

Construction Air Quality Management Sub Plan (Appendix B5)



NorthConnex & M2 Integration Projects Lend Lease Bouygues Joint Venture

	Name	Position	Date	Signed/Authorised
Originator(s)	Mark Turner	Environmental Approvals Manager	29/4/15	
Review	Grant Sainsbery	Environmental Manager	29/4/15	
Authorised	Rob Ioffrida	Project Director	29/4/15	

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Glossary / Abbreviations

CAQMP	Construction Air Quality Management Sub Plan
CCS	Community Consultation Strategy
CEMP	Construction Environmental Management Plan
CoA	Condition of Approval
Dump (Truck)	Means vehicle used to transport material within the project (such as within tunnels or M2 integration activities)
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EMS	Environmental Management System
EPA	Environment Protection Authority
EPL	Environment Protection Licence
EWMS	Environmental Work Method Statements
G36	Roads and Maritime Services QA Specification G36 Environmental Protection (Aug 2014).
G38	Roads and Maritime Services QA Specification G38 Soil and Water Management (Aug 2014).
Haulage (Truck)	Means vehicle used to transport material off-site
LLBJV	Lend Lease Bouygues Joint Venture
NCX Project Co.	NorthConnex Project Company
OEH	Office of Environment and Heritage (formally known as DEC and DECCW)
PESCP	Progressive Erosion and Sediment Control Plan
SPiR	Submissions and Preferred Infrastructure Report

1. Introduction

1.1 Context

This Construction Air Quality Management Sub Plan (CAQMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the construction of the NorthConnex Project. The Project was approved by the Minister for Planning on 13 January 2015.

The NorthConnex Project involves the construction of a multi-lane motorway linking the M1 Pacific Motorway at Wahroonga to the Hills M2 Motorway at West Pennant Hills, including integration works with the Hills M2 Motorway (the Project).

The Project comprises twin road tunnels generally following the alignment of Pennant Hills Road (the main alignment tunnels), with interchanges at the northern and southern end of the Project and the provision of a new westbound lane on the Hills M2 Motorway extending through to the Windsor Road off-ramp. The Project is being constructed by a joint venture partnership comprising Lend Lease and Bouygues (the LLBJV).

The Project consists of the following key features:

- Twin motorway tunnels around nine kilometres in length with two lanes in each direction and provision for a third lane in each direction if required in the future.
- A northern interchange with the M1 Pacific Motorway and Pennant Hills Road, including sections of tunnel for on-ramps and off-ramps, which also facilitate access to and from the Pacific Highway.
- A southern interchange with the Hills M2 Motorway and Pennant Hills Road including sections of on-ramps and off-ramps.
- Integration works with the Hills M2 Motorway including alterations to the eastbound carriageway to accommodate traffic leaving the Hills M2 Motorway to connect the Project travelling northbound and the provision of a new westbound lane on the Hills M2 Motorway extending through to the Windsor Road off-ramp.
- Tie-in works with the M1 Pacific Motorway extending to the north of Edgeworth David Avenue.
- A motorway control centre located near the southern interchange on the corner of Eaton Road and Pennant Hills Road that includes operation and maintenance facilities.
- Two tunnel support facilities incorporating emergency smoke extraction outlets and substations.
- Ancillary facilities for motorway operation, such as electronic tolling facilities, signage, ventilation systems and fire and life safety systems including emergency evacuation infrastructure.
- Modifications to service utilities and associated works at surface roads near the two interchanges and operational ancillary facilities.
- Modifications to local roads, including widening of Eaton Road near the southern interchange and repositioning of the Hewitt Avenue cul-de-sac near the northern interchange.
- Ancillary temporary construction facilities and temporary works to facilitate the construction of the Project.

This CAQMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the mitigation measures listed in the NorthConnex Environmental Impact Statement (EIS), the Submissions and Preferred Infrastructure Report (SPIR) and all applicable legislation.

1.2 Background

In October 2013, the NorthConnex Project was declared to be State significant infrastructure and critical State significant infrastructure (SSI 6136) under Part 5.1 the *Environmental Planning and Assessment Act 1979*.

The *NorthConnex - Environmental Impact Statement* (AECOM, July 2014) assessed the impacts of the construction of the Project on air quality, within chapter 7.

The EIS identified the potential for minor impacts on air quality during construction typically associated with dust. However, it concluded any potential impacts could be managed by standard mitigation and management measures. The SPIR provided further clarification and assessment of construction air quality impacts, the findings of which were consistent with the EIS.

1.3 Environmental Management Systems Overview

The overall Environmental Management System (EMS) for the Project is described in the Construction Environmental Management Plan (CEMP).

The CAQMP is part of the LLBJV environmental management framework for the Project, as described in Section 4.1 of the CEMP. In accordance with CoA D57 (e) this Plan has been developed in consultation with the NSW Environment Protection Authority (EPA).

Management measures identified in this Plan will be incorporated into site or activity specific Environmental Work Method Statements (EWMS). EWMS will be developed and signed off by environment and management representatives prior to associated works and construction personnel will be required to undertake works in accordance with the identified management measures.

