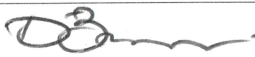
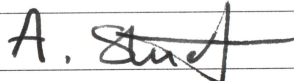


Utilities Management Strategy

Sydney Metro City & Southwest – Line-wide

Project number:	C600
Document number:	SMCSWLWC-SYC-1NL-PM-PLN-002793
Revision date:	17/01/2020
Revision:	B

Document Approval

	Utilities Coordination Manager	Project Director
Name:	D. Boorman	A. Stuart
Signature:		

Details of Revision Amendments

Amendments

Any revisions or amendments must be approved by the Project Director and/or client before being distributed / implemented.

Revision Details

Revision	Details
A	Draft issued for Sydney Metro review
B	Revised following Sydney Metro comment. Issued for Approval/Endorsement

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Compliance Matrix

Reference	Requirement	Section
E69	The Proponent must co-ordinate utility providers and relevant council(s) to identify opportunities for maintenance, replacement or augmentation of utilities that cross the rail corridor and facilitate and co-ordinate requests by the utility providers and relevant council(s) to undertake the Work during rail shutdowns, with particular reference to the final three (3) to six (6) month shutdown before metro services commence.	Section 1.6
E70	Nothing in this approval allows for the undertaking of any third-party utility Work identified through the implementation of Condition E69 and not required for the purposes of this CSSI. Note: Third-party utility Work, including but not limited to drainage, water or energy supply etc. identified not required for the project is not the responsibility of the Proponent and is subject to separate approvals process.	Section 1.6
E71	A Utilities Management Strategy must be prepared and implemented in line with the Utilities Management Framework, provided as Appendix H of the SPIR for all utility Work. The Strategy must identify how utility Work will be defined and managed. The Utilities Management Strategy must include: <ul style="list-style-type: none"> (a) the functions of the Utility Coordination Manager as required by Condition E72; (b) a description of all utility Work to be undertaken; and (c) management measures to be implemented to manage dust, noise, traffic, access and lighting impacts associated with utility Work. The Utilities Management Strategy must be submitted to the Planning Secretary for approval at least one (1) month before commencement of utility Work.	This Document Section 1.5 a. section 1.5 b. Section 3 c. Section 4
E72	A Utility Coordination Manager must be approved for the duration of the CSSI Work. The role of the Utility Coordination Manager must include, but not be limited to: <ul style="list-style-type: none"> (a) the management and coordination of all utility Work associated with the delivery of the CSSI, to ensure respite is provided to the community, as required under Condition E22; (b) investigating complaints received from the Community Complaints Mediator relating to utility Work and providing a response to the Community Complaints Mediator. 	Section 1.5

Glossary / Abbreviations

Term	Definition
CEMP	Construction Environment Management Plan
Client	Sydney Metro
CNVIS	Construction Noise and Vibration Impact Statements
CoA	Condition of Approval
CSSI	Critical State Significant Infrastructure
CTMP	Construction Traffic Management Plan
C2B	Chatswood to Bankstown – reference to works under CSSI 8256
DBYD	Dial-Before-You-Dig
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ER	Environment Representative
Low Impact Activities	Activities required to facilitate construction, that are not defined as construction as per the definitions provided under Planning Approvals SSI 8256.
OOH	Out of Hours
OHW	Overhead wire
Project	Sydney Metro Line-Wide Project
Project Planning Approval	State Significant Infrastructure (CSSI) Planning Approvals: <ul style="list-style-type: none"> CSSI 8256 Sydney Metro City & Southwest Sydenham to Bankstown
RMS	Roads and Maritime Services
ROL	Road Occupancy Licence
SCLWW	Systems Connect Line-wide Works
SEP	Site Environment Plans
SMTF	Sydney Metro Trains Facility North
SMTFS	Sydney Metro Trains Facility South
SPIR	Submissions and Preferred Infrastructure Report
STS	Sub-transmission Substation
SWM	Southwest Metro
SWTC	Scope of Work and Technical Criteria
S2B	Sydenham to Bankstown – reference to works under CSSI 8256

Term	Definition
TfNSW	Transport for New South Wales
TMP	Traffic Management Plan
UMS	Utilities Management Strategy
Pipe Types:	
CICL	Cast Iron Cement Lined (pipe)
DICL	Ductile Iron Cement Lined (pipe)
EW	Earthenware (pipe)
GRP	Glass Reinforced Plastics
HDPE	High Density Polyethylene
PE	Polyethylene
PVC	Polyvinylchloride
RC	Reinforced Concrete
SGW	Salt Glazed Ware
VC	Vitrified Clay

1. Introduction

1.1 Project Background and Description

The Sydney Metro City & Southwest project will extend Sydney Metro Northwest to the CBD and beyond to Bankstown. The project is being delivered through a suite of contracts for the tunnels, stations, line-wide infrastructure and Systems.

The Line-wide Works are the permanent systems, services and building works within, adjacent, or required for rolling stock to travel through the Sydney Metro City & Southwest Tunnels and Trackway.

The following key items of scope related to the Line-wide Contract are being delivered by Systems Connect (SCLWW) (an unincorporated Joint Venture between CPB Contractors and UGL):

- 31 kilometres of underground railway track to be laid in the twin railway tunnels from Chatswood to Bankstown
- 31 kilometres of overhead power equipment and 11 new substations to power the metro from Chatswood to Bankstown
- Installation of over 350km of high voltage, low voltage and tunnel services cables
- The expansion of the Sydney Metro Trains Facility (SMTF) at Rouse Hill to accommodate 37 new six car Sydney Metro trains for Sydney Metro City & Southwest
- The construction of the Sydney Metro Trains Facility South (SMTFS) at Marrickville to provide stabling for 16 six car Sydney Metro trains
- The fit out of the Sydney Metro City & Southwest tunnels and stations, including provision of track, overhead wiring, High Voltage reticulation, tunnel ventilation, fire services tunnel services
- Delivery of bulk power feeds to meet the Sydney Metro City & Southwest high voltage reticulation and traction power requirements
- The open northern dive works to tie Sydney Metro City & Southwest into the Sydney Metro Northwest at Chatswood
- Provision of High Voltage reticulation and traction power for the Southwest corridor from Sydenham to Bankstown

1.2 Scope

This Strategy is to define how Systems Connect propose to manage utilities works for works defined under planning approval CSSI 8256. Note, as per CSSI 8256, utility works that are not low impact are considered 'construction' and appropriate management measures are included in the approved Construction Environment Management Plan (CEMP).

As such, SCLWW scope where utility works have been assessed consist of:

- Traction substations – Dulwich Hill, Canterbury, Campsie, Lakemba and Punchbowl
- Campsie 33kV Bulk Power Supply

Within these locations, the scope of this Strategy is to:

- Define the works and assess their impact on existing utilities; and
- Identify all utility installation, protection, relocations, adjustments, and new connections which are proposed for the areas bound by the Planning Approval.

Figures 1 & 2 below illustrate SCLWW locations within the Sydney Metro Southwest project. Further scope details are provided in Section 3.



Figure 1: Sydenham to Campsie Line-wide Works



Figure 2: Campsie to Bankstown Line-wide Works

The utility services which have been considered in this Strategy are:

- Electricity
- Gas
- Communications
- Traffic signals
- Water
- Sewerage
- Stormwater

1.3 Planning Approval and Compliance Requirements

The Sydney Metro City & Southwest Project Line-wide Works have been assessed and approved via number of applications under the Environmental Planning and Assessment Act 1979 (EP&A Act) and are classified as Critical State Significant Infrastructure. This plan has been developed to address planning approval requirements under CSSI 8256 – Sydney Metro City & Southwest Sydenham to Bankstown.

Construction activities will not commence until this Strategy is approved, in accordance with Project Approval Condition E71. This strategy will be implemented for the duration of the Line-wide Works between Sydenham and Bankstown, as required by Condition E71.

1.4 Purpose

The Strategy addresses CSSI 8256 CoA E71, Identifies and describes all utility work being undertaken,

Outlines the management measures that Systems Connect will conduct as part of Line-wide Works Package (LW) of the Sydney Metro City & Southwest Sydneyham to Bankstown upgrade project (the Project) and the timeframe for submission shall ensure approval is gained prior to commencement of Utility work.

The purpose of this strategy is:

- To provide an overview of key responsibilities of the Utilities Coordination Manager in the Project;
- To outline the intended design for the provision of permanent power supply for the Project;
- To provide an overview of the approach to utility works across the Project;
- To assess the range of potential environmental impacts associated with utility works;
- To identify and assess potential impacts to existing utility assets;
- To outline a range of mitigation measures which would be applied to minimise the potential environmental impacts;
- To outline strategy of coordinating with utility providers and relevant council identify opportunities for maintenance, replacement or augmentation of utilities; and
- Outline management measures to be implemented to manage dust, noise, traffic, access and lighting impacts.

The strategy has also been prepared to address the relevant requirements of the following:

- Utilities Management Framework outlined in Appendix H of the Submissions and Preferred Infrastructure Report (SPIR) for all utility work
- the Project Planning Approval CSSI 8256
- contractual requirements including the LW Works Project Contract and Scope of Work and Technical Criteria (SWTC)

1.5 Sydney Metro Coordination Manager

The Sydney Metro Utilities Project Manager and the Utilities and Stakeholder Manager have been jointly appointed as the Sydney Metro Utility Coordination Manager (UCM) to coordinate delivery of the Sydneyham to Bankstown CSSI project utility works.

