
Appendix U

Geotechnical report

Sydney Metro West

Parramatta Over and Adjacent Station Development Geotechnical Report

Appendix U

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Glossary

Term	Definition
AHD	Australian height datum
ASD	Adjacent Station Development
ASS	Acid sulphate soil
CBD	Central business district
CEMP	Construction environmental management plan
Concept and Stage 1 CSSI Application	Application SSI-10038, including all major civil construction works between Westmead and The Bays, including station excavation and tunnelling, associated with the Sydney Metro West line
Concept SSDA	A concept development application as defined in section 4.22 of the EP&A Act. It is a development application that sets out the concept for the development of a site, and for which detailed proposals for the site or for separate parts of the site are to be the subject of a subsequent development application or applications
CSSI	Critical state significant infrastructure
DPE	Department of Planning and Environment
EIS	Environmental impact statement
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
GFA	Gross floor area
LGA	Local government area
NSW	New South Wales
OSD	Over station development
RL	Relative level
SEARs	Secretary's Environmental Assessment Requirements
SSD	State significant development
Stage 2 CSSI Application	Application SSI-19238057, including major civil construction works between The Bays and Hunter Street Station
Stage 3 CSSI Application	Application SSI-22765520, including rail infrastructure, stations, precincts and operation of the Sydney Metro West line
Sydney Metro West	Construction and operation of a metro rail line and associated stations between Westmead and the Sydney CBD as described in section 1.1
The site	The site which is the subject of the Concept SSDA

Executive summary

This Geotechnical Report supports a Concept State Significant Development Application (Concept SSDA) submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Concept SSDA is made under section 4.22 of the EP&A Act.

Sydney Metro is seeking to secure concept approval for an over station development (OSD) and adjacent station development (ASD) on the Parramatta metro station site (referred to as the 'proposed development'). The proposed development will comprise three new commercial office buildings (Buildings A, C, D), and one new residential building (Building B).

The Concept SSDA seeks consent for a building envelope and mixed-use purposes, maximum building height, a maximum gross floor area (GFA), pedestrian and vehicular access, circulation arrangements and associated car parking, and the strategies and design parameters for the future detailed design of the proposed development.

This report presents a geotechnical assessment including anticipated subsurface ground condition and geotechnical risk and specifically respond to SEARs issued for the Concept SSDA. Key geotechnical findings of this report include:

- the area underlain by medium dense alluvial sands (clayey sands and sandy clay) and firm to very stiff alluvial clay
- the underlying bedrock is Ashfield shale underlain by Mittagong formation over Hawksbury sandstone
- the top of bedrock within the study area ranges from -1.5 metres AHD to -4.2 metres AHD.

Based on the findings of this geotechnical assessment, the following recommendations are made:

- The geotechnical assessment is based on limited data. However, the proposed development scheme in the context of the existing geotechnical conditions on the site is considered to be suitable for its intended use.
- While the site contains a number of geotechnical challenges including the presence of Parramatta Dyke, high groundwater table, ASS and rock at depth, it is considered that these challenges can be adequately addresses through the utilisation of industry standard design and construction techniques and practices.
- The ground conditions assumed in design can vary from actual site conditions that may be encountered during construction. To reduce the potential for this variation, further geotechnical investigation will need to be carried out prior to detailed design and subsequent construction phase.
- The proposed development design should consider the existing foundation support system of the works carried out under the CSSI approval, so as to minimise further ground movement or impact on adjacent structures during construction and operation of the proposed development.

1 Introduction

1.1 Sydney Metro West

Sydney Metro West will double rail capacity between Greater Parramatta and the Sydney Central Business District (CBD), transforming Sydney for generations to come. The once in a century infrastructure investment will have a target travel time of about 20 minutes between Parramatta and the Sydney CBD, link new communities to rail services and support employment growth and housing supply.

Stations have been confirmed at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays, Pyrmont and Hunter Street (Sydney CBD).

Sydney Metro West station locations are shown in Figure 1-1.

