



APPENDIX B6

Construction Air Quality Management Plan

Woolgoolga to Ballina

Pacific Highway Upgrade (sections 3 to 11)

OCTOBER 2015

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- Appendix A** Dust deposition gauge locations and sensitive receivers
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Glossary / Abbreviations

CAQMP	Construction Air Quality Management Plan
CEMP	Construction Environmental Management Plan
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DP&E	Department of Planning and Environment
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EPA	Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPL	Environment Protection Licence
ERG	Environmental Review Group
ERSED	Erosion and sedimentation
ESCP	Erosion and Sediment Control Plan
EWMS	Environmental Work Method Statements
FM Act	<i>Fisheries Management Act 1994</i>
MCoA	NSW Minister's Conditions of Approval
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measures
NOW	NSW Office of Water
OEH	Office of Environment and Heritage
PC	Pacific Complete
Project, the	The Woolgoolga to Ballina Pacific Highway Upgrade (sections 3-11)
RMS	Roads and Maritime
Secretary	Secretary of the Department of Planning and Environment
SPIR	Submissions Preferred Infrastructure Report
SSI	State Significant Infrastructure
CSWQMP	Construction Soil and Water Quality Management Plan

1 Introduction

1.1 Context

This Construction Air Quality Management Plan (CAQMP) forms part of the Construction Environmental Management Plan (CEMP) for the planned construction of sections 3 to 11 of the Woolgoolga to Ballina Pacific Highway Upgrade. Sections 1 and 2 of the upgrade and soft soil early works (Wave 1, Wave 2, Wave 3 and Wave 4) have been included/will be included in separate CEMPs and their sub plans.

This CAQMP has been prepared to address the requirements of the Minister's Conditions of Approval (MCoA), the mitigation and management measures listed in the Pacific Highway Upgrade Woolgoolga to Ballina Environmental Impact Statement (EIS) and the Submissions / Preferred Infrastructure Report (SPIR), and all applicable legislation.

There are three tie-in projects within sections 3 to 11 of the Woolgoolga to Ballina project limits, namely the Glenugie Upgrade, Devils Pulpit and Ballina Bypass projects. These tie-in projects have been approved separately by the Minister for Planning.

1.2 Background

The Pacific Highway Upgrade Woolgoolga to Ballina Environmental Impact Statement (EIS) (December 2012) assessed the impacts of construction and operation of the Project on air quality, within Chapter 18.

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 EIS management measures were subsequently updated within the Woolgoolga to Ballina Submissions / Preferred Infrastructure Report (November 2013), with applicable management measures from that report included as part of this CAQMP, which are applicable to sections 3 to 11 from Glenugie Upgrade to Ballina.

1.3 Environmental management systems overview

The CEMP describes the overall system for the project's environmental management. That system forms part of the environmental management framework being delivered by Pacific Complete (PC) in partnership with Roads and Maritime.

The CAQMP has been developed in consultation with the Project Environmental Review Group, including NSW Environment Protection Authority (EPA).

Management measures identified in this Plan will be incorporated into site or activity specific Environmental Work Method Statements (EWMS).

Contractor EWMS will be developed and signed off by the Pacific Complete Environment Manager prior to commencement of works and construction personnel will be required to undertake works in accordance with the identified mitigation and management measures.

Used together, the CEMP, strategies, procedures and EWMS form management guides that clearly identify required environmental management actions for reference by contractor personnel.

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

2 Purpose and objectives

2.1 Purpose

The purpose of this Plan is to describe the processes that Pacific Complete will use to ensure that contractors manage their dust and air quality issues appropriately.

2.2 Objectives

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

- Ensure appropriate controls and procedures are implemented during construction activities to avoid or minimise air quality impacts and potential adverse impacts to sensitive receivers along the Project corridor
- Ensure appropriate measures are implemented to address the relevant MCoA outlined in Table 3.1 and the mitigation measures detailed in the EIS
- Ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in Section 3.1 of this Plan.

Refer to Appendix B7 Construction Waste and Energy Management Plan for measures to reduce greenhouse gas emissions during construction.

2.3 Key Issues

Particulate matter will be the main source of air pollution during construction of the Project, and so air quality management measures for the Project will focus primarily on particulate matter generated during construction.

Some emissions, such as those generated by vehicle exhausts are not considered to present a significant risk to the environment and community. However all vehicles, plant and equipment will be maintained to comply with the manufacturer's specifications, along with relevant standards and legislative requirements. Measures to reduce the potential impact of these emissions from vehicle and other sources are included in Table 7-1.

Vegetation clearing and excavation activities have the potential to affect air quality if not properly managed. Dust has the potential to be generated from earthworks associated with the upgrade. The total amount of dust generated depends on the silt and moisture content of the soil and the type of activities being carried out. Construction activities that have the potential to generate dust and other emissions that may have environmental impacts include the following and are addressed in Section 6.1:

- clearing & grubbing of vegetation
- excavations and earthworks (including demolition & removal of the existing structures)
- uncovered loads being transported to and from site
- use of site compounds during construction
- vehicle movements on site (excessive vehicle speed on unsealed roads and tracks and site machinery)
- wind erosion of spoil and/or material stockpiles
- wind erosion of cleared areas with bare earth (no vegetation or ground cover) or unsealed surfaces
- emissions associated with a batch plant operations
- blasting or processing of rock
- fire

- inadequate equipment maintenance
- storage of fuel and refuelling activities
- odour from uncovered wastes
- herbicide, spray drift
- paving activities
- lime stabilisation operations.

Weather conditions such as wind direction, wind speed, soil moisture and rainfall or dew will substantially influence the day to day potential for dust generation and suspension. Accordingly, project personnel involved in the activities above need to consider the factors effecting dust generation in consultation with their environmental representatives to ensure appropriate mitigation measures are adopted.

3 Environmental requirements

This Chapter describes legislative, regulatory and guidance framework that applies to the work.

3.1 Relevant legislation and guidelines

Attachment A contains details of the legislative, regulatory, guideline and standard provisions and their relevance to this management plan.

3.1.1 Legislation

Table 3-1 lists the principal legislation and regulation that applies to the air quality management.

Table 3-1 Principal legislation and regulation

Legislation and regulation	Relevance
Commonwealth	
<i>National Environmental Protection Measure Act 1994</i>	Provides the basis for establishing national environmental protection measures (NEPMs) for ambient water quality
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	Provides for the protection of matters of national environmental significance including species, populations, communities and their habitat that could be impacted by contamination or pollution
Environment Protection and Biodiversity Conservation Regulation 2000 (as amended).	Provides for the protection of world heritage sites (including the Gondwana Rainforests) and wetlands of international importance (ie Ramsar sites).
<i>National Environmental Protection Measure Act 1994</i>	Establishes the National Environmental Protection Council (NEPC) and the concept of National Environmental Protection Measures (NEPMs)
<i>National Greenhouse and Energy Reporting Act 2007</i>	Provides the statutory basis for the National Greenhouse and Energy Reporting Scheme in relation to greenhouse gas emissions and energy consumption and production.
State	
<i>Environmental Planning and Assessment Act 1979 (EP&A Act)</i>	Describes the processes for consenting development in NSW, managing land use and implementing environmental planning instruments. Also describes certain permitting and licencing streaming and exclusion provisions that will apply to the project
<i>Protection of the Environment Operations Act 1997 (POEO Act)</i>	Pollution control, incident notification and the provision of Environment Protection Licences.
<i>Protection of the Environment (Clean Air) Regulation 2002 (as amended)</i>	Key regulatory mechanism for reducing air emissions.
<i>Protection of the Environment (General) Regulation 2009</i>	Allows trade waste permits to be issued to allow discharge to sewers managed by water authorities
Protection of the Environment (Ambient Air Quality) Regulation 1998 (as amended)	Framework for protecting environmental and human health
Protection of the Environment Operations (Clean Air) Regulation 2010	Provides regulatory measures to control emissions from wood heaters, open burning, motor vehicles and fuels and industry.
Protection of the Environment (Air	Facilitates the management of air toxics to protect human

Legislation and regulation	Relevance
Toxics) Regulation 1998 (as amended).	health.

