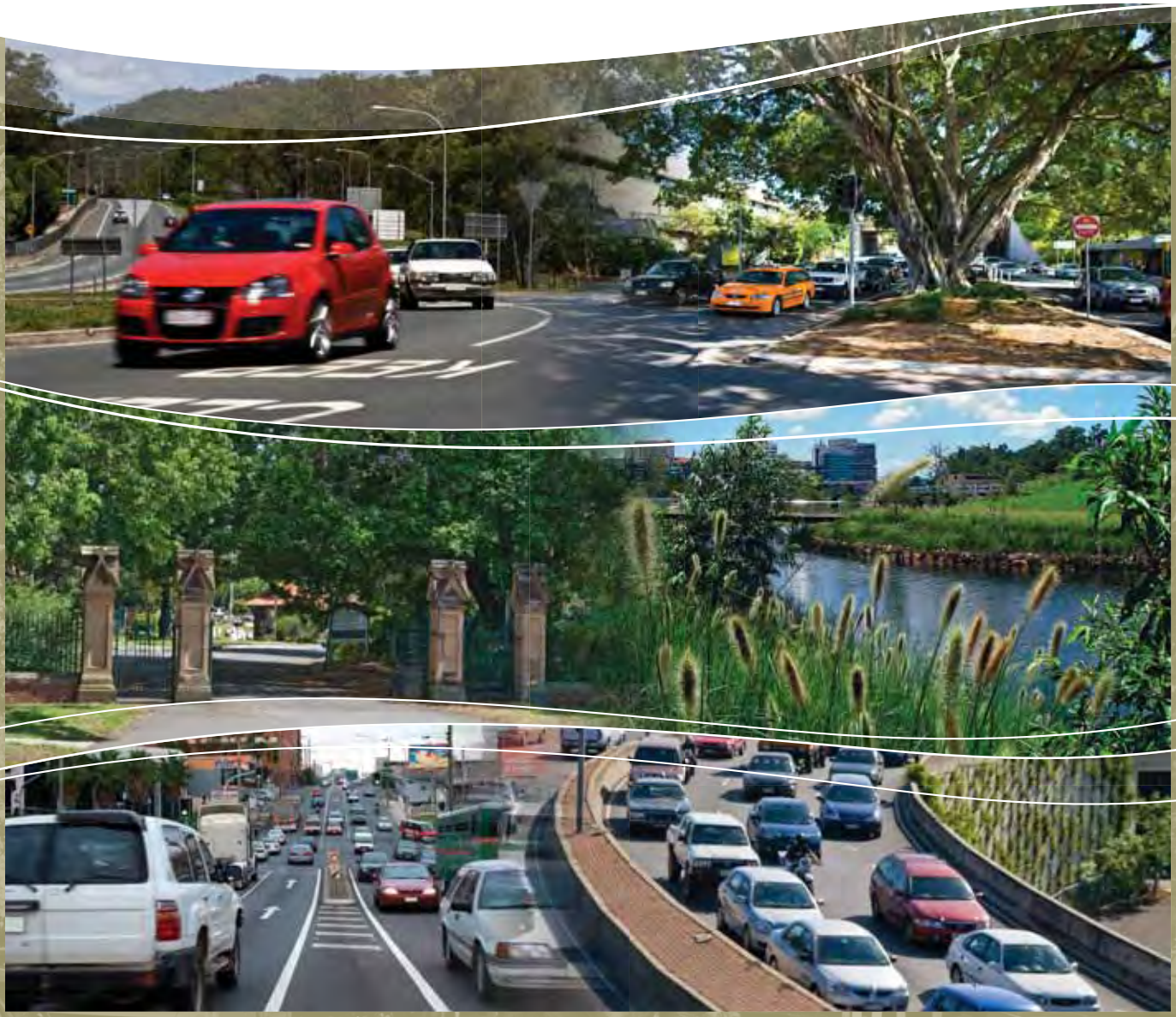
Northern Link

19. Draft Outline Environmental Management Plan



Northern Link

Phase 2 – Detailed Feasibility Study

CHAPTER 19

DRAFT OUTLINE

ENVIRONMENTAL MANAGEMENT PLAN

- September 2008

Contents

19. Draft Outline Environmental Management Plan

This chapter addresses Part B, Section 6 of the Terms of Reference (ToR). It provides draft outline Environmental Management Plans (EMPs) for the construction and operational maintenance phases of the Northern Link. The draft outline EMPs provide a framework for development of a detailed design and construction environmental management plan and appropriate subplans as well as an operational environmental management plan. It encapsulates the recommendations from the EIS about environmental management and mitigation measures, which could be adopted to the extent required by a contractor either constructing or operating the Project.

19.1 Project Overview

19.1.1 The Northern Link project

The Project is located in the Brisbane City Council local government area and is designed to provide motorway standard bypass of the CBD for road traffic and to connect the Western Freeway at Toowong with the Inner City Bypass at Kelvin Grove. Connections are also proposed with Milton Road/Croyden Street in Toowong and with Kelvin Grove Road in Kelvin Grove.

The alignment of the Project from the west passes beneath the inner western suburbs of Toowong, Auchenflower, Milton, Bardon, Paddington, Red Hill and Kelvin Grove traversing beneath Frederick Street, Baroona Road, Latrobe Terrace, Musgrave Road and Kelvin Grove Road before emerging onto the Inner City Bypass adjacent to the Inner Northern Busway.

The Project would be constructed as two parallel tunnels (one westbound and one eastbound) so that traffic flow would promote air flow to aid ventilation. Mechanical ventilation is also provided along the tunnel with ventilation stations and outlets situated near the tunnel portals. There would be no ventilation station or outlet at the Milton Road or Kelvin Grove Road portals.

The three main construction worksites would be located:

- between the boundary fence of the Brisbane Botanic Gardens, Mt Coot-tha and the Western Freeway at Toowong;
- at the corner of Frederick Street and Milton Road as far as Valentine Street, Toowong; and
- a site along the western side of Kelvin Grove Road between the Inner City Bypass (ICB) and Victoria Street, including the block between Lower Clifton Terrace and Kelvin Grove Road.

The Project is likely to take three years and six months to design and construct.

19.1.2 EIS Terms of Reference

The Project was declared a significant project for which an Environmental Impact Statement (EIS) is required by the Queensland Coordinator-General (CoG) pursuant to the *State Development and Public Works Organisation Act 1971* (SDA) on 31 October 2007. Terms of Reference (ToR) for the preparation of an EIS were issued by the CoG in April 2008.

The ToR provided that the draft outline EMP should include:

- An introduction, including a concise project description
- The Project's legislative requirements.
- Environmental objectives and performance criteria for inclusion in the detailed design and for the development of the construction contract documentation.
- The environmental objectives, performance criteria and mitigation strategies for the construction phase.
- The environmental objectives, performance criteria and mitigation strategies for the operational phase including any maintenance principles.
- A construction Traffic Management Plan including contingency plans for traffic diversion.
- A community engagement and communication plan to ensure proactive engagement with stakeholders throughout construction and operation of the Project.
- Monitoring, auditing and reporting strategies for the construction and operational aspects of the Project.
- Responsibilities assigned to a relevant person/organisation.
- The procedure and reporting framework, including a complaints register for the recording of complaints, a process for responding to complaints, a mechanism for the identification of non-conformances and a system for the implementation of subsequent corrective action is to be outlined.

Mitigation and management measures should provide the flexibility in achieving performance-based environmental outcomes consistent with the environmental objectives. There are to be measurable criteria against which the implementation of the actions and the level of achievement of the performance objectives would be measured.

This draft outline EMP addresses the environmental objectives and performance criteria with possible mitigation measures for each of the potential impacts of the Project.

19.2 Management Structure

A rigorous approach to environmental management is required in order to deliver the Project with the least possible impact on local communities and businesses. Part of that approach is the preparation and implementation of environmental management plans for both the construction and operation of the Project.

A clear implementation and management structure is required to achieve the objective of sound environmental management. This section provides a suggested structure, which regardless of the contractual delivery mechanism adopted for the Project, incorporates the following parties and their respective roles and responsibilities:

Queensland Government:

- Represented by the Coordinator-General who evaluates the EIS and is the concurrence agency for IDAS approvals of the Project under the Integrated Planning Act.
- The regulator for activities and represented by those agencies administering the relevant legislation (see attached schedule).
- An owner of land in the Northern Link corridor and represented by the Department of Natural Resources and Water (DNRW) or lessees nominated by the DNRW.

Brisbane City Council:

- The Principal, and proponent, in the head agreement or contract awarded for the Northern Link project.
- Administers and enforces the head agreement or contract to ensure that the contract conditions are met.
- Regulates the performance of works according to local laws, including City Plan, and delegated State laws under Brisbane City Council jurisdiction.
- Acts to facilitate the expression of community views.
- An owner/lessee of land in the Northern Link corridor.

Contractor:

- Prepares detailed engineering designs, detailed environmental management plans including subplans and site specific plans for the design and construct phase, operation management plans including environmental operation and management systems (EOMS).
- Obtains all necessary approvals, including development approvals, environmental licenses, workplace health and safety and all other construction-related approvals.
- Ensures all designs and construction works are prepared and conducted in accordance with the contract, relevant legislation and regulations, and local laws.
- Maintains for the duration of the construction phase, open and effective communications, with the communities in the vicinity of each of the Northern Link worksites about the construction program, scale, duration and nature of proposed work, and details of proposed impact mitigation measures and monitoring of impacts.
- Conducts the safe and efficient operation of the Project, upon completion of the construction phase, in accordance with contract conditions, relevant legislation and regulations, and local laws.

Community Consultative Committees:

- Review and provide comments in an advisory role to the Contractor on the draft construction management plans and draft operations plans prepared by the Contractor.
- Provide advice to the Contractor during the construction phase in relation to mitigating the impacts of construction in the local areas of each committee.
- Provide information to the wider community in relation to construction programming, the nature of construction work, and impact mitigation measures.

19.2.1 Queensland Government

As part of its normal business, the Queensland Government is required to administer relevant legislation, regulations and codes to regulate construction of the Project. There are a number of Queensland Government agencies with statutory roles and obligations and other interests for the construction and operation of the Project. An efficient and effective management structure is desirable to ensure all statutory requirements and conditions of any approvals provided by the Queensland Government are met.

19.2.2 Brisbane City Council

Brisbane City Council would be responsible for ensuring the Contractor performs the contract in accordance with the terms of the contract, City Plan, local laws and approvals. From an environmental management standpoint, the contractual conditions should require:

- the preparation of environmental management plans for both the construction and the operational phases of the Project and the gaining of necessary approvals for those environmental management plans prior to the commencement of works or operations;
- the satisfaction of conditions imposed on the Project by the Coordinator-General in his evaluation report;
- the satisfaction of conditions imposed on any development approval or other permit, licence or approval required to be obtained by the Contractor; and
- the requirements of relevant legislation, regulations and codes in the design and construction of the Project.
- liaison with relevant agencies within the Queensland Government, including the Queensland Government's Northern Link project review panel if one is established (refer section 18.2.1 above).
- liaison and coordination with Council stakeholders in order to provide timely advice for the Contractor to assist in the smooth and efficient construction of the Project.

19.2.3 Contractor

The Contractor is responsible for meeting the requirements of the contract with Brisbane City Council for the construction of the Project.

Conditions on the contract will include the following requirements:

- Obtaining all necessary approvals for the Project;
- Compliance with all approvals issued for the Project.
- Maintaining for the duration of the construction phase, open and effective communications with the communities in the vicinity of each of the Northern Link worksites about the construction program, scale, duration and nature of proposed work, and details of proposed impact mitigation measures.
- Undertaking all construction works in accordance with good environmental management practices.
- Responsibility for any sub-Contractors in meeting the good environmental management practices referred to above.
- Investigating means for undertaking and completing the construction works in a timely fashion and continuously seek to implement practical approaches to reduce the adverse impacts of the Project construction works on communities.

It is anticipated that the Contractor would implement a certified Quality Assurance (QA) system and comply with ISO 14001 to ensure the design and environmental requirements are met through detailed Quality Plans. These would be prepared to describe the procedures to follow to meet the relevant design and environmental requirements. The construction EMP would be an integral part of the Quality Plans and on-site operations and would be included in the Quality Plans as a 'special process'. Designating the EMP as a 'special process' has a particular meaning in QA terms, as it draws particular attention to the implementation of the EMP as part of the QA procedures.

Implementing the QA Plan and the EMP would be subject to inspection, testing and audits throughout the Project to monitor conformance during the Project, not simply at the end.

19.2.4 Overall Responsibilities

The following tables provide a summary of the likely responsibilities and accountabilities of various parties who would have active roles in the environmental management of the Project. The responsibilities have been divided into the construction (**Table 19-1**) and operation (**Table 19-2)** stages.