Utility works include any construction or physical modification of utility infrastructure (e.g. connections / disconnections) to ensure continual operation of utility assets/services during the delivery of the Sydneyham to Bankstown CSSI project. Utility works does not include investigative works (such as surveying or pot-holing of utility assets) to gather information to inform design and construction methodologies. Utility works for the Sydneyham to Bankstown CSSI project may involve the following utility assets:

- Gas (Jemena, Qenos);
- Power (Ausgrid, Transgrid);
- Telecommunications (Telstra, NBN Co, TPG, Vocus, Optus);
- Water and sewer (Sydney Water); and
- Stormwater (Sydney Water, Canterbury-Bankstown Council, Inner West Council).

Several Contractors, including LW, may be undertaking utility works on the Project at the same time.

The functions of the UCM include, but are not limited to:

- Establishing a Utilities Project Team with nominated representatives from utility service providers that may be impacted by the CSSI;
- Coordination of meetings with utility service providers as requested by Sydney Metro's Contractors;
- Involvement with reviews of CSSI designs and construction methodologies to assist with identifying potentially impacted utility assets;
- Assist with coordination of design and construction methodology reviews by utility service providers to identify necessary utility works;
- Communicate with the Utilities Project Team, Sydney Metro, and Sydney Metro's Contractors' delivery teams to understand the proposed program of works to coordinate intercepting, interconnecting and interrelated works and manage priorities as they may arise;
- Observation of utility works; and
- Manage escalation of utility work-related issues within Sydney Metro and the utility service providers as required.

- In conjunction with the Contractors, co-ordinate utility providers and relevant council(s) to identify opportunities for maintenance, replacement or augmentation of utilities that cross the rail corridor and facilitate and co-ordinate requests by the utility providers and relevant council(s) to undertake the Work during rail shutdowns

Respite for impacted receivers will be considered throughout the coordination and management of the utility works in accordance with the Sydney Metro City & Southwest Construction Noise & Vibration Strategy. Respite may be offered in the form of a reduction or absence of noise emissions for a period of time, or by removing the affected receiver from the noise emission point source (e.g. dinner/movie tickets and/or alternative accommodation offers). Consideration of respite will consider many factors, including but not limited to the predicted noise level, duration, time of day, surrounding land uses and community feedback from Sydney Metro Place Managers of the proposed works. The UCM will endeavor to coordinate works to avoid the same receiver being affected over consecutive nights by more than one Contractor as much as possible. The UCM, where required, will facilitate information sharing between Contractors where concurrent utility works (or other works and utility works) may occur to ensure that these are appropriately assessed within noise predictions. The UCM will collaborate with Contractors to ensure utility work staging is appropriately captured within any Construction Noise and Vibration Impact Statement (CNVIS), to ensure that cumulative impacts from utility works are accounted for. Furthermore, the UCM will endeavor to stage the timing of works by different Contractors that affect the same receiver as much as possible in order to maximise the respite period between the works.

The UCM will collaborate with all Contractor Community and Stakeholder Managers and Place Managers to ensure that notifications for works are accurate and up to date. Where a community complaint is received the UCM will work with the Contractors' communications team to ensure the complaint is resolved in a timely manner and to put in place measures to mitigate the risk of future complaints, where possible.

In the case of ongoing complaints, the UCM will assist in investigating complaints received by the Community Complaints Mediator relating to utility works by responding to the Community Complaints Mediator on complaints related to utility works as requested.

1.6 Identified Utility Service Providers

Each third-party utility service provider below is known to have assets located within the Systems Connect Line-wide project area. The utility type and contact details are given in Table 2 below. Note Sydney Trains/ARTC/Rail Corp assets will not be impacted by the works and hence have been excluded from this Strategy.

Table 1: Identified utility service providers

Utility Provider	Type	General contact number from DBYD
Ausgrid	High voltage underground / overhead electricity cables – 132kV, 33kV, 11kV Low voltage underground / overhead electricity cables	02 4951 0899
Jemena	Low pressure gas mains	1300 880 906
Sydney Water	Potable water mains Wastewater (sewerage) mains	132 092
Telstra	Underground communication cables including fibre optic	1800 810 443
Optus / Uecomm	Underground communication cables including fibre optic	1800 505 777

Utility Provider	Type	General contact number from DBYD
NBN Co	Underground communication cables including fibre optic	02 8918 8319
RMS	Traffic signals and associated infrastructure	02 8837 0450
Freyssinet / Qenos	High pressure petroleum line (to be relocated by others)	0438 168 750
Canterbury-Bankstown Council	Stormwater	02 9789 9300

In accordance with CoA E69:

- utility providers and Canterbury Bankstown Council will be provided the opportunity to perform maintenance, replacement or augmentation to services directly adjacent to work zones. Management of such works will be via coordination meetings with utility owners, UCM, SCLWW utilities lead and construction team, as required.

In accordance with CoA E70:

- It is not permitted to undertake any third-party utility work identified through the implementation of Condition E69 and not required for the purposes of the CSSI.

2. Utility Co-ordination and Protection

2.1 Identification and Location of Services

As part of the design development process the following will / has taken place to ensure utility interfaces have been identified.

- Obtain the Dial Before You Dig (DBYD) plans and Sydney Trains Detailed Site Survey (DSS) information (for works within the rail corridor).
- Identify the interface points through desktop studies of DBYD and DSS plans
- Confirm physical locations of underground utilities using non-destructive digging techniques. These include potholing, ground penetrating radar, electronic cable locating equipment and other suitable methods

Consultation will continue with asset owners on an ongoing basis to confirm and assess the locations of utilities. Updates to DBYD and DDS information will be reviewed and updated as required for the duration of the works.

2.2 Confirm Utilities Requiring Relocation or Protection Works

The design process for identifying, assessing and confirming interaction with existing utilities is as follows:

- The outcomes from the desktop studies of the DBYD (and DSS) plans and the site investigations is to confirm the utilities that will require relocation or protection from to the design and construction works.
- Utilities identified through the above searches and investigations are mapped and incorporated into the design. This mapping (using a web-based GIS program and other CAD software) analyses the identified utilities that may require relocation or protection works.
- Information such as size / type and owner of each utility must be obtained, along with environmental and community constraints in proximity to each major utility that require consideration during any relocation / protection works.
- Interface registers are compiled, and each interface is risk assessed with the above considerations. Mitigation measures and action plans will then be developed.

2.3 Utility Provider's Requirements

As the design progresses and the impact of project works on existing utilities develops, utility asset owners will be consulted on a regular basis. The aim of this consultation is to;

- Notify asset owner of the project works and interfaces,
- Confirm the technical or physical requirements for avoidance, protection or relocation.
- Obtain approval from the asset owner for the design, protection or relocation.
- Utility provider requirements will be confirmed during initial consultations. These requirements will be incorporated into the design philosophy throughout the design process and the asset owner will be afforded opportunity to comment at each stage of the design process.

2.4 Mitigation Measures and Process

- Where it has been determined that Utility assets will interface with the project works, treatment measures will be implemented to manage and mitigate the interface. The range of proposed treatment / control measures have been nominated below. These controls are listed in Table 3 below in order of preference from 1 to 4.

Table 2: Mitigation measures

Control Index	Works
Control 1	No impact is expected
Control 2	An administrative or engineering control methodology to manage the asset owner requirements, which may include asset owner supervision
Control 3	The construction of temporary or permanent works is required to protect the asset to the asset owners' requirements and approval
Control 4	The asset must be relocated

The mitigation process will manage the design associated with utility assets, which includes the risks associated with coordinating utilities, mapping utilities at appropriate quality levels, analysing utility conflicts, managing design and coordinating utility relocations. The following steps summarises this process:

- Reviewing the project design against existing utility information
- Deciding if a utility impact exists
- Deciding whether to modify the project design or the utility asset
- If modifying the utility asset, determining whether the design is identified as contestable or non-contestable
- Revising the project design and designing changes according to the utility-specific design process
- Managing the production of design for utility services
- Consulting with all relevant authorities to establish and provide for existing and planned future services.

2.5 Design Philosophy

Ideally the design will not have any impacts to utilities. However, this is not possible as connections / alterations are to take place due to the project scope. The design philosophy is to only relocate a utility asset when all other paths are exhausted or in other words, to prioritise the avoidance of interfaces / clashes with utility assets.

During design each utility interface is risk assessed and mitigation measures are incorporated. Control measure 2, may mean that the utility interface can be controlled by the construction team or a simple change in design.

If the utility interface cannot be mitigated by control 2, then temporary or permanent protection measures may be required. Coordination with the utility owner is necessary to ensure the utility's requirements are met. This may also require the utility's approval.

Finally, if none of the above are achievable then the asset will require relocation.

2.5.1 Asset Relocations

At present under CSSI 8256 Planning Approval, there are no projected utility relocations required.

2.6 Change Management

As the design develops and the requirements for individual utilities is confirmed, there is risk that the identified treatment measures will change. To capture these changes this document will be revised periodically as required.