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 Energy Management Plan (Appendix B7).

3.1.2 Guidelines and standards

Guidelines and standards relevant to air quality and this management plan include the following publications:

- National Environment Protection Council's (NEPC) – NEPM for Ambient Air Quality Guidelines
- Protection of the Environment Operations (Clean Air) Regulation, 2002
- AS 2922 Ambient Air Guide for Citing of Sampling Equipment
- AS 3580.1.1-2007 Methods for Sampling and Analysis of Ambient Air – Guide to Siting Air Quality Monitoring Equipment
- AS 3580.10.1-2003 Methods of Sampling Analysis of Ambient Air
- Action for Air 2009 (NSW DEC)
- Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales (DEC 2005)
- Air Quality Monitoring Criteria for Deposited Dust (DEC Guideline), Refer to Table 5-1.

3.2 Minister's Conditions of Approval

The NSW Ministers CoA (MCoA) relevant to this Plan are listed Table 3-2. A cross reference is also included to indicate where the condition is addressed in this Plan or other Project management documents.

Table 3-2 Conditions of Approval relevant to the CAQMP

MCoA No.	Condition Requirements	Document Reference
B24	The blasting criteria specified in conditions B22 and/or B23 may be increased where the Applicant has obtained the written agreement of the relevant landowner to increase the criteria. In obtaining the agreement the Applicant shall make available to the landowner: (b) the environmental impacts of the increased blast limits on the surrounding environment and most affected residences or other sensitive receivers including, but not limited to noise, vibration and air quality and any risk to surrounding utilities, services or other structures.	Chapter 7
B35	Where available, and of appropriate chemical and biological quality, stormwater, recycled water or other water sources shall be used, where feasible and reasonable, in preference to potable water for construction activities, including concrete mixing	Chapter 7

MCoA No.	Condition Requirements	Document Reference
B66	<p>and dust control.</p> <p>The SSI shall be constructed in a manner that minimises dust emissions from the site, including wind-blown and traffic-generated dust and tracking of material onto public roads. All activities on the site shall be undertaken with the objective of preventing visible emissions of dust from the site. Should such visible dust emissions occur at any time, the Applicant shall identify and implement all feasible and reasonable dust mitigation measures, including cessation of relevant works, as appropriate, such that emissions of visible dust cease.</p>	Chapter 7
B74	<p>Ancillary facilities that have not been previously identified and assessed in the documents listed in condition A2, and do not meet the criteria set out under condition B73, shall be approved by the Environmental Representative prior to its establishment.</p> <p>In obtaining this approval, the Applicant shall consult with the relevant public authority(s) and the relevant council, and demonstrate to the satisfaction of the Environmental Representative, how the potential environmental impacts can be Mitigated and managed to acceptable standards. The outcomes of the assessment shall be documented in a report and include, but not necessarily be limited to:</p> <p>(d) an assessment of the environmental impacts on the site and the surrounding environment, including, but not limited to noise, vibration, air quality, traffic and access during site establishment and operation, flora and fauna, heritage, erosion and sedimentation, water quality and light spill;</p>	Ancillary Facilities Management Plan
B80	<p>The Applicant shall ensure that all plant and equipment used at the site is:</p> <p>(a) maintained in a proper and efficient condition; and</p> <p>(b) operated in a proper and efficient manner.</p>	Chapter 7
C1	<p>Prior to the commencement of construction or as otherwise agreed by the Secretary, the Applicant shall prepare and implement a Community Communication Strategy to the satisfaction of the Secretary. The Strategy shall provide mechanisms to facilitate communication between the Applicant (and its contractor(s)), the Environmental Representative (see condition D22), the relevant council and community stakeholders (particularly adjoining landowners) on the construction environmental management of the SSI. The Strategy shall include, but not be limited to:</p> <p>Issues that shall be addressed through the Community Communication Strategy include (but are not necessarily limited to):</p>	Community Communication Strategy

MCoA No.	Condition Requirements	Document Reference
D22	<p>(vi) air quality and dust;</p> <p>D22. The Applicant shall prepare and implement a Borrow Sites Management Plan, to manage the construction, operation and rehabilitation of the borrow sites used to source construction material for the SSI, prior to the commencement of construction at the borrow sites, or as otherwise agreed by the Secretary. The Plan shall be prepared in consultation with the EPA and DPI (Fisheries) and to the satisfaction of the Secretary, and shall include, but not necessarily be limited to:</p> <p>(b) management and mitigation measures to be used to minimise surface and groundwater impacts, Aboriginal and non-Aboriginal heritage, air quality, noise and vibration, biodiversity and visual impacts;</p>	Borrow Site Management Plan
D25	<p>The Applicant shall prepare and implement (following approval) a Construction Environmental Management Plan for the SSI, prior to the commencement of construction, or as otherwise agreed by the Secretary. The Plan shall be prepared in consultation with the EPA, DPI (Fisheries), NOW and DoE and outline the environmental management practices and procedures that are to be followed during construction, and shall be prepared in consultation with the relevant government agencies and in accordance with the <i>Guideline for the Preparation of Environmental Management Plans</i> (Department of Infrastructure, Planning and Natural Resources, 2004). The Plan shall include, but not necessarily be limited to:</p> <p>(v) measures to monitor and manage dust emissions including dust from stockpiles, blasting, traffic on unsealed public roads and materials tracking from construction sites onto public roads;</p>	Chapter 7 Appendix A

4 Existing environment

The following sections summarise what is known about factors influencing air quality within and adjacent to the Project corridor.

The key reference document is Chapter 18 of the EIS.

4.1 Air quality records

There is limited information about air quality in the vicinity of the Project. Long-term monitoring is not usually undertaken outside metropolitan and/or industrial areas, because pollutants typically do not exist in concentrations that would cause adverse environmental or health impacts. However, there has been short-term air quality monitoring adjacent to a dual carriageway section of the Pacific Highway at Korora, which is located in an urban area approximately 20 kilometres south of Woolgoolga. A monitoring station was established at Korora to monitor the ambient air quality from October 2005 to January 2007.

Table 4-1 Korora air quality monitoring results

Pollutant	Averaging period	NEPM goals		Korora monitoring results	
		Maximum concentration	10-year goal (max allowable exceedence)	Maximum recorded concentration	Average recorded concentration
National standards and goals for ambient air quality					
Carbon monoxide	8 hr	9.0 ppm (10 mg/m ³)	1 day a year	0.2 ppm (0.3 mg/m ³)	0.03 ppm (0.04 mg/m ³)
Nitrogen dioxide	1 hr	0.12 ppm (246 µg/m ³)	1 day a year	0.036 ppm (73.8 µg/m ³)	0.004 ppm (9.2 µg/m ³)
Particles as PM ₁₀	1 day	50 µg/m ³	5 days a year	37.8 µg/m ³	20.3 µg/m ³
Advisory reporting goals					
PM _{2.5}	1 day	25 µg/m ³	Gather data to facilitate review of goal	15.4 µg/m ³	7.7 µg/m ³

4.2 Rainfall, soil dryness and wind

Climate and average weather records from Grafton Olympic Pool, Yamba Pilot Station and Ballina Airport have been selected to reflect the potential conditions along the Project alignment. A summary of the rainfall records, wind speeds and temperatures from the Bureau of Meteorology for each of these locations is provided in Table 4-2, Table 4-3 and Table 4-4. The tables provide the typical climatic factors that contribute to an increase of dust particles.

