Appendix F

Environmental risk analysis results

Appendix F

Environmental Risk Analysis Results

Potential impact	Initial risk rating (unmitigated)			Effect of proposed mitigation measures	Residual risk rating (with mitigation)		
	Unmitigated consequence	Unmitigated likelihood	Unmitigated risk rating		Residual consequence	Residual likelihood	Residual risk rating
Construction transport and traffic							
Potential temporary deterioration of traffic performance on surrounding road network to an unacceptable level of service due to construction vehicles and temporary road or lane closure	Moderate	Almost certain	High	Mitigation measures in relation to minimising construction vehicle movements in peak periods and during school drop off and pick up times would reduce the likelihood of traffic conflicts and congestion	Minor	Likely	Medium
Temporary loss of parking spaces undermining accessibility to transport, services and/or businesses	Moderate	Almost certain	High	Where existing parking is removed to facilitate construction activities for the proposal, consultation would occur with the relevant local council, local businesses, the community and schools (where appropriate) to investigate opportunities to provide alternative parking facilities	Minor	Very likely	Medium
Potential temporary impacts to the availability of on street parking in local streets surrounding construction sites	Moderate	Likely	Medium	Minimising demand for parking at construction sites would reduce the consequence and likelihood impacts	Minor	Unlikely	Low
Potential temporary reduced pedestrian and cyclist access or flows due to construction	Moderate	Likely	Medium	Where footpaths would be temporarily closed, pedestrian access would be maintained via signposts detours. These footpaths would be temporarily restored for the duration of the proposal tunnelling work and permanently restored following completion of all construction work. Cycleways would remain open at all times	Minor	Likely	Medium
Potential temporary changes to access to private property	Moderate	Likely	Medium	Access to existing properties and buildings would be maintained in consultation with property owners	Minor	Unlikely	Low
Potential temporary reduced safety and amenity for traffic, pedestrians and cyclists due to construction activities, including within existing stations, and due to potential conflicts with construction vehicles	Major	Unlikely	Medium	Additional enhancements for pedestrian, cyclist and motorist safety near the construction sites would be implemented during construction to reduce the likelihood of impacts	Major	Very unlikely	Medium
Potential temporary delays to emergency vehicles and obstructions to emergency vehicle access	Major	Likely	High	Construction sites would be made available for emergency vehicle passage if required and whenever possible. Access to properties for emergency vehicles would be provided at all times	Major	Very unlikely	Medium

Potential impact	Initial risk rating (unmitigated)			Effect of proposed mitigation measures	Residual risk rating (with mitigation)		
	Unmitigated consequence	Unmitigated likelihood	Unmitigated risk rating		Residual consequence	Residual likelihood	Residual risk rating
Potential temporary impacts on reliability of public transport services, including temporary relocation of bus stops, bus diversions and vehicle movements within the light rail corridor	Minor	Likely	Medium	In consultation with Transport for NSW and the City of Sydney, options will be considered to mitigate light rail and bus precinct impacts. This would include consideration of road space reallocation on the western part of Hunter Street to manage through traffic into Hunter Street from George Street / Margaret Street	Minor	Unlikely	Low
Construction noise and vibration							
Potential temporary exceedances of airborne noise management levels from tunnelling and surface construction sites during standard construction hours impacting sensitive receivers	Major	Almost certain	Very high	Application of feasible and reasonable noise mitigation measures, including use of low noise equipment, acoustic sheds and respite periods would reduce the likelihood and consequence of noise impacts	Moderate	Very likely	High
Potential temporary exceedances of airborne noise management levels from tunnelling and surface construction sites outside standard construction hours impacting sensitive receivers	Major	Almost certain	Very high	Minimising noisy activities at night-time and offering additional mitigation measures as outlined in the Sydney Metro Construction Noise and Vibration Standard (Appendix E) would reduce the likelihood and consequence of night-time noise impacts	Moderate	Very likely	High
Temporary construction traffic resulting in a potential increase in traffic noise greater than 2 dB	Moderate	Likely	Medium	Minimising the movements past sensitive receivers and during night-time periods and restricting idling near sensitive receivers would reduce the likelihood and consequence of traffic noise impacts	Minor	Unlikely	Low
Potential temporary exceedances of human comfort or damage vibration levels from tunnelling or surface activities	Moderate	Very likely	High	Alternative construction methodologies and measures that minimise noise and vibration levels during noise intensive work would be investigated and implemented where feasible and reasonable to reduce the consequence of potential impacts	Minor	Very likely	Medium
Potential temporary exceedances of ground-borne noise criteria from tunnelling	Moderate	Very likely	High	Feasible and reasonable measures would be implemented to minimise ground-borne noise where exceedances are predicted. This may require implementation of less ground-borne noise and less vibration intensive alternative construction methodologies	Minor	Very likely	Medium
Non-Aboriginal heritage							
Potential direct and indirect impacts on State, local and s170 register listed items during construction	Major	Likely	High	Use of low impact demolition methods would reduce the likelihood of indirect impacts on heritage items. Archival reporting, salvage and heritage interpretation would reduce the consequence of direct impacts on heritage items	Minor	Likely	Medium

