20 Environmental risk analysis

This chapter details the environmental risk analysis process for the proposed CBD Metro. It considers the significance of the potential environmental impacts, the effectiveness of the proposed management and mitigation measures, and any residual impacts likely to remain after the application of these measures.

The Director-General's requirements
The Environmental Assessment must include an environmental risk analysis to identify potential environmental impacts associated with the project (construction and operation), proposed mitigation measures and potentially significant residual environmental impacts after the application of proposed mitigation measures. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of this additional key environmental impact must be included in the Environmental Assessment.

20.1 Overview

20.1.1 Role of environmental risk analysis

The Director-General of the Department of Planning requires Sydney Metro to prepare an environmental risk analysis to identify potential environmental issues associated with the construction and operation of the CBD Metro.

The process began at the Project Application and Preliminary Environmental Assessment phase, and was further developed in the Environmental Assessment phase. The risk analysis process was used to scope the environmental investigations and guide project design.

Risk analysis enabled the Environmental Assessment to:

- Target those issues identified as key issues in the Preliminary Environmental Assessment. This took into account the significance of the potential environmental impacts and the effectiveness of the proposed management measures in minimising degradation or deterioration of the biophysical, economic or social environment.
- Identify those potential impacts that are not key issues, including those that would be expected to respond well to appropriate mitigation measures and management.
- Identify residual impacts likely to remain after the application of the mitigation measures. Where significant residual impacts remain, this may require greater commitment to management strategies to mitigate the effect or, in some instances, a re-scope of the design at that location.

20.1.2 Identification of key issues

The Preliminary Environmental Assessment identified the issues considered to be the key issues pertaining to the proposed CBD Metro, and these were used as the basis for the key issues in the Director-General's requirements (DGRs) for the project.

The DGRs identified the following key issues for consideration and assessment:

- Construction spoil management.
- Construction traffic.
- Construction noise and vibration.
- Non-indigenous heritage impacts.
- Water management.
- Land use implications.
- Operational transport impacts and interactions.
- Operational noise and vibration.
- Economic and social issues.

These key issues have been the focus of the Environmental Assessment for the project.

20.2 Risk analysis methodology

The environmental risk analysis was undertaken in accordance with the principles of the Australian and New Zealand standard AS/NZS 4360:2004 – Risk Management. It involved:

- Ranking the risk of each identified potential impact by identifying the consequences of the impact and the likelihood of each impact occurring.
- Considering the probable effectiveness of the proposed mitigation measures to determine the likely residual risk of each impact.

The first step involved an identification of the consequence levels should an impact occur. The levels are defined in Table 20.1.

Table 20.1 Risk analysis consequence definitions

Consequence level	Definition
Catastrophic	• Would result in a major prosecution under relevant environmental legislation. • Would cause long-term and irreversible impacts.
Major	• Would result in a fine or equivalent under relevant environmental legislation. • Would cause medium-term, potentially irreversible impacts.
Moderate	• Would result in medium-term, reversible impacts.
Minor	• Would result in short-term, reversible impacts.
Insignificant	• Would result in minor, negligible impacts.

The next step involved a definition of the risk rating categories. This was done by considering the frequency of activities that may cause the impact, and the probability (or likelihood) of the impact occurring during that activity. The level of likelihood was classed as:

- Very likely –the event is almost certain to occur in the course of normal or abnormal operating circumstances.
- Likely –the event is likely to occur in the course of normal operations.
- Unlikely – the event could occur in the course of normal or abnormal operating circumstances.
- Very unlikely – the event may occur in exceptional circumstance only.

The risk rating categories determined through the analysis are summarised in Table 20.2.

Table 20.2 Risk rating categories

Risk rating score	Risk category	General description
1, 2 or 3	High	Detailed assessment and planning are necessary to develop appropriate measures to mitigate and manage the potential impacts.
4 or 5	Medium	Potential impacts can be mitigated through the application of relatively standard environmental management measures.
6	Low	Potential impacts either require no specific management measures or are mitigated adequately through other working controls (such as detailed design requirements, normal working practice, quality and safety controls).

The risk rating category of each potential impact was then determined by combining the consequence and likelihood according to the matrix in Table 20.3.

Table 20.3 Risk matrix

		Likelihood			
		Very likely	Likely	Unlikely	Very unlikely
Consequence	Catastrophic	1	1	2	3
	Major	1	2	3	4
	Moderate	2	3	4	5
	Minor	3	4	5	6
	Insignificant	4	5	6	6

As shown in Table 20.3, impacts were allotted a risk rating score of between one and six. One represents an impact with major to catastrophic consequences and likely to very likely to occur; six represents an impact with minor to insignificant consequences and unlikely to very unlikely to occur.