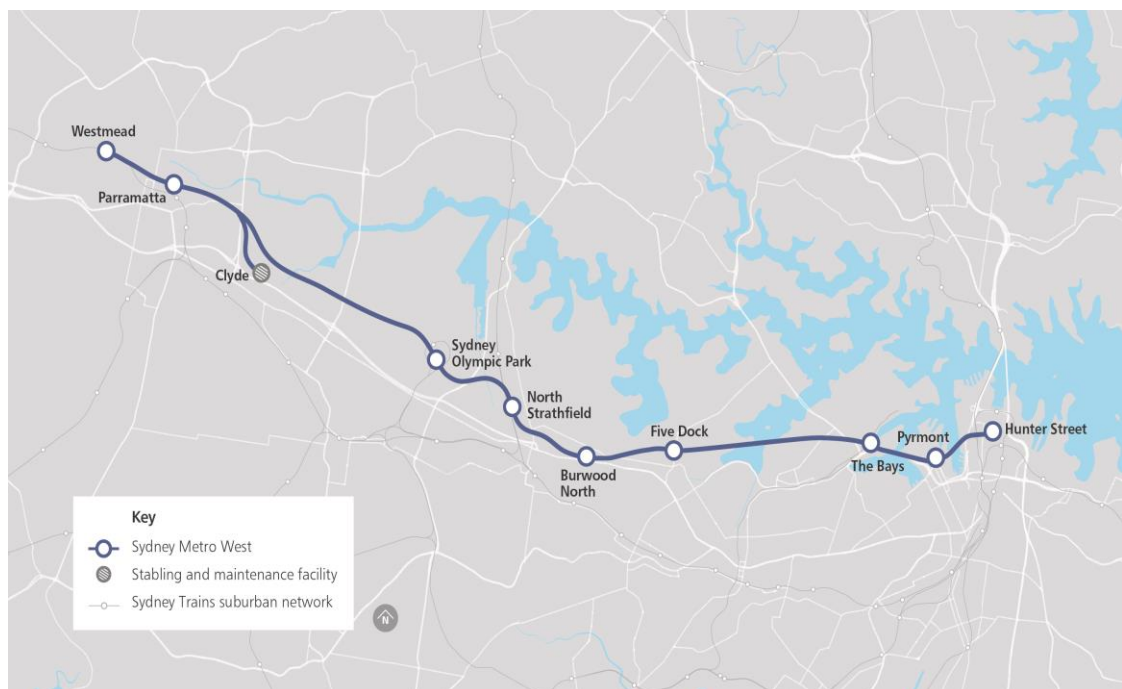


Figure 1-1 Sydney Metro West

1.2 Background and planning context

Sydney Metro is seeking to deliver Parramatta metro station under a two-part planning approval process. The station infrastructure is to be delivered under a Critical State Significant Infrastructure (CSSI) application subject to provisions under Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), whereas the over and adjacent station developments are to be delivered under a State Significant Development (SSD) subject to the provisions of Part 4 of the EP&A Act.

1.2.1 Critical State Significant Infrastructure

The State Significant Infrastructure (SSI) planning approval process for the Sydney Metro West metro line, including delivery of station infrastructure, has been broken down into a number of planning application stages, comprising the following:

- Concept and Stage 1 CSSI Approval (SSI-10038) – All major civil construction works between Westmead and The Bays including station excavation, tunnelling and demolition of existing buildings (approved 11 March 2021)
- Stage 2 CSSI Application (SSI- 19238057) – All major civil construction works between The Bays and Sydney CBD (approved 24 August 2022)
- Stage 3 CSSI Application (SSI- 22765520) – Tunnel fit-out, construction of stations, ancillary facilities and station precincts between Westmead and Hunter Street Station, and operation and maintenance of the Sydney Metro West line (under assessment, lodged).

1.2.2 State Significant Development Application

The SSD will be undertaken as a staged development with the subject Concept State Significant Development Application (Concept SSDA) being consistent with the meaning under section 4.22 of the EP&A Act and seeking conceptual approval for a building envelope, land uses, maximum building heights, a maximum gross floor area, pedestrian and vehicle access, vertical circulation arrangements and associated car parking. A subsequent Detailed SSDA is to be prepared by a future development partner which will seek consent for detailed design and construction of the development.

1.3 Purpose and scope

This geotechnical report supports a Concept SSDA submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the EP&A Act. The Concept SSDA is made under section 4.22 of the EP&A Act. The Concept SSDA is made under section 4.22 of the EP&A Act.

This report has been prepared to specifically respond to the Secretary's Environmental Assessment Requirements (SEARs) issued for the Concept SSDA on 22 February 2022 which states that the environmental impact statement is to address the following requirements shown in Table 1-1.

Table 1-1 SEARs and where this is addressed in this SSD report

Item	SEARs requirement	Addressed in
12. Ground and Water Conditions	Provide an assessment of the potential impacts on soil resources, including related infrastructure and riparian lands on and near the site.	Section 3
	Provide an assessment of the potential impacts on surface and groundwater resources (quality and quantity), including related infrastructure, hydrology, aquatic and groundwater dependent ecosystems, drainage lines, downstream assets and watercourses.	Section 3
	Where applicable, provide an assessment of salinity and acid sulfate soil impacts	Section 3.3.2

The objective of the geotechnical assessment is to present a summary of the ground conditions at the location of the Concept SSDA and comment on geotechnical risks and constraints to consider during the planning stage. The interpretations and assessments made are based on project specific geotechnical site investigation data (available at the time of writing) and historical site information data from projects carried out in proximity to the Concept SSDA site.

In preparation of this report, the following specific geotechnical objectives were considered:

- review of existing geotechnical data points and results
- analysis of geotechnical risks
- make recommendations to assist in assessing the suitability of the proposed land use described in this report.

2 The site and proposal

2.1 Site location and description

The subject application is in the Parramatta CBD, in the City of Parramatta Local Government Area (LGA). It is within the city block bounded by George Street, Church Street, Smith Street, and Macquarie Street.

The site presents a 164m long frontage to Macquarie Street, 125m frontage to George Street, 48m frontage to Church Street, and 15.5m frontage to Smith Street (in the form of Macquarie Lane).

The site location is shown in Figure 2-1 and Table 2-1.