Used together, the CEMP, plan/s and EWMS form management approaches that clearly identify required environmental management actions for implementation by LLBJV personnel and contractors.

The review and document control processes for this Plan are described in Section 10 of the CEMP.

2. Purpose and Objectives

2.1 Purpose

The purpose of this Plan is to describe how the LLBJV propose to manage and protect air quality during construction of the Project. Operational air quality items such as the air quality consultative committee (AQCC) and operational measures do not fall within the scope of this plan and hence, dealt with outside this process.

2.2 Objectives

The key objective of the CAQMP is to ensure that impacts to air quality are minimised and within the scope permitted by the planning approval. To achieve this objective, the LLBJV will undertake the following:

- Ensure appropriate controls and procedures are implemented during construction activities to avoid or minimise air quality impacts and potential adverse impacts to sensitive receivers adjacent to the Project.
- Ensure appropriate measures are implemented to address the relevant CoA and EIS management measures outlined in Table 3.1 and Table 3.2 of this plan.
- Ensure compliance with the Project's Environment Protection Licence (EPL).
- Ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in Section 3.1 of this Plan.

Appendix B7 of the CEMP - Construction Waste and Resource Management Sub Plan provides detail on measures to reduce greenhouse gas emissions during construction.

2.3 Key Performance Indicators

The Key Performance Indicators (KPIs) in Table 2-1 have been established for the management of local air quality impacts during construction of the Project.

Table 2-1 KPIs

Target / KPI no.	Target	KPI	Records
1	Comply with the air quality mitigation measures listed within this CAQMP, as well as any conditions listed in the NorthConnex EPL related to air quality.	No repeat non-conformances.	Project Audits.
2	Ensure that complaints from the community and stakeholders are managed in accordance with the Construction Complaints Management System, as detailed within the Community Communication Strategy.	An investigation into construction air quality related complaint will commence within 1 business day of being received.	Consultation Manager.
3	Ensure construction plant, vehicles and machinery do not cause continuous visible emissions that exceed the criteria set within the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> (DEC, 2007), (i.e. emissions must not be continuously visible for more than 10 seconds).	Any plant identified as having continuously visible exhaust emissions for more than 10 seconds to be stood down from construction operations.	Weekly Environmental Checklists and Forman Diaries.
4	Weekly documented inspections to be undertaken by the LLBJV environmental team members to identify and action any air quality issues.	Environmental inspections to be completed and recorded weekly during construction.	Weekly Environmental Checklists.
5	Ensure construction activities are undertaken in a way that minimises dust from the site to comply with the average annual deposited dust criteria of 2g/m ² /month increase in deposited dust level and 4g/m ² /month total deposited dust level, as per Table 7.1 of the <i>Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales</i> (DEC, 2005).	Exceedances above the average annual target, attributable to the Project.	Monitoring Registers/Records

3. Environmental Requirements

3.1 Relevant Legislation and Guidelines

3.1.1 Legislation

Legislation relevant to air quality management includes:

- *Environmental Planning and Assessment Act 1979.*
- *Protection of the Environment Operations Act 1997.*
- *Protection of the Environment Operations (Clean Air) Regulation 2010.*

Relevant provisions of the above legislation are explained in the register of legal and other requirements included in Appendix A1 of the CEMP. Matters relating to the *National Greenhouse and Energy Reporting Act 2007* are addressed in the Construction Waste and Resource Management Sub Plan.

3.1.2 Guidelines and standards

The main guidelines, specifications and policy documents relevant to this Plan include:

- National Environment Protection Council's (NEPC) – National Environment Protection Measure (NEPM) for Ambient Air Quality Guidelines.
- AS 3580.1.1-2007 Methods of Sampling Analysis of Ambient Air. Part 1.1 Guide to Siting Air Monitoring Equipment.
- AS 3580.10.1-2003 Methods of Sampling Analysis of Ambient Air. Determination of Particulate Matter – Deposited Matter - Gravimetric Method.
- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC 2005).
- Roads and Maritime Services QA Specification G36 Environmental Protection (Aug 2014).
- Roads and Maritime Services QA Specification G38 Soil and Water Management (Aug 2014).
- Managing Urban Stormwater: Soils and Construction, Volume 1 and Volume 2 (DEC 2004) (the "Blue Book").

3.2 Minister's Conditions of Approval

The CoA relevant to this Plan are listed in Table 3.1. A cross reference is also included to indicate where the condition is addressed in this Plan or other Project management documents.

