Appendix E

Summary of environmental risk analysis

Description of risk/ element	Potential impacts and consequences	Indicative management measures
Construction risks		
Geology/ geotechnical		
◗ Poor ground conditions ◗ Settlement ◗ Contamination and disposal of contamination ◗ Geological faults	◗ Delays to the construction program ◗ Ground settlement, settlement of adjacent building foundations and potential cracking/structural damage to building structures ◗ Adverse health impacts associated with contamination ◗ Adverse environmental impacts associated with ground contamination ◗ Tunnel collapse	◗ Geotechnical investigations and analysis ◗ Building and tunnel structural design based on interpreted ground conditions and known areas of risk ◗ Dilapidation and basement survey of buildings potentially affected by building works ◗ Contamination studies and management plans to be developed for disposal of contaminated spoil ◗ Alignment design to avoid deep building basements and other structures at risk due to tunnelling ◗ Selection of road header and other specialist equipment to suit likely ground conditions
Hydrogeology/ groundwater		
◗ Groundwater chemistry, treatment and disposal ◗ Groundwater extraction ◗ Potential acid sulphate soils	◗ Contamination issues from potential acid sulphate soils ◗ Contamination of receiving waters ◗ Drawdown of groundwater table ◗ Settlement of building foundations	◗ Geotechnical investigations and analysis ◗ Building and tunnel structural design based on interpreted ground conditions and known areas of risk ◗ Contamination studies and management plans to be developed to deal with the treatment and disposal of groundwater ◗ Similar groundwater treatment system to be installed as is currently operated at the City North and Campbell Street substations.
Erosion and sedimentation		
◗ Erosion and sedimentation ◗ Stormwater runoff and disposal	◗ Pollution of waterways as a result of erosion and sedimentation ◗ Fines and/ or prosecution by DECCW under the POEO Act	◗ Local site controls and management plans ◗ Implementation of checking/maintenance of sedimentation and erosion controls ◗ Water treatment prior to disposal, including collection and analysis of water samples during construction

Ecology		
◗ Groundwater disposal and affect on aquatic habitat in receiving waters	◗ Adverse impacts on aquatic ecology ◗ Turbidity / algae blooms in receiving waters	◗ Water treatment prior to disposal, including collection and analysis of water samples during construction.
Existing/ proposed underground assets		
◗ Building clearances and undermining of existing buildings and other underground services, Cross City Tunnel and Southern Rail Line ◗ Clearances and undermining of existing building basements ◗ Effect on Metro Pitt and CBD Metro Stage 1 tunnel corridors ◗ Offsite service interruptions	◗ Settlement and structural damage to, existing or proposed tunnels, buildings or other underground services ◗ Collapse of existing buildings and other structures ◗ Stray currents ◗ Electrocution ◗ Compromise viability of future development of the Metro Pitt and CBD Metro Stage 1 corridors.	◗ Geotechnical investigations and analysis ◗ Review as-built data and survey from existing underground structures ◗ Building structural design based on interpreted ground conditions ◗ Dilapidation and basement survey of buildings potentially affected by building works ◗ Consultation with Rail Corp and NSW Transport to ensure adequate clearance is provided ◗ Design the project to meet requirements for operation of the substation and accommodate possible future presence of CBD Metro Stage 1 tunnels ◗ Obtain Dial-before-you-dig searches before commencing construction
Noise and vibration / regenerated noise		
◗ Surface construction activity ◗ Ground vibration / regenerated noise ◗ Rock breaking ◗ Traffic / construction plant ◗ Ventilation plant	◗ Structural damage to buildings ◗ Loss of public amenity ◗ Complaints nuisance ◗ Sleep disturbance ◗ Works outside general construction hours (limited to defined works and work periods)	◗ Surface works generally limited to standard construction hours ◗ Limited hours for rock-breaking activities ◗ Noise attenuation measures ◗ Measurement of background levels and noise monitoring during construction works ◗ Community consultation and liaison ◗ Selection of specialist equipment to suit likely ground conditions and minimise regenerated noise ◗ Dilapidation and basement survey of buildings potentially affected by building and tunnelling works ◗ Alignment design to avoid deep building basements and other structures at risk as a result of tunnelling works