Potential impact	Initial risk rating (unmitigated)			Effect of proposed mitigation measures	Residual risk rating (with mitigation)		
	Unmitigated consequence	Unmitigated likelihood	Unmitigated risk rating		Residual consequence	Residual likelihood	Residual risk rating
Potential indirect impacts associated with views and vibration on State, local and s170 register listed items during construction	Major	Likely	High	Use of low impact demolition methods would reduce the likelihood of impacts on heritage items	Major	Unlikely	Medium
Potential damage to heritage items from vibration and settlement during tunnelling and construction	Moderate	Likely	High	Feasible and reasonable measures would be informed by further ground movement assessments and condition surveys to reduce the likelihood of vibration impacts on heritage items	Minor	Unlikely	Low
Potential impacts of temporary construction activities within the curtilage of listed items, but with no direct impacts on the significant components	Moderate	Unlikely	Medium	Use of low impact demolition methods would reduce the likelihood of indirect impacts on heritage items	Moderate	Very unlikely	Low
Potential impacts during construction on unknown heritage items (e.g. archaeological items)	Moderate	Very likely	High	Archaeological research design(s) informing archaeological testing, monitoring and mitigation measures, prepared in consultation with the NSW Heritage Division, including in situ conservation of State significant archaeology where feasible and reasonable, would reduce the consequence of impacting archaeological items	Minor	Very likely	Medium
Aboriginal heritage							
Potential impacts on a known Aboriginal heritage item	Major	Unlikely	Medium	Archaeological test excavation, including salvage when required, and interpretation carried out in consultation with Aboriginal parties would reduce the consequence of the impact	Minor	Very unlikely	Low
Potential impacts on unidentified Aboriginal heritage items	Major	Unlikely	Medium	Archaeological test excavation, including salvage when required, and interpretation, carried out in consultation with Aboriginal parties would reduce the likelihood and consequence of impacts on unidentified Aboriginal heritage items	Minor	Unlikely	Low
Property and land use							
Potential restrictions on future development due to subsurface tunnels and other infrastructure	Moderate	Likely	Medium	Coordination and consultation with relevant agencies and stakeholders would occur to manage the restrictions of future development	Minor	Unlikely	Low
Potential impacts on property associated with temporary use areas for construction purposes	Moderate	Likely	Medium	Except where required for subsequent construction activities, temporary use areas for construction purposes would be stabilised and appropriately rehabilitated after construction in consultation with the relevant landowner	Minor	Unlikely	Low

Potential impact	Initial risk rating (unmitigated)			Effect of proposed mitigation measures	Residual risk rating (with mitigation)		
	Unmitigated consequence	Unmitigated likelihood	Unmitigated risk rating		Residual consequence	Residual likelihood	Residual risk rating
Landscape and visual amenity							
Potential temporary impacts on landscape character during construction activities associated with new stations, ancillary infrastructure, (e.g. loss of street trees, use of plant and equipment etc.)	Major	Almost certain	Very high	Design of construction sites, including location of structures and buildings, design of hoardings, public art opportunities, and retention and replacement of trees would reduce the consequence of impacts on landscape character	Minor	Very likely	Medium
Potential temporary impacts on visual amenity from private/ public places as a result of acoustic sheds (or other acoustic measures) and hoardings associated with construction sites	Major	Almost certain	Very high	Design of acoustic measures and hoardings would seek to reduce the impact on views, would be maintained and kept free of graffiti, and would incorporate public art where appropriate to reduce consequence of impacts to visual amenity	Minor	Very likely	Medium
Potential temporary light spill from construction sites at night	Minor	Very likely	Medium	Lighting of construction sites would be orientated to minimise glare and light spill, thereby reducing the consequence and likelihood of light spill impacts on adjacent receivers	Minor	Unlikely	Low
Business impacts							
Potential temporary disruptions to servicing, deliveries and customer access during construction (including from traffic congestion and loss of parking)	Major	Very likely	High	Access to businesses would be maintained for customers, servicing and deliveries, reducing the likelihood of business disruption. Small business owner engagement would be carried out to assist small business owners adjacent to major construction sites that are adversely impacted by construction	Moderate	Likely	Medium
Potential temporary loss of power and utilities during planned or accidental shutdowns during construction	Moderate	Likely	Medium	Planned power and utility interruptions would be scheduled to be outside of typical business hours, where feasible and reasonable, reducing the likelihood of impacts. Businesses operating outside normal business hours and businesses operating financial market infrastructure will be consulted to ensure sufficient backup arrangements are in place	Moderate	Very unlikely	Low
Potential temporary reduced business visibility through the presence of construction activities, hoardings and other structures	Major	Likely	High	Appropriate design and location of hoardings, clear pathways, signage and lighting would maximise visibility of businesses. Small business owner engagement would be carried out to assist small business owners adjacent to major construction sites that are adversely impacted by construction	Minor	Unlikely	Low