Climate factors such as prolonged dry weather, combined with high winds, can increase the likelihood of dust particulate emissions when it occurs in conjunction with the exposure of unconsolidated material during construction eg earthworks.

Table 4-2 Summary of rainfall records

		Summer / Autumn						Winter / Spring						Year
		Dec	Jan	Feb	Mar	Apr	Ma	Jun	July	Aug	Sep	Oct	Nov	
<i>Grafton Olympic Pool</i>	<i>Mean rainfall (mm)</i>	121.5	141.3	150.8	129.4	88.4	80.4	69.2	38.1	40.9	37.9	76.5	104.5	1079.8
	<i>Mean rain days</i>	10.2	10.4	10.9	11.2	8.0	7.5	5.8	4.6	4.3	5.2	7.2	9.2	94.5
<i>Yamba Pilot Station</i>	<i>Mean rainfall (mm)</i>	117.2	139.2	159.3	182.9	162.8	156.5	134.8	101.6	75.5	59.0	78.9	93.8	1461.8
	<i>Mean rain days</i>	9.0	10.2	11.0	13.3	11.4	10.5	8.8	7.6	6.7	6.4	7.7	8.2	110.8
<i>Ballina Airport</i>	<i>Mean rainfall (mm)</i>	138.3	182.3	204.3	209.7	194.6	168.4	197.6	119.5	85.0	61.3	99.3	122.4	1782.1
	<i>Mean rain days</i>	9.7	10.8	12.3	14.0	12.0	11.8	10.5	9.0	7.2	5.8	8.5	9.7	121.3

Table 4-3 Summary of wind speed

		Summer / Autumn mean windspeed @3pm (km/h)						Winter / Spring mean windspeed @3pm (km/h)						Year
		Dec	Jan	Feb	Mar	Apr	Ma	Jun	July	Aug	Sep	Oct	Nov	
<i>Grafton Olympic Pool</i>		14.5	12.5	12.5	11.6	11.1	8.9	10.0	9.6	12.1	13.8	17.0	14.1	12.3
<i>Yamba Pilot Station</i>		21.5	21.1	20.6	20.6	17.9	15.4	15.4	15.7	18.1	21.2	23.0	21.9	19.4
<i>Ballina Airport</i>		24.7	24.4	23.0	21.5	18.9	16.8	15.9	18.1	19.9	23.7	24.8	24.8	21.4

Table 4-4 Summary of wind speed

	Summer / Autumn mean maximum temp (°C)						Winter / Spring mean maximum temp (°C)						Year
	Dec	Jan	Feb	Mar	Apr	Ma	Jun	July	Aug	Sep	Oct	Nov	
<i>Grafton Olympic Pool</i>	29.6	30.1	29.3	28.2	26.2	23.1	20.8	20.5	22.1	24.9	26.8	28.2	25.8
<i>Yamba Pilot Station</i>	25.9	26.7	26.7	26.0	24.3	21.7	19.6	19.0	20.1	22.0	23.4	24.7	23.3
<i>Ballina Airport</i>	27.4	28.2	27.9	27.0	24.9	22.4	20.3	19.9	21.2	23.6	24.9	26.2	24.5

Table 4-2 shows that rainfall is typically higher during summer and autumn. Winter and spring are typically drier periods during the year. There is also a general trend that rainfall is higher at the northern end of the Project, this may be a reflection of the northern end having a closer proximity to the coast compared with the southern end. Similarly wind speed is higher and temperatures are lower at the northern end. Despite this, the climatic differences are minor and the proposed work activities and mitigation measures should be appropriate for the entire length of the Project.

Project specific weather stations will be established along the project alignment to monitoring weather and climatic conditions. The locations for weather stations will consider the proximity to the Project boundary, ease of access and the requirements set out in the relevant Australian Standards.

4.3 Sensitive receivers

The construction of the Project will interact with a number of sensitive receivers and 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
- Businesses
- Threatened and endangered native vegetation
- Threatened fauna species
- Sensitive agricultural and commercial industries (crops and horticulture)
- Road users
- Watercourses.

The nearest potentially affected non-residential sensitive receivers have been identified as, but not limited to, the following:

- Local Businesses
- Passing Motorists
- Threatened native vegetation
- Wetlands
- Farmland.

Majority of the residential sensitive receivers are clustered around the townships adjacent to the Project alignment. These townships include;

- Section 3
 - Tyndale
- Section 5
 - Maclean
 - Harwood
- Section 8
 - Woodburn
- Section 9
 - Broadwater.

The Project passes through active agricultural areas with some properties in close proximity to the alignment. These have also been identified as sensitive receivers.

Pacific Complete will install Dust Deposition Gauges at representative locations along the project corridor to monitor potential air quality impacts from the construction activities. Locations of these dust gauges will consider the proximity to sensitive receivers, typical wind direction, scale of construction activities and the proposed establishment of ancillary facilities. The priority for siting of gauges will be on RMS or publically owned land first, then private land second. The specific locations of dust gauges, including control sites, will be developed during detailed design in consultation with government agencies and stakeholders prior to the commencement of Construction.

Dust Deposition Gauges will be installed at least one month prior to construction. Pacific Complete will procure a contractor to install and collect samples from the gauges on a monthly basis. Pacific Complete will collate the results collected by the contractor and report

this information to the Department of Planning and Environment 6-monthly in the compliance tracking report.

Table 4-5 outlines the major work being carried out in each section and the expected sensitive receivers that will be impacted based on information gathered in the EIS.

Table 4-5 Description of works and sensitive receivers

Section	Description of works	Local Environment	Wind directions	Impacts and locations of sensitive receivers	Land use
Section 3	<ul style="list-style-type: none"> • Considerable native vegetation clearance • Earthworks including excavation and embankment construction • Blasting and processing of rocks. 	<ul style="list-style-type: none"> • Vegetation • Low-density rural residential and pastoral land • Township of Tyndale. 	Highly variable	<ul style="list-style-type: none"> • The annual pattern of winds creates the potential for adverse dust impacts at all sensitive receivers surrounding the site. • • The majority of sensitive receivers are located near the proposed interchange at Tyndale. 	<ul style="list-style-type: none"> • State Forest • Open Paddocks • Grazing • Crops • Horticulture
Section 4	<ul style="list-style-type: none"> • Earthworks including excavation and embankment construction • Blasting and/or processing of rock (north of Shark Creek and north of McIntyres Lane) • Construction of embankments on soft soil sites (south of Shark Creek, north of McIntyres Lane, north and south of Edwards Creek) 	<ul style="list-style-type: none"> • Low-density rural residential and pastoral land • Small vegetated areas. 	Highly variable	<ul style="list-style-type: none"> • The annual pattern of winds creates the potential for adverse dust impacts at all sensitive receivers surrounding the project • The majority of sensitive receivers are located near the interchange at Maclean. 	<ul style="list-style-type: none"> • Crops • Gazing • Tourist facility

