Appendix 12 Air Quality Assessment

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Dear Alan

SUBJECT: BOWMANS CREEK DIVERSION

1 INTRODUCTION

PAEHolmes have been requested to investigate the potential air quality impacts from the construction of two diversion channels on Bowmans Creek between the New England Highway and the Hunter River.

The diversions are proposed as modification (MOD6) to the existing Ashton development consent (DA) 309-11-2001-i. An assessment of the proposed Ashton South East Open Cut (SEOC) Project and existing Ashton Coal Project (ACP) was undertaken recently by PAEHolmes. The assessment considered project and cumulative impacts and where relevant, results of this study have been used in the assessment of potential impacts from the proposed diversions.

The objectives of this report are to:

- Provide a qualitative analysis of the potential impacts, in terms of dust generation, from the construction of the diversion channels;
- Compare against existing levels of dust and particulate for the area; and
- Outline the measures proposed to reduce any adverse impacts.

1.1 Overview of the Proposal

The proposal involves the construction of two diversion channels on Bowmans Creek between the New England Highway and the Hunter River.

The local setting of the proposed Diversion Channels is presented in **Figure 1.1**, showing nearby Ashton operations and the closest residential receptors at Camberwell village.

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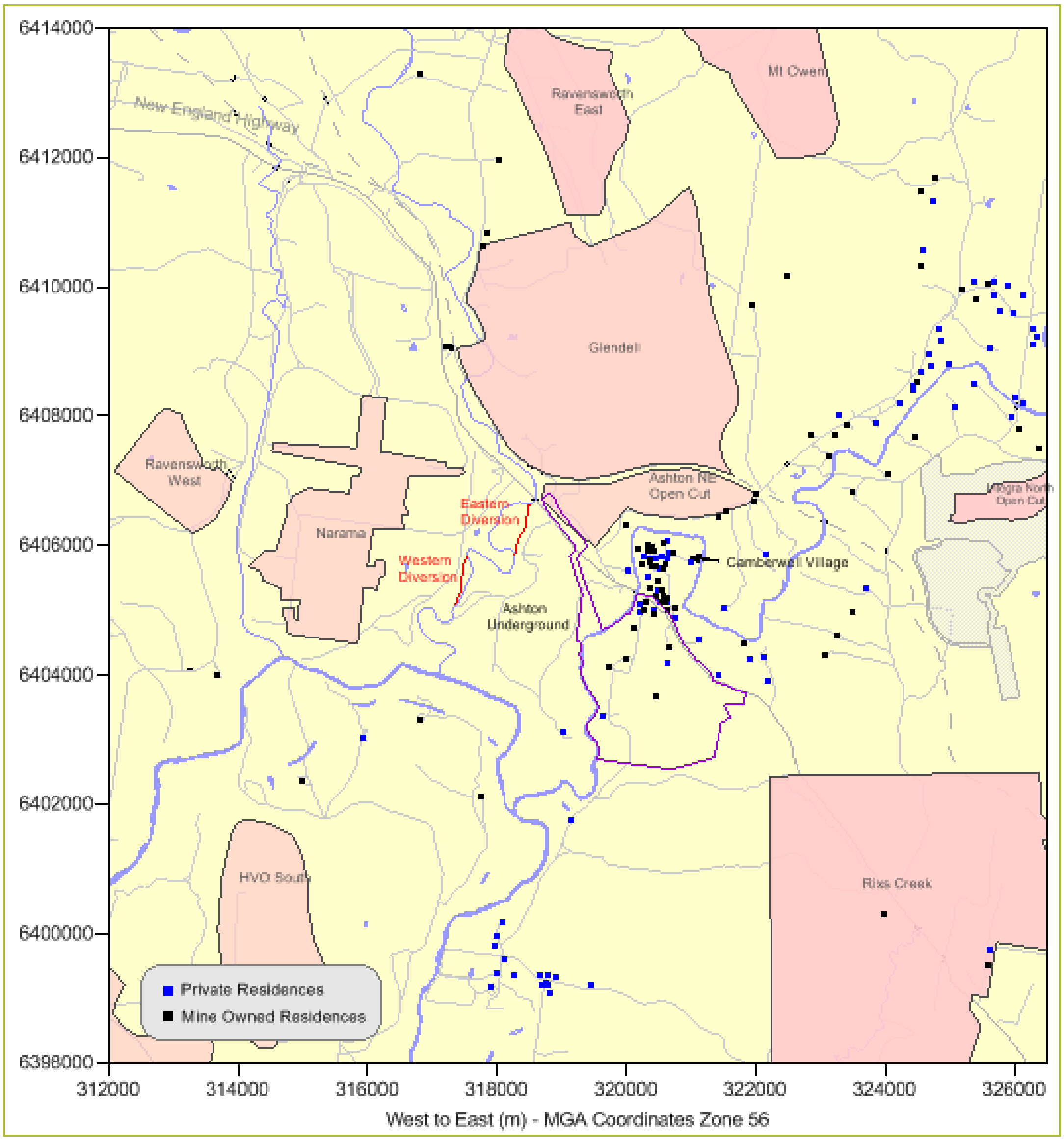