- **Table 19-1 Project Responsibilities - Construction**

	Project Responsibilities - Construction
Queensland Government	▪ Provide readily available expertise for the construction project as required. ▪ Various Government agencies will carry out responsibilities as regulators in specified fields and legislative roles.
The Proponent Brisbane City Council	▪ Manage the construction process; ▪ Review the EMP (Construction) submitted by the Contractor; ▪ Receive progress reports on performance by the Contractor for the purpose of acknowledging compliance with contract conditions; ▪ Ensure that requirements of the Conditions of Contract (Environmental Management) and approved EMP (Construction) included in the contract documentation are achieved; ▪ Review any revisions to the EMP (Construction) as required; and ▪ Maintain a current copy of the contract and the EMP (Construction) containing a record of the completion of planned actions, monitoring records and reports, supplied by the Contractor.
▪ Contractor	▪ Appoint independent facilitators to convene the community consultative committees, establish the committee terms of reference, facilitate meetings and pro-actively work to ensure efficient but comprehensive communication between the committee and the other parties takes place; ▪ Develop EMP (Construction) in accordance with the Conditions of Contract (Environmental Management) and the Coordinator General's Evaluation Report for submission to the Brisbane City Council; ▪ Maintain a master copy of the EMP (Construction) containing a record of the completion of planned actions, monitoring records, and reports which are made available during the audits; ▪ Obtain all necessary statutory approvals and licences and ensure that conditions of licences/approvals/permits are met; ▪ Provide copies of the EMP (Construction) to the relevant project staff having responsibilities defined in the EMP (Construction); ▪ Provide training to all project staff; ▪ Maintain a record of all training undertaken by all project staff, detailing the type and purpose of the training; ▪ Undertake regular monitoring in relation to environmental management issues and ensure that monitoring results are made available to the Brisbane City Council project management team and the community consultative committees; ▪ Ensure corrective actions arising from self-assessments and external audits are completed immediately and in accordance with the EMP (Construction); ▪ Notify the Brisbane City Council and any relevant State agency of any environmental incidents and maintain a record of events relating to the environmental incidents including any remedial action taken; ▪ Ensure there is adequate and accurate identification and reporting of any non-conformances and any other environmental issues that may arise during construction; ▪ Provide relevant and timely information about construction activities that may have

	Project Responsibilities - Construction
	local impacts to the relevant communities and consult with individuals that may be directly impacted upon by construction activities as required to ensure direct project impacts are being appropriately managed; and ▪ Ensure that environmental protection measures are implemented in accordance with the approved EMP (Construction).
Community Consultative Committees	▪ Provide timely advice to the Proponent about construction issues. ▪ Hold independently facilitated meetings at appropriate intervals (which may be monthly during the initial period of local construction) to consider and provide advice about design options, construction activities and views received from the greater communities, and provide information and recommendations to the Contractor; ▪ Provide timely reviews of complaints reporting, monitoring results and any other data made available by the Contractor in accordance with the contract; and ▪ Provide information to the wider community as required.

▪ **Table 19-2 Project Responsibilities - Operation**

	Project Responsibilities - Operation
Queensland Government	▪ On-going administration of relevant statutes, regulations and codes; ▪ In an arrangement with the Contractor / operator, provide emergency services to the Project including ambulance, fire fighting, chemical hazards emergency services and policing services; and ▪ To the extent required, work with the Brisbane City Council in managing the daily movement of traffic in the City, particularly along State-controlled roads.
Brisbane City Council	▪ Review for the EMP (Operation and Maintenance) prepared by the Contractor; ▪ Liaise as required with the Queensland Government and the Contractor / operator to ▪ ensure traffic management objectives are achieved in the City; ▪ Undertake periodic reviews and audits of the Contractor's performance where required by the contract.
Contractor/ Operator	▪ Prepare an EMP (Operation and Maintenance) for the Project, incorporating conditions of the contract; ▪ Continuously monitor the environmental and traffic performance of the Project and provide regular reports on performance to the Brisbane City Council. In this context, environmental performance includes monitoring in-tunnel air quality and ambient air quality at selected locations, with reporting intervals to be in accordance with contract conditions; ▪ Report to the Brisbane City Council and relevant government agencies on incidents of non-compliance, such as exceedances of air quality goals for in-tunnel air quality; ▪ Ensure that Northern Link is operated safely and with good environmental management practices at all times; and ▪ To the extent required, work with Brisbane City Council in managing the daily movement of traffic in the City.
Community Consultative Committees	▪ For the first 12 months of operation only: – Review the environmental reports prepared by the Contractor / operator in a timely manner; – Provide other community-based inputs as required.

19.2.5 Environmental Responsibilities

There are a number of general project responsibilities for all entities involved in the Project, with respect to the *Environmental Protection Act 1994*. Each member of project staff has a general environmental duty under Section 319 of the Act, and must not carry out any activities that cause, or are likely to cause, environmental harm, unless all reasonable and practical measures are taken to prevent or minimise harm. If in the performance of their work,

project staff notice that serious or material environmental harm is being caused or threatened by their actions or the actions of someone else, they should report the matter, under section 320 of the Act.

Additionally, project staff members will be required to comply with the following items at all times.

- Contractor's environmental policy and EMS.
- Relevant legislation, with particular attention to environmental legislation under this EMP.
- EMP requirements including relevant criteria for design, construction and operation.
- Training requirements.

19.2.6 Training and Awareness

Specific training and awareness requirements are outlined in **Table 19-3** below. Environmental training for on-site staff could be performed during the site-specific safety induction. Any further environmental training should be performed on an ongoing or periodic basis as required.

- **Table 19-3 Training and Awareness Requirements**

	Project Responsibilities – Training and Awareness Requirements
Contractor	General environmental duties under the Environmental Protection Act 1994 and other relevant legislation such as but not limited to: – Aboriginal Cultural Heritage Act 2003; – Fisheries Act 1994; – Integrated Planning Act 1997; – Vegetation Management Act 1999; – Water Act 2000; – Queensland Heritage Act; – Specific environmental objectives and mitigation measures; – General responsibilities in relation to the design of the Northern Link; – Responsibilities under the EMP (Construction) in relation to implementing mitigation measures, monitoring, reporting and implementing corrective actions; – Responsibilities in the event of an environmental incident; – The consequences of not implementing mitigation measures or departure from specified operating conditions; – Internal and external communication processes; – Community perspectives and expectations; and – Document control.

19.2.7 Communication

Internal Communication

Environmental protection should be achieved through clear and concise internal communications, which would be subject to periodic audits to ensure that the communication structure is performing adequately and all actions are performed and recorded. The audits should also provide for follow up on specific or corrective actions raised during previous audits to ensure responses are complete.

The internal communication process and structure for formal reporting should be clearly illustrated in the EMP (Construction).

External Communication

To ensure clear and unambiguous communication is achieved, only those project staff nominated by the Brisbane City Council should be involved in consultation with external bodies on environmental issues. Notwithstanding this provision, Brisbane City Council may invite the Contractor to attend meetings relevant to Northern Link with government agencies or any other bodies.

External communication responsibilities and training should be detailed in the Contractor's EMP (Construction).

19.3 Monitoring, Auditing and Reporting Strategies

19.3.1 Reporting

Reporting and documentation including the EMP (Construction) are intended to be subject to change, and would be amended to incorporate necessary variations. Control of all project reporting for the EMP (Construction), Project Quality Plans and any other documents or plans would be the responsibility of the Contractor in accordance with standard Document Control Procedures.

19.3.2 Monitoring Responsibilities and Standards

The Contractor would be responsible for monitoring of each element in the various project stages to ensure the necessary and agreed mitigation measures are implemented. The specific monitoring actions for each environmental element would be finalised in the EMP (Construction) and EMP (Operation and Maintenance), including monitoring requirements identified in this draft EMP.

The Contractor would be required to undertake the monitoring of the environmental elements in the EMP as specified and the conformance of the Project Quality Plan at least on a monthly basis. The monitoring is based on environmental performance, non-conformances, audit results, necessary changes in construction details, new standards or legislation and any other requirements. The review of the EMP (Construction), together with suggested amendments, should be provided to Brisbane City Council.

Project staff responsible for any baseline, construction or operational stage monitoring should ensure that all monitoring equipment used is regularly calibrated and the results of the calibrations recorded. All monitoring and sampling undertaken is to be in accordance with the relevant agency guidelines or Australian Standards. All analytical testing performed will use National Association of Testing Authorities (NATA) approved procedures or if this is unavailable, be performed to the best relevant standard. Provision should be made to permit new technologies or materials to be used so long as standards can be shown to be equal to or exceeding current recognised standards.

A mechanism for reporting on compliance must be established in the Construction EMP, consistent with the following hierarchy of reporting.

Table 19-4: Construction – Reporting on Compliance and Performance

Report	Frequency and Scope
Construction Compliance Report	Six-monthly ▪ compliance with Coordinator General's conditions; ▪ satisfaction of environmental objectives and EMP requirements; ▪ response to incidents of non-conformance, including corrective actions, revised construction practices, responsibility and timing. ▪ all other matters pertaining to environmental performance during construction.
Construction Incidents and Exceedance Report	Interim Report ▪ within 2 days of incident or an exceedance of a condition, goal or requirement being identified; ▪ details of incident and initial response. Full Report ▪ within 14 days of incident or an exceedance of a condition, goal or requirement being identified; ▪ details of incident, response, corrective action, responsibility and timing.
All reporting must be to the Coordinator-General, and must be available to relevant agencies on request.	

19.3.3 Non Compliance and Corrective Actions

The reporting and monitoring would incorporate continual improvement requirements identified through a non-compliance and corrective action procedure. These would be nominated in the Project Quality Plan and the EMP, and should specify methods for recording and reporting non-conformances and ensuring that corrective actions are implemented to rectify the problem. The non-conformances and corrective actions may trigger a review and modification of practice and should be reflected in amendments to the Project Quality Plan and EMP. The non-compliance process should include a complaints mechanism or procedure for the further identification of non-conformances and issues outside the scheduled monitoring and reporting periods.

19.4 Community Engagement and Communication Plan

To keep the community informed during the construction phase of the Project, a community engagement process will be developed and implemented.

19.4.1 Community Consultative Committees

To assist the Contractor in managing the possible impacts of the construction phase of the Project, advice should be sought from the community. An effective means of consulting with the community about construction impacts is available through community consultative committees that would be convened for this purpose.

Community consultative committees convened by the Contractor prior to commencement of construction for each major work area (Western Freeway, Toowong, Kelvin Grove, Inner City Bypass) would meet regularly until completion of the construction for the purpose of providing timely, open advice and representations of community issues and concerns arising from construction of the Project.

The community consultative committees would undertake the following tasks.

- Review construction plans and programs for the purpose of informing the relevant communities about the construction project.
- Provide community feedback to the Contractor about concerns with the construction project.
- Provide advice to the Contractor as required in relation to construction issues.

The Contractor would keep Brisbane City Council informed of the views and issues raised in meetings of the community consultative committees by providing endorsed copies of minutes and other meeting records as required.

19.4.2 Complaints and Responses

The environmental management process managed by the Contractor is to include a procedure for receiving and acting upon complaints. Attention to complaints should be carefully managed, prompt and effective, and should form a key part of the environmental reporting mechanism. Responsibility for maintaining the complaints procedure would rest with the Contractor, as a contractual requirement.

While the Construction EMP and Operation EMP would establish the procedure for complaints, basic requirements should include:

- A procedure for receiving and responding to complaints which is acceptable to the Proponent, and the Environmental Protection Agency (EPA);
- The Contractor maintaining, during the construction phase, a complaints telephone service operated, during the construction phase, on a 24 hour, seven days a week basis by staff with authority to stop or amend work orders if required. During the operations phase of the Project, the complaints system could be maintained on a ‘earliest opportunity’ or ‘next day’ basis for responses to the complainant;
- A process for registering and handling all complaints received in terms of:
  - Time and date complaint relates to and the time and date complaint received;
  - The identity of the complainant and the recorder of the complaint;
  - The specific action or activity causing the complaint including the place and time of occurrence ;
  - Whether environmental compliance requirements are being met in relation to the complaint;
  - The action taken to address the complaint if necessary;
  - A database for tracking of complaints and actions taken in response;
  - Immediate communication of the complaint to the contractor’s nominated representative;
  - Details on how the action taken is to be communicated to the complainant and the Proponent and the Contractor;
  - Feedback to the complainant and the Proponent and the EPA within a specified time period;
  - Any subsequent remedial action required to avoid cause for future complaints if relevant;
  - Regular reporting to the EPA and the Proponent on complaints and corrective actions; and
  - Monitoring and auditing of the complaint handling system.

19.4.3 Engagement process

The community engagement process would also include:

- early establishment of community information services including toll-free telephone service with 24 hour, 7 day servicing, project website and email service, regular newsletters, scheduled information sessions or open days;
- availability of information through the Project website generally and in response to specific inquiries about environmental performance;
- early and on-going engagement with owners and occupants of premises adjacent to the proposed works or proposed mitigation measures;
- early notification of owners and management of critical premises such as hospitals, nursing homes and schools likely to be affected by proposed construction works in terms of their scale, duration, location and potential effects;
- where required, special procedures to respond to complaints, issues or incidents, such as face-to-face meetings and on-going communications with affected parties and a documented process for issues resolution.

19.4.4 Consultation

Consultation procedures must include the community engagement measures above and further include:

- consultation with property owners and occupants of residences or other facilities identified as potentially affected by the construction works, as well as the wider community, must be conducted throughout the construction period;
- commencement of consultation well in advance of the commencement of works, and in some circumstances, should commence with the design of mitigation measures; and
- consultation with affected property owners and occupants must be conducted with confidentiality where requested by the owners or occupiers of premises; and
- consultation must be at a level of detail sufficient to address specific construction impacts and mitigation requirements.

19.5 Outline EMP

19.5.1 Overview

This draft outline Environmental Management Plan (draft EMP) is presented on the understanding that detailed EMPs (Design and Construction) and (Operation and Maintenance) as well as relevant sub management plans are to be prepared by the Contractor and approved by the Brisbane City Council and/or a relevant State agency. The detailed EMP (Design and Construction) would be part of the construction contract documentation and would need to include, but not be limited to, the mitigation measures outlined in this draft EMP and any conditions imposed either by the Coordinator-General in assessing the EIS or other agencies under other approvals.

This chapter outlines the strategies to be adopted to address the identified impacts and recommendations in the EIS. The draft EMP is an integral part of the EIS, but is also capable of being read as a stand-alone document, without reference to other parts of the EIS.

The purpose of the draft EMP is to set out the Project commitments to environmental management, including the identification of environmental aspects to be managed and how environmental values would be protected and enhanced and identifies mitigation measures relevant to the reference design for the Project.

Once in place, both Design and Construction and Operation and Maintenance EMPs would be dynamic documents. Each would be updated to incorporate further information and public concerns, approval conditions, changes in environmental management procedures in the light of ongoing monitoring results, new techniques, and relevant legislative requirements. Each EMP would be supported by sub-plans. The construction sub-plans are likely to deal with such matters as soil erosion and sedimentation, dust, noise and vibration management, surface water quality and groundwater quality, spoil removal haulage and deposition, hours of work and work practices on the worksites, safety hazard and risk management, community liaison and communications, among others. The operation sub-plans are likely to deal with such matters as ambient air quality, in-tunnel air quality, waste water management and disposal, landscape management and maintenance, tunnel traffic management and safety, emergency and risk procedures, community liaison and communications among others.