Section	Description of works	Local Environment	Wind directions	Impacts and locations of sensitive receivers	Land use
Section 5	<ul style="list-style-type: none"> • Vegetation clearance • Earthworks including excavation and embankment construction • Considerable import of fill material • Blasting and/or processing of rock would be required during the excavation of the cuttings • Construction of embankments on soft soil sites (south of bridge over Clarence River, north of the proposed bridge and south of the interchange at Harwood, North and south of Serpentine Channel, South of Carrolls Lane) 	<ul style="list-style-type: none"> • Low-density rural residential and pastoral land • Small vegetated areas • Townships of Maclean and Harwood. 	Highly variable	<ul style="list-style-type: none"> • The annual pattern of winds creates the potential for adverse dust impacts at all sensitive receivers surrounding the site • The majority of sensitive receivers are located in the built-up areas of Townsend in Maclean and Harwood. 	<ul style="list-style-type: none"> • Crops • National Park • Grazing • Urban.
Section 6	<ul style="list-style-type: none"> • Minimal vegetation clearance, • Imported fill and embankment construction 	<ul style="list-style-type: none"> • Vegetation • Low-density rural residential and pastoral land. 	Highly variable	<ul style="list-style-type: none"> • The annual pattern of winds creates the potential for adverse dust impacts at all sensitive receivers surrounding the site. 	<ul style="list-style-type: none"> • Crops • Bundjalung National Park. • Native Forest.
Section 7	<ul style="list-style-type: none"> • Minimal vegetation clearance • Imported fill • Earthworks including excavation and embankment construction • Blasting and/or processing of rock 	<ul style="list-style-type: none"> • Vegetation • Low-density rural residential and pastoral land. 	Commonly occur from the south-east to south-south-east	<ul style="list-style-type: none"> • The annual pattern of winds creates a greater potential for adverse dust impacts at sensitive receivers to the north-west and north-north-west of the site • Majority of sensitive receivers located adjacent to the northern portion of the project 	<ul style="list-style-type: none"> • State Forest • Crops • Native Forest • Urban • Tourist facility • Heritage sites

Section	Description of works	Local Environment	Wind directions	Impacts and locations of sensitive receivers	Land use
Section 8	<ul style="list-style-type: none"> • Vegetation clearance • Blasting and/or processing of rock (Woodburn and Lang Hill) • Embankment of fill at soft soil sites (north and south of Tuckombil Canal) • Earthworks excavation and embankment construction 	<ul style="list-style-type: none"> • Vegetation • Low-density rural residential and pastoral land. 	Commonly occur from the south-east to south-south-east	<ul style="list-style-type: none"> • The annual pattern of winds creates a greater potential for adverse dust impacts at sensitive receivers to the north-west and north-north-west of the site • Sensitive receivers are clustered near the interchange at Woodburn and along Evans Head Road, which runs in a north-west/south-east direction. 	<ul style="list-style-type: none"> • Native forest and grazing in the south • Grazing and sugarcane in the north.
Section 9	<ul style="list-style-type: none"> • Some vegetation clearance • Embankment construction • Excavation • Blasting and/or processing of rock. 	Traverses Broadwater National Park	Commonly occur from the south-east to south-south-east	<ul style="list-style-type: none"> • Annually, winds within the study area most commonly occur from the south-east to south-south-east • The annual pattern of winds creates a greater potential for adverse dust impacts at sensitive receivers to the north-west and north-north-west of the site • Greater densities of sensitive receivers are located to the north of the park and are largely rural residential properties. 	<ul style="list-style-type: none"> • Broadwater National Park • Grazing • Crops

Section	Description of works	Local Environment	Wind directions	Impacts and locations of sensitive receivers	Land use
Section 10	<ul style="list-style-type: none"> Vegetation clearance Earthworks including excavation and embankment construction Blasting and/or processing of rock (just west of Wardell). 	<ul style="list-style-type: none"> Vegetation Low-density rural residential and pastoral land. 	Commonly occur from the south-east to south-south-east	<ul style="list-style-type: none"> The annual pattern of winds creates a greater potential for adverse dust impacts at sensitive receivers to the north-west and north-north-west of the site The majority of sensitive receivers are located at the northern end of this section to the east and west and are screened by remnant vegetation. 	<ul style="list-style-type: none"> Crops Grazing Native Vegetation Urban
Section 11	<ul style="list-style-type: none"> Minimal vegetation clearing Imported fill Embankment required on soft soil sites (Whytes Lane, south of Duck Creek). Embankment construction 	<ul style="list-style-type: none"> Vegetated Low density rural residential and pastoral land. 	Commonly occur from the southeast to south southeast	<ul style="list-style-type: none"> The annual pattern of winds creates a greater potential for adverse dust impacts at sensitive receivers to the northwest and north-northwest of the site The largest portion of sensitive receivers are located at the southern portion of this section east of the project. 	<ul style="list-style-type: none"> Crops Grazing

5 Air quality criteria

The Environment Protection Authority (EPA) sets goals for ambient dust concentrations and dust deposition, which is a measure of the impacts of nuisance (EPA 2001).

The acceptable increment in annual average dust deposition depends on the existing deposition level. These are based on research by Dean (1990) and other investigations, which detail community response to dust fallout. It should be remembered that the air quality goals relate to the total dust burden in the air and not just the dust from the Project. In other words, there needs to be some consideration of background levels when using these goals to assess impacts.

Table 5-1 details the air quality monitoring criteria for deposited dust.

Table 5-1 Air quality monitoring criteria for deposited dust^a

Pollutant	Annual concentration		Source
Deposited dust ^b	2 g/m ² /month ^c	4 g/m ² /month ^d	NERDDC (1998)

Note:

- a. Adapted from DECCW guideline; Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DECCW 2005).
- b. Dust is assessed as insoluble solids as defined by AS 3580.10.1-1991 (AM-19).
- c. Maximum increase in deposited dust level.
- d. Maximum total deposited dust level.
- e. Refer to G36 Section 4.4 Air Quality

Should the criteria change once the Environment Protection License (EPL) is issued, the threshold criteria will be used accordingly.

6 Environmental aspects and impacts

6.1 Construction activities

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

- Dust and particulates
- Gaseous.

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

- General earthworks particularly during site establishment
- Vegetation clearing
- Bulk Earthworks
- Drilling and Blasting
- Operating, crushing and screening
- Operation of concrete / asphalt batching plants
- Topsoil / material handling including stockpiling, material loading and material haulage
- Vehicular movements over unpaved surface (including unsealed access roads)
- Wind erosion of exposed areas and temporary stockpiles
- Tracking of dirt onto roads
- Liming operations
- Mulching/chipping
- Concrete cutting.

Air emissions, other than dust, which may be generated by construction activities include:

- Vehicle and plant exhaust emissions, which may be excessive if vehicles and plant are poorly maintained
- Herbicide and pesticide spraying
- Odours/gases released during:
 - Excavations of organic or contaminated materials
 - During sealing works
 - Operation of concrete / asphalt batching plants
 - Waste storage.

6.2 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
- Extent of vegetation cover – vegetation assists in stabilising soils and reduces the ability for dust erosion to occur.