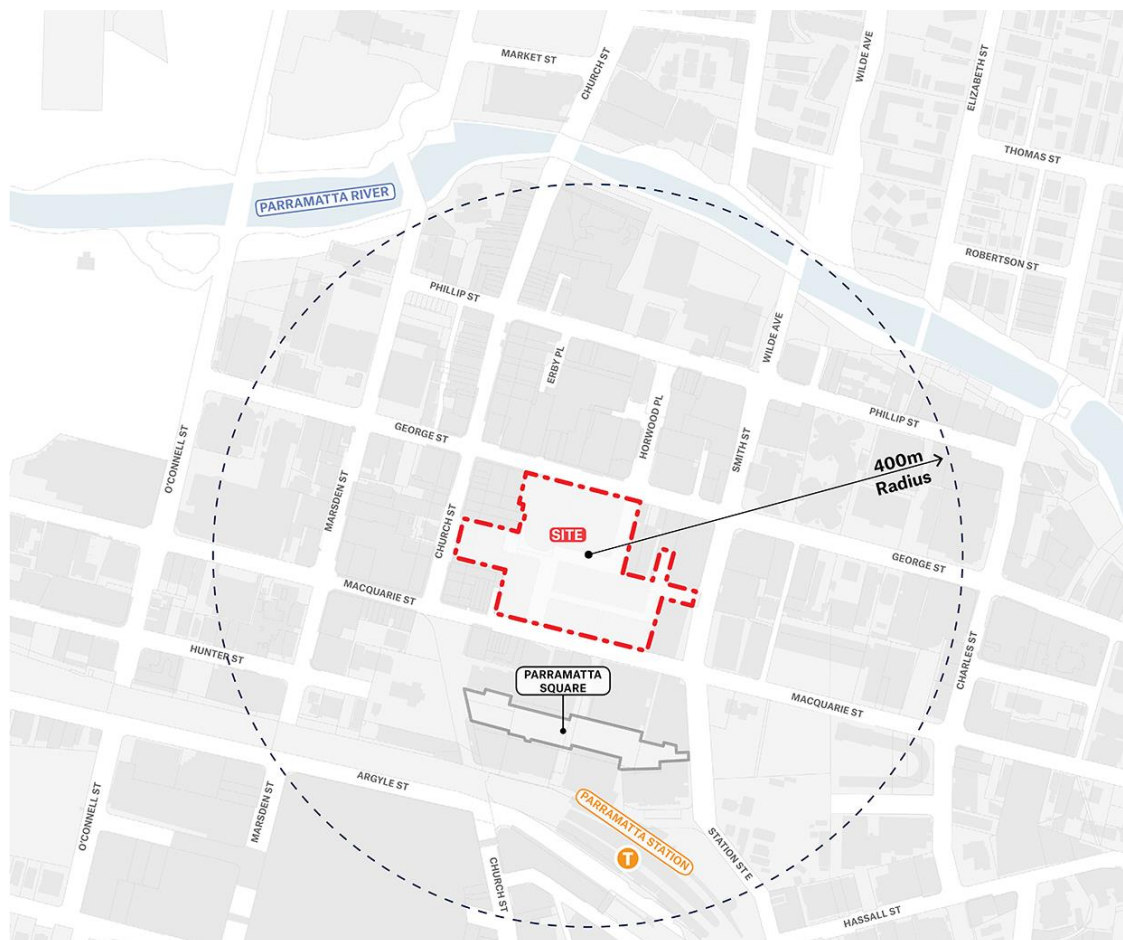


Figure 2-1 Parramatta metro station precinct location

As described in Table 2-1, the site comprises fourteen (14) different allotments of varying sizes. It is irregular in shape, with a total area of approximately 24,899m²

Table 2-1 Site legal description

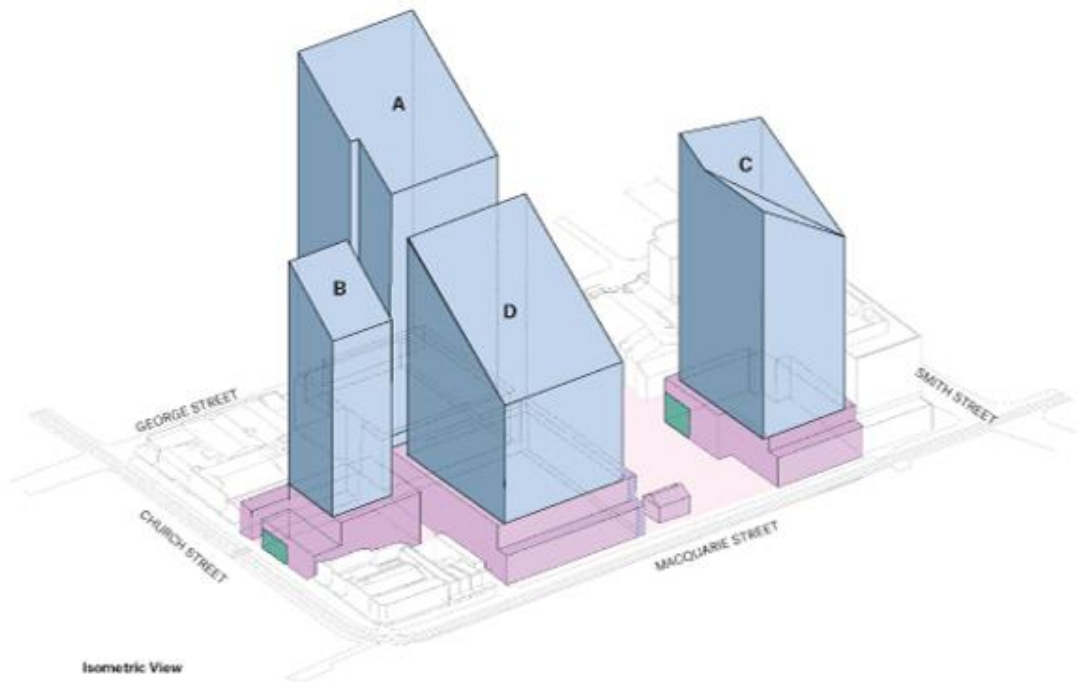
Street address	Legal description
41-59 George Street	Lot 10 in DP858392
45A George Street	Lot 2 in DP701456
61B George Street	Lot 1 in DP607181
71 George Street	Lot 100 in DP607789
220 Church Street	Lot 1 in DP1041242
222 Church Street	Lot 1 in DP702291
232 Church Street	Lot 1 in DP651992
236 Church Street	Lot 1 in DP128437
238 Church Street	Lot 2 in DP591454
48 Macquarie Street	Lot B in DP394050
58-60 Macquarie Street	Lot 1 in DP399104
62-64 Macquarie Street	Lot AY in DP400258
68 Macquarie Street	Lot 1 in DP711982
70 Macquarie Street	Lot E DP 402952
72 Macquarie Street	Lot 3 in DP218510
74 Macquarie Street	Lot H in DP405846