Table 3-1 Conditions of Approval relevant to the CAQMP

CoA No.	Condition Requirements	Document Reference
CoA D57 (e)	A Construction Air Quality Management Plan to detail how construction impacts on local air quality will be minimise and managed. The Plan shall be developed in consultation with the EPA, and shall include, but not necessarily be limited to:	This Air Quality Management Plan
	i. identification of sources (including stockpiles and open work areas) and quantification of airborne pollutants;	Section 5.1 and Section 5.3
	ii. key performance indicators for local air quality during construction;	Section 2.3
	iii. details of monitoring methods, including location, frequency and duration of monitoring;	Section 7.3
	iv. mitigation measures to minimise impacts on local air quality;	Section 6
	v. procedures for record keeping and reporting against key performance indicators;	Section 2.3 and Section 7
	vi. provisions for implementation of additional mitigation measures in response to issues identified during monitoring and reporting; and	Section 6 and Section 7.3
	vii. mechanisms for the monitoring, review and amendment of this	Section 8

CoA No.	Condition Requirements	Document Reference
	plan.	
D3	Soil and water management measures consistent with <i>Managing Urban Stormwater - Soils and Construction Vols 1 and 2, 4th Edition</i> (Landcom, 2004) shall be employed during the construction of the SSI to minimise soil erosion and the discharge of sediment and other pollutants to land and/or waters.	Section 6
FD4	Where available and practicable, and of appropriate chemical and biological quality, stormwater, recycled water or other water sources shall be used in preference to potable water for construction activities, including dust control.	Section 6

Note: Operational air quality CoA will be addressed in the Operational Environmental Management Plan.

3.3 Revised Environmental Management Measures

The revised environmental management measures from the SPIR relevant to this Plan are listed in Table 3-2 below. A cross reference is also included to indicate where the REMM is addressed in this Plan. Where REMM's are not specifically addressed in this Plan, justification is provided. The timing of when the commitment applies has also been included.

Table 3-2 Revised Environmental Management Measures relevant to this CAQMP

Ref #	Commitment	Timing	CAQMP Reference
REMM AQ1	Site inductions and ongoing toolbox talks would be provided to make construction works aware of air quality control practices and responsibilities.	Construction	Table 6-1
REMM AQ2	Construction activities would be modified, reduced or controlled during high or unfavourable wind conditions if they would potentially increase off-site dust emissions.	Construction	Table 6-1
REMM AQ3	Measures would be implemented to control dust emissions, such as the use of water carts, sprinklers, sprays and dust screens. The frequency of use would be modified in response to weather conditions.	Construction	Table 6-1
REMM AQ4	Dust extraction and filtration systems would be installed for tunnel excavation works.	Construction	Table 6-1
REMM AQ5	Should odour emissions arise from the groundwater treatment plant or stockpiles, a management plan would be developed to identify and implement appropriate mitigation measures.	Construction	Table 6-1
REMM AQ6	Disturbed areas would be stabilised as soon as practicable to prevent or minimise windblown dust.	Construction	Table 6-1
REMM AQ7	Cutting of materials such as concrete or bricks would be undertaken in a manner that minimises the generation of dust, such as the wetting of the cutting face.	Construction	Table 6-1
REMM AQ8	Controls, such as rumble grids or wheel wash facilities, would be implemented to minimise the tracking of dirt onto public roads.	Construction	Table 6-1
REMM AQ9	Hardstand areas and surrounding public roads would	Construction	Table 6-1

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Ref #	Commitment	Timing	CAQMP Reference
	be cleaned, as required.		
REMM AQ10	Speed limits would be posted and observed by all construction vehicles on the construction site.	Construction	Table 6-1
REMM AQ11	Loaded haulage trucks would be covered at all times on public roads and on-site where there is a risk of release of dust or other materials.	Construction	Table 6-1
REMM AQ12	Haul trucks, plant and equipment would be switched off when not in operation for periods of greater than 15 minutes.	Construction	Table 6-1
REMM AQ13	Construction plant, vehicles and machinery would be maintained in good working order and in accordance with manufacturers' specifications.	Construction	Table 6-1
REMM AQ14	<p>A formal dust observation program would be implemented during construction, involving daily reviews of weather forecasts, observations of meteorological conditions and on site dust generation.</p> <p>This would inform mitigation measures or alterations to construction activities to be implemented during unfavourable weather conditions (such as dry weather and strong winds).</p>	Construction	Table 6-1 and section 7.3
REMM HS12	Where available, and of appropriate chemical and biological quality, subject to a health risk assessment, stormwater, recycled water, groundwater inflows into the tunnel or other water sources shall be used in preference to potable water for construction activities, including concrete mixing and dust control.	Construction	Table 6-1
REMM RW14	Feasible and reasonable opportunities for wastewater re-use on-site or for construction purposes would be pursued (such as dust suppression both in the tunnels and for surface works).	Construction	Table 6-1
<p>Note: Operational REMMs are to be addressed in the Operational Environmental Management Plan.</p>			

4. Existing Environment

The following sections summarise what is known about factors influencing air quality impacts associated with the construction of the Project.

4.1 Rainfall, Temperature and Wind

The historical records from Pennant Hills (Station ID 066047) have been selected to reflect the potential rainfall and temperature conditions across the Project due to its proximity to the overall site, and extent of available data (1941 to present for rainfall; 1982 to present for temperature). Wind records were not available from the Pennant Hills Station and therefore the Prospect Reservoir (Station ID 067019) data was used to characterise wind conditions due to its proximity to the Project and the extent of available data (from 1965 to 2010).

A summary of the relevant climatic records from the Bureau of Meteorology is provided in Table 4-1 below. This data was sourced in October 2014.