6.3 Impacts

The potential for impacts on air quality will depend on a number of factors. Primarily impacts will be dependent on the nature, extent and magnitude of construction activities and their interaction with the natural environment. Potential impacts attributable to construction might include:

- Deposition of dust on surfaces where it may cause damage and/or lead to a need for increased cleaning or repair
- Aesthetic effects that arise from visible airborne dust plumes and from deposits of dust on surfaces
- Need for increased maintenance of air filtering systems (eg air conditioners etc)
- Potential adverse health effects including eye, nose and throat irritation from excessive inhalation of fine particles
- Impacts on water quality and/or vegetation health from dust deposition
- Impacts on residential sensitive receivers, including impacts on living areas, swimming pools and general amenities
- Complaints from the public relating to dust or odour
- Dust deposition impacts on threatened flora species or habitat for threatened fauna species
- Dust deposition impacts on sensitive agricultural receivers, including sugar cane and horticulture farms
- Dust contamination of water tanks.

Some impacts on air quality attributable to the Project are anticipated and have been described in the EIS.

MCoA B66 requires that:

- The SSI shall be constructed in a manner that minimises dust emissions from the site, including wind-blown and traffic-generated dust and tracking of material onto public roads. All activities on the site shall be undertaken with the objective of preventing visible emissions of dust from the site. Should such visible dust emissions occur at any time, the Applicant shall identify and implement all feasible and reasonable dust mitigation measures, including cessation of relevant works, as appropriate, such that emissions of visible dust cease.

Chapter 7 provides a suite of mitigation measures that will be implemented to avoid or minimise dust impacts.

7 Environmental control measures

A range of environmental requirements and control measures are identified in the various environmental documents, including the EIS, Submission Preferred Infrastructure Report (SPIR), supplementary assessments, Conditions of Approval and RMS documents, and from recent experience on similar road projects. Specific measures and requirements to address impacts on air quality are outlined in Table 7-1.

As part of detailed design and in consultation with Agencies and stakeholders, locations of dust deposition gauges (DDGs) will be selected with regard to nearby sensitive receivers and threatened species along the project alignment. Once locations are agreed these will be incorporated into mapping for the project and tabulated in Appendix A prior to construction.

Table 7-1 Air quality management and mitigation measures

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
GENERAL					
AQ1	Training will be provided to all project personnel, including relevant sub-contractors on sound air quality control practices and the requirements from this plan through inductions, toolboxes and targeted training.		Pre-construction Construction	Pacific Complete Environment Manager Project Contractor's Environmental Representative	G38/G36 Good practice
AQ2	Air quality control measures from this plan will be included in relevant Environmental Work Method Statements (EWMS) and/or Erosion and Sediment Control Plans (ESCP).		Pre-construction / Construction	Pacific Complete Environment Manager Project Contractor's Environmental Representative	Good practice
AQ3	Vegetation clearing will be staged where possible to minimise the area and time that surfaces are exposed.		Construction	Portion Manager Project Contractor's Project Engineer	G40, SPIR (AQ1)
AQ4	Exposed surfaces with no scheduled work for two weeks will be treated to minimise dust generation. Exposed surfaces will be stabilised progressively using the most practical site specific methods, such as watering and geo-fabrics for short term exposure and emulsion spray, spray grass, soil compaction and revegetation for longer term exposed areas or final finishes.		Construction	Pacific Complete Supervisor Project Contractor's Project Engineer / Foreman	SPIR (AQ1)
AQ5	Construction activities will be modified, reduced or controlled during high or unfavourable wind conditions if they have a potential to increase dust generation.		Construction	Project Contractor's Project Engineer / Foreman	G36, SPIR (AQ1)
AQ6	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 accommodate prevailing conditions. Dust control equipment will be maintained to ensure its operability.		Construction	Project Contractor's Project Engineer / Foreman Project Contractor's Environmental Representative	G36, SPIR (AQ1)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
AQ7	Erosion control structures will be checked regularly for build up of silt and other materials to ensure deposits do not become a dust source.		Construction	Pacific Complete Supervisor Project Contractor's Project Engineer / Foreman	Good practice
AQ8	Waste will be segregated and collected on a regular basis to ensure odours associated with waste do not become an issue.		Construction	Project Contractor's Foreman	Good practice
AQ9	The application of pesticides and herbicides will be modified, reduced or controlled during high or unfavourable wind conditions where wind can carry pesticides outside of the defined treatment area.		Construction	Pacific Complete Supervisor Project Contractor's Foreman	G36
AQ10	Stockpiles will be located in accordance with the criteria established in The Stockpile Management Protocol. 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. A suitable cover crop or provision of other covering over topsoil stockpiles will be established where stockpiles are in place for longer than 4 weeks.		Construction	Project Contractor's Project Engineer / Foreman in consultation with Pacific Complete Portion Manager	G36, SPIR (AQ1)
AQ11	Temporary stockpiles that are planned to be in place for long periods will be temporarily seeded and stabilised.		Construction	Project Contractor's Project Engineer / Foreman in consultation with Pacific Complete Portion Manager	SPIR (AQ1)
AQ12	Tall (3-4m high rolls) shade cloth screening will be installed along the edge of rainforest threatened ecological communities immediately after clearing to provide microclimate protection (to prevent potential dieback from over sun exposure, dust, edge effects).		Construction	Pacific Complete Planning and Approvals Leader Pacific Complete Portion Manager Project Contractor's Project Engineer / Foreman	Threatened Rainforest Communities and Rainforest Plants Management Plan
AQ13	If required shade cloths will be installed around low growing threatened species, in situ populations and		Construction	Pacific Complete Planning and	Threatened Rainforest Communities and

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	threatened invertebrate habitat to provide dust protection and maintain microclimate.			Approvals Leader Pacific Complete Portion Manager Project Contractor's Project Engineer / Foreman	Rainforest Plants Management Plan Threatened Invertebrate Management Plan
AQ14	There will be no burning off of waste.		Construction	Project Contractor's Project Engineer / Foreman	G36
AQ15	Storm water, recycled water or other water sources shall be used, where feasible and reasonable, in preference to potable water for construction activities, including concrete mixing and dust control.		Construction	Pacific Complete Portion Manager Project Contractor's Project Engineer / Foreman	CoA B35
AQ16	Disturbed areas will be progressively rehabilitated as soon as practical.		Construction/ Post-construction	Project Contractor's Project Engineer	SPIR (AQ1)
VEHICLE MOVEMENT AND MATERIAL STORAGE					
AQ17	Areas of disturbed material and access roads will be stabilised where possible by methods such as compaction. Compounds, ancillary facilities, administration access roads and standing areas will be hard surfaced.		Construction	Pacific Complete Portion Manager Pacific Complete Supervisor	G36
AQ18	Measures implemented to minimise dust, soil or mud from being deposited from vehicles on public roads. This will be achieved by implementing mitigation measures such as rumble grids and large aggregate at entry/exit points. Manual cleaning will also be carried out where appropriate. In the event of any spillage or tracking, the spilt material will be removed within 24 hours. Management measures should include: <ul style="list-style-type: none"> Watering of unsealed haul roads, as required Visual checks of exhaust emissions. 		Construction	Pacific Complete Portion Manager / Supervisor Project Contractor's Project Engineer / Foreman	G36, SPIR (AQ1)
AQ19	Hardstand areas and surrounding public roads will be cleaned, as required, using methods including brooms,		Construction	Project Contractor's Project Engineer /	Good practice