2.2 Overview of this proposal

The Concept SSDA will seek consent for four building envelopes as detailed in Table 2-2 and Figure 2-2.

Table 2-2 Parramatta metro station proposed development overview

Item	Description
Building use	Building A: Commercial and retail Building B: Residential and retail Building C: Commercial Building D: Commercial and retail
Building Height (Number of storeys)	Building A: 38 storeys Building B: 33 storeys Building C: 26 storeys Building D: 25 storeys
Gross Floor Area (m ²)	Building A: 78,700 Building B: 20,000 Building C: 35,950 Building D: 55,350 TOTAL: 190,000
Car parking spaces	455



Isometric View

Legend

- Parramatta Station CSSI Approval - Includes structure and building infrastructure and space for lift cores, access, parking, retail and building services for future OSD & ASD
- Metro Station Entry and Box (Indicative)
- OSD & ASD Concept SSD Building Envelope - Includes OSD & ASD Areas inside the CSSI 'shell' below ground and in the podium levels
- 3m Podium Articulation Zone - refer to Design Guidelines.
- Heritage Interface Zone - refer to Design Guidelines.

Figure 2-2 Proposed Concept SSDA development and CSSI scope

3 Scope of assessment

3.1 Interface with CSSI approvals

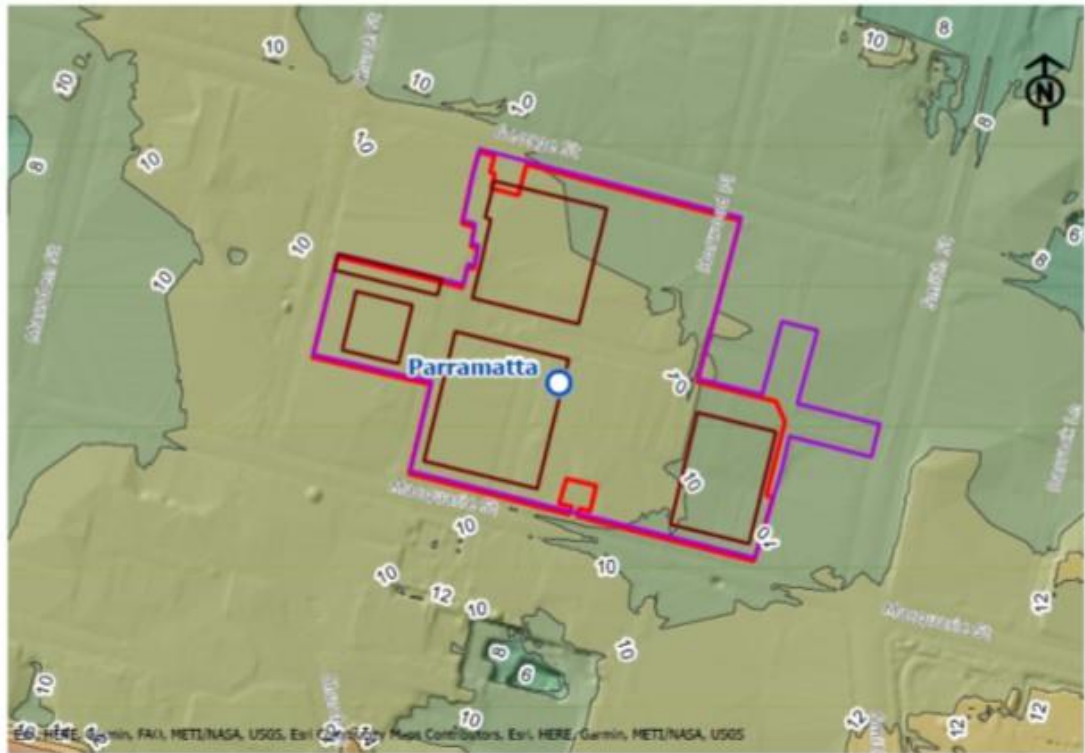
The proposed development is expected to be undertaken after the development works associated with Stage 1 CSSI and Stage 3 CSSI are completed. These development works will have their own associated geotechnical studies which may provide new information and should be considered in future detailed design application(s). The proposed development will be constructed above works carried out under CSSI approval, specifically the station box, the northern and southern basement carparks and the podium of Buildings B, C and D (refer to Figure 2-2), and therefore is not expected to interact with the existing ground. However, to respond to the SEARs as noted in section 1.3 above, a general description of the site and the expected geology is provided for context, along with any potential areas of geotechnical concern associated with the proposed development.