The potential effectiveness of the mitigation measures proposed was assessed and the degree of effectiveness of the mitigation measures was classed as:

- Very effective – the measure would increase the risk rating score by three points – for example, from three (high) to six (low).
- Effective – the measure would increase the risk rating score by two points – for example, from two (high) to four (medium).
- Partly effective – the measure would increase the risk rating score by one point – for example, from three (high) to four (medium).
- Not effective – the measure would not change the risk rating.

20.3 Environmental risk analysis

The environmental risk analysis was based on investigations and a review of the issues during the preparation of the Environmental Assessment, and knowledge from other major infrastructure projects. The analysis also considered the input from various government agencies and other stakeholders during the consultation process. The analysis specifically considered the mitigation and management measures developed and put forward in the assessment chapters (Chapters 9 to 19) of this Environmental Assessment report as well as the principles for ecologically sustainable development. The results of the environmental risk analysis are presented in Table 20.4.

Table 20.4 Environmental risk assessment results

Environmental issues								
Aspects	**Potential adverse impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Effectiveness**	**Factor**	**Residual risk rating**
Construction spoil management (excluding traffic)	• Noise, water and dust impacts associated with spoil processing, storage and haulage. • Disturbance to contaminated soil, with potential impacts on water quality.	Moderate	Very likely	2	Section 9.4	Very effective	3	Medium
Construction traffic	• Impacts on local traffic and through-traffic movement as a result of construction traffic (including spoil haulage). • Impacts from temporary lane and/or road closures and diversions. These would disrupt traffic movements, and have impacts on parking, road capacity, access and public transport. • Removal of parking spaces and loading zones for construction activities. • Disruptions to pedestrian and cyclist movements. • Disruptions to access to adjoining properties, including businesses.	Major	Very likely	1	Section 10.4	Partly effective	1	High
Construction noise	• Noise impacts on local residents and other sensitive receivers from construction activities, including excavation, demolition and station construction. • Noise impacts on local residents and other sensitive receivers from construction traffic movements (including spoil haulage and delivery trucks).	Major	Very likely	1	Section 11.4	Effective	2	High
Construction vibration	• Structural damage to buildings (including heritage items) from construction-related vibration levels. • Impacts on some sensitive receivers from construction-related vibration.	Moderate	Unlikely	4	Section 11.4	Effective	2	Low

Environmental issues								
Aspects	**Potential adverse impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Effectiveness**	**Factor**	**Residual risk rating**
Water management	• Impacts on surface and groundwater quality during construction from increased sediment loads and contaminants (including acid sulfate soils). • Impacts from the generation of wastewater (including contaminated water) during construction and operation. • Impacts from groundwater contamination encountered during construction. • Contamination of land and water through spills of fuels or chemicals.	Major	Unlikely	3	Section 12.4	Effective	2	Medium
Non-indigenous heritage	• Impacts on historical heritage sites, including demolition of, or alterations to, listed buildings and disturbance of state significant archaeological remains. • Visual impacts on heritage items, historic streetscapes and views. • Accidental damage to heritage items during construction (including impacts of vibration).	Major	Likely	2	Section 13.4	Partly effective	1	High
Transport changes during operation	• Changes to bus access arrangements and taxi stand locations. • Changes to bus, cyclist and pedestrian networks. • Changes to road lane configurations and access.	Moderate	Likely	3	Section 14.4	Effective	2	Medium
Noise during operation	• Noise impacts on local residents and other sensitive receivers from metro train operations within tunnels and along the surface track (between tunnel portal and Rozelle stabling and maintenance depot). • Noise impacts on local residents and other sensitive receivers during operation of the Rozelle stabling and maintenance depot, especially during night-time.	Major	Unlikely	3	Section 15.4	Effective	2	Medium