When a change is identified the following process will be undertaken:

1. Where an additional treatment Control 1 is identified, or a Control 1 treatment is upgraded to a Control 2 treatment, the affected utility service provider will be notified, however the Utility Management Plan will not require update.
2. Where a Control 1 or 2 treatment is upgraded to a Control 3 treatment, the affected utility service provider will be notified, and the Utility Management Strategy Plan will be updated to reflect this change.
3. Where a Control 4 treatment is deemed necessary, since this will require a diversion to a utility service, the asset owner will be consulted as early as practicable to assist with the development of a viable design solution. The Utility Management Strategy Plan will be updated to account for the inclusion of the diversion works and will identify the specific risks, controls and works methodology associated with the diversion works
4. Where Utility Service requirements from the asset owner are such that compliance will conflict with other aspects of the Deed, the issue will be raised at the relevant working group and addressed through the Change Control Process according to the resolution reached.

All instances of encountering an unexpected service will be dealt with on a case-by-case basis with consultation with utility service providers, hygienists, Canterbury Bankstown Council (where necessary).

2.7 Out of Hours Works

Where utilities work that is not subject to an EPL is scheduled to occur outside standard construction hours, the work will be undertaken in accordance with the Sydney Metro City & Southwest Out of Hours Work Protocol (as per CoA E25) and the Line-wide Construction Noise and Vibration Management Plan – C2B (SMCSWLWC-SYC-1NL-PM-PLN-000032).

Any utilities work that is subject to an EPL will be undertaken in accordance with the out of hours work provisions within the EPL. At this stage, Systems Connect is still in the process of obtaining an EPL for LW. Refer to the Line-wide Construction Environmental Management Plan – C2B (SMCSWLWC-SYC-1NL-PM-PLN-000033) for details about the EPL strategy.

3. Project Utilities Works

The identified 'Areas of Interest' for the proposed utility works have been identified to accommodate multiple utility services located within and adjacent to construction boundaries. The 'Areas of Interest' are shown in Appendix A and should be read in conjunction with the proposed management measures in Appendix B.

3.1 Bulk Power Supply

Line-wide Works includes construction of the incoming bulk supplies for the High Voltage reticulation scheme to provide power to rail and associated systems. This includes the following:

- 2 x 33kV feeders from Ausgrid Canterbury STS to Campsie bulk supply infeed & traction substation

The BPS route has been designed to maintain the required separation to existing services by being primarily located within the roadway. Minor route deviations may be necessary if unexpected services are encountered and will typically be dealt with on a case-by-case basis.

The proposed route for the traction feeder cable (bulk power supply) extends through Pat O'Connor Reserve via a cable bridge crossing Cup & Saucer Ck from the Ausgrid substation. It will be trenched underground along Anzac Street, High Street and Cooks Avenue, crossing RMS classified Canterbury Road, north along Gould Street before turning west on South Parade. Next crossing Beamish St into Lilian Lane into Lilian Street where it connects with the traction substation within the rail corridor.

The following Sections have been identified as points of interest (Refer to Appendix B for further details):

- Section 1 - Lilian Lane – proximity to Ausgrid HV & Sydney Water assets is less than standards for separation. Discussions ongoing with design for both parties to find solution;
- Section 3 – crossing Canterbury Road – RMS classified with high traffic volumes means works must only be performed Out of Hours. Important to note is separation discussions with Ausgrid HV running parallel/crossing, and proximity to Sydney Water. Adjacent to the road there are large residential apartments. Works will be carried out in accordance with Community Consultation
- Section 9 – crossing Cup & Saucer Creek – building over Sydney Water asset (BOA process). Design discussions ongoing with flood modelling and construction methodologies.

3.2 Traction substations between Sydenham to Bankstown

All traction substations are located within the Sydney Trains rail corridor. Prior to System Connect commencing works, all enabling works associated with delivery of Traction Sub-Stations will be performed by others.

Switchroom equipment installation will be performed off-site then transported via road to each site. Unloading and placement of such equipment will require an appropriately sized crane which will interface with existing Ausgrid overhead head wires (OHW). To safely perform this activity, a de-energisation/isolation permit is required. SCLWW will directly coordinate with Ausgrid to ensure planned outages are performed to ensure adequate notification and minimal disruption to the local community.

Traction substations locations are as follows: (refer location maps in Appendix A)

- Dulwich Hill Substation – located end of Randall Street, Marrickville. The site is within a residential area and access is via Randall Street
- Canterbury Substation – located adjacent to existing Sydney Trains Canterbury sectioning hut. Access is via two points in Hutton Street.
- Campsie Substation – located off Lilian Street, Campsie. Access is via Lilian Street.
- Lakemba Substation – located off The Boulevard, Lakemba. Access is via The Boulevard.
- Punchbowl Substation – located off South Terrace, Punchbowl. Access is via South Terrace.

4. Environmental Aspect Management

Utilities works will be undertaken in accordance with the management measures for dust, noise, traffic, access and lighting impacts as identified within the Construction Environmental Management Plan – C2B (SMCSWLWC-SYC-1NL-PM-PLN-000033), CEMP Sub-plans, Construction Traffic Management Plans (for each work area) and this Utility Management Strategy.

If utility works are to occur within the pre-construction phase, the works will be undertaken in accordance with an approved Pre-Construction Minor Works Approval (SM ES-FT-415) and this Utility Management Strategy.

Any utility work undertaken outside of standard construction hours will be subject to Out of Hours Work Approval (SM-17-00000115), to be approved by Sydney Metro and the Independent Environmental Representative prior to works.

Section 5 of the Utilities Management Framework (UMF) includes several typical mitigation measures that are to be implemented for utility work. An extract from the UMF containing these measures is included within Appendix C. Systems Connect will implement these measures, where appropriate to the LW scope.

In addition, Systems Connect has undertaken a risk analysis, based on the LW S2B scope and other risk factors known from Systems Connect's experience on previous projects to develop key mitigation measures. A summary of these key mitigation measures is included within the risk assessment below.

4.1 Risk assessment criteria

The risk assessment criteria has been developed as per the Risk Management Plan (SMCSWLWC-SYC-1NL-PM-PLN-000021). Qualitative measures are used to estimate the consequence or impact of an event, along with the estimate of likelihood, to produce consistent risk rankings across the identified risks. These values are described in **Error! Reference source not found.** and **Error! Reference source not found.** below.

Table 3: Likelihood criteria

Risk Likelihood Table						
Rating	L6	L5	L4	L3	L2	L1
Descriptor/ Definition	Almost Unprecedented	Very Unlikely	Unlikely	Likely	Very Likely	Almost Certain
Qualitative Expectation	Not expected to ever occur during time of activity or project	Not expected to occur during the time of activity or project	More likely not to occur than occur during the time of activity or project	More likely to occur than not occur during time of activity or project	Expected to occur occasionally during time of activity or project	Expected to occur frequently during time of activity or project
Quantitative Frequency	Less than once every 100 years	Once every 10 to 100 years	Once every 1 to 10 years	Once each year	1-10 times every year	10 times or more every year

Table 4: Consequence criteria

Consequence Table		
Rating	Descriptor	Environment Consequence
C6	Insignificant	No appreciable changes to environment and/or highly localised event
C5	Minor	Change from normal conditions within environmental regulatory limits and environmental effects are within site boundaries
C4	Moderate	Short term and/or well contained environmental effects. Minor remedial actions probably required
C3	Major	Impacts external ecosystem and considerable remediation is required
C2	Severe	Long-term environmental impairment in neighboring or valued ecosystems. Extensive remediation required.
C1	Catastrophic	Irreversible large-scale environmental impact with loss of valued ecosystems.

A Risk Matrix (Table) is used to evaluate the severity of the risk for each environmental aspect. As shown, the matrix axis are those of likelihood and consequence using the measures given above. A scale of consequences from A to D is used to indicate decreasing severity. The consequences are potential outcomes as a result of a hazard occurring.

Table 5 - Risk matrix

Risk Matrix Evaluation Table								
Risk Ratings A = Very High (31 – 36) B = High (22 – 30) C = Medium (11 – 21) D = Low (1 – 10)			Consequence					
			Insignificant	Minor	Moderate	Major	Severe	Catastrophic
			C6	C5	C4	C3	C2	C1
Likelihood	Almost Certain	L1	20	22	29	32	34	36
	Very Likely	L2	14	18	23	28	31	35
	Likely	L3	9	12	16	24	27	33
	Unlikely	L4	6	7	11	17	25	30
	Very Unlikely	L5	3	4	8	13	19	26
	Almost Unprecedented	L6	1	2	5	10	15	21

Aspect	Potential Environmental Impact	Control Measures	Likelihood	Consequence	Risk
Air Quality					
Dust generation from utility works, site establishment, excavations	<ul style="list-style-type: none"> Dust activity in close proximity to residential and commercial premises impacting air quality for the community Complaints received 	<ul style="list-style-type: none"> Implement the controls within the Air Quality Management Sub-Plan (SMCSWLWC-SYC-1NL-PM-PLN-000373) or relevant Pre-Construction Minor Works Approval. Toolbox training on Dust and Air Quality Management. Provide dust mitigation measures through water sprays/misting as required. Cover stockpiles that are not to be worked on for a period of greater than 10 days. Erosion and Sediment Control Plans approved before works commence. Controls reviewed as works progress. 	Likely	Minor	12
Exhaust from plant and equipment	<ul style="list-style-type: none"> Emissions from plant associated with utility works resulting in air pollution 	<ul style="list-style-type: none"> Implement the controls within the Air Quality Management Sub-Plan (SMCSWLWC-SYC-1NL-PM-PLN-000373) or relevant Pre-Construction Minor Works Approval. Inductions and toolbox training on Dust and Air Quality Management. Well maintained plant/ equipment, pre-start checks and servicing. Non-complaint vehicles removed from site / repaired. 	Unlikely	Minor	7
Noise					
Noise from general utility works resulting in impact to residents	<ul style="list-style-type: none"> Disturbance to residents or neighboring businesses. Potential for complaints 	<ul style="list-style-type: none"> Control measures as per Construction Noise and Vibration Management Plan C2B (SMCSWLWC-SYC-1NL-PM-PLN-000032) or relevant Pre-Construction Minor Works Approval are to be implemented. Respond to community enquiries and complaints in accordance with Sydney Metro requirements and Community & Stakeholder Manager (Sydney Metro) Control measures as per Community Communication Strategy (CCS) are to be implemented Consult with the community in relation to upcoming activities that may result in concern. Monitor noise for compliance as the works progress at receiver locations. Provide periods of respite for high noise generating activities. 	Unlikely	Minor	7