3.2 Topography





The Parramatta metro station precinct is located on a local high point within the Parramatta River floodplain and is in the City of Parramatta Local Government Area approximately 24 km west of the Sydney CBD. Parramatta metro station will be located on the block bounded by George, Macquarie, Church and Smith Streets.

Parramatta metro station will be a fully underground station, with the platforms approximately 27 m below existing ground level. The existing ground surface at the proposed station location is relatively flat and is approximately at 9 to 11 m AHD, shown in Figure 3-1.

The site is about 300 metres to the south of the Parramatta River and just downstream of the Charles Street weir. The site and surrounding area are subject to mainstream flooding during rare and extreme flood events from the Parramatta River which has an upstream catchment area of about 110 square kilometres. The site is also subject to minor overland flooding. The main flooding constraint on the site and the surrounding area is related to mainstream flooding during rare flood events. Horwood Place runs through the site and may act as a flood flow path at the existing site in these large flood events.



LEGEND

-  Metro station
-  SSD Boundary
-  OSD Boundary
-  EIS 3 Construction site

DTM:(m)








-  4 - 6
-  6 - 8
-  8 - 10
-  10 - 12
-  12 - 14
-  14 - 16
-  16 - 18



Figure 3-1 Parramatta metro station site topography

3.3 Ground conditions

3.3.1 Regional geology

The area of the Parramatta metro station has a relatively thin cover of anthropogenic ground (filling) which overlies thick quaternary deposits. Alluvial clays and sands are known to extend from the adjoining river into the Parramatta area. The alluvial clays are represented predominantly by clays and sandy clays which overlie the fluvial sand deposits (“Parramatta Sands”). Parramatta metro station will be constructed through a thick layer of “Parramatta Sands” (up to 10 m) which comprise sands, clayey sands and sandy clays. These sediments overlie residual clays weathered from the siltstones of the Ashfield Shale.

The underlying bedrock is Ashfield Shale underlain by Mittagong Formation and Hawkesbury Sandstone. The Ashfield Shale is described as black to dark grey shale and laminite. The Mittagong Formation separates the Hawkesbury Sandstone from the overlying Ashfield Shale. It is sometimes referred to as transition unit between the fine-grained Ashfield Shale and relatively coarse-grained Hawkesbury Sandstone and is described as medium-grained quartzose and micaceous quartzose sandstone, interlaminated with siltstone. The Hawkesbury Sandstone is described as medium to coarse grained quartz rich sandstone with occasional shale lenses.

Parramatta Dyke is expected to intersect adjacent to the east end of the proposed station. Several fault zones are also interpreted to cross the same portion of the station box. Therefore, the sandstone and siltstone rock at the locations decrease in quality and can have a significant reduction in rock mass strength.

3.3.2 Acid sulphate soils

As there is no interaction with the existing ground within the proposed development footprint, acid sulphate soil issues are not relevant to this phase of the approval.

3.3.3 Preliminary geotechnical model

A summary of subsurface profile along the centreline of the Parramatta metro station is presented in Table 3-1. This subsurface profile is presented purely to provide context for the overall metro station and is not directly relevant to the proposed development, which is not expected to interact with the subsurface profile.

The sandstone and shale classes discussed below are based on "Classification of Sandstones and Shales in the Sydney Region: A Forty Year Review", Pells, et al 2019. The top of bedrock at the Parramatta metro station (Class III or better according to Pells et al., 2019) ranges from about -1.5m AHD in the east to about -4.2m AHD in the west.

Table 3-1 Indicative ground profile

Geotechnical unit	Description	Depth to top of unit	Unit thickness
Fill	Existing, with variable material type and consistency	Ground surface	Less than 1.5m
Alluvial clay and sand	Firm to very stiff clay, medium dense alluvial sands, clayey sands and sandy clays.	0.5 to 15m	2.25 to 14m
Residual soil	High plasticity silty clay, trace fine to medium grained, bud-angular ironstone gravel.	9.8 to 15.2m	0.6 to 1m
Ashfield Shale and Mittagong Formation	Shale, varying from extremely weathered to fresh, and from very low to high rock strength	10.0 to 15.6 m	1.3 to 3.2 m
Hawksbury Sandstone	Sandstone, typically fresh, medium to very high rock strength	12.5 to 18.7m	Not proven

The unit depths, thicknesses and material properties presented in Table 3-1 should not be assumed to represent the maximum or minimum values within the site. Actual unit boundaries and material properties can be highly variable, particularly for fill. Figure 3-2 to Figure 3-5 present inferred surfaces of the tops of the predominant Units, Alluvial sediments, Residual Soils, Ashfield Shale and Hawksbury Sandstone. The surfaces representing the unit boundaries are based on interpolation, often between widely and variably spaced boreholes.