19.5.2 Planning for Ecologically Sustainable Development

The Northern Link would pursue the achievement of the following overall objectives for Ecologically Sustainable Development during the design, construction and operational stages:

- Adopt and integrate best available management practices through the design, construction and operation phases of project life, across all aspects of the Project, including:
- energy efficiency measures (eg: power demand management during construction, natural lighting and ventilation in appropriate locations, traffic management to enhance fuel efficiencies);
- waste minimisation, management and recycling;
- wise use and re-use of natural resources (eg: air, water including groundwater, rock and other spoil);
- maintenance of ecological processes and protection and enhancement of habitat values (eg: Anzac Park, Mt Coot-tha Botanic Gardens);
- avoidance if possible, or minimisation and mitigation of impacts on people, cultural values, communities and community facilities, businesses and other employment;
- optimise potential intergenerational benefits (eg: enhanced accessibility, provision for alternative modes of transport including public transport walking and cycling)
- Comply with all applicable laws, regulations, standards and guidelines for the protection of the environment;
- Adopt the best management means available to prevent or minimise adverse environmental impact;
- Describe monitoring and reporting procedures required to identify impacts on the environment;
- Describe incident response protocols and procedures, including:
    - lines of command or responsibility and extent of jurisdiction for categories of incidents

- an integrated emergency response arrangement and procedures between the emergency services, Queensland Police, hospitals, tunnel operators, traffic management authorities and EPA;
- an integrated environmental incident management group;

- Provide project employees and Contractors with adequate and contemporary training in safety, hazard and risk management, environmental procedures and social obligations; and
- Support the role and function of Northern Link Local Community Consultative Committees (CCCs).

19.5.3 Implementation

This draft outline EMP demonstrates how identified potential impacts are addressed and recommendations in the EIS can be implemented during the design, construction and operation stages. Preparation of the specified actions and recommendations in the draft outline EMP includes:

- Regulatory requirements expressed in regulations and local laws;
- Recommendations made in the EIS to minimise identified environmental/social impacts;
- Good practice environmental management;
- General content requirements of ISO 14001; and
- Management and responsibility for performance.

An outline of how each EMP element is considered and presented is shown in **Table 19-5**.

Table 19-5 EMP Elements

EMP Component	Description	Example
Environmental Element	The aspect of the environment requiring targeted Environmental Management.	Air Quality - Construction
Environmental Objective	A short description of the high level aim of the Project with respect to the particular element.	Prevent or minimise nuisance dust and odour impacts within EPP (Air) guidelines and with regard to community expectations
Performance Criteria	The performance criteria are designed to contribute to the overall objectives. If the criteria are maintained through the Project the objectives would be achieved. These criteria should be measurable and monitored to assess level of achievement.	Manage dust deposition with based on goals established in the Environmental Protection Policy (Air) 1997
Mitigation Measures	Mitigation measures may include measures such as changes in work procedures and practices, physical interventions to separate or buffer places from predicted construction impacts or physical relocation of affected parties for agreed periods of time. Such measures must be directed to achieving the Environmental Objectives and Performance Criteria or statutory requirements, and must be consistent with the conditions imposed by the Coordinator-General. The mitigation measures may include those in the Draft Outline EMPs or other measures that achieve the Environmental Objectives and Performance Criteria, the statutory requirements or conditions of an	Develop a Construction Dust and Odour Environmental Management Plan Establish minimum air quality targets at key locations

EMP Component	Description	Example
	approval from the Coordinator-General.	
Reporting, monitoring, auditing	Purpose and frequency of reporting to demonstrate achievement of the environmental objectives and satisfaction of the performance criteria	Ambient air quality at pre-agreed sites adjacent to worksites monthly or weekly for 4 weeks if complaint received in previous month.
Responsibility	The responsible entity	The Contractor

19.6 Environmental Requirements and Obligations

This draft EMP sets out a framework that would enable potential environmental impacts identified in relation to the Northern Link design, construction and operation to be avoided or minimised. In this regard, the draft EMP may refer to environmental legislation, controls, standards and guidelines relevant to impact mitigation and avoidance. The draft EMP and sub-plans also require that, wherever possible, works related to site development meet the environmental expectations of the broader community and the local communities. These expectations are:

- for the broader community reflected in relevant standards and controls; and
- for local communities, those identified during the community consultation process for the EIS.

Best practice source documents are referred to wherever possible to address identified environmental impacts or risk more effectively. The requirements presented in this plan are applicable to all aspects of the construction and operational phases of the Northern Link. All staff working on the Project, including sub-contractors, would be bound to comply with the requirements of the approved EMP (Design and Construction) and the approved EMP (Operation) and their respective sub-plans.

Applicable legislation, a range of best practice guidelines and associated standards relevant to construction works and environmental protection are listed herein. The Project Environmental Management representative would hold copies of the listed legislation, guidelines and standards on site.

19.6.1 National Strategies and International Conventions

The following national strategies provide higher level guidance and consideration for the design, construction and operation of the proposed Northern Link, and the preparation of this draft EMP:

- National Strategy for Ecologically Sustainable Development 1992;
- National Strategy for the Conservation of Australia's Biological Diversity 1996;
- National Greenhouse Strategy 1998; and
- National Environmental Protection (Ambient Air Quality) Measure 1998.

Relevant international conventions are:

- The Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment 1986 (CAMBA);

- The Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment 1974 (JAMBA);
- The RAMSAR Convention on Wetlands of International Importance 1971;
- The Bonn Convention on the Conservation of Migratory Species of Wild Animals 1979; and
- The United Nations Convention on Biological Diversity 1992.

19.6.2 Commonwealth Legislation

Commonwealth Legislation that is relevant to the Project and the draft EMP includes:

- Environment Protection and Biodiversity Conservation Act 1999;
- Native Title Act 1993; and
- National Greenhouse and Energy Reporting Act 2007;

19.6.3 Queensland Legislation

Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) is the umbrella legislation for the regulatory management of the environment in Queensland. The EP Act is based on self-regulation and duty of care which places the responsibility for protection of the environment on all persons during the conduct of all activities.

The Act provides for the licensing of Environmentally Relevant Activities (ERAs) and the granting of development approvals and registration certificates for the operation of the regulated activities. The Act also provides the power to administering authorities to order actions to be taken to improve environmental performance, conduct audits and environmental evaluations of activities, approve environmental management programs and impose penalties or prosecute persons for non-compliance within the requirements of the Act.

This Act is the primary legislative environmental tool in Queensland. The Act also allows for the preparation of Environmental Protection Policies (EPPs). The following EPPs have been proclaimed:

- Environmental Protection (Water) Policy 1997;
- Environmental Protection (Noise) Policy 1997;
- Environmental Protection (Air) Policy 1997; and
- Environmental Protection (Waste Management) Policy 2000.

Other State Legislation

The Draft EIS has been prepared under the provisions of the *State Development and Public Works Organisation Act 1971* (SDPWO Act). Relevant information in the EIS is then used to support applications for permits, licences and approvals. In addition to the EP Act, other major relevant legislation relevant to the Project includes:

- Aboriginal Cultural Heritage Act 2003;
- Acquisition of Land Act 1967;
- Animal Care and Protection Act 2001;
- Brisbane Forest Park Act 1977;
- Building (Flammable and Combustible Liquids) Regulation;
- Coastal Protection and Management Act 1995;
- Dangerous Goods Safety Management Act 2001;
- Environmental Protection Act 1994
- Fisheries Act 1994;
- Health Regulations under the Health Act;
- Integrated Planning Act 1997;
- Land Act 1994;
- Land Protection (Pest and Stock Route Management) Act 2002 ;
- Nature Conservation Act 1992;
- Plant Protection (Red Imported Fire Ant) Quarantine Notice 2001;
- Queensland Heritage Act 1992;
- Soil Conservation Act 1986;
- Transport Infrastructure Act 1994;
- Vegetation Management Act 1999;
- Water Act 2000; and
- Workplace Health and Safety Act 1995.

19.6.4 Guidelines, Codes and Best Practice

The standards described in **Table 19-6** apply to monitoring and auditing of performance.

Table 19-6 Performance Guidelines

Risk	AS 4360: 1999 Risk Management
Waste and Wastewater	
Water Quality Sampling Manual – For use in Testing for compliance with the *Environmental Protection Act 1994*. Second edition (Department of Environment Heritage 1995)	
Standard Methods of the Examination of Water and Wastewater – American Public Health Association (APHA)/Australian Waste Water Association (AWWA)	
AS 2031 Selection of Containers and Preservation of Water Samples for Chemical and Microbiological Analysis	
Soils	
Australian and New Zealand Environment and Conservation Council (ANZECC)/National Health and Medical Research Council (NHMRC) – Guidelines for the Assessment and Management of Contaminated Sites	
Queensland Government Chemical Laboratory – Guidelines for Soil Sampling	
Queensland Acid Sulphate Soils Investigation Team (QASSIT) "Sampling and Analysis Procedure for Lowland Acid Sulphate Soils (ASS) in Queensland" dated 1 October 1997.	
'Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland' (Department of Environment 1998)	
Soil Erosion and Sediment Control, Engineers Guidelines for Queensland	
Air	AS 3580 Methods of Sampling and Analysis of Ambient Air
Noise and Vibration	
'Interim Guidelines and Technical Notes for Road Traffic Noise Amelioration' (DMR 1992)	
Environmental Guideline "Noise from Construction, Maintenance & Demolition Sites" (EPA 1989)	
'Noise Measurement Manual' (EPA 1995)	
AS 1055.1 and AS 1055.2 Acoustics – Description and Management of Environmental Noise	

AS 2187 Explosives – Storage Transport and Use (Explosives Code)
AS 2436 Guide to Noise Control on Construction, Maintenance and Demolition Sites
AS2107 Acoustics – Recommended noise levels and reverberation times for building interiors
British Standard 7385 Evaluation & Measurement for reverberation in buildings; German Standard DIN4150
AS 2659.1 Guide to the Use of Sound Measuring Equipment
AS 2659 Sound Level Meters
AS 2702 Acoustics – Methods for Measurement of Road Traffic Noise.
Calculation of Road Traffic Noise (CORTN88) United Kingdom Department of Transport.
Dangerous Goods
AS 1216 Classification, Hazard Identification and Information Systems for Dangerous Goods
AS 1678 Emergency Procedure Guides – Transport
AS 1940 Storage and Handling of Flammable and Combustible Liquids
AS 2508 Safe Storage and Handling Information Cards for Hazardous Materials
AS 2809 Road Tank Vehicles for Dangerous Goods
AS 3780 – 1994 The Storage and Handling of Corrosive Substances
AS 2931 Selection & Use of Emergency Procedure Guides for Transport of Dangerous Goods.

19.6.5 Approvals, Permit and Licence Requirements

A summary of the approvals, permits and licences which may be required by the Project is provided in **Table 19-7**.

- **Table 19-7 Summary of Approvals**

Legislation	Authority	Trigger	Response	Timing
Environmental Protection Act 1994 and Integrated Planning Act 1997	EPA	ERA 7 Chemical storage – including dangerous goods storage – in containers having a design storage volume greater than 10m^3 and less than 1000m^3	Development approval and registration certificate to be obtained if storage exceeds the design storage volume	Detailed D & C
Environmental Protection Act 1994 and Integrated Planning Act 1997	EPA	ERA 15 If the final design were to include sewerage treatment works to treat water for recycling during construction.	Development approval and registration certificate to be obtained	Detailed D & C
Environmental Protection Act 1994 and Integrated Planning Act 1997	EPA	ERA 16 If the final design were to involve an on-site water treatment facility to treat bore water for use during construction	Development approval and registration certificate to be obtained	Detailed D & C
Environmental Protection Act 1994 and Integrated Planning Act 1997	EPA	ERA 20c - Extracting rock or other material – from a pit or quarry using equipment with a design capacity of 100,000 tonnes/ year or more (1)	Development approval and registration certificate to be obtained	Detailed D & C
Environmental Protection Act 1994 and Integrated Planning Act 1997	EPA	ERA 22 Crushing and Screening**.** If the Project creates a material change in the intensity or scale of the existing deemed development approval for the Quarry (Licence no. SR41). The	Development approval and licence required	Detailed D & C

Legislation	Authority	Trigger	Response	Timing
		processing of the material would occur in accordance with the existing ERA 22 licence.		
Environmental Protection Act 1994 and Integrated Planning Act 1997	EPA	ERA 62 – Concrete batching plant producing concrete or a concrete product by mixing cement, sand, rock, aggregate or other similar materials in works (including mobile works) having a design production capacity of more than 100t a year.	Development approval and registration certificate to be obtained	Detailed D & C
Integrated Planning Act 1997	Minister of the State or Brisbane City Council	Community Infrastructure designation for community infrastructure under Schedule 5 of the *Integrated Planning Act 1997* (2) if proposed.	Designation of land if required for parts of the Project including ventilation and tunnel management facilities, worksites	
Integrated Planning Act 1997	Brisbane City Council or Private Certifier	Building works under Schedule 8 Part 1 Table 1 *Integrated Planning Act 1997*	Development approval for building works for worksheds, tunnel control and ventilation buildings	
Integrated Planning Act 1997	Brisbane City Council	Excavation or filling for spoil placement that materially affect premises or their use	Development approval for spoil placement	
Integrated Planning Act 1997	Brisbane City Council	Reconfiguration of a lot under Schedule 8 Part 1 Table 3 (4)	Development approval for long term lease of land for tunnel control centre (3) (4)	
Integrated Planning Act 1997	EPA	Material change of use for land on the Environmental Management Register or Contaminated Land Register under Schedule 8 Part 1 Table 2	Development approval where tunnel developed on land on the EMR or CLR	
City Plan, Integrated Planning Act 1997	Brisbane City Council	Building works for demolition of character housing in a demolition control precinct.	Development approval for building works for demolition of character housing in a demolition control precinct	
Vegetation Management Act 1999 and Integrated Planning Act 1997	DNRW	Clearing of native vegetation on freehold land.	Development approval for operational works.	Detailed D & C
Environmental Protection (Waste Management) Regulation 2000	EPA	Various triggers relating to waste tracking	Waste management to comply with relevant provisions	Construction
Environmental Protection Act 1994	EPA	Potentially contaminated soils require compliance with site management plans prepared in accordance with the EP Act. Section 424 requires a disposal permit for disposal of	The construction of the Project would need to comply with the conditions applying to the existing site management plans for each of the contaminated sites under which it	Detailed Design and construction for disposal