Figure 1.1: Location of Proposed Diversion Channels

The Eastern Diversion which will start about 150 m south of the new England Highway and extend for about 810 m along the eastern edge of the floodplain to join an existing oxbow channel and then drain into the existing creek. This diversion will involve excavation of a meandering channel that mimics the geomorphic features of the adjacent reach of Bowmans Creek, including variable width (about 35m to 100m) and variable bed levels to create pools and riffles. Typical maximum excavation depth in this diversion is varies from 4.0m to 5.5m.

The Western Diversion which will start just downstream of the existing streamflow monitoring station (operated by the Office of Water) and extend for approximately 770 m, will also mimic the geomorphic characteristics of the adjacent reach of Bowmans Creek which is typically about 7 m deep. Top width of this diversion channel will vary from 45 to 70 m.

In each instance, block banks will be placed in the existing channel to direct flows up to about the 5 year average recurrence interval flood into the diversion channels.

Construction of each diversion will be undertaken in four phases over a total period of about four months for each diversion:

- Bulk earthworks to create the general form of the channel;
- Detailed channel shaping to develop the required geomorphic characteristics in the base of the channel and install rock bars and engineered log jams;
- Landscape detailing and revegetation;
- Construction of block banks and final cut-in at the ends of the diversion channels

The most significant dust generating activities will be bulk earthworks and channel shaping. Bulk earthworks will be undertaken using a combination of scrapers and bulldozers together with excavators and trucks. Scrapers will be used to undertake the bulk excavation and placement of surplus spoil into areas of the floodplain that are predicted to subside as longwall mining progresses. The excavators and trucks will be used to selectively extract suitable material for reconstruction of the geomorphic characteristics of the channel, principally cobbles and cobble/silt mix. The following machinery is envisaged for this phase of work:

- 5 x 657 scrapers;
- 2 x D9 dozers;
- 2 x 330 excavators;
- 4 x trucks.

With this fleet, the bulk earthworks for the Eastern Diversion are expected to take 7 weeks. Because of a larger volume of material to be extracted and longer haul distances, the works for the Western Diversion are expected to take about 11 weeks. Bulk earthworks for the Western Diversion would commence immediately following completion of work on the Eastern Diversion.

Detailed channel shaping will involve over-excavation of the low flow channel, placement of an impermeable geotextile clay liner and placement of selected material to form the low flow channel and adjacent cobble terraces. Construction of rock bars upstream and downstream of riffle sections, placement of rock armouring on the outside of bends and construction of engineered log jams will also be undertaken during this phase of the works. The following machinery is envisaged:

- 1 x 330 excavator for detailed excavation
- 1 x 330 excavator for placing of liner, cobbles, rock and logs;
- 6 x trucks attending above;
- 1 x 330 long reach excavator trimming batters;
- 1 x truck attending trimming;
- 1 x 966 loader to load stockpiled materials.

With this fleet, the detailed channel shaping for each diversion is expected to take 8 weeks.

Landscaping and revegetation work will commence immediately after completion of the channel shaping of a section of the diversion channel and progressively follow that work along the channel. This work will be undertaken using small backhoes and light tip trucks.

The construction of the block banks and subsequent cut-in of the ends of the diversion channels will be undertaken following completion of revegetation. As these works are likely to occur some time after completion of the detailed channel shaping, a separate machinery fleet will be required comprising:

- 2 x 330 excavator;
- 4 x trucks;
- 1 x 966 loader.

These works are expected to take about 2 weeks for each block bank with the upstream block bank being constructed first in each case.

2 PROJECT CONTRIBUTION TO DUST LEVELS

The construction of the diversion channels will result in the release of particulate matter. Estimates of dust emissions for the construction activities have been made based on commonly used emission factors developed both locally and by the US EPA.

Particulate emissions have been estimated for the following activities:

- Bulk Earthworks;
- Detailed Channel Shaping; and
- Construction of Block Banks.

Landscaping and Revegetation has not been considered due to the expected relatively small contribution to total particulate emissions from the project.