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	bobcat attachments or street sweepers.			Foreman	
AQ20	Vehicle movement will be confined to designated haul roads and areas. These roads will have speed limits of 40km/h in order to reduce dust generation. Reduced speed limit may be implemented where dust generation persists.		Construction	Project Contractor's Project Engineer / Foreman	G36, SPIR (AQ1)
AQ21	All loaded haulage trucks will be covered where there is a risk of release of dust or other materials and at all times on public roads.		Construction	Project Contractor's Foreman	G36, SPIR (AQ1)
PLANT AND EQUIPMENT					
AQ21	Haul trucks and plant equipment will be switched off when not in operation for periods of more than 30 minutes.		Construction	Project Contractor's Foreman	G36
AQ22	Engines of plant parked next to residents will be switched off when not in operation.		Construction	Project Contractor's Foreman / Project Contractor's Operators	Good practice
AQ23	Exhaust systems of construction plant, vehicles and machinery will be maintained in accordance with manufacturer's specifications to ensure that emissions do not exceed EPA regulations. Periodic visual checks will be undertaken to ensure ongoing compliance, typically weekly.		Construction	Project Contractor's Project Engineer / Foreman	G36
AQ24	Any plant, equipment or machinery will be immediately switched off should there be visible signs of smoke emissions emitting from equipment/machinery.		Construction	Project Contractor's Foreman	Good practice
AQ25	Dust suppression systems will be installed and used on crushing and screening plants and mulching equipment to minimise generation of dust from these activities.		Construction	Project Contractor's Project Engineer / Foreman	Good practice
BATCH PLANTS					
AQ26	Water carts will be used to suppress dust around batch plants.		Construction	Project Contractor's Project Engineer / Foreman	Good practice, SPIR (AQ1)
AQ27	Batch plants will be swept and cleaned to keep them in a tidy state to prevent the build up of dust, similarly with		Construction	Project Contractor's Project Engineer /	Good practice

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	storage of potentially dust generating material.			Foreman	
AQ28	High dust emitting structures or processors in batch plants (eg conveyer belts) will have water spraying systems installed to suppress dust.		Construction	Pacific Complete Portion Manager / Supervisor Project Contractor's Project Engineer / Foreman	Good practice, SPIR (AQ1)
AQ29	Concrete batch plants to be fitted with dust filters or similar to minimise air quality impacts from batching operations.		Construction	Pacific Complete Portion Manager / Supervisor Project Contractor's Project Engineer / Foreman	G36
BLASTING AND CRUSHING					
AQ30	Where practical during blasting, a combination of the following mitigation measures will be used to suppress dust: <ul style="list-style-type: none"> Weather reports checked prior to blasting minimise the potential for wind blown dust reaching surrounding residents. Controlled blasts to minimise dust produced. 		Construction	Project Contractor's Project Engineer / Foreman	Good practice
AQ31	Crushers will be positioned in protected areas, where practical, to reduce wind dispersion of dust particles (eg within cuts). Water spraying will be utilised if necessary.		Construction	Pacific Complete Portion Manager / Supervisor Project Contractor's Project Engineer / Foreman	Good practice
AQ32	To increase the blasting criteria specified in the CoA, written agreement from landowners will be obtained. The landowner will be provided with the environmental impacts of the increased blast limits on the surrounding environment and most affected residences or other sensitive receivers including, but not limited to noise, vibration and air quality and any risk to surrounding utilities, services or other structures.		Construction	Pacific Complete Portion Manager / Portion Environmental Officer	CoA B24

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
INSPECTION, MONITORING AND RECORDS					
AQ33	Dust deposition gauges will be established at least one month prior to the commencement of construction to establish background dust levels. Monitoring equipment will remain in place until completion of the construction works and/or where ground conditions are stable. Results will be captured on a monthly basis and collected in accordance with DEC's "Approved Method for the Sampling and Analysis of Air Pollutants in NSW" guidelines.		Pre-construction / Construction	Pacific Complete Portion Manager / Portion Environmental Officer	G36, SPIR (AQ1)
AQ34	An onsite weather station will be established to record weather data. Rainfall at the premises will be 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-construction / Construction	Portion Environmental Officer	Good practice
AQ35	Public roads will be inspected each day at main entry and exit points to and from areas where construction activities are taking place including the project compound and site offices. Material tracked onto the road pavement will be removed in accordance with AQ18.		Construction	Pacific Complete Portion Manager / Supervisor Project Contractor's Project Engineer / Foreman	G36
AQ36	Weather forecast will be reviewed on a daily basis and appropriate measures implemented where unfavourable weather conditions (dry weather, wind speed >10m/s) are anticipated. Measures to be implemented during unfavourable weather conditions are outlined in AQ5 and AQ9.		Construction	Pacific Complete Portion Manager / Portion Environmental Officer	Good practice
AQ37	Dust control and operational procedures will be reviewed and modified if results exceed the air quality criteria and are attributable to construction activities.		Construction	Pacific Complete Portion Manager / Supervisor Project Contractor's Project Engineer / Foreman	Good practice, SPIR (AQ1)
AQ38	Threatened flora species and threatened invertebrate habitat will be monitored monthly for dust deposition.		Construction	Portion Environmental Officer	Threatened Flora Management Plan Threatened Invertebrate

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
					Management Plan
AQ39	Water captured in excavations will be used for construction or dust suppression.		Construction	Project Contractor's Project Engineer / Foreman	Construction Waste and Energy Management Plan
PROTECTION OF HERITAGE ITEMS					
AQ40	Monitoring of dust will be undertaken at New Italy Settlement, museum complex, memorial and stone-lined well (item 23: New Italy Settlement sites, New Italy) in accordance with the dust management plan.		Construction	Pacific Complete Environment Manager	SPIR (HH28) SPIR(HH31)
AQ41	Dust mitigation measures outlined in AQ5, AQ6, AQ10, AQ11 and AQ16, dust gauge monitoring and/or visual day to day monitoring will occur in the vicinity of the following heritage listed items: <ul style="list-style-type: none"> Item 2: House, sheds and yard at Milleara (Lot 9 DP 707325) Item 7: Service Station Complex at Halfway Creek (Lot 411 DP883976) Item 12: Cane barge and former Ashby ferry, Maclean Item 23: New Italy Settlement (Museum Complex) Item 23: Roder's Stone-lined Well and Orchard on Lot 97 DP755609 Item 28: Byrne Property, Broadwater, Lot 6 DP1043232. 		Construction	Pacific Complete Planning and Approvals Leader Project Contractor's Project Engineer / Foreman	Good practice

8 Compliance management

Pacific Complete will manage the environmental performance and compliance of the Project Contractor's by ensuring ongoing awareness training is delivered to project personnel and through independent inspections and audits. Project Contractors will be required to complete their own environmental inspections and report outcomes to Pacific Complete.

8.1 Roles and responsibilities

The organisational structure and overall roles and responsibilities for Pacific Complete and Project Contractors are outlined in Section 4.2 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Chapter 7 of this Plan.

8.2 Training

All employees, contractors and subcontractors 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
- EPL conditions (eg. specifically dust management competency and maintenance of plant and equipment conditions, and the Dust Assessment Handbook)
- Roles and responsibilities for air quality management
- Air quality mitigation and management measures
- Procedure to be implemented in the event of an incident (eg release of dust or gaseous emissions from site).

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

- ERSED control installation methodology
- Planning and preparedness for high wind events / dust risk periods
- Lessons learnt from dusty periods, incidents and other event eg low rainfall/high wind

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

8.3 Monitoring and inspection

Regular monitoring and inspections will be undertaken during construction. Monitoring and inspections will include, but not be limited to:

- Project Contractor's supervisory inspections on a daily basis and environmental representative weekly inspections
- Pacific Complete environmental inspections undertaken weekly
- Monthly dust monitoring in accordance with DEC's "Approved Method for the Sampling and Analysis of Air Pollutants in NSW" guidelines
- 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.