Legislation	Authority	Trigger	Response	Timing
		contaminated land	passes. Disposal permits would be required for any contaminated soil excavated during construction or otherwise to be disposed of	permit
State Planning Policy 2/02: Planning and Managing Development Involving Acid Sulfate Soils	EPA, DNRW	Potential Acid Sulphate Soils	Acid Sulphate Soils Management Plan, prepared in accordance with the QASSIT Guidelines	Detailed Design
Aboriginal Cultural Heritage Act 2003	DNRW	Preparation of a Cultural Heritage Management Plan	A cultural heritage study is included in the EIS to identify the locality of places of cultural heritage significance. Any works affecting a place of Indigenous cultural heritage significance to be undertaken under the Cultural Heritage Management Plan.	Detailed Design
Queensland Heritage Act 1992 and Integrated Planning Act 1997	EPA (QHC)	Any development carried out on a registered place is assessable development under the Integrated Planning Act 1997.	A development application, for code assessment, would be required.	
Transport Infrastructure Act 1994	Chief Executive Department of Main Roads	Works to be undertaken on a State Controlled Road or that have a significant impact on a State Controlled Road	Approval required for tunnel or road works that are on a State Controlled Road or that have a significant impact on a State Controlled Road	
City Plan, Integrated Planning Act 1997	Brisbane City Council	Development on a local heritage place.	Development approval for any development on a local heritage place	
Transport Infrastructure Act 1994	Queensland Rail	Works that interfere with a railway	Approval required for any works that interfere with a railway	
Land Act 1994	DNRW	Road closures	Road closures would be required	
Nature Conservation Act 1992	EPA	Taking, using, keeping or interfering with a protected animal or plant (5)	Permit to be obtained if protected plants are affected by the Project. Fauna to be relocated in accordance with a Fauna Relocation Plan.	
Water Act 2000	DNRW	Taking of or interfering with water	Water licence may be required if taking or interfering with water	
Water Act 2000	DNRW	Clearing of vegetation in a	A Riverine Protection	

Legislation	Authority	Trigger	Response	Timing
		riparian corridor	Permit may be required	
Brisbane Forest Park Act 1977	Brisbane Forest Park Administration Authority	Development in Brisbane Forest Park	Development approval for any development in Brisbane Forest Park	
Approvals under Local Laws	Brisbane City Council			

Table Notes:

(1) Only if road and tunnel works constitute either a pit or a quarry and the definition of "extracting" in Schedule 9 to the Environmental Protection Regulation.

(2) If it is determined to proceed with the designation, where assessable under City Plan.

(3) If leasehold tenure for 10 years or more is pursued.

(4) Unless under a community infrastructure designation.

(5) If protected animals or plants are identified and required to be relocated/removed during construction.

19.7 Design and Construction Environmental Management Plan

Environmental Management Plan Element Strategies describe each environmental element, objectives and identified mitigation measures for applicable stages of the Project. Some of the environmental elements suggest specific monitoring requirements and/or statutory requirements.

The environmental element topics for this **Draft Design and Construction EMP** are:

- Traffic and Transport
- Geology and Soils
- Hydrogeology and Groundwater Quality
- Surface Water Quality
- Air Quality
- Noise and Vibration
- Flora and Fauna
- Land Use and Planning
- Cultural Heritage
- Social Environment
- Hazard and Risk
- Waste Management

- Element 1. General – Construction	
Environmental Objective	■ Manage construction in accordance with the Construction EMP and EMP sub-plans to avoid or minimise impacts of the project on the environment and the community.
Performance Criteria	■ Worksites prepared in accordance with designs providing for the management and mitigation of construction impacts. ■ Construction works are managed to avoid, or mitigate and manage impacts on the amenity and environmental conditions prevailing in the vicinity of the worksites. ■ Exceedances of standards established in this EMP are avoided or minimised. ■ Maintain safe and efficient access near worksites for emergency vehicles. ■ Take reasonable measures to minimise potential construction risks to construction workers, to the general public in adjacent areas and to the environment.
Mitigation Measures	**Hours of work:** ■ Works on or above the surface which may generate excessive levels of noise, vibration, dust or traffic movements should only be undertaken between 6.30am and 6.30pm Monday to Saturday and at no time on Sundays or Public Holidays except for special circumstances where the above surface works should be conducted outside these days and hours. ■ Special circumstances include works on Arterial Roads (to avoid disruption to peak traffic flows), works in railway corridors or works involving transport of large prefabricated components such as Tunnel Boring Machines; ■ Collection, loading and haulage of spoil from construction worksites by truck would be undertaken between 6.30am Mondays and 6.30pm Saturdays; transport of spoil by conveyor may be undertaken 24 hours per day seven days per week providing that operation of the conveyor is in accord with the provisions of this EMP, particularly with respect to noise and dust goals; ■ Notify local communities of duration and timing of surface works to be conducted outside of usual working hours. **Construction worksites:** ■ To be designed and constructed for the minimisation, management and mitigation of construction impacts; ■ To include construction work sheds over tunnel portals where large quantities of spoil are loaded and removed. Such work sheds to incorporate acoustic lining, ventilation and dust filtration to achieve environmental objectives and performance criteria for noise and air quality as set out in the EMP; ■ To conduct spoil handling, storage and loading at all times within enclosures designed and constructed to achieve environmental objectives and performance criteria for noise and air quality as set out in the EMP; ■ To have night lighting, including security lighting and avoid light spill onto adjoining premises, in excess of 8 lux measured at the common boundary; ■ To include solid (not see-through and may double as noise walls) fencing to worksite boundaries to ensure safety for pedestrians and cyclists and prevent sight-seeing by passing drivers; ■ To have pedestrian and vehicle site access according to the Transport, Access, Parking and Servicing Planning Scheme Policy in City Plan. Comply with the requirements of the *Hazard and Risk Assessment Planning Scheme Policy* in City Plan. Rehabilitation of construction worksites is to be carried out as quickly as reasonable and practicable to manage and mitigate the potential impacts of dust, soil erosion and sedimentation. Surface earthworks must be managed to minimise adverse environmental impacts on waterways and sensitive receptors.
Monitoring	■ Weekly during site preparation and construction start-up.
Reporting	■ Monthly until completion of construction and for six months following rehabilitation.
Responsibility	■ Contractor

- Element 2. Traffic and Transport – Construction	
Environmental Objective	■ Manage construction traffic and transport issues to minimise potential impacts on the community and the operation of the road network.
Performance Criteria	■ Take reasonable and practicable measures to avoid, or mitigate and manage the potential construction traffic impacts on communities near the worksites, including on local parking. ■ Minimise as far as reasonably practicable, potential traffic disruptions to the operation of the road network and the public transport network (bus, rail) due to construction works. ■ Maintain safe access near all project work areas for road users, including pedestrians and cyclists. In particular, develop local access strategies in consultation with stakeholder groups to maintain safe, convenient and efficient access to community facilities such as schools, child care facilities, churches, aged care accommodation, health care and shopping facilities. ■ Implement traffic management measures near worksites and other project works to avoid conflicts between construction traffic, and pedestrians and cyclists. ■ Take reasonable and practicable measures to inform the local and broader communities about the timing and scale of changes to traffic conditions on roads in the vicinity of worksites and construction works. ■ Monitor traffic flows near construction works and take corrective action in response to traffic impacts as a consequence of construction works.
Mitigation Measures	**Truck routes and construction site access** ■ In consultation with Queensland Transport, Department of Main Roads and Brisbane City Council, develop and implement a Construction Traffic Management Plan to address the following issues: – Use of established truck routes and arterial roads for the haulage of construction materials and spoil; – Where practicable, provide direct access from worksites to arterial roads to minimise truck traffic in local streets; – Avoid haulage tasks during peak traffic periods as far as practicable. Where haulage in peak periods is unavoidable, such activities are to be managed in accordance with specific traffic management sub-plans provided to the relevant agencies and Council in advance. – Control heavy vehicle movements on the ICB to avoid interference with major events, such as events at RNA Exhibition Ground or Suncorp Stadium; – Investigate the capacity of intersections on haulage routes to minimise impact on intersection operations by heavy vehicles servicing the construction worksites; – Prepare and implement a comprehensive construction traffic management plan to control truck movements to avoid, or mitigate and manage the impacts of heavy vehicle traffic on the road network, except in exceptional circumstances, and after consultation with the local community. – Exceptional circumstances would arise when no suitable alternative routes are available for specific construction tasks (eg: delivery and removal of tunnelling machinery). ■ Measures to manage the operation of the construction truck fleet for incorporation into a Construction Vehicle management subplan to include: – Real-time monitoring of truck position, speed, route and performance in relation of traffic conditions and schedule requirements; – Management of truck speed and position to avoid queuing on the approaches to the spoil handling and loading facilities; – Management of traffic signals on nominated spoil haulage routes in night-time hours to achieve optimum performance of the truck fleet and to minimise impacts on communities along the routes; – Maintain all vehicles transporting material to and from the construction sites to a high standard (ADR28/01) with regards noise emissions, exhaust emissions, traffic safety and operational safety;

- Element 2. Traffic and Transport – Construction	
	– Ensure all vehicles leaving a construction site pass over or through devices designed and maintained to remove soil and other materials. **Traffic diversions** ■ Prior to commencing construction, analyse traffic conditions, including nearby arterial roads and surrounding roads, to predict the effect of potential traffic redistribution as a result of temporary traffic diversions; ■ Identify and, in conjunction with DMR and QT, implement measures to manage traffic flows resulting from predicted changed traffic conditions; ■ Notify the local and broader community, including potentially affected businesses and the administrations of community facilities and emergency services, about proposed diversions and provide clear signage of changed traffic conditions arising from construction activities and take other measures to ensure safe traffic movement (eg: traffic controllers, traffic signal operational changes, dynamic advanced warning using variable message signage, real time monitoring of traffic conditions using closed circuit television (CCTV)); ■ Monitor traffic flows and review the traffic management measures, to address local traffic issues; ■ During daylight hours, whenever possible and practicable, retain at least two lanes of traffic in each direction on Kelvin Grove Road, Milton Road, Western freeway and Inner City Bypass in the vicinity of project works; ■ Identify and promote possible alternative arterial routes which have sufficient spare capacity to accommodate non-construction traffic; and ■ Maintain access to properties adjoining the project works, wherever practicable, or consult with affected owners and occupants to make alternative arrangements for property access. **Construction Traffic Hazards** ■ Provide road geometry and screening of project works to minimise distractions for motorists. **Local Traffic** ■ Implement management measures to avoid, or minimise increase in traffic caused by the project works in local streets as practicable; ■ Notify the local community about proposed changes to local traffic access arising from construction activities, and provide clear signage of changed traffic conditions and take other measures to ensure safe traffic movement; ■ Prepare and implement an employee parking policy for the construction worksites to manage the impacts on car parking in the vicinity of worksites and help avoid project parking in local streets; **Public Transport** ■ Relocate bus stops impacted by the project works and notify users prior to the relocation and implement appropriate signage and access during works to minimise inconvenience as far as practicable; ■ Avoid, as far as practicable, any hindrance to Brisbane City Council buses entering or leaving the Miskin Street depot; ■ Implement traffic management measures near construction works to minimise disruption to bus routes and timing. **Pedestrians and Cyclists** ■ Maintain safe pedestrian and cycle access near construction works (particularly for elderly and children), including to community facilities, such as schools, child care facilities, churches, aged care accommodation, open space, health care and shopping facilities, and particularly: ■ Across and along Kelvin Grove Road and Milton Road; ■ Along the Western Freeway or a near alternative; ■ In the vicinity of the Croydon Street/Milton Road intersection.; ■ Notify the local community, and in particular, local schools, about changes to

- Element 2. Traffic and Transport – Construction	
	pedestrian and cycle access during construction near construction works; ■ Provide traffic controls designed for the safe movement of pedestrians and cyclists near the worksites.
Monitoring	■ Monitor traffic flows weekly and monthly against modelled flows, and review the construction traffic management plan.
Reporting	■ Monthly report on local traffic conditions, including any accidents involving construction traffic
Responsibility	■ Contractor

- Element 3. Geology & Soils – Construction	
Environmental Objective	■ Avoid or minimise impacts due to settlement due to tunnelling or soil erosion due to construction. ■ Avoid or manage impacts of construction works on the environmental values of the Brisbane River. ■ Avoid or manage the environmental or public health impacts and risks associated with working in potential acid sulphate and/or contaminated soils encountered during earthworks. ■ Maximise recovery of construction spoil for re-use in the Project and for recycling.
Performance Criteria	■ Take all reasonable and practicable measures to: – Identify the potential for and then avoid or minimise, monitor and manage the impacts of surface settlement caused by construction works; – Manage and mitigate the impacts of spoil removal, haulage and placement at spoil placement sites – Manage and mitigate the risks of soil erosion, impacts from acid sulphate soils, and/or contaminated soils if encountered during construction works; ■ Conduct induction and training for construction staff on procedures for recognizing, remediation and management of contaminated land and spills and leaks of hazardous materials.
Mitigation Measures	**Soil Erosion** ■ Develop and implement mitigation measures in accordance with the Queensland Engineers guideline for sediment control, to manage the risk of erosion during construction to minimise: – Potential surface water quality impacts from sediment and contaminants entrained in surface runoff; – Loss of topsoil material during site preparation and from stripping and stockpiling for extended periods; – Erosion due to vegetation clearing and soil disturbance; and – Erosion of exposed vulnerable soils by wind or water action. ■ Plan construction works to provide for the progressive and timely stabilisation and rehabilitation of disturbed areas; ■ Undertake an erosion risk assessment which identifies flow paths, suitable stockpile locations, soil cover type, and soil stability; and ■ Undertake finishing and landscaping requirements for on-going sediment and erosion control around the worksites following construction.
	Settlement ■ Identify and implement management measures to minimise the potential for settlement, including: – Excavation induced settlement; – Drawdown induced settlement; and – Local ground relaxation effects. ■ Identify and implement mitigation measures for tunnel face loss, design of tunnel