Dust / air quality		
◗ Surface works ◗ Shaft and tunnel excavation ◗ Spoil stockpiles, handling and transport ◗ Construction ventilation ◗ Bulk excavation ◗ Equipment exhausts	◗ General health to the public and site workers ◗ Air pollution ◗ General public amenity and comfort ◗ Breach of environmental standards ◗ Public complaints ◗ Potential exposure to asbestos fibres during excavation	◗ Environmental management plans ◗ Dust suppression measures utilised on site ◗ Covering of spoil stockpiles and trucks leaving the site ◗ Filtration/ scrubbers for ventilation plant ◗ Regular maintenance of vehicles/ plant used on site ◗ Monitoring and measurement of air quality during construction works ◗ Management of asbestos in accordance with WorkCover guidelines and Australian Standards ◗ Licensed removal of asbestos
Social issues		
◗ Public perception of risks associated with excavation and tunnelling (ie building collapse, fatalities etc)	◗ Loss of reputation ◗ Increase in complaints on the project ◗ Poor publicity	◗ Community consultation ◗ Planning / information forums / community information plan ◗ Regular project updates
Traffic and transport		
◗ Disruption to local traffic due to haulage routes including spoil disposal ◗ Road dilapidation ◗ Temporary / partial road closures ◗ Loading / unloading materials and equipment ◗ Pedestrians and other road users ◗ Parking ◗ Queuing in the vicinity of construction sites ◗ Disruption to special events	◗ Noise and vibration ◗ Air quality and pollution ◗ General public safety ◗ Sediment tracking onto roads ◗ Complaints and access restrictions to local residents and businesses ◗ Traffic congestion ◗ Damage to roads ◗ Loss or disruption of parking ◗ Impact on pedestrian safety / access ◗ Injury to construction personnel or members of the general public	◗ Selection of appropriate haulage routes ◗ Traffic assessment and route/intersection analysis ◗ Traffic management plans during construction ◗ Restrictions on working hours for loading/unloading of materials ◗ Environmental Management Plans dealing with erosion and sedimentation; truck washes, street cleaning etc ◗ Dilapidation surveys along affected roads/haulage routes in the immediate vicinity of the site ◗ Rerouting of buses and other public transport if required ◗ Consultation with RTA, City of Sydney, NSW Transport, and State Transit ◗ Pedestrian access to be maintained around construction sites

		◗ Signage in and around construction sites ◗ Tunnel entry/egress protocols (e.g. tag board) ◗ Tunnel safety induction ◗ Tunnel communication systems ◗ Establish emergency response and evacuation procedures
Waste management and hazardous materials		
◗ Contamination (surface works) ◗ Inappropriate waste disposal ◗ Hazardous materials associated with demolition of existing assets / buildings	◗ Health and safety of workers and the general public ◗ Environmental harm and contamination as a result of waste disposal ◗ Hazardous materials associated with demolition, such as asbestos, causing damage to the environment or health of employees ◗ Disposal to landfill is an inefficient use of resources such as VENM	◗ Waste management plan to include mitigation measures for control and storage and handling of hazardous materials ◗ Contamination assessment ◗ Assessment of options for re-use and/or recycling of spoil (including VENM) and other waste materials ◗ Treatment and isolation of hazardous materials during construction activities ◗ Management of waste in accordance with DECC Waste Classification Guidelines (2008b) ◗ Assessment of sites for disposal of materials
Heritage and archaeology		
◗ Damage to heritage sites potentially affected by works ◗ Areas of archaeological significance ◗ Buried or unknown heritage items	◗ Damage to heritage buildings and other assets ◗ Delay to works ◗ Legal and statutory issues ◗ Loss of reputation / adverse publicity	◗ Cultural heritage and archaeology assessment ◗ Vibration monitoring during construction, if required ◗ Dilapidation survey of heritage listed buildings ◗ Develop protocols for notification and treatment of impacts on heritage listed structures during construction (eg stop work provisions)
Visual amenity		
◗ Construction sites ◗ Night works / lighting	◗ Complaints ◗ General public disturbance and perception ◗ Potential to delay works	◗ Consultation and planning ◗ Design review ◗ Environmental Management Plans ◗ Placement of hoardings