Environmental issues								
Aspects	**Potential adverse impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Effectiveness**	**Factor**	**Residual risk rating**
Vibration during operation	• Impacts on local residents and other sensitive receivers during operation of CBD Metro from ground vibration disturbance at Rozelle stabling and maintenance depot, or from rolling stock within tunnels.	Moderate	Unlikely	4	Section 15.4	Very effective	3	Low
Economic and social issues (construction)	• Impacts on the local community during construction, including reduction in amenity (such as noise, dust and visual impacts), changes to services and accessibility.	Moderate	Likely	3	Section 16.5	Effective	2	Medium
Economic and social issues (operation)	• Impacts on businesses where land acquisition and relocation are required. • Impacts on businesses from reduced parking and changed/ reduced access to their premises.	Moderate	Likely	3	Section 16.5	Effective	2	Medium
Land use implications	• Impacts on some existing land uses and properties directly affected by CBD Metro. • Changes to current and potential future uses of land, as future land developments need to consider the depth and structural integrity of tunnels.	Moderate	Likely	3	Section 17.4	Effective	2	Medium
Cumulative interactions	• Construction traffic, noise and vibration and socio-economic impacts from the CBD Metro project would have synergistic interactive impacts with other CBD projects.	Moderate	Very likely	2	Section 18.4	Partly effective	1	High
Visual and urban design	• Impacts on visual amenity due to construction sites and hoardings. • Visual impacts on existing and future land uses, from new aboveground station entrances in prominent locations and/or affecting existing heritage listed buildings. • Impacts on views currently enjoyed by residential receivers adjacent to the Rozelle stabling and maintenance depot.	Moderate	Likely	3	Section 19.1.3	Effective	2	Medium

Environmental issues								
Aspects	**Potential adverse impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Effectiveness**	**Factor**	**Residual risk rating**
Air quality	• Impacts of dust generated from erosion of stockpiles and exposed surfaces, excavation, demolition and spoil haulage. • Impacts of exhaust emissions from construction plant, equipment and vehicles. • Impacts from the release of emissions from plant, equipment and vehicles during operation of the Rozelle stabling and maintenance depot. • Impacts from the generation of particulates during train operations.	Minor	Likely	4	Section 19.2.3	Effective	2	Low
Ecology	• Removal of a few planted trees, including at least one mature Morton Bay Fig at Belmore Park.	Insignificant	Likely	5	Section 19.3.3	Partly effective	1	Low
Indigenous heritage	• Potential disturbance of previously unidentified Aboriginal objects and places.	Major	Very unlikely	4	Section 19.4.3	Effective	2	Low
Geology and groundwater	• Settlement-related impacts from tunnelling and groundwater drawdown, which may cause damage to buildings and structures. • Impacts on groundwater quantity and quality during construction due to deep excavations and/or tunnelling. • Impacts on groundwater quality during construction.	Moderate	Unlikely	4	Section 19.5.3	Effective	2	Low
Energy and greenhouse gas	• Impacts from the generation of greenhouse gases from construction of the project (from construction plant and vehicles). • Impacts from the generation of greenhouse gases from operation of the project, particularly from the operation of the metro trains, and from the Rozelle stabling and maintenance depot operations.	Insignificant	Likely	5	Section 19.6.3	Partly effective	1	Low

Environmental issues								
Aspects	**Potential adverse impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Effectiveness**	**Factor**	**Residual risk rating**
Climate change	• Impacts of climate change and sea level rise on the project, including increased risk of flooding, higher temperatures and severe storms that may affect structures and train performance.	Moderate	Likely	3	Section 19.7.3	Very effective	3	Low
Resource use and waste	• Generation of waste and potential for impacts on land resources due to excess waste sent to landfill, including spoil. • Impact on supply due to the increased demand on local and regional resources.	Minor	Likely	4	Section 19.8.3	Effective	2	Low

20.4 Conclusions

The environmental risk assessment has identified the following key issues that would present a high level of residual risk:

- Construction traffic.
- Construction noise.
- Impacts on non-indigenous heritage.
- Cumulative interactions.

The identification of these environmental aspects that are likely to have significant impacts despite the application of mitigation and management measures identified within each respective chapter, suggest that more detailed management strategies should be developed before construction and throughout the construction of the project to appropriately address the impacts to meet an acceptable level.

Based on the outcomes of the environmental risk analysis, cumulative interactions were added to the 'key issues' for assessment.

Other issues that would have a medium residual risk include:

- Management of construction spoil (excluding traffic impacts).
- Construction vibration.
- Water management.
- Operational transport.
- Operational noise and vibration.
- Economic and social issues.
- Land use changes.
- Visual and urban design.

The level of assessment undertaken for these issues has determined the likely extent of impacts and recommended appropriate mitigation/management required to ensure that the risk is abated.

Finally, the non-key environmental issues for the project would be:

- Air quality.
- Ecology.
- Indigenous heritage.
- Climate change.
- Energy and greenhouse gas.
- Resource use and waste.

These issues can be routinely managed through detailed design and by the implementation of standard management and mitigation measures aimed at ensuring that all necessary environmental criteria and guidelines are achieved.