Table 4-1 Summary of climatic records

Summary of Pennant Hills rainfall records from 1941 to present													
	Summer / Autumn						Winter / Spring						
	Dec	Jan	Feb	Mar	Apr	Ma	Jun	July	Aug	Sep	Oct	Nov	Year
Mean rainfall (mm)	99.7	115.4	122.2	103.9	81.0	110.3	79.7	65.8	56.3	69.0	80.7	91.3	1075.2
Mean rain days	7.3	8.1	8.6	7.6	6.4	7.4	5.9	6.1	6.1	6.7	7.1	7.3	84.6
Summary of Pennant Hills temperature records from 1982 to present													
	Summer / Autumn						Winter / Spring						
	Dec	Jan	Feb	Mar	Apr	Ma	Jun	July	Aug	Sep	Oct	Nov	Year
Mean max temp (°C)	27.6	27.3	25.5	22.2	19.1	16.3	15.8	17.9	20.9	23.4	25.1	27.0	22.3
Summary of Prospect Reservoir wind speed records from 1965 to 2010													
	Summer / Autumn						Winter / Spring						
	Dec	Jan	Feb	Mar	Apr	Ma	Jun	July	Aug	Sep	Oct	Nov	Year
Mean 9am wind speed (km/h)	7.5	7.0	7.3	8.0	7.7	8.0	8.1	9.2	9.7	10.0	8.5	8.2	8.3
Mean 3pm wind speed (km/h)	12.7	12.4	12.0	11.5	10.3	12.3	12.4	14.3	15.3	15.4	14.4	14.5	13.1
Summary of Prospect Reservoir wind direction records from 2007 to 2011													
	Summer / Autumn						Winter / Spring						
	Dec	Jan	Feb	Mar	Apr	Ma	Jun	July	Aug	Sep	Oct	Nov	Year
Mean wind direction (degrees)	170	153	175	188	233	240	245	243	216	190	168	170	199

The above Table 4-1 provides a consideration of typical climatic factors that contribute to the proliferation of dust particulates. In addition to the exposure of unconsolidated material during construction (e.g. earthworks), climatic factors such as prolonged dry weather, combined with high winds, can increase the likelihood of dust particulate emissions.

It can be seen from table 4-1 that rainfall is typically higher during summer and autumn. Winter and spring are typically drier periods during the year, coinciding with the windier period of the year.

Wind direction varies slightly throughout the year, however due to the urban environment that surrounds the project; wind direction will not be a factor that greatly influences air quality management. Table 4.2 contains general wind speed guidance for the project.

Table 4.2: Wind speed guidance

Wind Speed (km/h)	Characteristics
10	Wind felt on skin, leaves rustle
20	Leaves and small debris constantly moving,
30	Dust, leaves and loose paper lifted in the air. Small branches move
40	Small trees begin to sway, dust evident.
50 +	Large tree branches moving. Dust clearly evident.

4.2 Soil Characteristics

The following Soil Landscape Groups are located within the construction footprint:

- Hawkesbury (Hawkesbury Sandstone).
- West Pennant Hills (Wianamatta Shales).
- Glenorie (Winamatta Shales).
- Gymea (Hawkesbury Sandstone).
- Lucas Heights (Mittagong Formation with alternating bands of shale and sandstone).

All of these soils are susceptible to wind erosion.

4.3 Sensitive Receivers

The construction of the Project will interact with a number of sensitive receivers and some natural environments. The lands surrounding the Project have been considered for potential sensitivity to dust and air quality impacts. The potential sensitive receivers include:

- Residences.
- Native vegetation.
- Sensitive commercial or industrial users.
- Schools.
- Aged care facilities.
- Child care facilities.
- Hospitals.
- Road users.
- Recreational areas.

Residential sensitive receivers generally surround the Project and are identified in the Sensitive Area Plans – Appendix A5 to the CEMP.

In addition to numerous residential receivers, the nearest potentially affected non-residential sensitive receivers have been identified as, but not limited to, those listed in Table 4-3.