Aspect	Potential Environmental Impact	Control Measures	Likelihood	Consequence	Risk
		<ul style="list-style-type: none"> Apply noise mitigation measures during for the duration of the project Noise efficient equipment to be used on site 			
Noise during utility works required to be undertaken outside of standard construction hours.	<ul style="list-style-type: none"> Disturbance to residents or neighboring businesses with potential for complaints 	<ul style="list-style-type: none"> Implement noise mitigation strategies for out of standard hours work as defined in the Construction Noise and Vibration Management Plan C2B (SMCSWLWC-SYC-1NL-PM-PLN-000032) Monitor noise for compliance to project goals. Obtain Out of Hours Work Approval as required. Control Measures as per the CNVMP are to be implemented. 	Unlikely	Moderate	11
Vibration					
Vibration intensive activities undertaken on the site such as vibratory rolling, etc.	<ul style="list-style-type: none"> Disruption, annoyance and nuisance to residents. Potential damage to adjacent residential and commercial residences and structures. Disruption to businesses as a result of vibration nuisance 	<ul style="list-style-type: none"> Control Measures as per the CNVMP (SMCSWLWC-SYC-1NL-PM-PLN-000032) or relevant Pre-Construction Minor Works Approval are to be implemented. Determine vibration limits and structure/receiver offset distances. Consult with potentially affected parties prior to commencement of works on their upcoming activities that may be impacted by construction vibration. Ongoing vibration monitoring during vibration intensive works. 	Unlikely	Minor	7
Traffic and Access					
Loss of on-street car parking in adjacent residential streets and commercial areas during construction	<ul style="list-style-type: none"> Loss of parking availability to adjacent residential and commercial properties due to utility works could result in community complaints. 	<ul style="list-style-type: none"> Implement the Construction Traffic Management Plan (CTMP) Community notifications in accordance with Sydney Metro Community Communication Strategy. Site vehicles shall be parked within the rail corridor (or within the site boundaries) and not affect public parking area where possible Develop Traffic Management Plan / Traffic control procedures. 	Likely	Minor	12
General construction traffic disturbing public access between local roads.	<ul style="list-style-type: none"> Disturbance to local residents due to utility works resulting in complaints being made, limited access, and potential 	<ul style="list-style-type: none"> Implement the Construction Traffic Management Plan (CTMP) Deliveries of plant and materials shall be undertaken outside of peak periods where possible Site vehicles shall be parked within the site boundaries and not affect public parking areas 	Unlikely	Minor	7

Aspect	Potential Environmental Impact	Control Measures	Likelihood	Consequence	Risk
	for delays at local road access points resulting in complaints.	<ul style="list-style-type: none"> Scheduled road movements shall be minimised where possible Oversized deliveries would be undertaken in accordance with the requirements of NSW Police or Roads and Maritime Services. Approved Traffic Management Plans in consultation with relevant authorities. Detour routes to be advertised/ notified. Approved access routes, detailed Traffic Control Plans. Clear notifications / signage. 			
Management of heavy vehicles / access routes.	<ul style="list-style-type: none"> Complaints from sensitive receivers due to increased level and frequency of noise 	<ul style="list-style-type: none"> Implement the Construction Traffic Management Plan (CTMP) Deliveries of plant and materials shall be undertaken outside of peak periods where possible Site vehicles shall be parked within the construction boundaries and not affect public parking areas Scheduled road movements shall be minimised where possible Oversized deliveries would be undertaken in accordance with the requirements of NSW Police or Roads and Maritime Services. Designated access routes. Approved Traffic Management Plans. Community Notifications. Pedestrian management with traffic controller in place where required. 	Likely	Minor	12
Pedestrian/Cyclist access	<ul style="list-style-type: none"> Loss or disruption of pedestrian and/or cyclist access around the project site due to utility works 	<ul style="list-style-type: none"> Construction Traffic Management Plan (CTMP) to be in place Traffic Control Plans to be in place Clear signage Appropriate barriers, fencing or other to direct pedestrians and cyclists 	Unlikely	Minor	7
Landscaping, urban design and visual amenity					
Landscaping, urban design and visual amenity	<ul style="list-style-type: none"> Surrounding aesthetic temporary altered during construction Lighting towers used during out of hours works may spill on nearby residents Post-construction surfaces 	<ul style="list-style-type: none"> Implement the Visual Amenity Management Sub-Plan (SCLW-SYC-1NL-PM-PLN-000376) The work area shall be maintained in an orderly manner Housekeeping will be monitored on a regular basis Lighting required during night works shall be directed towards the work area and away from adjacent sensitive receivers Any land disturbed for the works will be restored to its prior state or, where appropriate, restored to a state that is in line with the 	Very Unlikely	Minor	4

Aspect	Potential Environmental Impact	Control Measures	Likelihood	Consequence	Risk
		approved urban design, contract requirements and/or Council requirements.			
Utilities					
Utility management	<ul style="list-style-type: none"> Service strike leading to environmental degradation 	<ul style="list-style-type: none"> Develop and implement the Utilities Management Strategy in accordance with the Sydney Metro Utilities Management Framework Implement a Permit to excavate and penetrate Induction and toolbox talks Detailed Site Survey to be managed by an appropriately qualified surveyor Site specific risks identified in in the relevant Work Pack 	Very Unlikely	Moderate	8
Hazard and Risk					
Hazards and risk associated with utility works	<ul style="list-style-type: none"> Hazardous substances High risk works Exposure to radiation and electromagnetic fields 	<ul style="list-style-type: none"> Work in accordance with the Project Health and Safety Management Plan (SMCSWLWC-SYC-1NL-PM-PLN-000010) Develop a Safe Work Method Statement (SWMS) for high risk works, works with hazardous substances or where anyone may be exposed to radiation or electromagnetic field issues. An occupational hygienist is review and supervise works as required. Specific risks will be identified in the relevant CAP and Work Pack. Pre-start meetings will highlight any high risk works and key general risks 	Unlikely	Moderate	11
Heritage					
Non-aboriginal heritage	<ul style="list-style-type: none"> Impacts to build items and structures with heritage significance Impacts to areas of archaeological potential Unexpected finds potentially leading to damage or relics 	<ul style="list-style-type: none"> Implement the mitigation measures included within the Heritage Management Sub-Plan (SCLW-SYC-1NL-PM-PLN-000375) or relevant Pre-Construction Minor Works Approval. Work to plant specific safe working distances for vibratory works and seek the advice of a heritage engineer. Implement the Unexpected Finds Heritage and Human Remains Procedure (SMCSWLWC-SYC-1NL-EM-PRO-000389) 	Very Unlikely	Moderate	8

Aspect	Potential Environmental Impact	Control Measures	Likelihood	Consequence	Risk
Aboriginal heritage		<ul style="list-style-type: none">Specialist consultant to manage heritage unexpected finds			8
	<ul style="list-style-type: none">Impacts to areas of archaeological potentialUnexpected finds potentially leading to heritage damage	<ul style="list-style-type: none">Implement the mitigation measures included within the Heritage Management Sub-Plan (SCLW-SYC-1NL-PM-PLN-000375) or relevant Pre-Construction Minor Works Approval.Implement the Unexpected Finds Heritage and Human Remains Procedure (SMCSWLWC-SYC-1NL-EM-PRO-000389)Specialist consultant to manage heritage unexpected finds	Very Unlikely	Moderate	
Flora, Fauna and Biodiversity					
Flora	<ul style="list-style-type: none">Unauthorised clearing of vegetationImpacting on threatened species, threatened vegetation communities or fauna habitat	<ul style="list-style-type: none">Implements the measures within the Flora, Fauna and Biodiversity Management Sub-Plan (SMCSWLWC-SYC-CSW-EM-PLN-002579) or relevant Pre-Construction Minor Works Approval.Implement a Permit to Clear Land or Vegetation systemIdentify all sensitive areas, sign post and demarcateEstablish tree protection zonesAn ecologist is to undertake a pre-clearance survey of all vegetation to be removed.An ecologist is to be present during the removal of native vegetation or fauna habitat.Site Environment Plans (SEPs) will identify tree protection zones and any sensitive areasToolbox training on management of flora and fauna during construction	Unlikely	Moderate	11
Fauna	<ul style="list-style-type: none">Impacting on fauna	<ul style="list-style-type: none">Implements the measures within the Flora, Fauna and Biodiversity Management Sub-Plan (SMCSWLWC-SYC-CSW-EM-PLN-002579) or relevant Pre-Construction Minor Works Approval.Implement Flora and Fauna Unexpected Finds Procedure (SMCSWLWC-SYC-1NL-EM-PRO-000386)Implement a Permit to Clear Land or Vegetation systemIdentify all sensitive areas, sign post and demarcateEstablish tree protection zonesAn ecologist is to undertake a pre-clearance survey of all vegetation to be removed.	Very Unlikely	Moderate	8