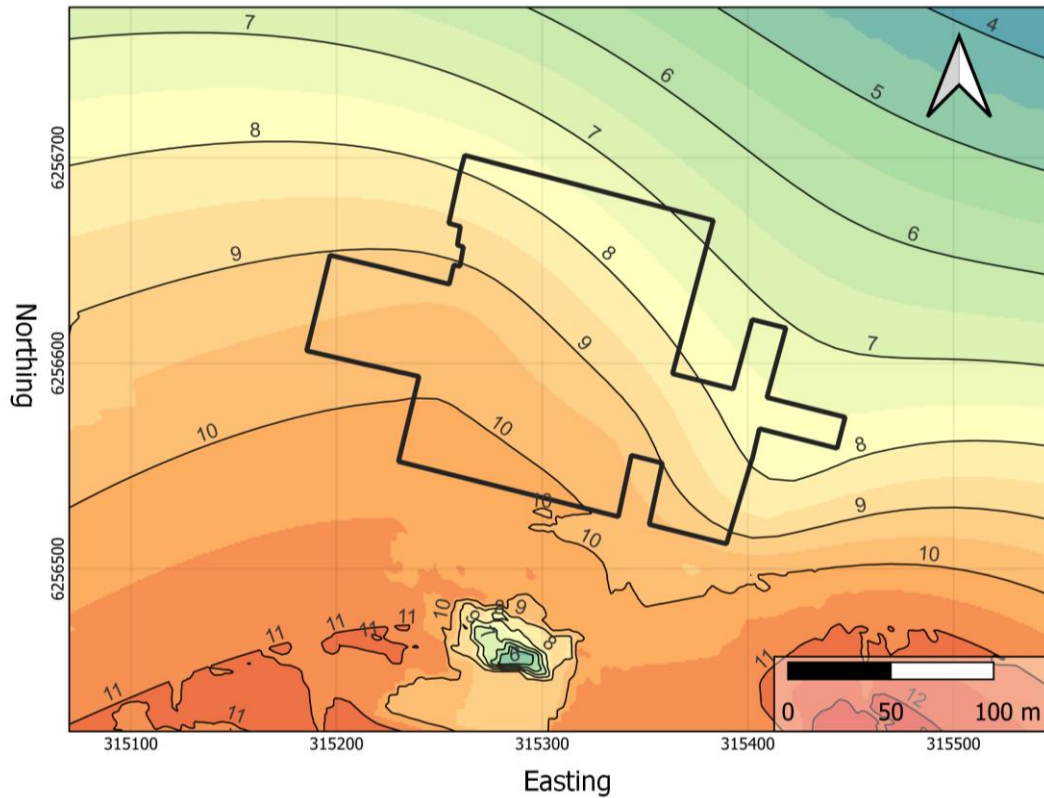


Figure 3-2 Inferred contours of elevation of top of alluvial soils

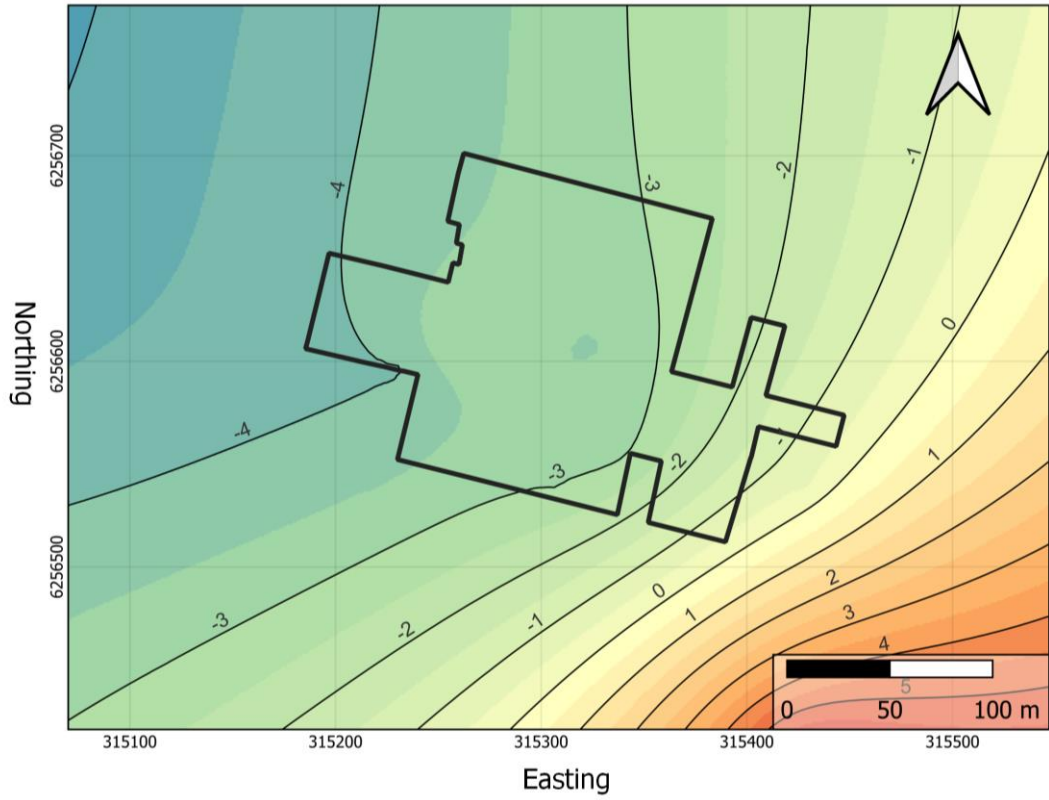


Figure 3-3 Inferred contours of elevation of top of residual soils

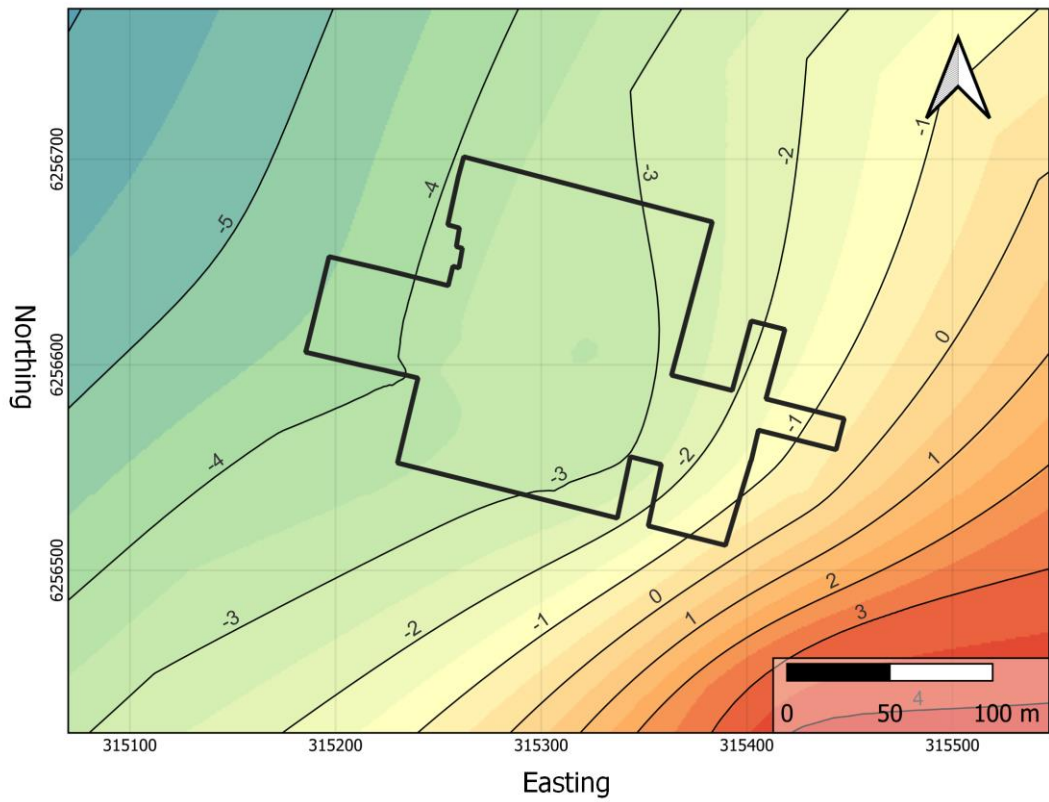


Figure 3-4 Inferred contours of elevation of top of Ashfield Shale

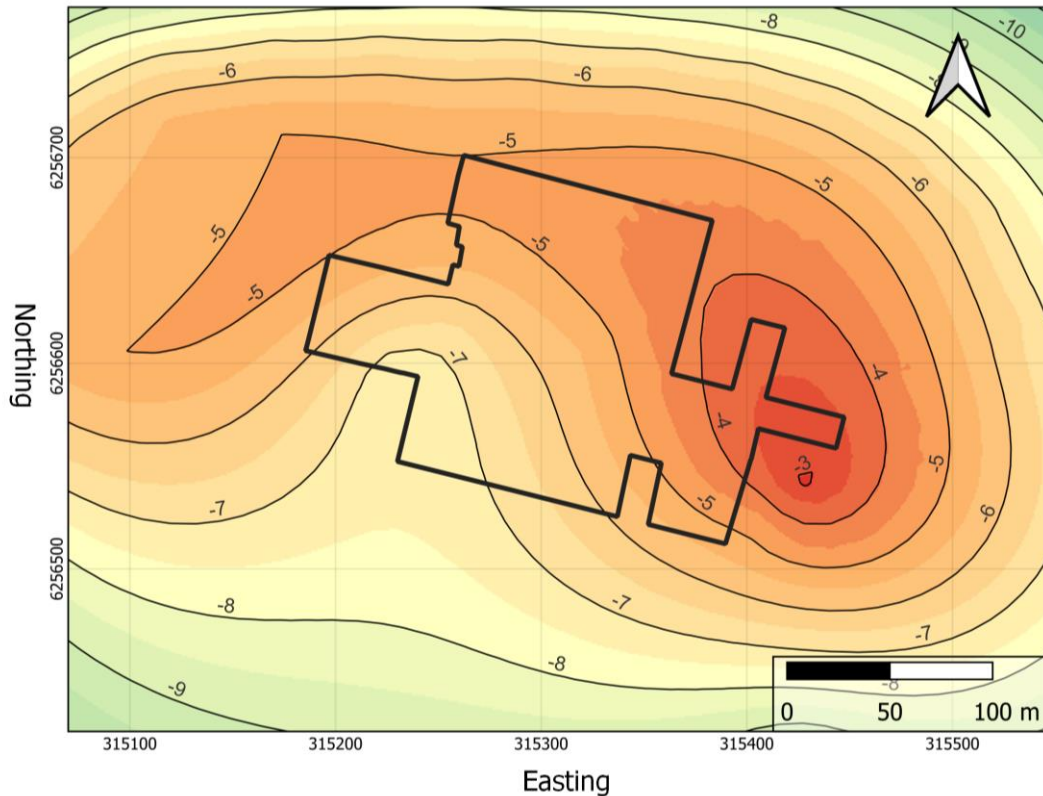


Figure 3-5 Inferred contours of elevation of top of Hawkesbury Sandstone

3.3.4 Groundwater

As the proposed development is located above the works carried out under CSSI approval, groundwater is not expected to be affected during construction. In addition, as the area of the precinct is highly urbanised and altered from its natural state, with pockets of open spaces and parkland, soil erosion due to surface or groundwater influence is likely to be negligible and constrained to the boundaries of the construction footprint.

3.4 Potential impact assessment

3.4.1 Ground movement

As noted above, the proposed development is to be constructed above the works carried out under CSSI approval. Therefore, the majority of the ground movement is expected to occur during these CSSI works. Some ground movement could occur due to the increased loading of the proposed development, but it is assumed that the CSSI works will be designed in such a way to account for this additional load. Therefore, it is considered that ground movement due to the construction or operation of the proposed development will be negligible. Considering this, it is critical that the foundation system and its capacity of the CSSI works is understood during further design of the proposed development, in order to mitigate the risk of ground movement following construction.

3.4.2 Building risks

The proposed development will be supported by the works carried out under CSSI approval. It is assumed that the CSSI works will be designed to transfer the additional loading of the proposed development directly into the foundation support system and then into the underlying high strength rock siltstone and sandstone. This may cause minor lateral movement within the foundation support system but ground settlement due to the construction or operation of the proposed development is not expected. The design of the proposed development should consider the existing foundation support system and its capacity to minimise interaction with existing structures such as the Parramatta metro station box, running tunnels (both Metro West tunnels and future rail tunnels) and the heritage listed Kia-Ora building.