- Element 3. Geology & Soils – Construction	
	support and liners, stability assessment of portals and the driven tunnel and groundwater modelling of any impact by the tunnel; ■ Undertake comprehensive geotechnical assessment to define the subsurface profile and materials along the alignment of the tunnel, including an assessment of stability and groundwater issues; ■ Undertake a building condition survey of buildings, structures and significant landscaping works and heritage landscape features within the ANSETTLE trough footprint where consent of owners is obtained; ■ Ensure that where predictive modelling indicates groundwater impacts are likely, construction measures are design and implemented to manage and mitigate those impacts; and ■ Monitor and review the settlement management measures from the commencement of construction works.
	Contaminated Land ■ A suitably qualified individual, as per section 381 of the EP Act, must undertake site history investigations, as part of a preliminary site investigation (PSI), on identified land parcels within the study corridor to identify areas of soil and or groundwater contamination; ■ Undertake a contaminated land investigation in locations where earthworks may encounter potentially contaminated soils; ■ Notify the EPA of any land parcels containing contaminated soil that are not listed on the EMR/CLR. ■ Obtain a disposal permit from the EPA Contaminated Land Unit for the removal of contaminated soil, in accordance with the *Environmental Protection* Act 1994. ■ Obtain a disposal permit from the EPA If the removal of contaminated soil is required; ■ Develop appropriate Hazardous Materials Register to be located at worksites and other sites as required by OHS and other regulations or guidelines, to include details on: – Storage location; – Storage requirements; – Proper usage; – Handling information; and – Disposal procedures; ■ Develop and maintain Material Safety Data Sheets for all materials and chemicals within the Hazardous Materials Register. ■ Design chemical and fuel storage areas to comply with Australian Standards including, AS1940: Storage and Handling of Flammable and Combustible Liquids, and AS3780: The Storage and Handling of Corrosive Substances; ■ Incorporate spill response procedures and Incident Management Plans in overall site emergency response procedures; ■ Ensure spills and leaks are cleaned up and remediated as specified in Incident Management Plans; ■ Undertake induction and training for construction staff in relation to the management and remediation of contaminated land; ■ Ensure spill response and containment equipment is kept on the worksite in close proximity to storage and handling areas; and ■ Adopt and implement applicable guidelines for storage of hazardous materials.
Monitoring	**Soil Erosion** ■ Monitor sediment and erosion control structures and measures and review the management measures monthly; in wet weather or when using large quantities of water in construction works daily monitoring may be necessary. **Settlement** ■ Monitor the effects of settlement (if any) from tunnelling, through surveys and other

- Element 3. Geology & Soils – Construction	
	displacement monitoring; and ■ Monitor embankments and structures for compliance with the design specifications. **Contaminated Land** ■ While handling contaminated soils, carry out dust monitoring at adjacent properties to assess levels of dust generation, if any, affecting nearby sensitive receptors; ■ Carry out regular formal inspections of stockpiles, work areas and adjacent areas to ensure dust and odour impacts are identified and dealt with.
Reporting	■ Monthly reporting for all aspects of compliance with EMP and monitoring results; ■ Immediate reporting of any incident, spill or release of materials to the environment.
Responsibility	■ Contractor

- Element 4. Hydrogeology and Groundwater Quality – Construction	
Environmental Objective	■ Groundwater quality to be maintained at pre-disturbance levels during and after construction. ■ Groundwater levels in the surrounding area as a result of construction activities should be maintained as close as possible to pre-construction levels and managed. ■ Groundwater inflow to the tunnels to be minimised and managed.
Performance Criteria	■ Take all reasonable and practicable measures in construction activities to avoid contamination of groundwater. ■ Monitor and manage the extent of groundwater level drawdown. ■ Monitor all groundwater usage in the study corridor and minimise any impacts from construction activities.
Mitigation Measures	■ Undertake targeted monitoring of groundwater quality and levels in adjacent areas prior to construction to establish a baseline against which to assess any discharges and define the level, if any, of treatment required. ■ Design and construct a dedicated groundwater seepage system, ensuring that seepage into the tunnel would be diverted away from all other tunnel runoff. ■ Identify and implement management measures to ensure that accident spills are cleaned up and remediated to avoid contamination of groundwater seepage. ■ Develop and implement mitigation measures based on results of the groundwater monitoring program. ■ Undertake surveys and consultations to identify any unregistered water bores in the area potentially impacted and manage any possible effect on such bores by the tunnelling works.
Monitoring	**Water Level Drawdown Monitoring** ■ Assess deviations from seasonal baseline groundwater levels and identify/ formulate appropriate mitigation options from the list of mitigation measures above. ■ Supplement monitoring program currently undertaken by Brisbane City Council, which monitors groundwater level drawdown. **Contaminant migration monitoring** ■ Monitor groundwater reporting to the tunnel to determine whether groundwater migration induced by the tunnel construction is causing migration of contaminants or could be draining from ASS.
Reporting	■ Monthly reporting
Responsibility	■ Contractor

- Element 5. Surface Water Quality – Construction	
Environmental Objective	■ During construction, surface water quality in local receiving waters retains its ecological, recreational and aesthetic values.

- Element 5. Surface Water Quality – Construction	
Performance Criteria	■ Contaminants, including sediments, that could cause adverse environmental impact to surface waters are not released as a consequence of construction, construction vehicle movements or spoil placement. ■ Surface water flows through the Botanic Gardens to Anzac Park and through York's Hollow are maintained during construction to the extent reasonable and practicable. ■ Maintain stormwater drains along other local drainage lines in the vicinity of construction works. ■ Drainage from construction worksites is managed to avoid a loss of water quality in local receiving waters. ■ Establish and maintain sufficient baseline data prior to construction to manage surface water quality.
Mitigation Measures	■ Conduct targeted baseline monitoring of receiving waters for TSS, metals and hydrocarbons, prior to construction to establish a baseline to assess any discharges and define the level, if any, of treatment required prior to any discharge from the site.
	Stormwater ■ Identify and implement measures for the management of stormwater and drainage from construction worksites, spoil placement sites and storage areas for plant, equipment, fuels, lubricants and other potential contaminants, including diversion of clean stormwater away from sites where possible. ■ Identify and implement management measures to ensure that spills and leaks are cleaned up and remediated to minimise impacts on surface water. ■ Identify and implement management measures to minimise potential surface water quality impacts from sediment and contaminants entrained in surface runoff. ■ Provide adequate bunding of spoil placement areas to prevent surface run-off entering nearby stormwater drains without treatment or inundation by flood waters in a one in five year design flood event; ■ Place and maintain sediment fencing around areas of concern, such as adjacent waterways, to minimise construction impacts on the waterway.
	Waste water ■ Identify and implement measures for the management of construction wastewater; ■ Establish suitably sized sediment basins at the construction worksites for the management of wastewater during construction to minimise uncontrolled releases.
	Groundwater Seepage ■ Identify and implement management measures to avoid potential contamination of surface waters by groundwater seepage from construction activities.
Monitoring	Monitor the quality of water being discharged from worksites and receiving waters against baseline data.
Reporting	■ Monthly reporting ■ Immediate reporting of an incident, spill or other uncontrolled release of contaminants to the environment ■ Worksites and spoil placement areas - reporting after a rainfall event exceeding a two-year Average Recurrence Interview (ARI)
Responsibilities	■ Contractor

- Element 6. Air Quality – Construction	
Environmental Objective	■ Ambient air quality is maintained at properties adjacent to worksites and spoil placement sites throughout construction. ■ Community concerns and complaints about air quality are addressed quickly and effectively

- Element 6. Air Quality – Construction	
Performance Criteria	■ Establish targeted baseline data prior to construction for pre-disturbance air quality levels. ■ Avoid, or mitigate and manage potential air quality impacts including dust, odour and vehicle emissions from construction, spoil haulage and spoil placement. ■ Take reasonable and practicable measures to manage the potential for diminished air quality (dust, odour, plant and vehicle emissions) at properties adjacent to work sites due to construction activities. ■ Take corrective action in response to diminished air quality for properties adjacent to construction sites as a consequence of construction works or operation of construction vehicles. ■ Report upon the effectiveness of any corrective action taken.
Mitigation Measures	**Dust and Odour** ■ For each construction worksite required for tunnelling works involving extensive spoil handling and haulage, except for sites involving 'cut and cover' works: – Erect an enclosed acoustic-lined shed equipped with ventilation and dust filtration equipment over the tunnel entrance (decline or shaft); – Maintain the ventilation and dust filtration equipment for the enclosed sheds to achieve acceptable performance – Undertake the loading of construction spoil into haulage vehicles within enclosures or the enclosed shed, with the shed doors being closed when meteorological conditions would cause dust from within the shed to impact on adjacent properties. – Ensure any conveyor system for spoil transport that continues out of the enclosed shed is appropriately designed (eg: may be enclosed, may use idlers designed for quiet operation, may include water spray system if not enclosed etc) to ensure compliance with established dust and noise goals and minimise dust and noise emissions along its route. ■ For each construction site including spoil placement sites: – Use watering or other effective techniques on unsealed areas to minimise wheel-generated or wind-generated dust – As soon as land becomes available, engage in the progressive rehabilitation of construction sites and spoil placement sites with landscaping. ■ Take measures (eg: rumble bars and wheel wash bays) to ensure dust-creating material (earth or similar material) is not transported from construction sites to roads or other areas in the public domain. ■ Ensure all trucks carrying spoil or other loose material are covered, and if necessary, treated (eg: mist sprays) prior to leaving a construction site. ■ Ensure all loose earth and similar material spilled or otherwise deposited within a construction site is cleared and removed from trafficked areas as soon as practicable. ■ At construction sites and spoil placement sites, monitor meteorological conditions, particularly wind speed and direction and where necessary take measures to avoid impacts of dust or odour on adjacent properties. Such measures may include: – Modification of construction methods; – Increase in dust suppression measures; or – Cessation of work when no other reasonable or practical measure is available. ■ During the first disturbance of potentially odorous soils, implement reasonable and practicable measures to avoid or mitigate and manage impacts of odours on adjacent properties. Such measures may include: – Proceeding slowly to monitor and determine the potential for odour impacts at off-site sensitive receptors; – Conducting works with odorous soils when wind directions are unlikely to affect sensitive receptors; – Covering odorous, excavated soil stockpiled either on a construction site or a spoil placement site to reduce odour impacts.
	Diesel Exhaust Emissions

- Element 6. Air Quality – Construction	
	■ Take measures to manage the movement of construction vehicles entering and leaving construction sites to avoid, or mitigate and manage the potential for vehicle emissions impacting on adjacent properties, except where such residential or sensitive activities front an arterial road to be used for access to or from a construction site. Measures for construction fleet management are to be provided in the construction vehicle management plan and the construction traffic management plan. Such measures may include avoiding or minimising queuing in streets approaching the worksites or adjacent to other sensitive activities; ■ Adopt procedures to avoid construction vehicles idling for excessive periods (e.g. more than 5 minutes) if required to queue to enter construction sites; ■ For stationary plant and equipment powered by diesel motors, take measures to avoid or mitigate and manage the potential impacts of exhaust emissions on adjacent residential or other sensitive activities. For example, ensure all construction vehicles and stationary plant and equipment powered by diesel motors are fitted with emission control measures, and are regularly maintained to manufacturers' specifications.
Monitoring	**Ambient Air Quality** ■ Undertake local, daily monitoring of ambient air quality in the vicinity of construction sites in areas representative of the receiving environment and sensitive receptors for the duration of surface works, and in response to complaints, based on the following parameters: – Total suspended particulates – Particulates (PM 10); and – Dust deposition ■ Monitor and manage the incidence of dust deposition and odour and manage construction vehicle emissions in relation to ambient air quality.
	Dust ■ Monitor daily or more frequently if weather conditions require, construction sites, stockpiles, conveyor systems, vehicles and roads leaving construction sites for evidence of dust generation or loose, unstable material with potential for dust. For this requirement, weather conditions requiring more frequent monitoring include strong winds, winds prevailing upon sensitive activities, such that monitoring each hour is required for the duration of the weather conditions. ■ Monitor regularly (weekly minimum) by inspection or other effective sampling: ■ The performance of dust filtration systems on construction shed ventilation systems; ■ Dust deposition rates at nearby properties; and ■ Spillage or deposition of loose material on roads leaving a construction site. ■ Monitor performance of mitigation measures in relation to the construction air quality goals set out in **Table 1** below. **Table 1 – Construction Air Quality Goals**

Pollutant	Construction Air Quality Goals	
	Aim to achieve	Not to be exceeded
Particles as PM_{10}	50 µg/m^3 (24 hr average)	150 µg/m^3 (24 hr average)
	-	50 µg/m^3 (annual average)
Total Solid Particulates	-	90 µg/m^3 (annual average)
Dust deposition	120 mg/m^2/day	-

	Vehicle Emissions

- Element 6. Air Quality – Construction	
	▪ Monitor construction vehicle management with regards to: – Queuing in streets other than those in which arrangements have been made for such action in the construction traffic management plan (on-going); – Vehicle motors idling for periods exceeding 5 minutes while in queues to access construction sites (on-going) ▪ Inspect the position of stationary plant and equipment powered by diesel motors to ensure exhaust emissions are directed away from sensitive activities and neighbouring properties (initially on establishment).
Reporting	▪ Monthly. If more than one complaint is received in the preceding week, then weekly for 4 weeks.
Responsibility	▪ Contractor

- Element 7. Noise and Vibration – Construction	
Environmental Objective	▪ Maintain a reasonable acoustic environment for living, in particular for sleeping, and use of properties along the corridor of construction influence during construction works. ▪ Significant heritage buildings and other structures are protected from the effects of vibration from tunnelling activities. ▪ Consultation with concerned property owners and occupants in the corridor of the construction influence is effective and responsive.
Performance Criteria	▪ Mitigation measures proposed to protect the Toowong Cemetery from the effects of tunnel vibration during construction would be effective in avoiding or limiting damage to graves and monuments to cosmetic levels, and that any such damage would be repaired upon completion of tunnel construction in this location. ▪ Demonstrate through predictive modelling of the proposed construction techniques and monitoring ambient noise and vibration readings prior to construction to establish pre-disturbance levels, the likely levels of noise and vibration due to construction works throughout the construction period. ▪ Having regard for the goals for noise and vibration during construction, achieve a 'reasonable' noise and vibration environment within the corridor of construction influence, having regard for the scale and duration of construction works, the nature of the terrain through which the construction works are to pass and the character of land use activities; ▪ Monitor and report regularly on the performance of construction works with regards environmental guidelines for noise and vibration
Mitigation Measures	**Workshed Ventilation Noise** ▪ Acoustic screening is to be provided for workshed plant and equipment, any workshed ventilation and any conveyor system as required, to achieve a reasonable noise environment. ▪ Implement measures to ensure workshed ventilation noise does not exceed the goals established in Tables 1 and 2 below.
	Construction Noise Goals ▪ Limit above-ground construction works which generate excessive levels of noise, and vibration, to between 6.30am to 6.30pm Mondays to Saturdays and at no time on Sundays or public holidays. ▪ For surface construction works beyond standard construction hours, take reasonable and practical measures to minimise potential impacts to achieve the noise goals established in **Tables 1 and 2** below for nearby properties (eg: provide acoustic screens or barriers). ▪ Reasonable and practicable measures to achieve the construction noise goals may include, for example: – Commence advanced notification of works and undertake on-going consultation with potentially affected property owners and occupants.