Aspect	Potential Environmental Impact	Control Measures	Likelihood	Consequence	Risk
		<ul style="list-style-type: none"> An ecologist is to be present during the removal of native vegetation or fauna habitat. Site Environment Plans (SEPs) will identify tree protection zones and any sensitive areas Toolbox training on management of flora and fauna during construction 			
Land Use and Property					
Land use and Property	<ul style="list-style-type: none"> Changes to land use and property impacts Construction compounds impacting on nearby receivers Works through easements 	<ul style="list-style-type: none"> Design to avoid impacts to nearby properties Obtain required approvals for working within easements Council and community consultation as required 	Unlikely	Minor	7
Soils and Contamination					
Soils and contamination	<ul style="list-style-type: none"> Encountering contamination Creating contamination through utility works Acid Sulphate Soils 	<ul style="list-style-type: none"> Works to occur in accordance with Soil, Water and Groundwater Management Sub-Plan (SMCSWLWC-SYC-1NL-PM-PLN-000372) or relevant Pre-Construction Minor Works Approval. Implement Unexpected Finds Soil Contamination and Asbestos Procedure (SMCSWLWC-SYC-1NL-EM-PRO-000388) and Waste Management and Recycling Procedure (SMCSWLWC-SYC-1NL-EM-PRO-000399) All waste is to be classified in Accordance with the Waste Classification Guidelines (NSW EPA, 2014) Acid Sulphate Soils are to be managed in accordance with the Acid Sulfate Soil Manual (ASSMAC, 1998) An occupational hygienist is to provide guidance and, where appropriate, supervise works with contaminated soils or substances Remove any excess hazardous substances from services before relocating 	Unlikely	Moderate	11
Waste and Recycling					

Aspect	Potential Environmental Impact	Control Measures	Likelihood	Consequence	Risk
Waste generation and management during utilities works	<ul style="list-style-type: none"> Inadequate waste management and disposal leading to pollution Regulatory actions Litter affecting neighbors 	<ul style="list-style-type: none"> Waste, Recycling and Spoil Management Sub-Plan (SMCSWLWC-SYC-1NL-PM-PLN-000374) Waste Management and Recycling Procedure (SMCSWLWC-SYC-1NL-EM-PRO-000399) Spoil Classification Reuse and Recycling Procedure (SMCSWLWC-SYC-1NL-EM-PRO-000461) Induction included waste management requirements Toolbox training of workforce on waste management practices All waste will be tracked and records kept Regular monitoring of housekeeping 	Very Unlikely	Moderate	8

Appendix A – Areas of Interest



Figure 3: Campsie BSP route - North



Figure 4: Campsie BSP route – South



Figure 5: Dulwich Hill traction substation location

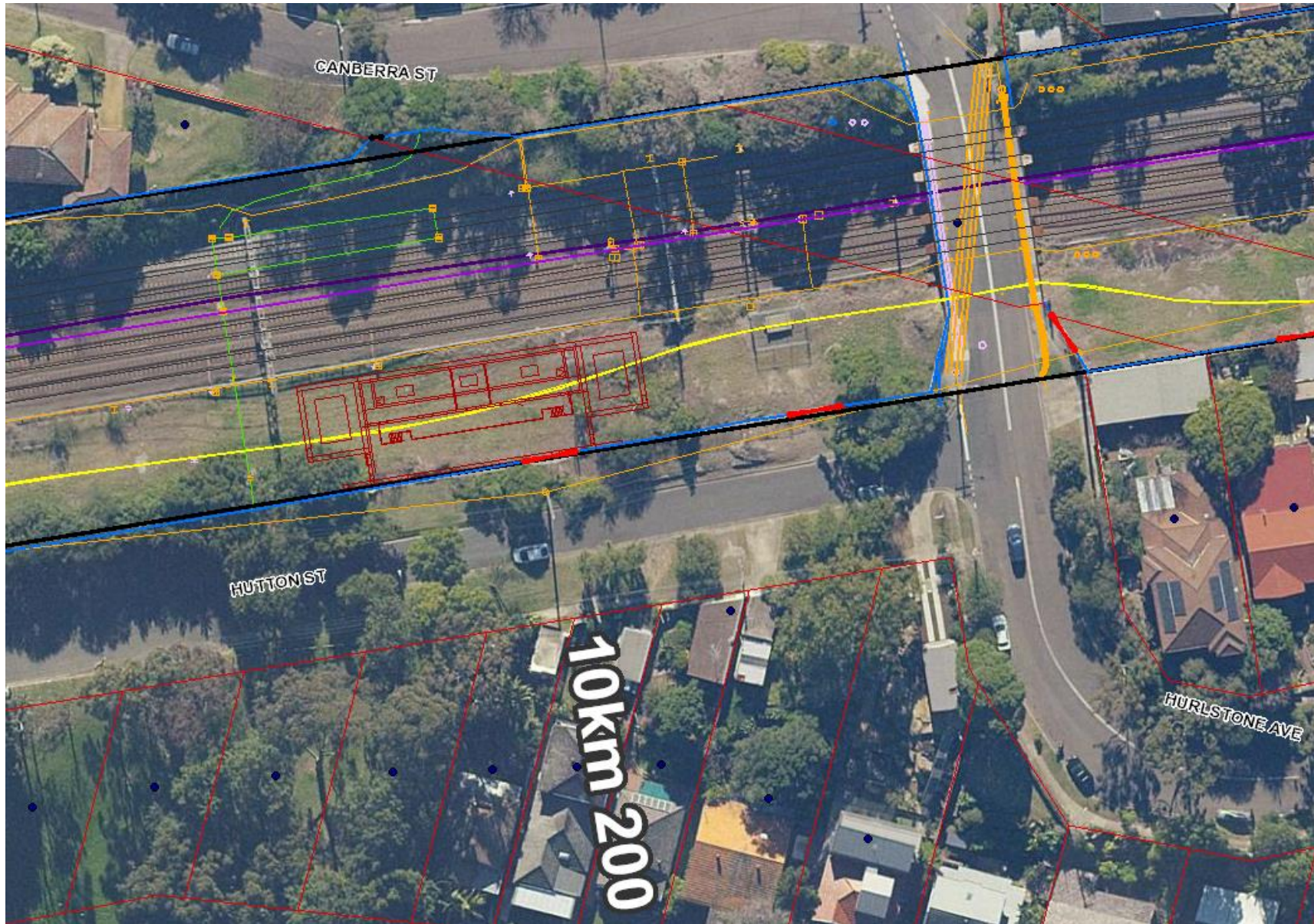


Figure 6: Canterbury traction substation location



Figure 7: Campsie traction substation location



Figure 8: Lakemba traction substation location



Figure 9: Punchbowl traction substation location

Appendix B – Summary of Proposed Utility Works for the Bulk Power Supply Works

Section 1

Section	Utility Service	Location	Asset Type	Description	Parallel Crossing /	Control Index	Proposed Management Measures
1	Qenos (Freyssinet)	Rail corridor	High Pressure gas pipeline	150mm line managed by Freyssinet. Runs in rail corridor, parallel to South Pde.	Crossing	2	To be discussed with asset owner. Potentially line redundant
1	Ausgrid	Lilian Ln	Electrical / LV Cables	LV Cables running along Lilian St	Parallel	1	No impact
1	Ausgrid	Lilian Ln near Dewar St	Electrical / LV and HV Cables	LV Cables running along Lilian St	Parallel	3	Protect
1	Ausgrid	Lilian Ln near Dewar St	LV and HV Cables	LV Cables running along Lilian St to a UGOH	Parallel	3	Protect
1	Ausgrid	Lilian St / Dewar St	Electrical / LV Cables	LV cables crossing Lilian St	Crossing	2	Protect and feeders go under
1	Ausgrid	Lilian St / Dewar St	Electrical / HV Cables in	33kv transmission cables	Crossing	2	Protect and go under. Feeder to go deeper
1	Sydney Water	Lilian Ln parallel	Water	150 DICL water pipe parallel	Parallel	1	No impact
1	Sydney Water	Lilian Ln parallel	Sewer	225 Sewer VC running parallel along Lilian Ln	Parallel	3	Protect – separation non-compliance. Feeder bank to be redesigned via consult with SW and under BOA approval
1	Sydney Water	Dewar St crossing Lilian St	Sewer	225 Sewer VC	Crossing	1	No impact
1	Sydney Water	Lilian St parallel	Water	100 CICL water pipe	Parallel	1	No impact
1	Sydney Water	Lilian St crossing	Stormwater	1520x1520 Reinforced concrete stormwater crossing Lilian St	Crossing	3	Protect service. Feeders to be in flat formation and go over with reduced cover
1	NBN Co	Lilian St crossing at Dewar St	Conduits	50mm PVC conduits	Crossing	2	protect and go under
1	Stormwater	Lilian St crossing West of Dewar St	Culvert	1580x1600 stormwater culvert	Crossing	3	Protect and feeders to go in flat formation. Reduced cover arrangement requires mechanical protection