4 Conclusion

This report has addressed the geotechnical requirements as per the SEARs for the project. Key geotechnical findings of this report include:

- The area underlain by medium dense alluvial sands (clayey sands and sandy clay) and firm to very stiff alluvial clay then underlying bedrock (Ashfield shale underlain by Mittagong formation underlain in turn by Hawksbury sandstone).
- The top of bedrock within the study area ranges from -1.5 metres AHD to -4.2 metres AHD.
- The proposed development will be constructed entirely after the works carried out under CSSI approval, specifically the station box, the northern and southern basement carparks and the podium of Buildings B, C and D. Therefore, no direct interaction with the existing ground is anticipated during construction or operation of the proposed development.
- The foundation of the works carried under the CSSI will be within high strength rock. Ground movement and impact on existing structures is expected to be minimal due to the construction of the proposed development, as this will have already occurred during construction of the CSSI works.
- Design of the proposed development will need to account for the existing foundation support system of the works carried out under the CSSI approval.

Based on the findings of this geotechnical assessment, the following recommendations are proposed:

- The geotechnical assessment is based on limited data. However, the proposed development scheme in the context of the existing geotechnical conditions on the site is considered to be suitable for its intended use.
- While the site contains a number of geotechnical challenges including the presence of Parramatta Dyke, high groundwater table, ASS and rock at depth, it is considered that these challenges can be adequately addresses through the utilisation of industry standard design and construction techniques and practices.
- The ground conditions assumed in design can vary from actual site conditions that may be encountered during construction. To reduce the potential for this variation, further geotechnical investigation will need to be carried out prior to detailed design and subsequent construction phase.