- Element 7. Noise and Vibration – Construction

- Establishing temporary noise barriers between construction worksites and sensitive activities (e.g. residential, schools, community facilities).
- Launching tunnel construction from within an acoustically screened enclosure, except for surface works and cut and cover construction works that are to be mitigated by effective temporary screens.
- Fitting noise-reduction measures to all plant and equipment engaged in above-ground construction works;
- Designing worksites to minimise potential noise impacts on nearby sensitive places.
- With the consent of owners and occupants of potentially-affected premises, undertake mitigation actions such as temporary modifications to nearby buildings, temporary relocation during construction or other measures to achieve reasonable environmental conditions.

- Undertake predictive modelling of potential construction noise and vibration impacts having regard to the goals set out in **Tables 1, 2 and 3**. The proposed construction methods, the proximity of sensitive places, and where the duration of construction exceeds two weeks in a particular locality.
- Where surface construction noise impacts are predicted due to specific construction activities, reasonable and practicable mitigation and management measures must be adopted and notified in advance to potentially affected owners and occupants of adjacent properties. If such activities are to occur often during the construction works, a program for a regular, scheduled occurrence should be devised and implemented in consultation with the owners and occupants of nearby properties.
- Potentially affected property owners and occupants are to be notified well in advance (7 days or more) as to the scale, extent and duration of construction works, as required by the consultation and communications program.
- Mitigation measures generally are to be designed and implemented to achieve goals for construction noise for acceptable internal living conditions consistent with AS/NZS 2107:2000 and summarised in **Table 1** and **Table 2**.

Table 1 – Daytime Construction Internal Noise Goals

Type of Building Occupancy	Maximum Construction Internal Noise Targets	
	Steady LAeq(15minute) (dBA)	Non-steady LA10(15minute)
Residential buildings ▪ Sleeping areas ▪ Living areas	 45 – near major roads 40 near minor roads	 55 – near major roads 50 near minor roads
Place of worship	40 – with speech amplification	50 – with speech amplification
Schools ▪ Music rooms ▪ Teaching areas ▪ Libraries ▪ Gymnasia	 45 45 50 55	 55 55 60 65
Commercial buildings ▪ Office space ▪ Retail space	 45 50	 55 60

Table 2 –Internal Noise Goals to Avoid Sleep Disturbance

- Element 7. Noise and Vibration – Construction

Criterion	Hours	Goal
For intermittent construction noise	6.30pm - 6.30am	▪ For residences within R1 – R3 categories as described in NIAPSP – 45dBA $L_{A\ max}$ ▪ For residences within R4 – R6 categories as described in NIAPSP – 50dBA $L_{A\ max}$
For steady construction noise	6.30pm – 6.30am	▪ For residences within R1 – R3 categories as described in NIAPSP: 35dBA $L_{Aeq\ adj\ (15mins)}$ for temporary noise 30dBA $L_{Aeq\ adj\ (15mins)}$ for long-term noise
		▪ For residences within R4 – R6 categories as described in NIAPSP: 40dBA $L_{Aeq\ adj\ (15mins)}$ for temporary noise 35dBA $L_{Aeq\ adj\ (15mins)}$ for long-term noise

Construction Vibration Goals - Property

- Develop predictive models for potential property damage as a basis for forward work planning, consultation and negotiations with property owners and occupants.
- For sites of cultural heritage, the structural audit and condition report carried out for the EIS (March 2008) be reviewed and updated where necessary, for all graves, monuments and other structures located along the proposed route of the driven tunnel;
- Undertake predictive modelling of potential construction vibration levels prior to the commencement of tunnelling or other works likely to cause vibration impacts. Where the goals for construction vibration are set out in **Table 3** and **Table 4** are predicted to be exceeded, commence advanced consultation with potentially affected property owners and occupants and implement mitigations measures to minimise the impacts.
- Continuous vibration monitoring devices to be located at numerous points within the Toowong Cemetery during construction, to confirm the predictions and to provide accurate data on which to base decisions regarding any changes to mitigation strategies, while tunnel construction is under way.

Mitigation measures should be designed and implemented to achieve the goals for minimising building damage from construction vibration in **Table 3** and **Table 4**.

Table 3 – Vibration Guide Values – Minimal Risk of Cosmetic Damage

Vibration Type	Peak Particle Velocity (mm/sec)		
	Heritage Listed	Residential	Sensitive Commercial
Transient Vibration (e.g. Blasting)	2	10	10
Continuous Vibration (e.g. TBM, roadheading, rockhammering)	2	5	5

Construction Vibration Goals – Building Contents & Human Comfort

- For sensitive areas, such as but not limited to residential, hospitals, places of cultural heritage significance (eg: Toowong Cemetery), adopt construction techniques which seek to avoid or minimise impacts of vibration or regenerated noise leading to a loss of reasonable environmental conditions.
- For places of cultural heritage significance likely to be impacted by construction vibration, adopt such construction techniques or mitigation measures recommended in any Cultural Heritage Management Plan required in respect of the site or structure.
- Mitigation measures generally are to be designed and implemented to achieve the

- Element 7. Noise and Vibration – Construction

goals in **Table 4** for minimising impacts from construction vibration on sensitive buildings or their contents.

Where predictive modelling indicates the goals in **Table 5** may be exceeded, the Contractor is to devise and implement reasonable and practicable measures to mitigate potential impacts on buildings and their contents. The Contractor should also provide advanced notification of construction, the potential impacts and the procedures for addressing any impacts that are to occur.

Table 4 – Satisfactory Vibration Values – Sensitive Building Contents

Equipment Type	Maximum Vibration Levels
Precision balances	0.5 – 2.0 mm/sec
Some optical microscopes	0.5 mm/sec
Large computer disk drives Sensitive electronic equipment	1.0 – 5.0 mm/sec
Special circumstances (Rosemount Hospital, Amarina Nursing Home)	4.0 mm/sec

Mitigation measures should be designed and implemented to minimise impacts on human comfort. Construction techniques are to be designed and implemented having regard to the goals established in AS 2670:1990 for vibrations ranging from 8Hz to 80Hz, and summarised in **Table 5**.

Table 5 – Goals for Peak Vibration Criteria – Human Comfort – 8Hz to 80Hz

Type of Occupancy	Time of Day	RMS Vibration Levels (mm/sec) Low Probability of Reaction			
		Continuous Vibration (16 hr day, 8 hr night)		Transient Vibration (Several/day)	
Critical working areas	Day or Night	0.14	0.4	0.14	0.4
Residential	Day Night	0.3 – 0.6 0.2	0.8 – 1.5 0.6	4.0 – 13.0 0.2 – 3.0	13.0 – 36.0 6.0 – 8.4
Offices	Day or Night	0.6	1.7	8.0 – 18.0	24.0 – 52.0
Source: AS 2670:1990					

- Where predictive modelling indicates the goals in **Table 4** and **Table 5** are likely to be exceeded during construction, the Contractor is to notify property owners and occupants of the likely implications and duration of the construction techniques proposed, and to advise them of the procedures for addressing any impacts that actually occur. The Contractor should also implement advanced notification of construction.

Where necessary, undertake such off-site mitigation measures as may be necessary to minimise, mitigate or otherwise off-set the impacts of construction vibration on buildings and human comfort (e.g. temporary modifications to premises or equipment sensitive to the predicted range of vibration, offer temporary accommodation or other acceptable measures for people demonstrably sensitive to the predicted range of vibration).

Monitoring

Routine Construction Monitoring

Blasting

- Ground vibration (as peak particle velocity) is to be monitored for every blast and recorded in accordance with AS2187.2-1993 Form B. Airblast should also be monitored if blasting is open to the surface.

-	Element 7. Noise and Vibration – Construction
	■ Monitoring location(s) should represent the highest level of ground vibration and overpressure experienced by both the nearest building structure(s) and the most sensitive building structure(s). ■ Sensitive structures include heritage-listed buildings, hospitals, residential buildings, and any other buildings where it is anticipated that standard statutory vibration limits may not provide satisfactory protection due to particular circumstances of building contents, or the condition of the building structure. **Mechanical Tunnelling** ■ Building vibration (as peak particle velocity) should be manually monitored and recorded in accordance with BS7385.1-1990. ■ In response to complaints, regenerated noise is to be manually monitored and recorded in accordance with AS1055. ■ Monitoring location(s) should represent occupied buildings where the highest levels of vibration and/or regenerated noise are anticipated. **Surface Excavations and Construction** ■ Building vibration (as peak particle velocity) would be manually monitored and recorded in accordance with BS7385.1-1990. ■ Noise would be manually monitored and recorded in accordance with AS1055. ■ For every monitoring occasion, a sample of ambient noise and/or vibration (in the absence of the construction work) would be recorded at a suitable pause in construction activity. ■ Monitoring location(s) should represent occupied buildings where the highest levels of noise and/or vibration are anticipated. ■ Results of noise and vibration sampling would be included in monthly reporting unless there is a community query about levels, in which case it should be dealt with through the complaints procedures. **Construction Ventilation, Materials Handling Systems, Backup Power Generation** ■ At each worksite, conduct noise surveys at the most sensitive nearby receptor locations to check compliance with daytime and night-time noise goals. ■ Noise surveys are to be performed during commissioning of spoil removal (including conveyor systems outside tunnel entry sheds) and ventilation systems, and yearly thereafter or if required for the investigation of a complaint. ■ Noise testing of backup power generation is to be conducted at commissioning. ■ Measurements and reporting in accordance with AS1055 at quarterly intervals. **Spoil Truck Fleet Noise Monitoring** ■ Prior to commencement of spoil haulage operations, and at half-yearly intervals thereafter, conduct testing and reporting (or provide evidence of prior testing) to demonstrate that the spoil haulage fleet conforms to Australian Design Rule 28/01 for engine noise emissions, tested in accordance with the National Road Transport Commission document Stationary Exhaust Noise Test Procedures for In-Service Motor Vehicles **Construction Monitoring in Response to Noise/Vibration Complaint** ■ The Contractor is to implement measures to receive and respond to complaints about construction noise and vibration made at any time during the construction phase of the Project. Such measures may include a complaints management and correction action system developed and incorporated in the Design and Construction EMP. Key requirements for the system include: ■ On receipt of a complaint, implement a complaint lodgement procedure for tracking and responding to the issue(s) and the complaint; ■ Identify the relevant construction activity at which the complaint is directed; ■ As soon as practicable, investigate and measure the level of noise and/or vibration from that activity; ■ Respond to the complainant as soon as practicable upon completion of the investigation and describe the corrective action taken; and

- Element 7. Noise and Vibration – Construction	
	■ Report to the Proponent on the complaint, the activity, the corrective action and the response.
Reporting	■ Results of all blast monitoring should be included in monthly reporting. ■ Vibration and regenerated noise sampling should be reported in monthly reporting. ■ Monthly reporting on performance and complaints
Responsibility	■ Contractor

- Element 8. Flora and Fauna – Construction	
Environmental Objective	■ Ecological and habitat values in the Mt Coot-tha Botanic Gardens, Brisbane Forest Park, Anzac Park and York's Hollow are maintained. ■ Construction impacts on native flora and fauna are avoided or minimised and rehabilitated.
Performance Criteria	■ Implement measures to maintain the ecological and habitat values of Mount Coot-tha Botanic Gardens, Brisbane Forest Park, Anzac Park and York's Hollow during construction. ■ Take reasonable and practicable measures to ensure that native fauna is not harmed as a result of the works. ■ Ensure habitat for native flora removed during construction is restored and vegetation communities rehabilitated to the extent possible and practicable. ■ Rehabilitate and landscape work sites as soon as they become available.
Mitigation Measures	■ Minimise disturbance to vegetation communities during construction, including identifying and marking vegetation to be retained to minimise loss of habitat. ■ Where reasonable and practicable, avoid the root zones of adjacent trees for vehicle access, material storage and the cleaning of plant and equipment. ■ Implement site management procedures to minimise the potential for harming native fauna. Such procedures may include checking site works, such as trenches and culverts, each morning and after periods of inactivity for any fauna trapped or likely to be harmed by construction activities. ■ Implement measures to rehabilitate and revegetate disturbed areas, as quickly as practicable upon completion of the works, and ensure that areas of revegetation become established and are in a healthy condition. Such measures may include: – Replacing vegetation removed during construction with local native species, unless non-native species are consistent with existing landscaping. – Undertaking a health assessment of significant trees (e.g. the fig trees at Gregory Park, Milton or others protected by VPO in the vicinity of the Project) prior to commencement of construction; if necessary adopt a program of watering and fertilising to ensure minimum effect and rapid recovery (eg: water and fertilise the fig trees up to 6 months before tunnel excavation beneath them; continue watering the fig trees after tunnel excavation for a period of 6 months or until such time as it can be demonstrated they have recovered from the effects of construction).
	Imported Red Fire Ants ■ Liase with the DPI&F Fire Ant Control Centre and the Brisbane City Council Fire Ant Control Officer during the Design stage of the Project, to identify suitable mitigation measures and management options for the management of fire ants during the construction of the Project. ■ Implement an inspection, control and disposal system for fire ants, approved by the DPI&F Fire Ant Control Centre and the Brisbane City Council Fire Ant Control Officer. ■ Provide awareness training for all site staff in regard to identification of fire ants and nest sites. ■ Maintain regular contact with the Brisbane City Council Fire Ant Control Officer and the DPI&F Fire Ant Control Centre during construction.
Monitoring	■ Inspect work sites to assess compliance with mitigation measure requirements to