Emission estimates are made based on the construction scenario described in **Section Error! Reference source not found.** and derived as follows:

SCAPERS - BULK EARTHWORKS

Emissions from scrapers on topsoil have been calculated using the US EPA emission factor equation (**US EPA, 1985 and updates**), as follows:

$$E = 7.6 \times 10^{-6} s^{1.3} W^{2.4} \; kg/VKT$$

Where,

s = silt content

W = vehicle gross mass

The TSP emission factor for topsoil removal by scraper is 0.82 kg/VKT, assuming a default silt content of 10% and vehicle mass of 48t. A 50% control factor is also assumed for the application of water sprays to dampen the surface. It is assumed that scrapers and dozers will operate on topsoil and overburden respectively for approximately 50% of the total construction period.

EXCAVATORS AND TRUCKS DUMPING

Each tonne of material would generate a quantity of TSP (kg/t) that will depend on the wind speed and the moisture content, described by the following equation.

$$E = k \times 0.0016 \times \left((U/2.2)^{1.3}/((M/2)^{1.4})\right) \; kg/t$$

Where,

K = 0.74

U = wind speed (m/s)

M = moisture content(%)

The wind speed value was taken from the Repeater Station 2007/2008 meteorological dataset. The moisture content was assumed to be 4%. The material moisture content is doubled from the default as the works occur in moist soils near the water table. Total quantities of material handled (scrapers and dozers) has been assumed to be 320,000 m^3 with a density of material of 1.5 kg/m^3. Selective excavation during channel shaping will be undertaken with an excavator. The quantity of material handled by the excavators is assumed to comprise 10% of the total volume of extracted material. Extraction volumes for the low flow channel shaping have been estimated based on a 1 m depth and 10 m width for the low flow channel.

DOZERS

Emissions from dozers on overburden have been calculated using the US EPA emission factor equation (**US EPA, 1985 and updates**), as follows:

$$E = 2.6 \times \frac{s^{1.2}}{M^{1.3}} \; kg/hr$$

Where,

s = silt content (%)

M – moisture content (%)

The operational hours for the dozers are based on an 8 hour day, 6 days a week for a total period of 7 weeks (for bulk earthworks), however they are only assumed to operate for 50% of the time, with scrapers operating for the remaining 50%.

Using default value of 10% for silt content and 2% for moisture content gives a default emission factor of 17 kg/h. The material moisture content is doubled from the default based on excavation works occurring in soils near the water table.

HAULING

After the application of water, the emission factor used for trucks hauling material on unsealed surfaces is 1 kg per vehicle kilometre travelled (kg/VKT). Hauling distances have been estimated based on the total quantity of material required to be moved, a capacity of 40t per load for haul trucks and an average speed of 20 km/hr on site. This is an over estimate as scrapers will be used to transport a proportion of material.

WIND EROSION

The emission factor for wind erosion was assumed to be 0.4kg/ha/h as per **SPCC (1983)**. Wind erosion is assumed to occur from an approximate area of 15 ha, based on 50% of the maximum footprint of disturbance for both channels being active at any time. This is conservatively assumed to occur for the entire project duration. A control factor of 50% is applied to the emission factor based on the application of water sprays to areas of the site and based on works occurring in soils near the water table with higher moisture contents.

2.1 Summary of Emissions

The emission estimates for each stage of construction are presented in **Table 2.1**. The emissions are presented as the total dust (TSP) generated in completing the project.

Table 2.1: Emission Estimates for Diversion Channel Construction

Activity Group	TSP Emissions (kg/project)
Bulk Earthworks	13,246
Channel Shaping	3,983
Block Bank Construction	2,017
Wind Erosion	13,140
Total	**32,386**

3 CURRENT PERFORMANCE AND ACP EMISSIONS

Comparison of the total project emissions is made with the total dust emissions from the existing ACP Project and also with the total dust emissions estimated for all other mines in the vicinity of the project, for Year 1 operations or 2010. The emissions estimates are taken from the cumulative assessment for the SEOC assessment (**PAEHolmes, 2009**) and are presented in **Table 3.1** where they are compared to emissions from the project.

Emissions for SEOC and existing ACP are taken from Table 7.1 of **PAEHolmes (2009)** refer to the total estimated TSP (kg/annum) emissions for Year 1 (2010) SEOC operations. 2010 is chosen as the diversion project would occur in this year, however the conclusions can broadly be applied to any year of operations.

Emissions for all other mines in the vicinity are taken from Table 7.2 of **PAEHolmes (2009)**.