Table 4-3 Non-residential sensitive areas

Location	Receiver Type
Hills M2 Motorway integration works (including the Darling Mills Creek construction compound, Barclay Road construction compound and the Yale Close construction compound)	<ul style="list-style-type: none"> • Native Vegetation (Richard Web Reserve, Ted Horwood Reserve & Bidjigal Reserve). • Darling Mills Creek. • Blue Gum Creek. • Recreational (Muirfield Golf Club). • Commercial (Westfield North Rocks and surrounding businesses). • Schools (Muirfield High School, Murray Farm Public School, Royal Institute for Deaf And Blind Children & North Rocks Public School). • Road users.
Southern interchange construction compound	<ul style="list-style-type: none"> • Recreational (Pennant Hills Golf Club). • Native Vegetation. • Commercial (Carman drive community shopping centre). • Road users.
Wilson Road construction compound	<ul style="list-style-type: none"> • Schools (Mount St Benedict High School and St Agatha's Catholic Primary School) • Recreational (Ludovic Blackwood Memorial Sanctuary and Observatory Park) • Aged care facilities (Lutanda Manor) • Places of worship (Christian City Church Carlingford and St Agatha's Parish)
Trelawney Street construction compound	<ul style="list-style-type: none"> • Thornleigh commercial area. • Thornleigh industrial area. • Recreational (Headen Park, Brickpit Sports Stadium and Thornleigh Golf Centre). • Schools (Normanhurst West Community Pre-School and Public School) • Road users. • Places of worship (Chinese Australian Baptist Church).
Pioneer Avenue construction compound	<ul style="list-style-type: none"> • Thornleigh commercial area. • Thornleigh industrial area. • Recreational (Headen Park, Brickpit Sports Stadium and Thornleigh Golf Centre). • Schools (Normanhurst West Community Pre-School and Public School) • Road users.
Northern interchange construction compound	<ul style="list-style-type: none"> • Schools (Abbotsleigh School for Girls, Peter Rabbit Preschool, Normanhurst Boys High School & Saint Leo's Catholic College). • Hospital (Hammond Care Neringah Hospital). • Aged care facilities (Netherby Aged Care Facility, Thomas and Rosetta Agst Aged Care Facility, Bowden Brae Retirement Village, Greenwood Aged Care & Belvedere Community Aged Care Centre). • Road users.
Northern Interchange: – M1 Integration works (including Bareena Avenue construction compound, Junction Road construction compound)	<ul style="list-style-type: none"> • Native Vegetation. • Cockle Creek. • Schools (Abbotsleigh College & Waitara Public School). • Road users. • Places of worship (St. Paul's Anglican Church Wahroonga).

While the risk of impact to nearby sensitive receivers is predicted to be low (with implementation of the measures described in Section 6), notification of upcoming works (including those activities that may impact air quality) will be provided to residential and non-residential receivers throughout the Project, in accordance with the Community Consultation Strategy, typically via the monthly update.

5. Environmental Aspects and Impacts

5.1 Construction Activities

Emissions to the atmosphere during construction that could result in adverse impacts to air quality are typically divided into two categories. These are:

- Dust and particulates.
- Gaseous.

Key aspects of the Project that could result in dust and particulate emissions include:

- Worksite establishment activities such as vegetation clearing and earthworks.
- Demolition of buildings, structures and road pavement.
- General earthworks.
- Exposure of surfaces which may be susceptible to wind erosion.
- Material handling including stockpiling, material loading and material haulage.
- Minor excavations and utility installations.
- Vehicle movements on unsealed roads, resulting in wheel generated dust.
- Drilling and blasting.
- Tunnel shaft and decline excavation activities.
- Tracking of dirt onto roads.

Gaseous emissions which may be generated by construction activities include:

- Vehicle and plant exhaust emissions, which may be excessive if vehicles and plant are poorly maintained.
- Odours/gases released during:
 - Excavations of organic or contaminated materials.
 - Sealing works.
 - Groundwater treatment

Table 5-1 provides a high level summary of construction activities with potential air quality implications, based on key construction sites.

Table 5-1 key construction locations

Location	Typical activities with potential to generate air emissions
Hills M2 Motorway integration works (including the Darling Mills Creek construction compound, Barclay Road construction compound and the Yale Close construction compound)	<ul style="list-style-type: none"> • Establishment of work areas. • Earthworks and exposed areas associated with the formation of the finished design levels for the additional lane, cuttings and embankments. • Bridge construction works, including piling. • General civil works. • Spoil handling and management, estimated at around 39,800 m3 of spoil. • Paving. • Exhaust emissions from the operation of construction vehicles and plant. • Surface site rehabilitation and restoration. • General stockpiling associated with the above activities.
Southern interchange and Southern interchange construction compound	<ul style="list-style-type: none"> • Establishment of work areas, including vegetation removal, building demolition and exposed surfaces. • Earthworks associated with the formation of finished design levels, cuttings, cut-and-cover sections (including tunnel structures), and the excavation of decline ramps, main alignment tunnels, and shafts. • General civil works, including retaining walls. • Removal, storage and transport of around 613,900 m3 of spoil from construction activities. • Paving. • Exhaust emissions from the operation of construction vehicles and plant. • Construction of permanent operational ancillary facilities. • Surface site rehabilitation and restoration. • General stockpiling associated with the above activities.