Additional requirements and responsibilities in relation to inspections are documented in Section 8.2 of the CEMP.

8.3.1 Incident Response

Response to incidents will be undertaken as described in Section 7 of the CEMP and in accordance with the Environmental Incident Management Plan (refer to Appendix A6 of the CEMP).

8.4 Licences and permits

An EPL will be obtained for the scheduled activity “road construction”.

Any other relevant licences or permits will be obtained in the lead up to and during construction as required.

8.5 Auditing

Audits will be undertaken to assess the effectiveness of environmental controls, compliance with this plan, MCoA and other relevant approvals, licenses and guidelines.

An audit schedule will be developed for the project by the PC Environment Manager and will include internal and third party external audits which will include this CHMP.

Audit requirements are detailed in Section 8.3 of the CEMP.

8.6 Reporting

Reporting requirements and responsibilities are documented in the Sections 8.3 and 8.5 of the CEMP.

Monthly reporting of dust monitoring will be reported through the ERG, EPL monthly report and project monthly reporting. Monthly monitoring results will also be reported to DP&E on a 6-monthly basis through the Compliance Tracking Program (MCoA D27(b)).

9 Review and improvement

9.1 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.

9.2 CAQMP update and amendment

The processes described in Section 8 and Section 9 of the CEMP may result in the need to update or revise this Plan. This will occur as needed.

Any revisions to the CAQMP will be in accordance with the process outlined in Section 1.6 of the CEMP.

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.

Appendix A

Dust deposition gauge locations and sensitive receivers

Appendix B

Dust deposition gauge procedure

1 Purpose

This Dust Deposition Gauge Procedure forms part of the Construction Air Quality Management Plan (CAQMP), a sub plan of the Construction Environment Management Plan (CEMP) for the planned construction of sections 3 to 11 of the Woolgoolga to Ballina Pacific Highway Upgrade.

Activities to be undertaken during construction have the potential to cause an increase in dust that can impact sensitive receivers within the vicinity of the Project. The purpose of this procedure is to outline the method for monitoring air quality adjacent to the Project alignment.

2 Scope

The procedure applies to locations adjacent to the Project alignment where dust fall out levels may be impacted by construction activities.

The procedure outlines the following:

- Site selection and positioning of dust deposition gauges
- Equipment
- Methodology
- Monitoring frequency, sample collection and analysis of dust samples
- Recording, analysis and reporting.

3 References

The following standards and factsheets have been used to write this Dust Deposition Gauge Procedure:

- AS/NZS 3580.1.1:2007: Methods for sampling and analysis of ambient air – Part 1.1: Guide to siting air monitoring equipment.
- AS/NZS 3580.10.1:2003: Methods for sampling and analysis of ambient air – Method 10.1: Determination of particulate matter —Deposited matter—Gravimetric method
- Environmental Defender's Office Ltd (NSW) Technical Fact Sheet: Air Quality – Dust Monitoring.

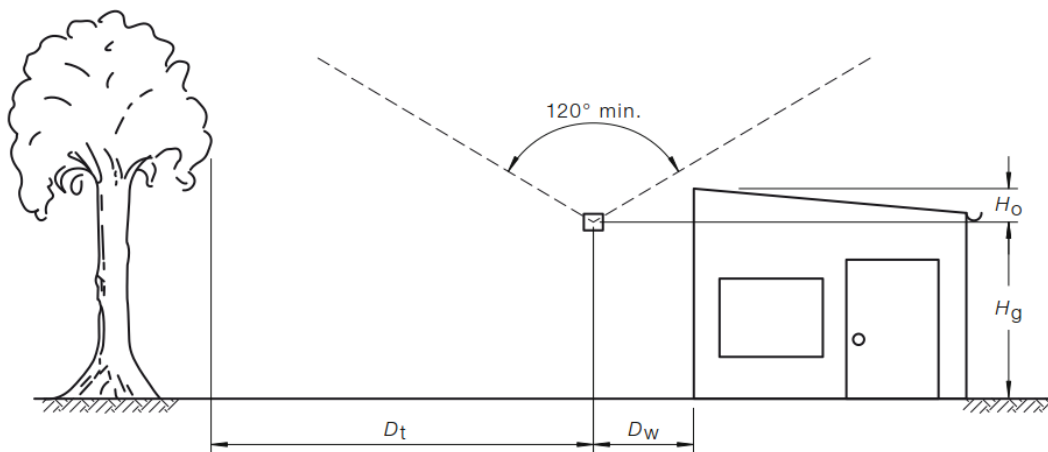
4 Procedure

4.1 Site selection and positioning dust deposition gauges

The dust deposition gauges (DDG's) will be positioned in accordance with the *A/NZS 3580.1.1:2007: Methods for sampling and analysis of ambient air, Part 1.1: Guide to siting air monitoring equipment* will be followed. The following guidelines will be considered:

- DDG positions will be representative of the location. Dust gauge locations are provided in Appendix A of the Construction Air Quality Management Plan
- DDG will be positioned in low or sparsely built up areas
- Locations will be avoided where:
 - Airflow is restricted, such as behind trees or structures. DDG's should have a minimum clear sky angle of 120° (see Figure 4-1).
 - Objects might alter the pollution concentration by adsorption or absorption, such as leafy vegetation and some building materials

- Chemical interference may interfere with the pollutant being measures, such as near vehicle or plant emissions
- Physical interference may produce atypical results, such as domestic or commercial incinerators or where electrical interference to sampling equipment could occur from nearby high voltage power lines
- Where unrelated local emissions may interfere with the pollutant being measures.
- Monitoring site will be located where:
 - There is a low potential for vandalism
 - There is adequate access for transporting equipment
 - Staff can perform their activities in a safe environment.
- If DDG's are located on private property, permission must be granted by the land owner to access the gauges on a monthly basis.



LEGEND:

- H_g = Height of sampling inlet above ground – 2 to 5 m for ground based sampling sites and up to 15 m for roof top sampling sites.
- H_o = Height of nearby obstacle above sampling inlet – $2H_o \leq D_w$
- D_t = Distance to nearby tree – ≥ 10 m
- D_w = Distance to wall (supporting structure) – minimum 1 m
- 120° = Minimum clear sky angle above sampling inlet

Figure 4-1 Generalised ground level sampling site (Source: A/NZS 3580.1.1:2007: Methods for sampling and analysis of ambient air – Part 1.1: Guide to siting air monitoring equipment)

4.2 Equipment

DDG's measure dust deposition rates by passive deposition and capture of dust using a funnel and bottle arrangement. The equipment required for DDG's includes:

- Grade A volumetric glassware, complying with AS2164 and its use complying with AS 2162.1.
- Pipettes complying with AS2166.
- Glass deposition gauges consisting of a 150 ± 10 mm diameter funnel (with a 60° angle of cone sides). The internal diameter of the funnel stem needs to be sufficient to permit passage of particulate matter during washing. It will be supported in the neck of a wide-mouth, glass bottle of a suitable size, preferably of minimum volume 4L, by means of a rubber or plastic stopper with a groove or outlet pipe to allow water

overflow under excessive rainfall conditions. The funnel diameter shall be known to the nearest millimetre when used in calculating results (refer to Figure 4-2).

- Tight fitting, impermeable, non-reactive lid for deposition gauge collection and transportation.