Potential impact	Initial risk rating (unmitigated)			Effect of proposed mitigation measures	Residual risk rating (with mitigation)		
	Unmitigated consequence	Unmitigated likelihood	Unmitigated risk rating		Residual consequence	Residual likelihood	Residual risk rating
Potential temporary reduction in amenity at nearby business premises (particularly due to noise, vibration, visual and air quality impacts)	Moderate	Likely	Medium	Noise, visual and air quality mitigation measures would minimise local amenity impacts of construction, reducing the consequences of these impacts for businesses. Small business owner engagement would be carried out to assist small business owners adjacent to major construction sites that are adversely impacted by construction	Minor	Likely	Medium
Impacts to businesses located within properties being acquired	Major	Likely	High	Sydney Metro manages property acquisition in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*, Small business owner engagement would be carried out to assist small business owners adjacent to major construction sites that are adversely impacted by construction	Minor	Unlikely	Low
Social impacts							
Potential temporary impacts on the way of life for local communities, local employees and visitors due to travel disruptions and changes to routines	Moderate	Likely	Medium	Access would be maintained to local services, business and public transport infrastructure. Consultation with the relevant council and public transport service operators, and use of wayfinding signage would minimise disruptions, reducing the consequence of impacts	Minor	Likely	Medium
Potential community concern with proposed changes to the character of local areas	Moderate	Likely	Medium	The development and implementation of a community benefit plan would provide local benefits to counteract and reduce the likelihood of potential impacts	Moderate	Unlikely	Medium
Potential temporary impacts on community facilities or open space due to construction activities including changes to access and amenity during construction	Moderate	Likely	Medium	Noise, traffic, access and local amenity mitigation measures would reduce the consequence and likelihood of impacts affecting the useability of social infrastructure, including community facilities and open space	Minor	Unlikely	Low
Groundwater and ground movement							
Potential impacts as a result of ground movement/ settlement due to tunnelling and other excavations	Moderate	Likely	Medium	A detailed geotechnical model for the proposal would be developed and progressively updated during design and construction. Condition surveys of buildings and structures in the vicinity of the tunnel and excavations would be carried out prior to the start of excavation at each site	Moderate	Very unlikely	Low

