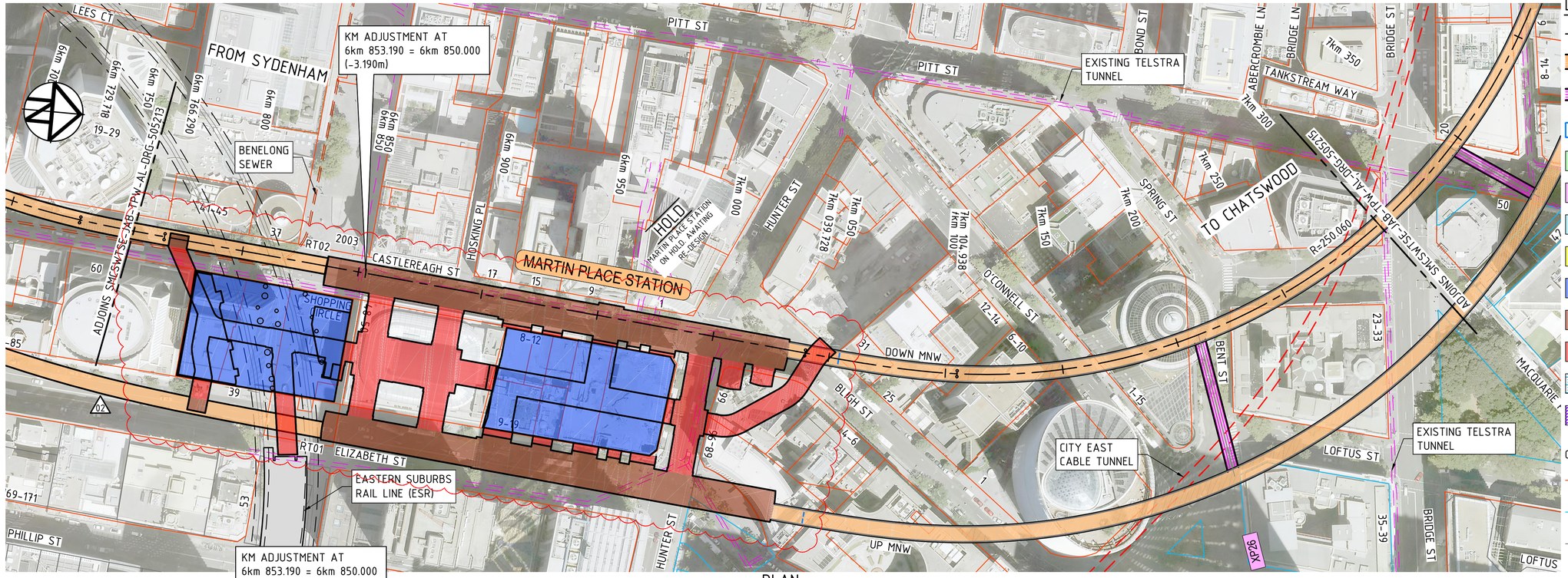
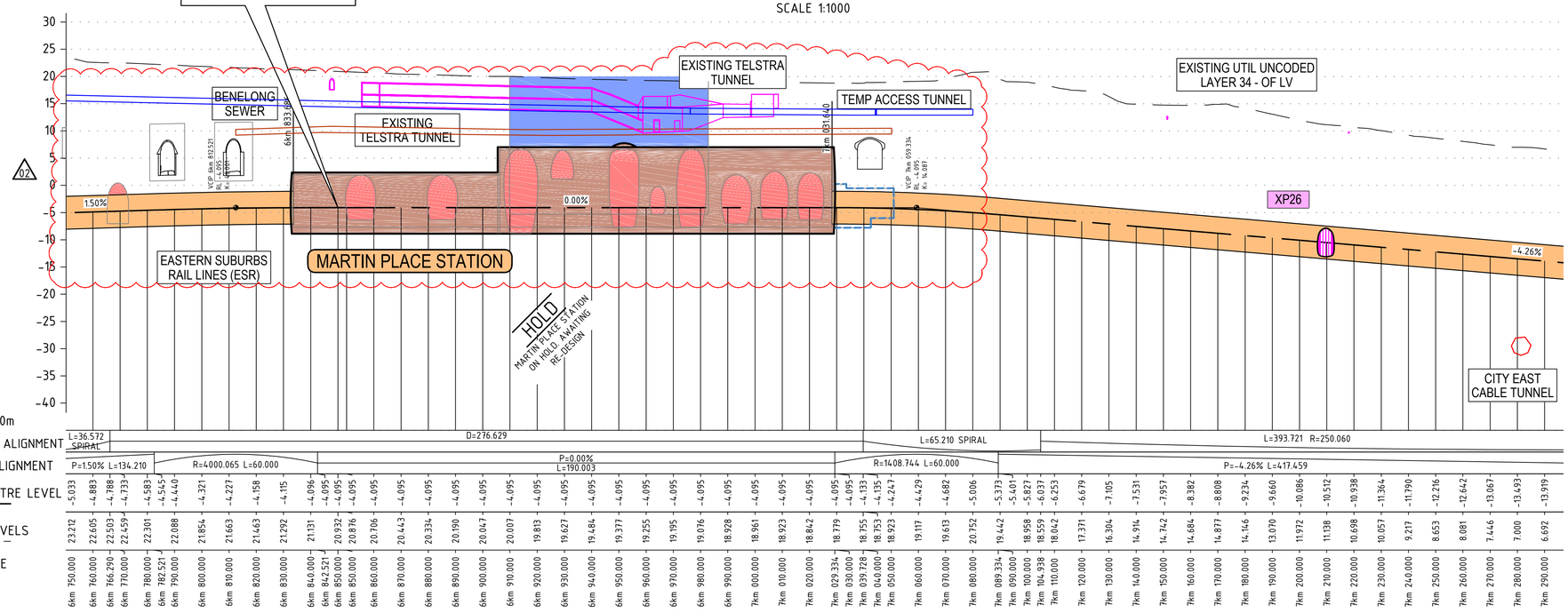
Plotted by EEAZ4049