Location	Typical activities with potential to generate air emissions
Wilson Road construction compound	<ul style="list-style-type: none"> • Establishment of work areas, including vegetation removal, building demolition and exposed surfaces. • Earthworks associated with the formation of the finished design levels for the site and the excavation of the decline to the main alignment tunnels. • Removal, storage and transport of around 441,950 m3 of spoil from tunnelling activities. • Exhaust emissions from the operation of construction vehicles and plant. • Decommissioning and removal of construction-related buildings and plant. • Construction of permanent operational ancillary facilities. • Surface site rehabilitation and restoration. • General stockpiling associated with the above activities.
Trelawney Street construction compound	<ul style="list-style-type: none"> • Establishment of work site, including building demolition, vegetation clearance and exposed surfaces. • Earthworks associated with the formation of the finished design levels for the site and the excavation of the decline to the main alignment tunnels. • Removal, storage and transport of around 492,200 m3 of spoil from tunnelling activities. • Exhaust emissions from the operation of construction vehicles and plant. • Decommissioning and removal of construction-related buildings and plant. • Construction of permanent operational ancillary facilities. • Surface site rehabilitation and restoration. • General stockpiling associated with the above activities.
Pioneer Avenue construction compound	<ul style="list-style-type: none"> • Establishment of work site, including building demolition and exposed surfaces. • Construction of temporary structures, and paving for car parking areas. • Decommissioning and removal of construction-related buildings. • Surface site rehabilitation and restoration. • Exhaust emissions from the vehicles. • General stockpiling associated with the above activities.
Northern Interchange: – M1 Integration works (including Bareena Avenue construction compound, Junction Road construction compound and the Northern interchange construction compounds)	<ul style="list-style-type: none"> • Establishment of work site, including building demolition and exposed surfaces. • Earthworks associated with the formation of the finished design levels for the interchange, cuttings, cut-and cover sections (including tunnel structures), and the excavation of on-ramps and off-ramps, shafts and the main alignment tunnels, • Removal, storage and transport of around 1,024,350 m3 of spoil from construction activities from the northern interchange compound. • General civil works. • Paving. • Exhaust emissions from the operation of construction vehicles and plant. • Decommissioning and removal of construction-related buildings and plant. • Construction of permanent operational ancillary facilities at the Bareena Avenue compound. • Surface site rehabilitation and restoration. • General stockpiling associated with the above activities.

5.2 Factors likely to affect dust generation and impacts

In addition to the inherent risks of specific construction activities creating the potential to generate dust, a number of other environment factors also affect the likelihood of dust emissions. These include:

- Wind direction – determines whether dust and suspended particles are transported in the direction of the sensitive receivers.
- Wind speed – governs the potential suspension and drift resistance of particles.
- Soil type - more erodible soil types have an increased soil or dust erosion potential.
- Soil moisture – increased soil moisture reduces soil or dust erosion potential.
- Rainfall or dew – rainfall or heavy dew that wets the surface of the soil and reduces the risk of dust generation.
- Proximity of the work area to receivers.
- Duration of construction activities.

5.3 Impacts

As described in the EIS, construction activities have the potential to impact on the surrounding air quality from activities which may generate dust, and from exhaust emissions from construction plant and equipment. Some impacts on air quality attributable to construction of the Project are anticipated.

A dust emissions rate for the project has been quantified as 0.0272 tonnes per hectare per month. This rate has been defined in accordance with section 3.2.3.3 of the National Pollutant Inventory Emissions estimation technique manual for Fugitive Emissions (Dep. of Sustainability, Environment, Water, Population and Communities, 2012). The amount of dust that could be generated is proportional to the area of land that is being worked and is fully exposed. In reality, work areas will be opened up and then stabilised progressively, meaning that the rate is only applicable to specific work areas for a relatively short period of time. In order to ensure that this rate and subsequent impacts are minimised, mitigation measures such as those listed in Table 6-1 will be implemented. Based on these mitigation measures, and the duration of construction activities, there would be limited potential for significant risks to human health, nuisance or the environment during this phase of the Project.

6. Environmental Management Measures

A range of environmental requirements and control measures are identified in the various environmental documents, including the EIS, SPIR, Conditions of Approval, LLBJV EMS and other Roads and Maritime and NCX Project Co documents. Specific management measures to address these requirements and impacts on air quality are outlined in Table 6-1.

Table 6-1 Air quality management measures

ID	Measure / Requirement	When to implement	Responsibility	Reference
GENERAL				
AQ1	Training will be provided to relevant Project personnel, including relevant sub-contractors on sound air quality control practices and the requirements from this plan through inductions, toolboxes and targeted training.	Prior to construction/ Construction	Construction Manager / Environment Manager	G38, G36, SPIR / EIS Section 7.3.5
AQ2	Air quality control measures from this plan will be included in relevant Environmental Work Method Statements (EWMS) and/or Progressive Erosion and Sediment Control Plans (PESCP).	Prior to construction / Construction	Site Engineer / Environmental Officer	Good practice
AQ3	Construction activities will be modified, reduced or controlled if dust is being generated or during high or unfavourable wind conditions if they have a potential to increase the generation or emission of dust.	Construction	Foreman / Superintendent / Environmental Officer	SPIR / EIS Section 7.3.5
AQ4	Control measures including water carts, sprinklers, sprays, dust screens or the application of geo-binding agents will be utilised where applicable to control dust emissions. The frequency of use will be modified to accommodate prevailing conditions.	Construction	Foreman	SPIR / EIS Section 7.3.5
AQ5	Dust suppression will be used during demolition as required.	Construction	Foreman	Good practice
AQ6	The application of pesticides will be modified, reduced or controlled during high or unfavourable wind conditions where wind can carry pesticides outside of the defined treatment area.	Construction	Foreman	G36
AQ7	Disturbed areas will be stabilised as soon as practicable in accordance with Managing Urban Stormwater – Soils and Construction Vols 1 and 2, 4 th Edition to prevent or minimise windblown dust.	Construction	Site Engineer / Foreman	SPIR / EIS Section 7.3.5
AQ8	The groundwater treatment plants will be of a modular design that will enable the system to be modified if required to control odours.	Construction	Environmental Manager	SPIR / EIS Section 7.3.5 & 7.3.4
AQ9	Cutting of materials such as concrete or bricks would be undertaken in a manner that minimises the generation of dust, such as the wetting of the cutting face.	Construction	Foreman	SPIR / EIS Section 7.3.5
AQ10	Should regular inspections or monitoring identify air quality issues, mitigation measures being implemented are to be reviewed and revised to ensure that the most appropriate measure or combination of measures is employed.	Construction	Environmental Officer	Good practice