- The proposed development design should consider the existing foundation support system of the works carried out under the CSSI approval, so as to minimise further ground movement or impact on adjacent structures during construction and operation of the proposed development.

5 Limitations

This report has been prepared for use by the Client who has commissioned the works in accordance with the Concept SSD brief only and has been based in part on information obtained from the Client and other parties.

The advice in this report relates only to the Concept SSD and all results, conclusions and recommendations made should be reviewed before being used for any other purpose. Mott Macdonald accepts no liability for use or interpretation by any person or body other than the Client who commissioned the works.

This geotechnical assessment should not be reproduced without prior approval by the Client or amended in any way without prior approval by Mott Macdonald, and should not be relied upon by other parties, who should make their own enquires.

The interpretations, assessment, conclusions and any recommendations in this report are based on information obtained and reviewed at the date of preparation of this report, conditions encountered and findings at the time of fieldwork investigations, and testing undertaken at or in connection with specific sample points by. Site conditions at other parts of the site may be different from the site conditions found at the specific sample/investigation points which are relied upon for the assessment. Changes to site conditions may also occur subsequent to the investigations, through natural processes or through the construction or other human activities.

The assessment conducted relies on the geotechnical investigation carried out by various consultants for Sydney Metro West and publicly available information such as limited historical geotechnical information, aerial photographs and government records. Mott Macdonald has not independently verified or checked information other than scoped by Mott Macdonald. Mott Macdonald does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in the that information.

This report does not provide a complete assessment of the geotechnical conditions at the site, and it is limited to the purpose defined herein. Should any new information become available regarding conditions at the site, Mott Macdonald reserves the right to review the report in the context of the additional information.

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