Section 2

Section	Utility Service	Location	Asset Type	Description	Parallel Crossing /	Control Index	Proposed Management Measures
2	Ausgrid	South Pde / Beamish Lane	Electrical / LV and HV Cables	1x UGOH on northern side of South Ave, 1x street light, 1x11KV HV, 1 UGOH, out of service street light crossing	Crossing	2	Protect and go under. Feeder to go deeper
2	Ausgrid	South Pde/ Beamish St	Electrical / LV and HV Cables	1x 400V LV cable, 4x 11KV feeder cables, 1 Out of service 11kv feeder, 1x Comms pilot cable	Crossing	2	Protect and go under. Feeder to go deeper
2	Ausgrid	South Pde	Electrical / HV Cables	Along footpath opposite to rail corridor	Parallel	1	No impact
2	Ausgrid	Corner of Lilian Ln / Beamish St	Electrical / LV Cables	LV Cables	Parallel	2	protect
2	Jemena	Beamish St crossing near South Pde	Gas / low pressure	150mm steel sleeve	Crossing	2	protect and go under
2	Jemena	Beamish St crossing near Lilian St	Gas / low pressure	100mm steel sleeve	Crossing	2	protect and go under
2	Sydney Water	Beamish St crossing	Water	150 CICL water pipe	Crossing	2	Protect and feeders go under
2	Sydney Water	Beamish St crossing	Water	200 CICL water pipe	Crossing	2	Protect and feeders go under
2	NBN Co	South Pde crossing east of Beamish St	Conduits	Conduit crossing, Beamish St and Beamish Ln	Crossing	2	protect and go under
2	NBN Co	South Pde crossing at Beamish Rd	Conduits	100mm Telstra PVC and asbestos conduits	Crossing	2	protect and go under
2	NBN Co	Lilian Ln crossing at Beamish St	Conduits	Telstra 100mm & 50mm PVC conduits	Crossing	2	protect and go under
2	Telstra	South Pde crossing at Beamish St	Conduits	100mm PVC and asbestos conduits	Crossing	2	protect and go under
2	Telstra	South Pde crossing at Lilian St	Conduits	100mm & 50mm PVC conduits	Crossing	2	protect and go under
2	Stormwater	South Pde crossing at Harold St	RC pipe	375mm Stormwater	Crossing	2	Protect and feeders go under stormwater
2	Stormwater	South Pde crossing at Beamish Ln	RC pipe	375mm Stormwater	Crossing	2	Protect and feeders go under stormwater

Section 3

Section	Utility Service	Location	Asset Type	Description	Parallel Crossing /	Control Index	Proposed Management Measures
3	Ausgrid	South Pde near Gould St	Electrical / LV Cables	LV Crossings along South Pde	Crossing	2	Protect and go under
3	Ausgrid	South Pde	Electrical / HV Cables	Along footpath on rail corridor side	Parallel	1	No impact
3	Ausgrid	South Pde and Park St	Electrical / HV Cables	33KV transmission feeders	Crossing	2	Protect and go under. Feeder to go deeper
3	Ausgrid	South Pde / Duke St	Electrical / HV Cables	1x 11kV HV cable, 1x pilot Cable	Crossing	2	Protect and go under
3	NBN Co	South Pde crossing at Park St	Conduits	100mm Telstra PVC conduits bank	Crossing	2	protect and go under or over in flat arrangement - design to be updated
3	Stormwater	South Pde crossing at Gould St	RC pipe	375mm Stormwater	Crossing	2	Protect and feeders go under stormwater
3	Stormwater	South Pde crossing at Park St	RC pipe	375mm Stormwater	Crossing	2	Protect and feeders go under stormwater
3	Stormwater	South Pde crossing at duke St	RC pipe	375mm Stormwater	Crossing	2	Protect and feeders go under stormwater

Section 4

Section	Utility Service	Location	Asset Type	Description	Parallel Crossing /	Control Index	Proposed Management Measures
4	Ausgrid	Gould St / Redman St Intersection	Electrical / LV & HV Cables	LV and HV cables crossings in Gould St	Crossing	2	Protect and go under. Feeder to go deeper
4	Ausgrid	Gould St / Evaline St crossing	Electrical / HV cable	HV cable crossing Gould St - potentially direct buried	Crossing	2	Protect and go under. May have to run feeders lower
4	Jemena	Gould St crossing at Evaline St	Gas / low pressure	100mm steel sleeve crossing Gould St at Evaline St	Crossing	2	Protect and go under
4	Jemena	South Pde crossing at Gould St	Gas / low pressure	150mm steel sleeve crossing Gould St and South Pde	Crossing	2	Protect and go under

4	Sydney Water	Evaline St crossing Gould St	Sewer	225 Sewer VC crossing	Crossing	1	No impact
4	Sydney Water	South Pde crossing at Gould St	Water	100 CICL	Crossing	1	Feeders go under
4	Sydney Water	South Pde	Water	100 CICL	Parallel	1	No impact
4	Sydney Water	Park St crossing South Pde	Sewer	1500 RC pipe	Crossing	2	Protect and feeders go over
4	NBN Co	Gould St crossing at South Pde	Conduits	100mm PVC conduit	Crossing	2	Protect and go under
4	Stormwater	Gould St crossing at Evaline St	RC pipe	375mm Stormwater	Crossing	2	Protect and feeders go under stormwater

Section 5

Section	Utility Service	Existing Location	Asset Type	Size (mm)	Parallel Crossing /	Control Index	Proposed Management Measures
5	Ausgrid	Gould St / Redman St Intersection	Electrical / LV & HV Cables	LV and HV cables in the footpath area	Parallel	1	No impact
5	Sydney Water	Gould St between Canterbury Rd and Emu St	Water	200 CICL	Crossing & Parallel	1	No impact
5	Sydney Water	Gould St between Canterbury Rd and Emu St	Sewer	225 EW pipe	Parallel	1	No impact
5	Sydney Water	Emu St crossing Gould St	Water	100 CICL	Crossing	1	No impact
5	Sydney Water	Emu St crossing Gould St	Sewer	150 VC pipe	Crossing	1	No impact
5	Sydney Water	Emu Ln crossing Gould St	Sewer	225 EW pipe	Crossing	2	Protect and feeders go over and reduced cover for feeders
5	Sydney Water	Waratah St crossing Gould St	Water	150 Ductile iron cement lined (DICL)	Crossing	1	No impact
5	Sydney Water	Waratah Ln crossing Gould St	Sewer	225 EW pipe	Crossing	1	No impact

5	Sydney Water	Gould St between Emu St and Redman St	Water	150 & 200 CICL and DICL pipes	Parallel	1	No impact
5	Sydney Water	Redman St crossing Gould St	Water	100 CICL	Crossing	1	No impact
5	Sydney Water	Gould St between Redman St and South Pde	Water	100 CICL water pipe	Parallel	1	No impact
5	Sydney Water	Gould St between Redman St and South Pde	Water	200 CICL water pipe	Parallel	1	No impact
5	Sydney Water	Gould St between Redman St and South Pde	Sewer	225 Sewer VC closer to footpath	Parallel	1	No impact
5	Telstra	Gould St crossing at Clunes Ln	Conduits	35mm PVC conduit	Crossing	2	protect and go under
5	Telstra	Gould St crossing at Waratah St	Conduits	100mm Asbestos conduit	Crossing	2	protect and go under
5	Telstra	Gould St crossing at Redman St	Conduits	100mm asbestos Conduits	Crossing	2	protect and go under
5	Telstra	Gould St crossing north of Redman St	Conduits	100mm Asbestos conduit	Crossing	2	protect and go under
5	Telstra	South Pde crossing at Park St	Conduits	100mm PVC conduit bank	Crossing	2	protect and go under or over in flat arrangement
5	NBN Co	Gould St crossing at Clunes Ln	Conduits	100mmm Telstra PVC conduit	Crossing	2	Protect and go under
5	NBN Co	Gould St crossing at Waratah St	Conduits	100mm Telstra Asbestos conduit	Crossing	2	Protect and go under
5	NBN Co	Gould St crossing at Redman St	Conduits	100mm Telstra asbestos Conduit	Crossing	2	Protect and go under
5	NBN Co	Gould St crossing north of Redman St	Conduits	100mm Telstra Asbestos conduit	Crossing	2	Protect and go under
5	Stormwater	Gould St crossing north of Redman St	RC pipe	1200mm Stormwater	Crossing	1	Protect and feeders go under stormwater