- Element 8. Flora and Fauna – Construction	
	minimise the impacts on flora and fauna. ■ Inspect and monitor on a monthly basis, spoil placement sites for the presence of fire ants. ■ Monitor such significant trees as have been identified as being under any threat from the Project for two growing seasons after completion of the tunnel.
Reporting	■ Monthly during site preparation and site rehabilitation
Responsibility	■ Contractor

- Element 9. Cultural Heritage – Construction	
Environmental Objective	■ Avoid or minimise disturbance, possible building damage or loss of cultural heritage values for significant cultural heritage sites, places or structures during construction
Performance Criteria	■ Undertake all works in accordance with the provisions of cultural heritage management plans ■ Where harm to non-indigenous heritage values cannot be reasonably avoided undertake archival recording of cultural heritage values with the advice of an appropriately qualified heritage consultant. ■ Monitor and manage the effects of potential settlement on places of non-indigenous cultural heritage significance.
Mitigation Measures	**Indigenous Cultural Heritage** ■ In consultation with both the Jagera and Turrbal people, and pursuant to the requirements of the *Aboriginal Cultural Heritage* Act 2003, prepare a Cultural Heritage Management Plan(s). ■ Explore potential for acknowledgment of an area's significance through the erection of signage or public art and through involvement of indigenous people in any ground-breaking ceremonies that might precede construction works; and ■ Undertake work in accordance with the CHMPs.
	Non-Indigenous Cultural Heritage ■ Conduct condition surveys on each building of State Heritage significance along the tunnel alignment prior to the commencement of construction works to record present conditions. ■ Conduct detailed structural inspections 6-12 months prior to construction, including all timber framing, stonework, brickwork, etc and sealing of all timber in the stone/brickwork. ■ Prepare site specific Cultural Heritage Management Plans (CHMP) for each place of State significance likely to be affected, based on the condition surveys, including: – Mt Coot-tha Forest; – Toowong Cemetery; – Anzac Park, Toowong; – Kelvin Grove Road fig trees; and – Victoria Park, including the golf course.
Monitoring	■ Monitoring of compliance with the measures outlined in the CHMP.
Reporting	■ Indigenous cultural heritage – on completion of surface work, or, in case of intercepting archaeological relics or artefacts of heritage significance, as provided by the CHMP. ■ On completion of construction for each site, or as provided by the CHMP.
Responsibility	■ Proponent to be responsible for development of a Cultural Heritage Management Plan under the *Aboriginal Cultural Heritage Act, 2003.* ■ Contractor to be responsible for Cultural Heritage Management Plan(s) relating to places on the State Heritage Register.

- Element 10. Social Environment – Construction	
Environmental Objective	■ Avoid or mitigate and manage construction impacts on social infrastructure.
Performance Criteria	■ Construction techniques and procedures avoid or minimise, mitigate and manage impacts on community life throughout the construction phase. ■ Local and broader communities are notified in advance of construction activities, temporary arrangements, traffic management arrangements and any special construction activities of short duration. ■ Communities have access to a communication and complaints process to address and respond to impacts. **Note:** The social environment includes residential and neighbourhood amenity, connectivity, community health, community diversity, social infrastructure provision and safety.
Mitigation Measures	**Amenity and Community Life** ■ Liaise with key stakeholders and the community through Consultative Committees to provide and maintain safe and usable pedestrian and cycle connections with existing networks, public open space, (eg: the Mt Coot-tha Botanic Gardens, Anzac Park and Victoria Park) community facilities, schools and public transport stations during construction. ■ As soon as is practicable after the completion of construction, reinstate community facilities affected by the works, including: – Cycle path along Western Freeway; – Anzac Park; – Pedestrian connections across the major arterials (e.g. Milton Road, Kelvin Grove Road)
	Social Infrastructure ■ Consult with managers of community facilities in neighbourhoods adjacent to worksites to develop effective mitigation strategies and maintain regular communication with these facility managers.
	Complaints and Corrective Actions ■ Develop an effective and responsive system for receiving, handling and responding to complaints received during the construction of project works. ■ Ensure complaints are received and responded to on a 24-hour per day basis for the duration of the construction phase. ■ Provide reporting on complaints received, responses provided, timeliness of responses, and corrective actions taken on a monthly basis. ■ Raise community awareness of the complaints systems and procedures through public notifications and website facilities.
	Early Consultation ■ Initiate consultation with owners and occupants of directly affected properties and nearest neighbours to construction activities as soon as practicable after a decision to proceed with the Project is taken. ■ Conduct consultation and community information strategies in conjunction with Community Consultative Committees. ■ Establish Community Consultative Committees to represent nearest neighbours to worksites and community facilities.
	Community Consultation Program ■ Undertake and maintain a comprehensive community information program to inform residents, businesses, community groups and motorists of Project activities and potential impacts. Effective and accessible consultation measures are required including maintenance of a 24-hour contact line operated by a person with authority to stop works if goals and agreements with the community are not met. ■ Ensure medical facilities, childcare centres, community centres and schools along the alignment have access to construction updates and community education during construction.

- Element 10. Social Environment – Construction	
	Regional Communication ▪ Monitor traffic volumes and traffic congestion affecting the regional population during construction and if necessary adopt travel demand and signal stage management strategies.
Monitoring	▪ Evaluate effectiveness of consultation, liaison and mitigation outcomes; ▪ Survey and report on provision and maintenance of temporary pedestrian, cycle and public transport access in work site neighbourhoods. ▪ Report Community Consultation Committee's activities and on consultation, liaison and environmental compliance.
Reporting	▪ Six monthly; or ▪ Immediately in case of a safety incident or written complaint from a neighbour.
Responsibility	▪ Contractor

- Element 11. Hazard and Risk – Construction	
Environmental Objective	▪ Hazardous events during construction are avoided, or managed to minimise risk if they do occur. ▪ Flood potential is not increased by construction activities.
Performance Criteria	▪ Maintain a safe environment for construction workers. ▪ Minimise potential construction hazards and risks for construction workers, nearby communities and passing motorists. ▪ Design and construct the Project to avoid adverse impacts on flood levels for an ARI 100 yr storm event in upstream of the Project works.
Mitigation Measures	▪ Prepare and implement a safety plan for all aspects of construction in consultation with relevant agencies. ▪ Develop and implement safety measures for the construction works including treatment strategies that address inundation, flood, tunnel collapse, fire and chemical hazard, communications, access for emergency services, response coordination and management. ▪ Develop emergency response procedures, and implement in the event of accidents and emergencies. ▪ Provide fire and life safety measures, including ventilation, smoke extraction and fire fighting systems for the duration of the construction phase. ▪ Develop and implement a communication process with the Department of Emergency Services in relation to temporary road closures and disruptions and/or relocation of water mains that would affect hydrants near construction works. ▪ Construction works are designed and implemented to avoid impacts on the level of the Q100 flood in the drainage lines across construction works areas.
Monitoring	▪ Daily as part of routine site management procedures, for movement of hazardous goods, safe workplace practices, and regular testing and monitoring of fire and life safety systems.
Reporting	▪ Monthly except in case of an incident when reporting should occur immediately on completion of any investigation required to resolve the incident.
Responsibility	▪ Contractor

- Element 12. Waste Management – Construction	
Environmental Objective	▪ All forms of waste from construction of the Project are minimised.

- Element 12. Waste Management – Construction	
Performance Criteria	■ Implement waste management principles (Reduce, Re-use, Re-cycle) and effective and sustainable disposal strategies. ■ Take all reasonable and practicable steps to minimise the impacts of handling and disposal of construction waste. ■ Take all reasonable and practicable measures to reduce waste generated on the construction worksites through reuse and/or recycling.
Mitigation Measures	■ Prepare and implement waste management procedures to deal with construction waste. ■ Prepare management plans to deal with any potential incident in which waste material with the potential to cause environmental harm, is released to the environment. ■ Report immediately to the relevant authorities any incident where harmful waste material is accidentally released to the environment. ■ In the event of an environmental incident, take such corrective or remedial action as is required to render the area safe and avoid or minimise environmental harm.
	Avoid and Reduce ■ Identify and implement measures for avoiding waste generation and, if avoidance is not reasonable or practicable, reducing waste generation on site. ■ consider using materials and products that have a recycled content wherever cost/performance competitive, and where environmentally preferable to the non-recycled alternative; ■ arrangements with suppliers to return any unused construction materials; ■ where possible, goods to be ordered in bulk to minimise packaging waste and packaging material returned to the supplier wherever practicable; and ■ encouraging everyone working on the project to avoid and reduce waste, wherever possible.
	Re-use ■ Identify and implement strategies for the re-use of waste products during construction. ■ chipping and mulching of vegetation cleared during construction and reuse of mulched material for landscaping purposes; ■ reuse of excavated material as fill at approved fill sites; ■ topsoil free of weeds to be stockpiled and stored for re-use, if possible; ■ re-use of concrete formwork throughout the project; ■ re-use of reinforced steel structures in the project; ■ re-use of structures including culverts, cabling, poles and similar infrastructure; ■ broken bricks, tiles and other masonry to be used in fill or transferred to a building supply company; and ■ asphalt to be re-used by transferring to batching plants or use as a select/earthworks coarse layer.
	Recycle ■ Identify and implement recycling strategies for construction. ■ Implement training for employees in the waste management plan and recycling opportunities. ■ kerb and pavement materials (concrete, asphalt) to be transferred to crushing and recycling plants; ■ provision of recycling bins for general rubbish, (ie: glass, plastic, paper, metals, using colour-coded bins); ■ collection of demolition materials and re-use on site where possible or transport to a recycling depot; ■ collection and return of packaging materials (eg: pallets) to suppliers wherever practicable; ■ investigation of the availability of treated wastewater, stormwater runoff or groundwater in-flow for spraying roadworks to reduce dust generation, for wheel

- Element 12. Waste Management – Construction	
	washes and other washdown uses or for watering progressive landscape works; ■ incorporation of a closed water recycling system if a concrete and/or asphalt batching plant is to be established on or close to the construction site (although the provision of such plants is not anticipated); ■ use of recycled materials to the limits of design in concrete, roadbase, asphalt and other construction materials; ■ collection and recycling of used oils by a licensed contractor; ■ collection by a licensed contractor of empty oil and fuel drums and other containers for return to recycling facilities;
	Disposal ■ Dispose of waste that is unable to be reused or recycled in a certified land fill site. ■ Ensure the transport of regulated wastes and contaminated soils or other materials is conducted by licensed Contractors for disposal at licensed facilities, in accordance with legislative requirements.
	Waste Transport ■ Restrict all site works and surface truck movements for transport of waste material to 6.30 am to 6.30 pm, Monday to Saturday. ■ Ensure the movement of hazardous materials and regulated wastes occurs at non-peak times to minimise the possibility of traffic conflicts and associated risks.
	Hazardous Materials or Dangerous Goods ■ Undertake storage and transport of materials according to relevant Australian standards. ■ Ensure transport and storage of dangerous goods for construction purposes are in accordance with dangerous goods standards and guidelines. ■ Undertake refuelling and maintenance activities in designated bunded areas to minimise the potential for soil and water contamination to result from these activities. Prepare and implement, if required, spill response measures. ■ Prepare and implement a hazardous goods management plan.
	Contaminated Soil ■ Obtain a disposal permit by the EPA Contaminated Land Unit for the removal of contaminated soil, in accordance with the *Environmental Protection* Act 1994. ■ Remove contaminated soils in accordance with an EPA approved Remediation Action Plan (RAP) if required. ■ Prepare and implement procedures for the remediation of contaminated soil spills that may occur during transport.
Monitoring	■ Monitoring in accordance with specific management plan requirements (eg: ASS Management Plan, Site Management Plan, Surface Water Management Plan, Hazardous Goods Management Plan)
Responsibility	■ Contractor

19.8 Operation Environmental Management Plan

Environmental Management Plan Element Strategies describe each environmental element, objectives and identified mitigation measures for applicable stages of the Project. Some of the environmental elements suggest specific monitoring requirements and/or statutory requirements.