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AQ11	Where available and practicable, stormwater, recycled water, groundwater inflows shall be used in preference to potable water for construction activities, such as concrete mixing, compaction or dust control.	Construction	Superintendent / Foreman	CoA D4 SPIR / EIS Section 7.8.4 SPIR / EIS Section 8.3.2
AQ12	Soil and water management measures consistent with <i>Managing Urban Stormwater - Soils and Construction Vols 1 and 2, 4th Edition</i> (Landcom, 2004), including but not limited to those listed in this table or table 6-1 of the CSWMP shall be designed, installed and managed during the construction of the Project to minimise soil erosion and the discharge of sediment and other pollutants to land and/or waters.	Construction	Superintendent / Foreman / Environmental Officer	CoA D3
VEHICLE MOVEMENT AND MATERIAL STORAGE				
AQ13	Measures will be implemented to minimise dust, soil or mud from being deposited by vehicles on public roads. This will be achieved by implementing one or more of the following mitigation measures - rumble grids; hardstands; large aggregate at entry/exit points; or wheel wash facilities.	Construction	Superintendent	SPIR / EIS Section 7.3.5
AQ14	Hardstand areas and surrounding public roads will be cleaned as required, using methods including brooms, bobcat attachments or street sweepers.	Construction	Foreman	SPIR / EIS Section 7.3.5
AQ15	All loaded haulage trucks will be covered onsite when there is potential for the release of dust or other materials off site, and at all times on public roads.	Construction	Foreman	SPIR / EIS Section 7.3.5
AQ16	Spoil trucks would enter and exit the construction compounds on access roads that would be stabilised where there is a risk of dust generation that could impact sensitive receivers.	Construction	Foreman	SPIR / EIS Section 7.3.4
AQ17	Speed limits would be posted and observed by all construction vehicles on the construction site.	Construction	Foreman	SPIR / EIS Section 7.3.5
AQ18	Cover, or otherwise stabilize stockpiles that are susceptible to wind or water erosion, within 10 days of forming each stockpile. Where possible, the project would stabilise stockpiles within this nominated timeframe.	Construction	Foreman	G38
PLANT AND EQUIPMENT				
AQ19	Haul trucks, plant and equipment would be switched off when not in operation for periods of greater than 15 minutes.	Construction	Foreman / Operators	SPIR / EIS Section 7.3.5
AQ20	Construction plant, vehicles and machinery (including sub-contractors and plant hire) will be maintained in good working order and in accordance with manufacturer's specifications.	Construction	Workshop Foreman / Operators	EPL, SPIR / EIS Section 7.3.5
AQ21	Construction plant, vehicles and machinery will be maintained or shutdown to ensure no continuous visible emissions for longer than 10 seconds.	Construction	Workshop Foreman / Operators	Good practice

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AQ22	Construction compounds will be connected to mains power supply as soon as possible to minimise the generation of exhaust emissions.	Construction	Superintendent	SPiR / EIS Section 7.3.4
AQ23	Where small generators (<40KVA) are used they will be positioned as far away from sensitive receivers as possible to avoid any temporary impacts.	Construction	Superintendent	Good practice
AQ24	Dust scrubbing equipment will be installed at key locations during the tunnelling operation to collect dust emission generated during tunnelling. The dust scrubbers are an integral part of the road header excavation process, as such they will be positioned in close proximity to the working face and will follow the location of the road headers as they progress through the excavation	Construction	Superintendent	SPiR / EIS Section 7.3.5
BLASTING AND CRUSHING				
AQ25	If blasting is required for the project, a blasting strategy will be prepared and will address potential air quality impacts and mitigation measures.	Construction	Foreman	Good practice
INSPECTION, MONITORING AND RECORDS				
AQ26	Weather forecasts, site activities & conditions will be reviewed on a daily basis and appropriate measures implemented where unfavourable weather conditions (dry weather, strong winds) are anticipated. The Environmental Manager will send out alerts to the site teams advising them if unfavourable weather is imminent.	Construction	Environmental Officer / Foreman	Good practice
AQ27	Treated ground water and open exposed areas including stockpile areas will be monitored for odours on a regular basis during inspections. If nuisance odours are generated and are impacting sensitive receivers, an odour management plan will be developed and control measures will be implemented consistent with the SPiR.	Construction	Environmental Officer / Engineer	SPiR / EIS Section 7.3.5
AQ28	Regular monitoring and inspections will be undertaken during construction at work sites with the potential to generate dust, in accordance with section 7.3 of this plan. Monitoring and inspections will determine if additional mitigation measures need to be implemented in response to issues identified. Additional measures may include more of those listed in Table 6-1 or varying combinations of those measures.	Construction	Environmental Officer / Manager	SPiR / EIS Section 7.3.5 CoA D57(e)(vi)

7. Compliance Management

7.1 Roles and Responsibilities

The LLBJV Project Team's organisational structure and overall roles and responsibilities are outlined in Section 4.2 of the CEMP. Specific responsibilities for the implementation of environmental controls relating to air quality during construction are detailed in Chapter 6 of this Plan.