Table 3.1 Emission from Project, SEOC and other mines

Dust Sources	TSP Emissions (kg/year) – Year 1	Project fraction
This project	32,386	100%
Existing ACP and SEOC	1,646,925	2%
Other Mines in the vicinity	30,595,489	0.1%

Based on the information presented in **Table 2.1** and **Table 3.1**, the relative contribution of the diversion project to the total predicted emissions from existing ACP and SEOC is estimated as 2% for 2010. When compared with all other mines in the vicinity for that same year, the relative contribution of the diversion project to total dust produced is 0.1%.

Whilst consideration of the total dust emissions is a key factor in evaluating potential impact, another important factor the proximity of the project near sensitive receptors, and especially the proximity in the prevailing upwind wind direction from sensitive receptors.

The diversion project will take place well away from any private sensitive receptor. The project is located approximately 2km – 2.5km northwest of the closest receptor at Camberwell village, as shown in **Figure 1.1**.

Annual and seasonal windroses for the Ashton repeater site were analysed and are shown in **Figure 3.1**. The dominant winds are from the west-northwest and the east-southeast for all seasons, with less winds from the west-northwest during summer and from the east-southeast during winter.

An analysis of the local dispersion patterns, based on the figures in the SEOC EA was conducted to estimate the location of receptors that are in the prevailing downwind direction. These residences are south of Camberwell Village, some 2.0km to 2.5km away. There are no private receptors closer in the prevailing wind directions.

Separation distances of 2.0km to 2.5km provide an adequate buffer to minimise any potential impact from even significantly large projects, and in this case are most likely to ensure dust levels from the project would not be discernable.

The small contribution of the project to the total dust levels, short duration, and large separation from sensitive receptors, mean that if the project were modelled, this would result in very low predicted dust concentrations (much less than any uncertainty in dispersion modelling).

Thus specific dispersion modelling is not considered to be warranted for this project.

It is noted that the emission estimates for the diversion project are based on conservative worse case assumptions and the actual emissions are likely to be less. It is also noted that the project duration is limited to less than 6 months.