PLAN
SCALE 1:1000



DESIGN CONTROL RT02 - DOWN MNW
SCALE - HORIZ. 1:1000, VERT. 1:500

LEGEND

- TUNNEL ALIGNMENT CONTROL LINE
- RUNNING TUNNELS
- CROSS PASSAGES AND CROSS PASSAGES WITH SUMP
- STUB TUNNEL
- DIVE STRUCTURES
- STATION EXCAVATIONS
- NOZZLE ENLARGEMENTS
- CROSSOVER CAVERN
- STATION SHAFTS
- STATION CAVERNS
- STATION ADITS
- SHAFT
- LIFT SHAFTS

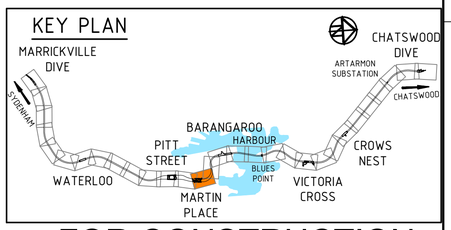
CADASTRAL MODEL (BASED ON PR124656-SACM-001-E)

- SURVEY ACCURATE CADASTRAL MODEL
- NEAR SURVEY ACCURATE CADASTRE
- DIGITAL CADASTRAL DATABASE

NOTE

1. FOR ALL ALIGNMENT NOTES REFER DRAWING NO. SMCSWTSE-JAB-TPW-AL-DRG-505005.

KEY PLAN



DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

FOR CONSTRUCTION

AMD	DESCRIPTION	DESIGNER SIGN./DATE	VERIFIED SIGN./DATE	APPROVED SIGN./DATE
02	MARTIN PLACE STATION PLAN AND SECTION UPDATED	04.02.19	04.02.19	04.02.19
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00	ASSURED FOR CONSTRUCTION	09.01.18	09.01.18	09.01.18