Section 6

Section	Utility Service	Existing Location	Asset Type	Size (mm)	Parallel Crossing /	Control Index	Proposed Management Measures
6	Ausgrid	Cooks Ave near Canterbury Rd	Electrical / LV Cables	5x150mm PVC & 1x50mm PVC	Parallel	1	No impact
6	Ausgrid	Canterbury Rd / Cooks Ave intersection	Electrical / LV Cables	1x 400V LV cable in 125 PVC conduits	Crossing	2	Protect and go under
6	Ausgrid	Canterbury Rd / Cooks Ave intersection	Electrical / HV Cables in	5x 11KV HV feeder cables, 3x 125PVC conduits, 2x LV cable to UGOH's	Crossing	2	Protect and go under. Feeder to go deeper
6	Ausgrid	Canterbury Rd / Cooks Ave intersection	Electrical / HV Cables in	2 x 33KV HV transmission cables, 2x pilot comms cables	Crossing & Parallel	2	Protect and go under. Feeder to go deeper
6	Ausgrid	#2 & #4 Cooks Ave	Electrical / LV Cable	1x 400V LV cable to UGOH near #4 cooks Rd	Parallel	1	No impact
6	Jemena	Canterbury Rd / Cooks Ave intersection	Gas / low pressure	150mm steel sleeve	Crossing	2	Protect and go under
6	Jemena	Canterbury Rd / near Gould St intersection	Gas / low pressure	300mm steel pipe	Crossing	2	Protect and go under
6	Jemena	Canterbury Rd / near Gould St intersection	Gas / low pressure	100mm steel sleeve	Crossing	2	Protect and go under
6	Sydney Water	Cooks Ave / Canterbury Rd / Gould St	Sewer	1500 RC pipe running diagonally across all three streets	Crossing	1	Protect if necessary and feeders go over
6	Sydney Water	Canterbury Rd / Cooks Ave intersection	Water	300 CICL	Crossing & Parallel	1	Protect and feeders go under
6	Sydney Water	Canterbury Rd / Cooks Ave intersection	Water	450 CICL	Crossing & Parallel	1	protect and feeders go under
6	Stormwater	Canterbury Rd diagonally crossing near Cooks St	RC pipe	750mm Stormwater	Crossing	2	Protect and feeders go under stormwater
6	Telstra	Cooks Ave crossing at Canterbury Rd	Conduits	100mm PVC conduit	Crossing	2	Protect and go under
6	Telstra	Canterbury Rd crossing at Cooks Ave intersection	Conduits	100mm asbestos conduit	Crossing	2	Protect and go under
6	Telstra	Gould St crossing at Canterbury Rd	Conduits	100mm EW and PVC conduits	Crossing	2	Protect and go under

6	NBN Co	Cooks Ave crossing South of Onslow Ln	Conduits	100mm PVC conduit	Crossing	2	Protect and go under
6	NBN Co	Cooks Ave crossing at Canterbury Rd	Conduits	100mm Telstra PVC conduit	Crossing	2	Protect and go under
6	NBN Co	Gould St crossing at Canterbury Rd	Conduits	100mm Telstra EW and PVC conduits	Crossing	2	Protect and go under

Section 7

Section	Utility Service	Existing Location	Asset Type	Size (mm)	Parallel Crossing /	Control Index	Proposed Management Measures
7	Ausgrid	Cooks Ave/Lorking St and High St intersection	Electrical / HV Cables in	33KV transmission feeders, 3x 33KV Feeder cables, 3x Pilot cables	Crossing & Parallel	2	Protect and go under. May have to run feeders lower
7	Ausgrid	Rd crossing Cooks Ave/Lorking St	Electrical / HV Cable	1x 11KV HV Cable	Crossing	2	Protect and go under
7	Ausgrid	Cooks Ave crossing near Onslow Ln	Electrical / LV Cable	1x 400V LV cable in 4x 125 PVC conduits	Crossing	2	Protect and go under
7	Jemena	Cooks Ave crossing near Lorking St	Gas / low pressure	100mm steel sleeve	Crossing	2	protect and go under
7	Jemena	Cooks Ave crossing near Mons St	Gas / low pressure	80mm steel sleeve	Crossing	2	protect and go under
7	Jemena	Cooks Ave crossing near Short St	Gas / low pressure	100mm steel sleeve	Crossing	2	protect and go under
7	Sydney Water	Along Cooks Ave	Water	100mm CICL	Parallel	1	No impact
7	Sydney Water	Crossing Cooks Ave near Short St	Sewer	300mm SGW (salt glazed ware) pipe running at an angle across Cooks Ave	Crossing	1	Protect and feeders go over
7	Sydney Water	Crossing #20 Cooks Ave	Sewer	225 EW pipe crossing Cooks Ave	Crossing	3	Protect and feeders go over and reduced cover for feeders
7	Sydney Water	Along Cooks Ave	Water	125 PE poly pipe - parallel from #15 Cooks Ave to Canterbury Rd	Parallel	1	No impact
7	Sydney Water	Crossing Cooks Ave near Cooks Ln	Sewer	225 PVC pipe	Crossing	1	Protect and feeders go over

7	Stormwater	Cooks Ave near Short St crossing	RC pipe	1050mm Stormwater	Crossing	1	Protect and feeders go under stormwater
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Section 8

Section	Utility Service	Existing Location	Asset Type	Description	Parallel Crossing /	Control Index	Proposed Management Measure
8	Ausgrid	Anzac St	Electrical / HV Cables in	33KV Transmission feeder cables, 3x 33KV Feeder cables, 4x Pilot cables	Parallel	1	No impact
8	Jemena	High St crossing near Anzac St	Gas / low pressure	100mm steel sleeve with 75mm nylon inside	Crossing	2	Protect and go under
8	Jemena	Cooks Ave crossing near High ST	Gas / low pressure	80mm steel sleeve	Crossing	2	Protect and go under
8	Sydney Water	Crossing Anzac St	Sewer	225 SGW (salt glazed ware) pipe crossing at end of Anzac St	Crossing	1	Protect and feeders go over and reduced cover for feeders
8	Sydney Water	Along Anzac St	Water	100mm CICL	Parallel	1	No impact
8	Sydney Water	Along High St	Water	100 CICL	Parallel	1	No impact
8	Sydney Water	Along High St	Water	100 CICL	Crossing	1	No impact
8	Telstra	Anzac St crossing at High St	Conduits	2x100mm PVC conduits	Crossing	2	Protect and go under
8	Telstra	High St crossing at Anzac St	Conduits	50mm & 35mm PVC conduits	Crossing	2	Protect and go under
8	NBN Co	Anzac St crossing at High St	Conduits	2x100mm Telstra & 2x100mm PVC conduits	Crossing	2	Protect and go under
8	NBN Co	High St crossing at Anzac St	Conduits	35mm Telstra PVC conduits	Crossing	2	Protect and go under

Section 9

Section	Utility Service	Existing Location	Asset Type / Sub-type	Description	Parallel Crossing /	Control Index	Proposed Management Measures
9	Sydney Water	Along North side of Canterbury Sub	Sewer	225 SGW pipe	Crossing	3	Protect and feeders go over and reduced cover for feeders
9	Sydney Water	North side of Canterbury Sub	Sewer	750 RC pipe running along north side of substation	Crossing	1	Protect and feeders go over
9	Sydney Water	Running through	Stormwater	7315x1676 Cup and Saucer Ck open channel	Crossing	3	Cable bridge with feeders over. RL subject to flood study information

Entire route

Section	Utility Service	Existing Location	Asset Type / Sub-type	Description	Parallel Crossing /	Control Index	Proposed Management Measure
ALL	Jemena	Multiple locations throughout feeder route	Gas / domestic connections	Domestic crossings to dwellings	Crossing	2	Protect and go under
ALL	Jemena	Multiple locations throughout feeder route	Gas / low pressure	Gas mains parallel to conduit route	Parallel	1	No impact
ALL	Sydney Water	Multiple locations throughout feeder route	Water / Sewer	Metal parallel services	Parallel	1	No impact
ALL	Telstra	Multiple locations throughout feeder route	Conduits	Comms in parallel	Parallel	1	No impact

Appendix C – Utility Management Framework Measures

Sydney Metro

(Uncontrolled when printed)



Environmental aspect	Typical mitigation measures to be adopted as required
Traffic and access	<p>During detailed design:</p> <ul style="list-style-type: none"> • Road occupancy licence(s) for temporary closure of roads would be obtained prior to construction, where required, from the relevant road authority. • A Traffic Control Plan would be developed during detailed design and would identify all traffic control arrangements required to be implemented during construction. • To keep the road user delays to a minimum, all works would be planned and staged to avoid road occupancies during peak periods, where possible. • An emergency response plan would be developed for construction traffic incidents. • A pre and post-construction assessment of road pavement assets would be conducted in areas likely to be used by construction traffic or disturbed by the proposed trenching and HDD activities. <p>During construction:</p> <ul style="list-style-type: none"> • Heavy vehicles would be restricted to allowable routes. • Where schools or child care centres occur in the immediate vicinity of the construction sites, heavy vehicle movement would be minimised (where reasonable and feasible), between 8 am and 9.30 am and 2.30 pm–400 pm Monday to Friday (on school days). • Traffic controllers would be located at worksite access point(s) as required to direct vehicle movements, vehicle deliveries, pedestrians and cyclists, where required. • Public communications would be conducted to notify the community and local residents of vehicle movements and anticipated effects on the local road network relating to the site works. • Access to all private properties adjacent to the works would be maintained during construction, where possible. Where access is known to be restricted, all proposed changes to existing access arrangements would be discussed with residents and/or businesses prior to the commencement of works. Upon completion of the construction works, the original property access would be reinstated. • Early advanced communication with affected properties would be undertaken to identify alternative arrangements. • During Project inductions, all heavy vehicle drivers would be provided with the emergency response plan for construction traffic incidents. • Project staging, vehicle movement and scheduling, equipment and resourcing would be coordinated to minimise impacts. • Construction vehicle parking would be discouraged on local roads and construction staff encouraged to use public transport, car share, or in some cases workers can park in a designated off-site area and ferried to site via a shuttle bus. • Temporary closure or relocation of any bus stops impacted by the works would be coordinated with bus companies and advertised locally in advance.