The environmental element topics for this Draft Outline Operation EMP are:

- Traffic and Transport
- Geology and Soils
- Hydrogeology and Groundwater Quality
- Surface Water Quality
- Air Quality
- Noise and Vibration
- Hazard and Risk
- Fauna and flora

- Element 1. Traffic and Transport – Operation	
Environmental Objective	■ In-tunnel traffic flows are managed to achieve stated operational goals for in-tunnel air quality and efficient movement into, through and beyond the tunnel system. ■ Emergency services have easy and direct access to the tunnel systems to attend to incidents, and stage evacuations if necessary.
Performance Criteria	■ Manage traffic flows to achieve or remain within limits for in-tunnel air quality and to achieve safe and efficient movement of traffic into, through and beyond the tunnel system.
Mitigation Measures	■ Prepare and implement traffic management measures to support air quality management measures for in-tunnel traffic conditions and traffic flows on the approaches to the tunnel system. ■ Prepare and implement local area traffic management measures to maintain the role and function of surface road network.
Monitoring	■ Monitor in-tunnel traffic management measures. ■ Monitor local area traffic impacts.
Reporting	■ For in-tunnel traffic management, three-monthly for first twelve months of operations, then annually for the next two years ■ For local area traffic management, annually for first three years of operation
Responsibility	■ Operator

- Element 2. Geology and Soils – Operation	
Environmental Objective	■ Permanent facilities and project property are maintained to avoid any impacts associated with soil erosion or settlement.
Performance Criteria	■ Success of rehabilitation treatments of construction areas and soil and water control devices for long-term surface stability and protection against erosion.
Mitigation Measures	■ Maintain permanent soil and water control devices for long-term surface stability and protection against erosion by wind or water. ■ Periodically inspect the embankment and structures to monitor settlement in relation to design specifications.
Monitoring	■ Monitor permanent soil and water control devices installed during construction for evidence of soil erosion and sedimentation. ■ Surveys and other displacement monitoring would be used to monitor the effects of settlement (if any) from tunnelling; and

- Element 2. Geology and Soils – Operation	
	■ Monitor to ensure embankments and structures comply with the design specifications for performance.
Reporting	■ Six monthly for 3 years after commencement.
Responsibility	■ Operator

- Element 3. Hydrogeology and Groundwater Quality – Operation	
Environmental Objective	■ Groundwater levels are monitored and managed to identify any ongoing drawdown in the surrounding area as a result of inflow to the tunnel. ■ Groundwater reporting to the tunnels is monitored for volume and quality to maintain inflow within specification.
Performance Criteria	■ Minimise the extent of groundwater level drawdown in the surrounding area as a result of inflow to the tunnel.
Mitigation Measures	■ Assess changes to surrounding groundwater levels and apply mitigation measures where needed. ■ Assess changes to volume or quality of groundwater reporting to the tunnels, endeavour to identify the causes of significant changes and rectify if potential risks are identified.
Monitoring	■ Monitoring of water levels in key locations 6 monthly or as required for 5 years post-construction. ■ Continuous monitoring of volume and quality of groundwater reporting to tunnels.
Reporting	■ Six-monthly, for five years post-construction.
Responsibility	■ Operator

- Element 4. Surface Water Quality – Operation	
Environmental Objective	■ Surface water quality in surface drainage systems is maintained.
Performance Criteria	■ Reasonable and practicable measures be taken to avoid or mitigate and manage the potential impacts of any fluids collected in tunnel sumps before discharge to surface stormwater or other appropriate systems.
Mitigation Measures	■ Separate storm water, groundwater and waste water runoff within the storm water drainage system. ■ Manage surface water quality to avoid impacts on the Anzac Park wetlands, York's Hollow and the Brisbane River. ■ Identify and implement management measures to minimise potential surface water quality impacts from sediment and contaminants entrained in surface runoff.
	Tunnel Waters ■ Divert storm water run-off and wash down waters away from seeping ground water. ■ Identify and implement management measures to ensure that accident spills are cleaned up and remediated to avoid potential contamination of groundwater. ■ Collect groundwater in a dedicated system for subsequent treatment and disposal to an approved point of release; ■ Establish and implement a tunnel water monitoring regime, assess any captured water against baseline receiving water quality, and determine the level of treatment required if any. Treat as necessary, prior to discharge.

- Element 4. Surface Water Quality – Operation	
	Storm water ■ Prepare and implement storm water management measures for the tunnel operation. Such measures may include: – Collecting storm water from the portals, plus that carried into the tunnel on vehicles, in specially designed grated inlet pits which incorporate flame traps and trash baskets; and – Cleaning litter baskets on a regular basis to prevent litter blocking the underflow sections of the pits or getting through to the pumps in the sumps.
	Waste water ■ Prepare and implement wastewater management measures for the tunnel operation. Such measures may include: – Ensuring that the drainage system switches automatically to wastewater collection system in the event of fire deluge or a ruptured fire main. – Using the drainage system to collect waste water in the event of a spillage, or during the wash-down process. – Removing wastewater from the collection system for removal by tanker and treatment at a specialised licensed depot.
Monitoring	■ Monitor tunnel water discharge. ■ Inspect erosion and sediment control devices at regular intervals.
Reporting	■ For tunnel waters (groundwater), six-monthly, for five years post-construction. ■ For other drainage, annually, except in the case of an incident involving the fire-fighting system, then immediately on completion of an investigation into the incident.
Responsibilities	■ Operator

- Element 5. Air Quality – Operation	
Environmental Objective	■ In-tunnel air quality goals are achieved. ■ Minimise impacts on ambient air quality adjacent to the tunnels.
Performance Criteria	■ In-tunnel air quality achieves the nominated goals identified in Table 1, under mitigation measures, below. ■ The ventilation system is designed to be capable of minimising impacts on ambient air quality
Mitigation Measures	**In-tunnel Air Quality** ■ Take all reasonable design and operation measures to achieve air quality goals during operation. Such measures may include, for example: – The operation of exhaust fans; – Controlling the inflow of traffic within the tunnel by engagement of traffic management; – In situations where traffic flows halt, requiring motorists to turn off engines until the incident has been cleared to resume normal traffic operations; or – Any combination of the measures above.
	■ In the event that an incident involving a fire or other release of toxic or hazardous gases occurs in the tunnel system, the in-tunnel air quality is managed by activation of the smoke duct and exhaust system and possibly the deluge fire management system as required.

- Element 5. Air Quality – Operation

Ambient Air Quality

- In preparation for the operational phase of the Project, establish an air quality monitoring station near each ventilation outlet for the tunnel ventilation system as soon as practicable but no less than 12 months before commencement of tunnel operations.
- Design and operate the ventilation system to minimise the impacts on ambient air quality. Design and operational measures include:
  - Dispersing vitiated air from the tunnel system into the atmosphere via ventilation outlets at least 15m in height above the ground level or no less than 10m higher than the highest building within 100m and existing at commencement of construction, whichever is the higher.
  - Making provision in the ventilation system design for the possible future fitting of air treatment devices for the purpose of treating oxides of nitrogen or particulate matter.
- Monitoring land use and building development in the vicinity of the ventilation outlets to avoid adverse impacts on the performance of the ventilation outlets after their construction.

Monitoring

In-tunnel Air Quality

- Monitor, in real time, in-tunnel air quality for visibility, carbon monoxide and nitrogen dioxide through monitoring devices positioned along the tunnel system and in each of the ventilation outlets in relation to the adopted goals for satisfactory, in-tunnel air quality set out in **Table 1**;
- Link real-time monitoring results with automatically operated ventilation system including exhaust fans in the tunnel ceiling and ventilation station.

Table 1 – In-Tunnel Air Quality Goals

Carbon monoxide (CO)	70 ppm at peak (traffic flows >10kph) 90 ppm in extreme congestion (traffic flows <10kph)
Nitrogen dioxide (NO_2)	1 ppm (average)
Visibility	0.005 m^{-1}

Source: PIARC guidelines

Ambient Air Quality

- Establish and maintain at least two monitoring stations near to each ventilation station, with the location of the monitoring station to be agreed by the Contractor with the Proponent and the Environment Protection Agency.
- Monitor ambient air quality in real time and review performance in relation to the adopted goals for ambient air quality set out in **Table 2**.

Table 2 – Ambient Air Quality Goals

Pollutant	Goal	Unit	Measuring Period
Carbon monoxide (CO)	8 10	ppm mg/m^3	8 hour* maximum
Nitrogen dioxide (NO_2)	0.12 246	ppm $\mu g/m^3$	1 hour maximum
	0.03 62	ppm $\mu g/m^3$	annual mean
Particulate matter less than 10 μm (PM_{10})	50 25	$\mu g/m^3$ $\mu g/m^3$	24 hour maximum** annual mean

- Element 5. Air Quality – Operation

	Particulate matter less than 2.5 μm ($PM_{2.5}$)	25 8	$\mu g/m^3$ $\mu g/m^3$	24 hour maximum annual average
	Total suspended particulate matter (TSP)	90	$\mu g/m^3$	annual average

*****One day per year maximum allowable exceedance.

**Five days per year allowable exceedance, not including exceedance in ambient goals due to external events (e.g. dust storms, fires, construction works)

Reporting	■ For in-tunnel air quality: ■ For the first 12 months of operation report in real time for average hourly monitoring results, via a project website established and operated by the Contractor. ■ Issue validated reports monthly via the Project website. ■ From thereafter, report quarterly via the Project website. ■ For ambient air quality: ■ For the first 12 months of operation, report in real time for average hourly monitoring results, via the Project website. ■ Issue validated reports monthly via the Project website. ■ From thereafter, report quarterly via the Project website. ■ For public health indicators, report annually in the Project's environmental report.
Responsibility	■ Operator

- Element 6. Noise and Vibration – Operation

Environmental Objective	Minimise potential noise from the operation of ventilation and other plant and equipment, and from road traffic noise for newly exposed properties.
Performance Criteria	■ Achieve the acoustic goal for noise from the ventilation system, including the ventilation outlets and operation of plant and equipment in the ventilation station, as identified in the mitigation measures below. ■ Meet 68 dBA LA10 (18 hours), for State controlled roads and 63 dBA LA10 (18 hours) for other roads. ■ Meet the status quo noise levels where road traffic planning noise levels are already exceeded at sensitive locations and it is not reasonable or practicable to achieve compliance with these planning noise levels.
Mitigation Measures	■ Submit operational noise and vibration management plan to BCC and EPA for comment before finalisation. **Ventilation System** ■ Use an effective combination of design, site and management in ventilation system and ventilation outlet operations to meet noise goals and avoid adverse impacts on the owners and occupants of nearby properties ■ The ventilation system must be designed and operated to achieve the following goal at the commencement of operation of the Project: – The overall A-weighted sound pressure level component from ventilation plant, assessed as an $LA_{max,adj}$ level with tonality penalty adjustments determined in accordance with AS1055.1, should not exceed the Average Background Noise Level, as defined in AS1055.2 at a noise sensitive location at any time of the day or night. ■ In developing mitigation strategies, include consideration of the following: – New buildings as an alternative to dedicated noise barriers and/or mounding on resumed land; – In-tunnel acoustic absorption; – Upgrading acoustical insulation of elevated building facades; and

- Element 6. Noise and Vibration – Operation	
	– Additional building resumptions combined with redevelopment. **Traffic Noise** ■ Provide traffic noise mitigation for new tunnel portals, ramps and widened surface roads, with particular attention given to: – Road widening involving the resumption of properties; – New elevated ramps; and – Reverberant traffic noise emissions from tunnel portals. ■ Design of the Project should aim to minimise airborne traffic noise levels. Appropriate goals would be 68 dBA LA10 (18 hours) for State controlled roads and 63 dBA LA10 (18 hours) for other roads. However, where road traffic planning noise levels are already exceeded at sensitive locations it may not be reasonable or practicable to achieve compliance with these planning noise levels. In these instances, the "status quo" noise levels should replace the goals (i.e. maintain noise at levels anticipated in 2026, the design year, without the Project).
Monitoring	**Operational Ventilation Noise** ■ Replicate commissioning noise testing within 12 months of commencement of operations, normalise the results to the design duty cycle based on records of the actual operating conditions at the time of testing, and report all results and corrections to the Proponent. ■ Monitoring results must be reported on a quarterly basis and must be undertaken in accordance with accredited procedures and must be publicly available. ■ In circumstances where the goals are not met, the reporting must also describe the corrective actions to avoid a recurrence and to minimise the impacts of ventilation system noise. **Operational Traffic Noise** ■ Replicate baseline traffic noise measurements within 12 months of commencement of operations, normalise the results to the design traffic conditions based on records of traffic flows at the time of monitoring, and report all results and corrections to the Proponent. ■ Provide explanation of differences of greater than 3dBA and identify measures to address the exceedance.
Reporting	■ Monthly reporting of baseline noise monitoring results, operational design goals for ventilation and traffic noise, operational duty cycle and traffic projections, and projected levels of ventilation system and traffic noise (with and without mitigation). These monitoring results to be included in the Annual Environmental Report to be issued by the Operator. ■ Compliance report within 12 months of commencement of operations.
Responsibility	■ Operator

- Element 7. Hazard and Risk – Operation	
Environmental Objective	■ Minimise the potential risk for hazardous events.
Performance Criteria	■ Traffic safety, fire safety and emergency response systems are managed and maintained to standards agreed with Queensland Police, Fire and Ambulance services. ■ Minimise hazards and risks for Northern Link users and tunnel workers. ■ Take reasonable and practicable measures to minimise potential hazards and risks for communities near the portals.

- Element 7. Hazard and Risk – Operation	
Mitigation Measures	**General** ■ Establish and maintain a tunnel control centre to monitor and control the safe and effective operation of the tunnel and accommodate provision of utilities for emergency response.
	Control of Dangerous Goods Vehicles ■ Exclude (by regulation) Dangerous Goods vehicles from access to the tunnel. In the event of illegal entry, activate response and notification systems.
	Traffic Management and Control System ■ Implement Traffic Management and Control System to monitor, control and respond to traffic conditions within the tunnel, to Australian industry standards (eg: CCTV, loop detectors, optical beams, lane usage signalling, variable message signage, adjustable speed limit signage, weigh in motion detectors, etc).
	■ Implement a Communication System including radio rebroadcast breakthrough, public address system and communications points containing three landline telephone systems (Help, Operation and Maintenance; and Fire Coordination).
	■ Maintain fire detection and protection equipment including heat and smoke detectors, deluge system and fire extinguishing equipment as per Australian Standards and consultation with Emergency Services authorities.
	■ Develop emergency incident management response procedures in consultation with Emergency Services (Police, Fire, Ambulance, etc). The incident management plan must include 1) simulation exercises prior to operation of the tunnel; 2) provision for routine testing of emergency response systems; and 3) designation of responsibilities in the event of an incident. ■ Ensure operational staff undertake regular training for incident handling procedures.
Monitoring	■ Monitor and control the safe and effective operation of the tunnel from the Tunnel Control Centre and report as agreed with the Proponent and Emergency Services.
Responsibility	■ Operator

- Element 8. Flora and Fauna – Operation	
Objective	■ Maintain rehabilitated areas.
Performance Criteria	■ All areas adjacent to the tunnel entrances and exits and any other project elements operating on the surface are well maintained. ■ Successful rehabilitation of all areas disturbed during construction/operation.
Mitigation Measures	■ Maintain rehabilitated and landscaped areas according to Landscape Management Plan. ■ Undertake corrective action when re-vegetation of areas is not successful.
Monitoring	■ Monitor rehabilitated and landscaped areas.
Responsibility	■ Operator