CO-ORDINATE SYSTEM: MGA | HEIGHT DATUM: AHD | SCALE: AS SHOWN

SCALES
SCALE 1:1000 AT A1 SIZE
SCALE 1:500 AT A1 SIZE

IC CERTIFIED - IC CERTIFICATE SMCSWTSE-IC-CER-B2-008

CLIENT
NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS: Metro city & southwest; John Holland; CPB; Ghella; ARCADIS; BG&E; NOMA CONSULTING; HOCHTIEF; PSM; McMillen Jacobs Associates

DRAWN	E. ESTORES JR.	04.02.19
DESIGNED	TINSW	-
DRG CHECK	F. BATHAN	04.02.19
DESIGN CHECK	N/A	-
APPROVED	D.ROBERTSON	04.02.19

SYDNEY METRO CITY & SOUTHWEST
TSE PROJECT WIDE
ALIGNMENT
GA PLAN AND LONGITUDINAL SECTION
TUNNEL ALIGNMENT CONTROL LINE RT02 - SHEET 14

FILE No. | SHEET: 60 OF 76 | A1
STATUS: FOR CONSTRUCTION ©
DRG No. SMCSWTSE-JAB-TPW-AL-DRG-505214 | 02 | EDMS No.

DF 801*554

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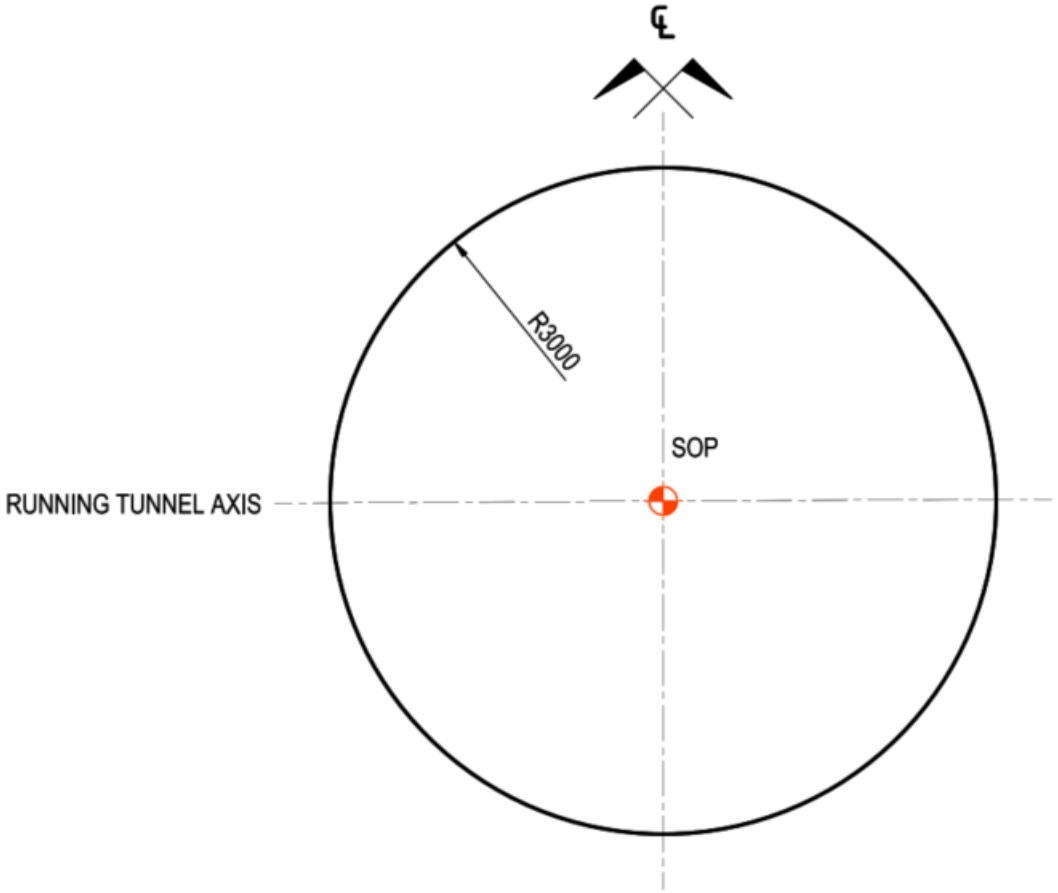
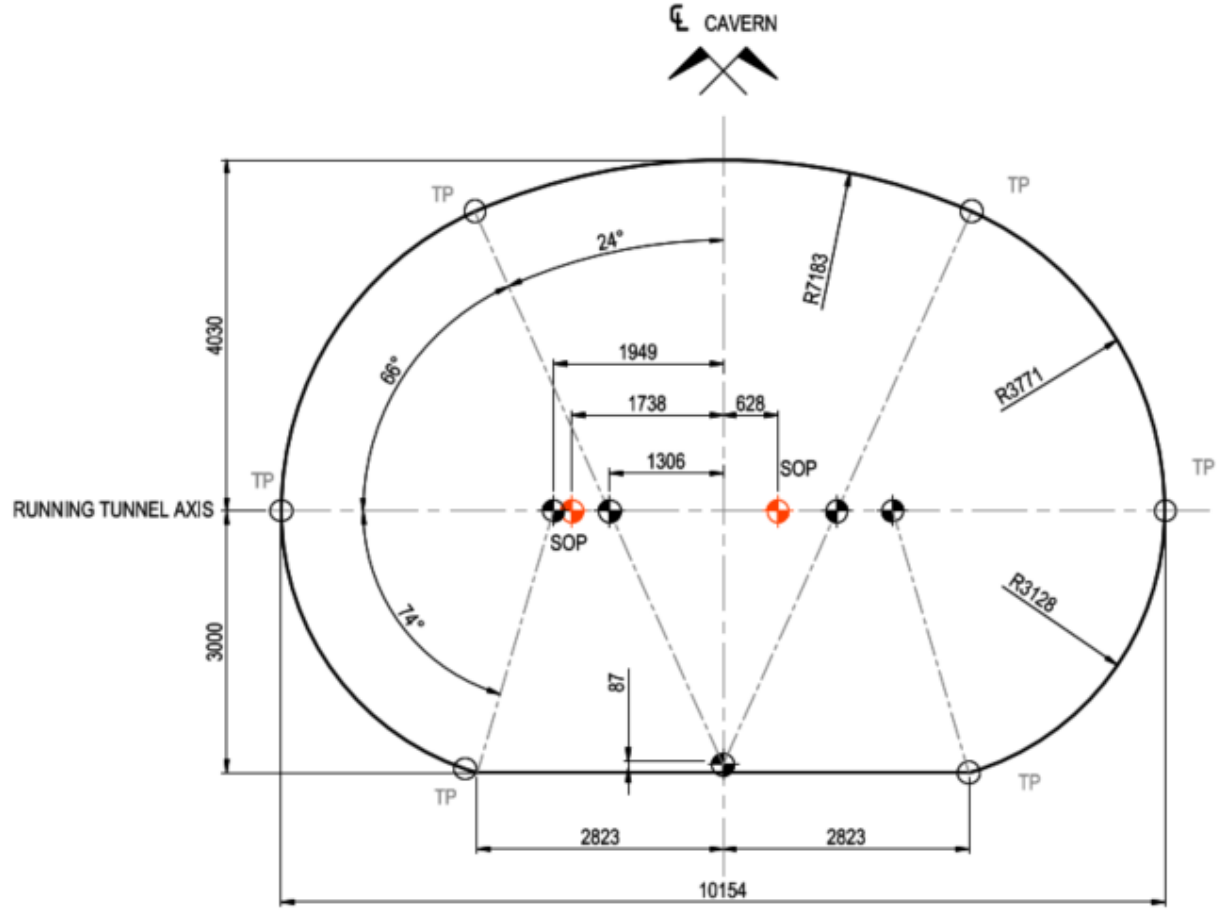
Plotted by EEAZ4049

Indicative Cross Section for TB1 and TB2





Section for TB1

Section for TB2

Note:

SOP: Set Out Point at running tunnels axis

The dimensions are to the internal face of the tunnels.
The tunnel lining with a thickness of approximately 500 mm should be allowed.
The design is subject to revision at detail design stage.