Environmental aspect	Typical mitigation measures to be adopted as required
Noise and vibration	<p>During construction:</p> <ul style="list-style-type: none"> • Carry out work mainly during standard construction hours when in the vicinity of residential receivers. • Use a portable barrier (or similar protection) to shield the drilling equipment where works occur in proximity to residential receivers where reasonable and feasible. The height and nature of the barrier would be determined when the equipment selection is finalised. The barrier would be constructed of a material of minimum mass 12 kilograms per metre squared such as 20 millimetre plywood or a proprietary barrier such as Echobarrier. • Provide periods of respite from use of the road saw. • Schedule the use of the road saw to times when the community are less sensitive by avoiding early morning and late evening/night periods, where feasible with respect to the proposed construction methodology. • Inform surrounding residents by mail of planned works prior to the works commencing. • Organise the site to avoid unnecessary use of reversing alarms on vehicles. • Truck drivers to use approved access routes to the site. • Orientate and place water pumps and vacuum trucks away from receivers. • Turn equipment off when not in use and avoid idling machinery or trucks near sensitive receivers. • Utilise vehicles, obstacles and stockpiles on site to provide shielding to receivers, where possible. • Avoid dropping tools or materials from height, striking materials or making metal-metal contact • Operate the excavator in a manner that avoids maximum noise levels associated with striking or shaking the bucket. • Educate workers on the importance of minimising noise and avoid creating short duration high noise level events. • Carry out a survey of sensitive receivers to ensure adequate acoustic performance of façade. <p>During reinstatement/rehabilitation works:</p> <ul style="list-style-type: none"> • Schedule deliveries to be carried out to avoid sensitive periods in the early morning and late evening/night. • Turn equipment off when not in use and avoid idling machinery or trucks near sensitive receivers. • Provide respite periods from tipper and compactor usage. • Select equipment such as a compactor and tipper trucks, based on lower noise emissions and use equipment that has lower noise levels • Inform surrounding residents by mail of planned works prior to the works commencing.
Non Aboriginal heritage	<ul style="list-style-type: none"> • Construction works associated with utilities relocation/adjustment with the potential to impact non Aboriginal heritage would be managed through a Heritage Management Plan that would be prepared for the Sydney Metro Sydenham to Bankstown upgrade project. • The presence or potential presence of a heritage item or archaeological deposit would inform the construction method adopted, for instance underboring using HDD may be preferable to trenching in some sensitive locations.

Environmental aspect	Typical mitigation measures to be adopted as required
Biodiversity	<p>During construction</p> <ul style="list-style-type: none"> Where vegetation clearing is required, pre-clearing surveys would be completed to mitigate potential impacts and identify risks to flora, fauna and habitat prior to construction activities occurring and to identify the presence of any unidentified threatened or endangered species. Where impacts to existing street trees are unavoidable, both the relevant Council and an ecologist or arborist would be consulted prior to removal or pruning of any trees If the removal of any tree with hollows/dead trees/tree stump is unavoidable (subject to detailed design and advice from contractor) further assessment by a qualified ecologist would be undertaken. Any sensitive areas along alignment would be identified during detailed design and/or pre-construction planning activities and would be indicated on a site environmental plan for the proposed works. Protective fencing and environmental signage would be installed as required. Vegetation removal would only be carried out under a permit system. Flora and/or fauna located during works would be subject to a Vegetation Clearing Procedure and/or Fauna Rescue Procedure. Site office, stockpiles, machinery wash down areas, and plant storage areas would be located outside of any ecologically sensitive areas. Fuel (or other chemical) storage would be located outside all identified riparian zones, and at least 10 metres from any retained ecologically sensitive areas onsite.

Environmental aspect	Typical mitigation measures to be adopted as required
Air quality	<p>During construction:</p> <ul style="list-style-type: none"> • Trucks carrying spoil onto or off site are to be covered. • Any stockpiling of materials would be located away from sensitive receivers, where feasible and reasonable, and protected from the elements through barriers or appropriate coverings. • On-going monitoring for dust (e.g. site inspections) would be undertaken during trenching works to assess the effectiveness of mitigation measures. • Water sprays and/or water carts would be used as required for dampening exposed surfaces to control dust generation. • Silt accumulated in sediment control devices (e.g. silt fences and spoon drains) would be removed on a regular basis to prevent dust generation. • Cutting, grinding or sawing equipment (such as for concrete/bitumen surfaces) must only be used in conjunction with suitable dust suppression techniques, such as water sprays or local extraction. • Dust generating activities would be assessed during periods of strong winds and rescheduled, where required. • Exhaust systems of construction plant, vehicles and machinery would be maintained to minimise exhaust emissions to the atmosphere. All equipment and vehicles are to be regularly maintained and records kept of maintenance. • Engines would be switched off when vehicles and plant are not in use, to minimise idling, and refuelling areas would be away from areas of public access and sensitive receivers. • Plant would be well maintained and serviced in accordance with manufacturers' recommendations. • Low emission vehicles and plant fitted with catalysts, diesel particulate filters or similar devices would be used, where feasible and reasonable. • Plant and other machinery (including generators) would be sited away from sensitive receivers, such as dwellings and schools, where feasible and reasonable. • The amount of excavated material stored on site would be minimised, and replaced within the open trench as soon as possible. • Dust generating activities would be assessed during periods of strong winds and rescheduled where required. • Dust complaints would be handled accordance with the complaints handling process in the Community Communication Strategy to be developed by each Sydney Metro Principal Contractor.

Environmental aspect	Typical mitigation measures to be adopted as required
Hazard and risk	<p>With regard to EMF:</p> <ul style="list-style-type: none"> Where practical, site the electrical infrastructure in the carriageway of roads, away from residential property boundaries, so that the magnetic field contribution at and beyond them would be lower. Adopt an underground cable concept rather than overhead lines. Use 3-core cables, which greatly increase the rate at which the magnetic field levels drop off with increasing distance from the source when compared to the single core alternative. Include consideration of public awareness/education as part of community information material to identify the minimal impacts with respect to EMF. <p>General:</p> <ul style="list-style-type: none"> Hazardous substances would only be used onsite as required, in accordance with the manufacturer/ supplier instructions. The use of any hazardous substance that could result in a spill would be undertaken away from drainage or stormwater lines and, wherever possible, within defined bunds Contractors to operate under appropriate Work Health and Safety Plan
Property and land use	<p>During pre-construction:</p> <ul style="list-style-type: none"> In consultation with utility providers, the ongoing maintenance and access requirements would be identified and the potential impact to an existing easement or need for a new easement considered. The proposal would not permanently restrict any future access to residential, commercial, industrial or recreational land uses.
Soils and contamination	<p>During construction:</p> <ul style="list-style-type: none"> All fuels, chemicals and hazardous liquids would be stored in accordance with Australian standards and EPA guidelines. Any refuelling undertaken on site would be undertaken in designated areas only. Spill kits would be available as part of any worksite for use in case of fuels, chemical or other spill(s) which may occur during construction. All spills or leakages would be immediately contained and absorbed. Should any signs of contamination be identified during work within the site, the material would be tested against the National Environment Protection Council's National Environment Protection (Assessment of Site Contamination) Measure 1999, and managed accordingly. Soil excavated in areas with identified surrounding industrial land uses (including former uses) would be assessed for either its potential re-use on-site or classified for waste disposal purposes. If groundwater is encountered during the works, groundwater quality would be investigated and appropriate management measures implemented to avoid further impacts. In the event of unexpected finds of contamination a Contamination Unexpected Finds and Contingency (refer to the CSWMP) procedure would be implemented.

Environmental aspect	Typical mitigation measures to be adopted as required
Landscaping/urban design matters	<p>During construction:</p> <ul style="list-style-type: none"> Visual mitigation measures would be implemented as soon as feasible and practical and remain in place during the construction period. All effort would be made for vegetation to be retained where practical and feasible. Site sheds, where required, would be located to minimise visual impact where it is feasible and reasonable to do so. Hoarding banners for the external faces of hoardings and fences at each construction site would be a non-obtrusive colour, which would comply with the Sydney Metro style guidelines (co-branding). Hoarding would be maintained in an excellent condition with prompt removal of graffiti. No signage, advertising or branding (other than safety signage or other required signage) would be placed on the external face of any hoarding or fence without the prior written approval of TfNSW. Temporary works to be designed and constructed as per the requirements of crime prevention through environmental design. Temporary fencing, walls, and hoarding would be designed and implemented to increase natural surveillance with straight runs. Way finding signage to direct pedestrians, commuters and vehicles around the construction site would be installed as required. The storage of materials and construction machinery would be minimised as far as possible. The site would be maintained in an orderly and tidy fashion through good housekeeping. Cut-off and directed lighting would be used to ensure glare and light spill are minimised lit during night work periods (where this is required).
Aboriginal heritage	<p>During construction</p> <ul style="list-style-type: none"> If suspected Aboriginal objects are located during construction, an archaeologist would be notified to assess the nature and significance of the find. If the find is an Aboriginal object, further investigation and permits may be required before works commence. If the find is an Aboriginal object, then OEH and the relevant Local Aboriginal Land Council (LALC) would be notified. If suspected human skeletal remains were uncovered at any time within the area of the utility works, the following actions would need to be followed: <ul style="list-style-type: none"> immediately cease all excavation activity in the vicinity of the remains notify NSW Police notify OEH via the Environment Line on 131 555 to provide details of the remains and their location no recommencement of activity in the vicinity of the remains unless authorised in writing by OEH