Urban design		
◗	◗	
CBD Metro Stage 1		
◗ Potential future presence of tunnels for the CBD Metro Stage 1 below the City East Zone Substation	◗ Impact on structural integrity of either the tunnels for the CBD Metro Stage 1 tunnels or the substation	◗ Design of the project in consultation with NSW Transport to preserve the viability and structural integrity of both the substation and the tunnels for the CBD Metro Stage 1 ◗ Develop deed of agreement consultation with Sydney Metro, if necessary
Other risks		
◗ Security	◗ Damage / vandalism to construction sites and equipment ◗ OH&S risks to workers and the general public	◗ Security management plan to be developed as part of the CEMP to restrict public access to worksites
Operating risks		
Structural integrity / settlement		
◗ Settlement ◗ Building or stub tunnel collapse, or other structural failures	◗ Injury or death to occupiers of the building, maintenance workers or the general public ◗ Ground settlement, settlement of building foundations and potential cracking/structural damage to building structure ◗ Damage to electrical assets within the stub tunnel ◗ Disruption to business and general public amenity	◗ Stub tunnel structural design based on interpreted ground conditions and likely permanent groundwater and earth pressure loads during construction ◗ Tunnel lining to be designed to accommodate all in-service loads ◗ Structural inspections to be undertaken regularly throughout the operation phase of the tunnel
Operation noise impacts		
◗ Noise generated from operation of substation	◗ Loss of public amenity ◗ Complaints ◗ Sleep and general public disturbance	◗ Noise generating operational plant to be designed with acoustic enclosures/dampers, if and where required
EMF		

◗ EMF from operation of substation	◗ Negative public perception regarding the effects of EMF	◗ Consultation ◗ Model EMF emissions
Traffic management during operation		
◗ Disruption to traffic flow and pedestrians with vehicles entering and exiting the site ◗ Infrequent delivery of substation material/equipment such as transformers (once in every 10 years)	◗ General public safety ◗ Noise ◗ Air quality and pollution	◗ Traffic control plans to be development in consultation with the appropriate road authority (RTA or City of Sydney Council) if temporary closures are required during delivery of major equipment or maintenance tasks
Groundwater management and stormwater		
◗ Groundwater chemistry, treatment and disposal	◗ Pollution/contamination of waterways and parklands	◗ Provide a water treatment plant to treat groundwater before disposal ◗ Regular maintenance of WTP facilities ◗ Regular disposal of wastes (e.g. sludge) generated from water treatment ◗ Regular monitoring, testing and analysis of water samples during operation
Fire/explosion		
◗ Tunnel plant and equipment ◗ Substation plant and equipment	◗ Injury to staff and/or general public ◗ Damage to electrical infrastructure	◗ Design of permanent fire system included in substation and stub tunnel design ◗ Monitoring systems included in substation and stub tunnel design ◗ Access restrictions to substation and stub tunnel facilities ◗ Minimise/prevent the use of fire generating materials during operation ◗ Emergency evacuation and response procedures
Cable/substation security		
◗ Unauthorised access to stub tunnel or substation	◗ Injury to the general public ◗ Vandalism and other damage to electrical infrastructure	◗ Design of substation and stub tunnel to include security measures to prevent access from unauthorised personnel ◗ Monitoring of substation and stub tunnel entrances ◗ Operational security management plans to be developed

Operational safety risks		
◗ Safety of operational and maintenance staff ◗ Safety of staff working within the commercial building	◗ Injury to operational and maintenance staff or staff working in commercial building	◗ Development of stub tunnel operation protocols for access and egress ◗ Operational safety management plans ◗ General operating PPE ◗ Emergency evacuation procedures
Urban design		
◗ Safety and security ◗ Passive surveillance ◗ Lighting	◗ Injury to substation staff, staff working in commercial building or general public	◗ Onsite security and safety procedures ◗ Ongoing maintenance to ensure of building ◗ Development of reporting system for design and safety concerns
Other operating risks		
◗ Waste and contamination ◗ Visual amenity and landscape	◗ Health and safety of workers and the general public ◗ Environmental harm and contamination as a result of waste disposal ◗ General public amenity and complaints	◗ Operation waste management plans to be development, including waste disposal protocols ◗ Urban design of above-ground structures to take into account general public and visual amenity ◗ Consider land-use options after construction that maximise public amenity and use