Potential impact	Initial risk rating (unmitigated)			Effect of proposed mitigation measures	Residual risk rating (with mitigation)		
	Unmitigated consequence	Unmitigated likelihood	Unmitigated risk rating		Residual consequence	Residual likelihood	Residual risk rating
Soils and surface water quality							
Temporary erosion of soils resulting in off-site sedimentation of waterways during construction, potentially resulting in exceedances of water quality criteria	Moderate	Unlikely	Medium	Erosion and sediment measures would be implemented at all construction sites in accordance with the principles and requirements in *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004) and *Volume 2D* (NSW Department of Environment, Climate Change and Water 2008), commonly referred to as the 'Blue Book'. Additionally, any water collected from construction sites would be appropriately treated and discharged to avoid any potential contamination or local stormwater impacts	Minor	Unlikely	Low
Potential exposure of acid sulfate soils during construction, potentially resulting in off-site discharge of acidic water	Moderate	Unlikely	Medium	Prior to ground disturbance in areas of potential acid sulphate soil occurrence, testing would be carried out to determine the presence of actual and/or potential acid sulphate soils. If acid sulphate soils are encountered, they would be managed in accordance with the *Acid Sulphate Soil Manual* (ASSMAC, 1998)	Moderate	Very unlikely	Low
Potential exposure of soil salinity/saline soils during construction resulting in off-site discharge of saline water, potentially resulting in exceedances of water quality trigger levels	Minor	Likely	Medium	Prior to ground disturbance in high probability salinity areas, testing would be carried out to determine the presence of saline soils. If salinity is encountered, excavated soils would not be reused or would be managed in accordance with *Book 4 Dryland Salinity: Productive Use of Saline Land and Water* (NSW DECC, 2008). Erosion controls would be implemented in accordance with the 'Blue Book' (Landcom, 2004)	Minor	Unlikely	Low
Potential temporary water quality impacts on nearby watercourses due to discharge of treated groundwater, contaminated water, or spills during construction	Major	Unlikely	Medium	Prior to discharge, water would be treated to comply with ANZECC/ARMCANZ (2000) and ANZG (2018) default guidelines for 95 per cent species protection. A surface water monitoring program would be implemented to observe any changes in surface water quality that may be attributable to construction and inform appropriate management responses	Major	Very unlikely	Medium
Potential contamination of land or groundwater due to spills and leaks during construction	Moderate	Likely	Medium	Locating all fuels in a sealed bunded area, together with the use of spill kits, would reduce the likelihood of soil or groundwater contamination	Moderate	Very unlikely	Low

Potential impact	Initial risk rating (unmitigated)			Effect of proposed mitigation measures	Residual risk rating (with mitigation)		
	Unmitigated consequence	Unmitigated likelihood	Unmitigated risk rating		Residual consequence	Residual likelihood	Residual risk rating
Contamination							
Disturbance of contaminated land during construction potentially causing impacts to human health or receiving environments	Major	Likely	High	Areas with a higher potential for contamination would be subject to a Detailed Site Investigation and, if necessary, a Remedial Action Plan to reduce contamination risks during and following completion of construction, reducing the consequence of contamination and the likelihood if impacts	Moderate	Unlikely	Medium
Disturbance of contamination (soil or groundwater) potentially exacerbating existing contamination risks by mobilising otherwise stable contamination and causing on-site and off-site migration	Major	Likely	High	Areas with a higher potential for contamination would be subject to a Detailed Site Investigation and, if necessary, a Remedial Action Plan to reduce contamination risks from throughout and following completion of construction, reducing the consequence of contamination and the likelihood of impacts	Moderate	Unlikely	Medium
Potential impacts from the management or incorrect disposal of contaminated soils	Major	Likely	High	Contaminated soils would be kept separate from other spoil, and classified for disposal, reducing the likelihood of cross-contamination or inappropriate disposal	Major	Very unlikely	Medium
Hydrology and flooding							
Alterations to existing stormwater flows and drainage infrastructure	Moderate	Likely	Medium	Detailed construction planning would consider flood risk at construction sites, including identification of measures to not worsen flood impacts, flood-proofing and a review of site layout and staging of construction activities to avoid or minimise flood impacts	Minor	Unlikely	Low
Biodiversity							
Direct impacts on threatened ecological communities, threatened flora species and Matters of National Environmental Significance within or near construction sites	Insignificant	Very unlikely	Low	The unmitigated risk rating is low because only about 16 trees and around 250 square metres of exotic vegetation would be removed as a result of this proposal, none of which constitute threatened ecological communities, threatened flora species, or Matters of National Environmental Significance. No further mitigation measures are required	Insignificant	Very unlikely	Low
Impacts on habitat for threatened fauna species that may use trees for foraging	Insignificant	Very unlikely	Low	The unmitigated risk rating is low because the removal of a limited number of trees is not considered likely to significantly impact threatened fauna species that may use trees for foraging. No further mitigation measures are required	Insignificant	Very unlikely	Low