7.2 Training

Relevant employees, contractors and utility staff working on site will undergo site induction training relating to air quality management issues. The induction training will address elements related to air quality management including:

- Existence and requirements of this sub plan.
- Relevant legislation.
- Roles and responsibilities for air quality management.
- Air quality mitigation and management measures.
- Procedure to be implemented in the event of an incident (e.g. release of dust or gaseous emissions from site).

Targeted training in the form of toolbox talks or specific training will also be provided to personnel with a key role in air quality management. Examples of training topics include:

- Erosion and sediment controls installation methodology.
- Planning and preparedness for high wind events / dust risk periods.
- Lessons learnt from dusty periods, incidents and other event (e.g. low rainfall/high wind).

Further details regarding staff induction and training are outlined in Chapter 5 of the CEMP.

7.3 Monitoring and Inspection

Regular monitoring and inspections will be undertaken during construction at work sites with the potential to generate dust. Monitoring and inspections will determine if additional mitigation measures need to be implemented in response to issues identified. Additional measures may include more of those listed in Table 6-1 or varying combinations of those measures. Monitoring and inspections will include the following:

- Weekly documented inspections to be undertaken by the LLBJV environmental team members to identify and action any air quality issues. These are to include visual monitoring of dust and gaseous emissions (e.g. no continuous visible emissions for longer than 10 seconds).
- Daily informal checks by site supervisors, engineers and the environmental team to identify and action any air quality issues. This would include daily reviews of weather forecasts, observations of meteorological conditions, on site dust generation and on site gaseous emissions. This would inform mitigation measures or alterations to construction activities to be implemented during unfavourable weather conditions (such as dry weather and strong winds).
- Weather data at the premises, including rainfall measured and recorded in millimetres per 24-hour period at the same time each day from the time that the site office is established.
- Pre use plant inspection will be conducted and recorded to ensure that plant is in good working order and ensure no continuous visible emissions for longer than 10 seconds.
- Depositional dust gauges will be installed at 5 compound locations – Northern Interchange, Trelawney St, Wilson Rd, Southern Interchange and at the Perry St compound located along the Hills M2 .

Additional requirements and responsibilities in relation to inspections are documented in Section 8 of the CEMP.

7.4 Complaints

Complaints will be recorded in accordance with the Construction Complaints Management System. Information to be recorded will include location of complainant, time/s of occurrence of alleged air quality impacts, perceived source, prevailing weather conditions and similar details that could be utilised to assist in the investigation of the complaint. All resident complaints will be responded to in a timely manner and action taken recorded in accordance with the Construction Complaints Management System.

7.5 Licences and Permits

An EPL will be obtained for the scheduled activity of "road construction". EPL conditions relating to air quality will be complied with.

7.6 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this sub plan, CoA and other relevant approvals, licences and guidelines.

Audit requirements are detailed in Section 8 of the CEMP.

7.7 Reporting

Reporting requirements and responsibilities are documented in Section 8 of the CEMP. This includes reporting against construction KPIs on a six monthly basis.

7.8 Records

Records will be kept and maintained in accordance with Section 10 of the CEMP. Recording specific to construction air quality will include:

- Weekly environmental inspections will be documented within Weekly Environmental Checklist forms.
- Daily informal checks to identify and action any air quality issues will be documented within foreman diaries.
- Weather data will be recorded within an onsite weather register.
- Complaint management via Consultation Manager.
- Induction and toolbox training records will be maintained.
- Pre use plant inspection will be conducted and recorded to ensure that plant is in good working order and ensure no continuous visible emissions for longer than 10 seconds.
- Records of compliance with KPI will be kept in accordance with Table 2.1 to track the projects air quality management performance.

8. Review and Improvement

8.1 Continuous Improvement

Continuous improvement of this Plan will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance.
- Determine the cause or causes of non-conformances and deficiencies.
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies.
- Verify the effectiveness of the corrective and preventative actions.
- Document any changes in procedures resulting from process improvement.
- Make comparisons with objectives and targets.

8.2 CAQMP Update and Amendment

Revisions to this plan will be in accordance with the process outlined in Section 1.6 and Section 9 of the CEMP. Amendments in response to processes described in Section 8 may also occur.

Between the above processes, a register of issues will be maintained by the project to ensure that any issues are recorded.

Changes to this plan will be approved by the client and stakeholders (if required) and documented in the document control section for each revision. A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure – refer to Section 10.2 of the CEMP.