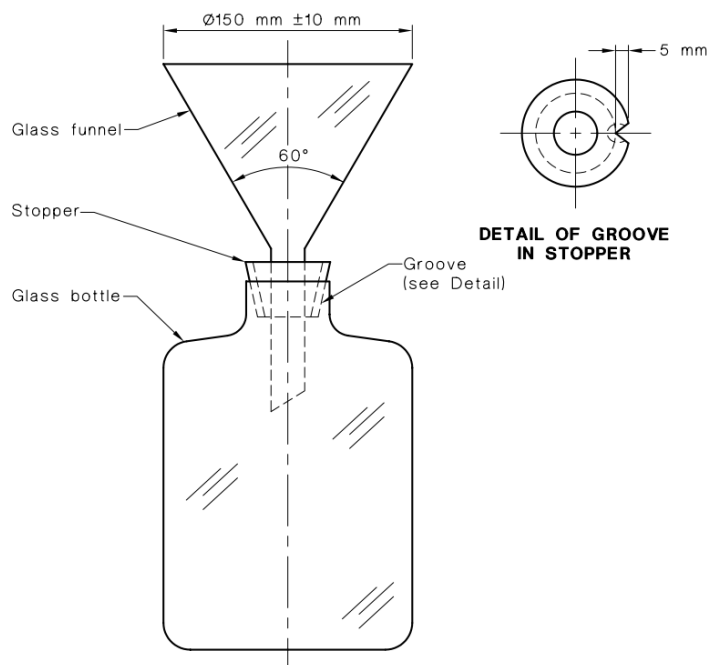


Figure 4-2 Typical standard deposition gauge (Source: A/NZS 3580.1.1:2007: Methods for sampling and analysis of ambient air – Part 1.1: Guide to siting air monitoring equipment)

- A stand supporting the horizontal plane of the funnel at a height of 2 ± 0.2 metres above the ground. The stand generally incorporates a container or beaker to protect the bottle contents from sunlight. A hole at the base should be provided to prevent rainwater build up (refer to figure 4-3).
- Filtration apparatus consisting of silica crucibles with porous filter bases (porosity 3) or Gooch crucible of porcelain, silica or alundum with filter pads of equivalent retention are acceptable for separation of the insoluble fraction from the soluble fraction. Alternatively, Buchner funnels with an appropriate filter pad of glass, quartz or ashless filter paper and membrane filters may be used.
- A bird ring made of inert or corrosion-resistant metal wire (diameter 4mm-6mm) with a suitable design to prevent birds perching on the funnel (optional).
- A test sieve with a 1mm aperture complying with AS 1152.

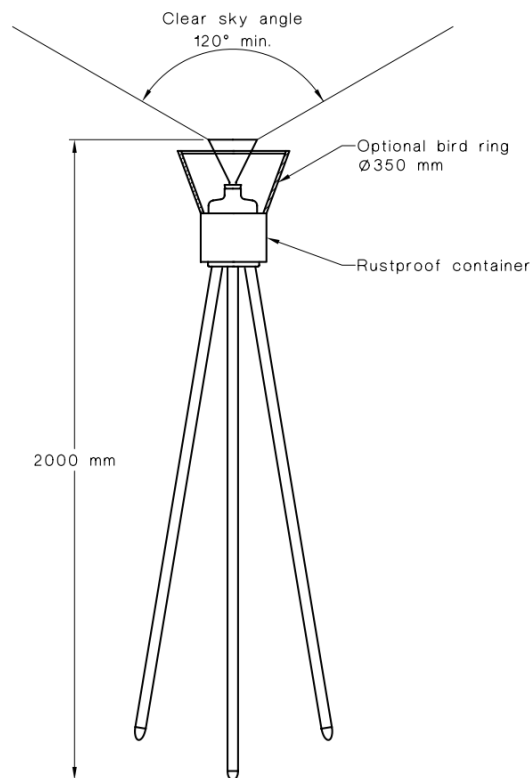


Figure 4-3 Typical stand with deposition gauge

4.3 Methodology

4.3.1 Preparation and installation

- Where permission is required to enter privately owned land for bottle change over, property owners will be contacted in accordance with the pre-arranged time frame.
- Once erected the stand will remain in-situ for the duration of the project or until there is sufficient proof that works being carried out are no longer affecting the monitoring site.
- All equipment will be labelled for traceability of each sample as it proceeds through the analysis process.
- The deposit gauge bottle will be prepared in accordance with AS/NZS 33580.10.1
- Each new bottle will be labelled with:
 - Location ID
 - Sample type (dust)
 - Date and time sampling commenced.

4.3.2 Gauge exchange procedure

- Ensure that the number on the bottle matched the number on the stand.
- At the end of the exposure period, wash any deposited matter adhering to the inside of the funnel into the deposit gauge bottle using a minimal volume of distilled water.
- Do not remove any collected rainwater, bugs, leaf litter, bird faeces or any other material from the glass bottle.
- Remove the funnel and attached stopper and seal the bottle with the specified lid.

- Fill in the dust deposition gauge sampling field sheet, noting any contamination to assist in identifying anomalies.
- Label the bottle with:
 - Location ID
 - Date sampling commenced and ended
 - Funnel diameter (to the nearest mm)
 - Recent activities in the area which may contribute to recorded dust fall out.
- Return bottles to the laboratory and perform analysis.
- Insert the clean funnel with attached stopper into a fresh bottle containing algicide and leave exposed for the next sampling period. Ensure that the funnel is firmly held in the neck of the bottle and that the funnel aperture is horizontal.
- Label the new bottle as described in Section 4.3.1.

4.3.3 Monitoring frequency, sample collection and analysis of dust samples

- Samples must be collected every 30 (± 2) days. AS/NZS 3580.10.1 recommends that gauges are changed on/ near to the first day of each month.
- A photo of the condition of each dust gauge shall be taken prior to the removal of each sample.
- The weather and any visible land use conditions adverse to local air quality shall be noted on a suitable field sheet and included in the relevant monthly monitoring report.
- When samples are collected, new laboratory prepared bottles will be taken to replace the old bottles to continue sampling for the next 30 days.
- Analysis of the sample should be performed as early as possible and within 30 days of collection. During storage, deposition gauges shall be tightly sealed and kept in a cool, dark environment to prevent the growth of algae, fungi or other micro-organisms.
- The following information must be supplied to the laboratory:
 - Location of DDG's including relevant information such as coordinates to within 100m, height above sea level, classification of area (e.g. industrial, residential, agricultural or urban)
 - Height above ground level at the given location
 - Date sampling commenced and ended
 - Recent activities in the area which may contribute to recorded dust fall out (e.g. meteorological conditions, proximity to bushfires, farm ploughing activities, traffic on unsealed roads).
- The following will be determined from analysis carried out by laboratory staff in accordance with procedures outlined in AS/NZS 3580.10.1:
 - Total solids
 - Insoluble solids
 - Ash and combustible matter
 - Soluble solids.

4.3.4 Recording, analysis and reporting

- Label each new bottle with:
 - Location ID
 - Sample type (dust)

- Date and time sampling commenced
- Complete all fields in the dust deposition gauge monitoring sheet (Appendix C in the CAQMP).
- Take a photograph of the glass bottle to keep on record with the dust deposition gauge monitoring sheet.
- Fill in the Chain of Custody sheet (provided by the laboratory), keep a photocopy on file and send original with samples to the laboratory.
- The test report will be submitted to Pacific Complete monthly outlining the requirements in AS/NZS 3580.10.1. Exceedances will be investigated by Pacific Complete's Environment Manager to determine the validity of the results and adjust management practices if required.

Appendix C

Dust deposition gauge sampling field sheet