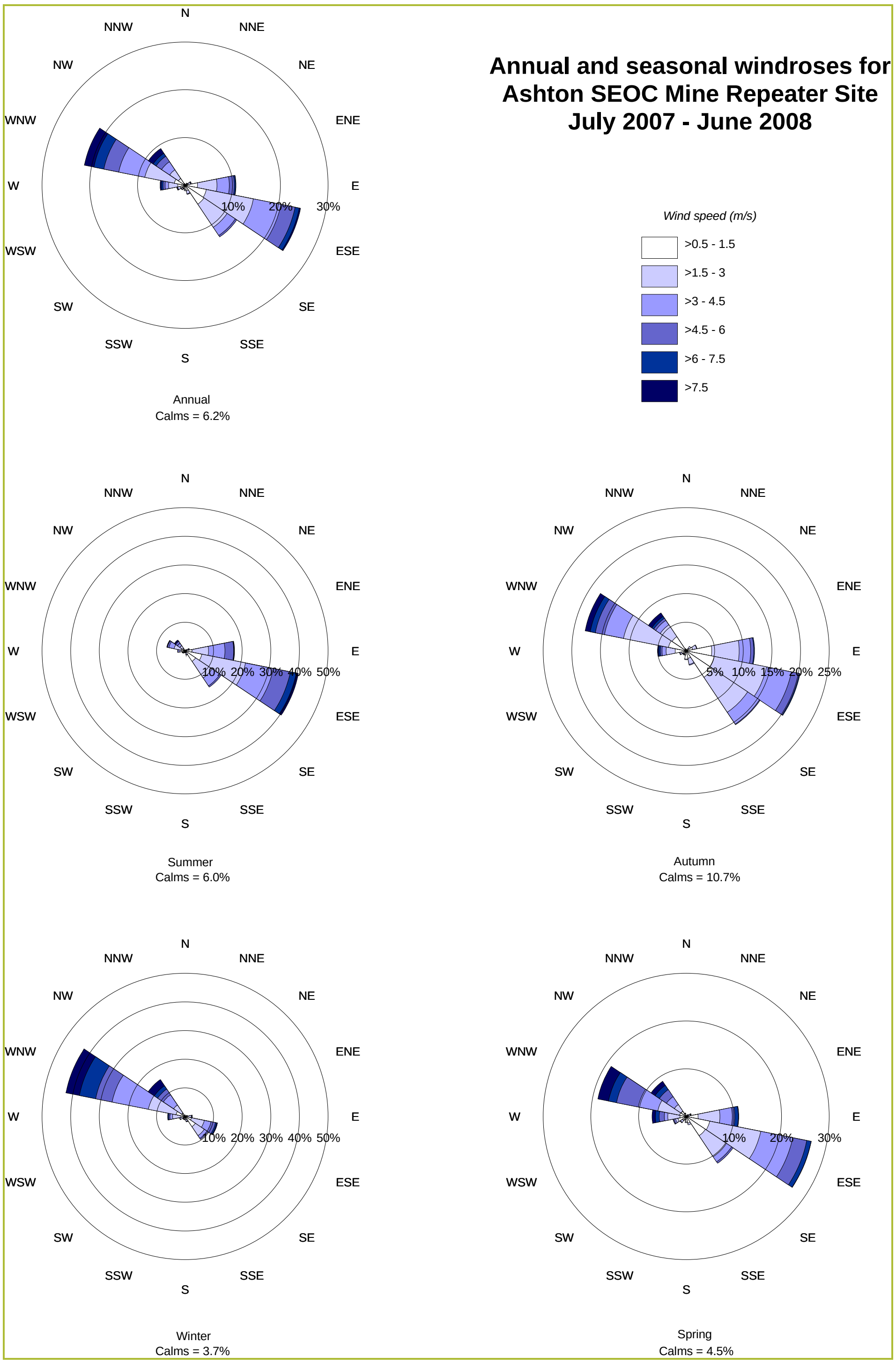

Figure 3.1: Wind Roses for Ashton Repeater Site

3.1 Current Performance

An existing air quality monitoring network is operated in the vicinity of existing mine operations and a detailed analysis of existing conditions was provided in the SEOC assessment (**PAEHolmes, 2009**). The existing monitoring indicates:

- Generally annual average PM_{10} concentrations comply with air quality goals;
- Annual average TSP concentrations generally comply with the air quality goals, however, each of the monitoring sites recorded levels above the annual TSP criterion in at least one year;
- On average, annual dust deposition levels comply with air quality goals, however, levels above the goals are recorded at certain sites;

These monitoring data are used to provide an indication of existing performance level and are used in this assessment to infer worst-case cumulative impacts.

3.2 Predicted Emissions

On the basis of the cumulative assessment for year 1 of the SEOC project, the addition of emissions from the diversion project would result in a negligible increase in predicted concentrations at receptors in Camberwell Village.

An increase of 2% in dust emissions from the diversion project does not translate to a 2% increase in concentration at receivers (0.1% when compared to the cumulative of all sources).

The reason is that the Bowmans Creek diversion works are located further from receptors than the SEOC or existing ACP surface facilities and NEOC and due to the greater level of dispersion from source to receiver, any relative impact is likely to be less than the 2% relative fraction of SEOC and existing ACP emissions impact.

This means the potential change in impact would be likely to be less than around 0.5 $\mu g/m^3$ for PM_{10} and TSP and less than 0.1 g/m^2/month for dust deposition. This is a small change and is well below any inherent error in dispersion modelling.

3.3 Proposed dust management and control procedures

Notwithstanding the small contribution of the diversion project to total dust levels at receptors in the area, it is important for construction projects to apply appropriate dust control.

The main sources of dust from the diversion project are bulk earthworks and wind erosion from exposed surfaces. It is proposed that a water cart will operate to dampen areas for scrapers and hauling to minimise emissions from bulk earthworks. It is also recommended that truck movements and haul route distances be minimised to the greatest practical extent by careful project planning in terms of access routes, and positioning of spoil areas and overall operational management.

Revegetation and rehabilitation should also be completed as soon as practical following disturbance to minimise wind erosion.

4 CONCLUSIONS

Emission estimates for the diversion project show that the contribution to total dust levels is small when compared to the existing ACP and SEOC project and other sources in the vicinity (2% and 0.1% respectively).

The works are located well away from the nearest private sensitive receptors in the prevailing down wind direction (receptors south of Camberwell Village).

There is negligible potential for any dust impact to arise from this project at private residences, largely due to separation distances of 2.0km to 2.5km and the small nature of the project.

Dust emissions will be minimised through use of a water cart and appropriate project planning to minimise material handling and maximise revegetation.

5 REFERENCES

PAEHolmes (2009)
"Air Quality Impact Assessment – Ashton South East Open Cut Mine" 7 August 2009

SPCC (1983)
"Air Pollution from Coal Mining and Related Developments", Published by NSW State Pollution Control Commission (now NSW DECC).

US EPA (1985)
"Compilation of Air Pollutant Emission Factors", AP-42, Fourth Edition United States Environmental Protection Agency, Office of Air and Radiation Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711.