Potential impact	Initial risk rating (unmitigated)			Effect of proposed mitigation measures	Residual risk rating (with mitigation)		
	Unmitigated consequence	Unmitigated likelihood	Unmitigated risk rating		Residual consequence	Residual likelihood	Residual risk rating
Potential indirect impacts on threatened fauna species, migratory and endangered populations from light and noise impacts, sedimentation, spread of weeds and/or as a result of collisions with construction plant and vehicles	Minor	Unlikely	Low	The implementation of measures such as those to control light spill and minimise construction noise would reduce the likelihood of impacts	Insignificant	Very unlikely	Low
Air quality							
Potential temporary impacts on local air quality due to construction plant and equipment and increase in vehicle movements	Moderate	Likely	Medium	Vehicles, plant and equipment would be maintained in a proper and efficient manner, reducing the likelihood of air quality impacts from plant	Minor	Unlikely	Low
Potential temporary impacts on local air quality during construction due to dust generation from exposed surfaces, spoil stockpiles or spoil haulage	Moderate	Likely	Medium	Best practice dust management measures would be implemented during all construction works, reducing the likelihood and consequence of air quality impacts from dust	Minor	Unlikely	Low
Potential temporary impacts on local air quality during demolition	Moderate	Likely	Medium	Best practice measures would be implemented during demolition, including demolition sequencing and water suppression, reducing the consequence and likelihood of potential impacts	Minor	Unlikely	Low
Potential temporary mobilisation of airborne hazardous materials, odours or vapours as a result of uncovering contaminated soils or hazardous materials during excavation or demolition	Moderate	Unlikely	Medium	Best practice odour management measures would be implemented, including minimising the disturbance of contaminated soil, use of odour suppression agents, and regular monitoring. These mitigation measures would reduce the consequence and likelihood of mobilising airborne hazardous materials, odours or vapours	Minor	Unlikely	Low
Spoil, waste management and resource use							
Potential temporary impacts associated with inappropriate management of waste during construction	Minor	Unlikely	Low	Waste would be assessed, classified, managed and disposed in accordance with the *Waste Classification Guidelines* (Environment Protection Authority, 2014a), reducing the likelihood of impacts	Minor	Very unlikely	Low
Potential temporary impacts associated with the management and disposal of spoil from tunnel construction	Minor	Unlikely	Low	Spoil would be managed in accordance with the spoil management hierarchy, and 100 per cent of usable spoil would be reused. This would reduce the likelihood of impacts associated with spoil management.	Minor	Very unlikely	Low
Potential temporary increased demand on electricity and water supply during construction	Minor	Unlikely	Medium	Sustainability initiatives would be incorporated into the detailed design and construction to minimise demand for water and electricity, reducing the likelihood of the potential impacts	Minor	Very unlikely	Low

Potential impact	Initial risk rating (unmitigated)			Effect of proposed mitigation measures	Residual risk rating (with mitigation)		
	Unmitigated consequence	Unmitigated likelihood	Unmitigated risk rating		Residual consequence	Residual likelihood	Residual risk rating
Potential temporary increased demand on local and regional resources including sand, aggregate and fuel during construction resulting in resource becoming in short supply	Minor	Unlikely	Low	Sustainability initiatives would be incorporated into the detailed design and construction to minimise demand for resources, reducing the likelihood of the potential impacts	Minor	Very unlikely	Low
Hazards							
Potential incidents associated with transportation and storage of hazardous substances and dangerous goods during construction	Moderate	Very unlikely	Low	Storage and handling of dangerous goods and hazardous substances would be in accordance with the *Dangerous Goods (Road and Rail Transport) Act 2008* and Dangerous Goods (Road and Rail Transport) Regulation 2014, and would comply with the Australian Dangerous Goods Code. As such, no mitigation measures are required	Moderate	Very unlikely	Low
Potential damage, rupture and/or failure to shut down, isolate or otherwise appropriately manage underground utilities, resulting in the release of sewage, water, gas or electrical currents	Moderate	Very unlikely	Low	Dial before you dig searches and non-destructive digging would be carried out to identify the presence of underground utilities, and ongoing consultation would be carried out with utility providers for high pressure gas or petroleum pipelines to identify appropriate construction methodologies, reducing the likelihood of impacts to utilities	Moderate	Almost unprecedented	Low
Sustainability, climate change and greenhouse gas							
Emissions of greenhouse gases from embodied energy in materials	Minor	Likely	Medium	Sustainability initiatives, including a sustainable procurement strategy would reduce the consequence of impacts	Insignificant	Likely	Low
Emissions of greenhouse gases from construction activities, including emissions associated with energy use for tunnel boring machines	Minor	Likely	Medium	Sustainability initiatives, including offsetting 25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction would reduce the potential consequence of this impact	Insignificant	Likely	Low
Cumulative impacts							
Potential temporary cumulative construction impacts, including potential construction fatigue with other major projects	Major	Almost certain	Very high	Coordination and consultation with relevant agencies and stakeholders would occur to manage the interface of projects under construction at the same time, including identifying conflicts and strategies to manage conflicts, such as making adjustments to construction program, work activities or haul routes, and coordination of traffic management arrangements between projects	Moderate	Almost certain	High

This page has intentionally been left blank