ENVIRONMENT PROTECTION LICENCE 2504

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Pollution Reduction Program 22

Report prepared for Environment Protection Authority, January 2015

Review History

Revision	Description of Changes	Date	Approved
1	Submitted Report	Jan 2015	Scott Coleman

Persons involved in the preparation of this Report:

Name	Title	Company
Scott Coleman	Environment Manager	Illawarra Coal
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1. Introduction

Illawarra Coal owns and operates three high-volume underground longwall mines – Appin, West Cliff and Dendrobium Mines. The mines operate in the Wongawilli and Bulli Seams at depths ranging from 180 metres to over 500 metres. The Bulli Seam Operations incorporate the underground mining areas and associated surface activities at Appin Mine and West Cliff Mine.

The Appin Mine and West Cliff Mine are located approximately 25 kilometres north-west of Wollongong in New South Wales, and owned and operated by Illawarra Coal Holdings Pty Limited (ICHPL), wholly owned subsidiary of BHP Billiton Limited. Activities associated with both Appin and West Cliff Mines are managed in accordance with Environmental Protection Licence 2504.

Run-of-Mine (ROM) coal from the Appin underground mining operations is transported from the Appin East Pit Top via truck along Appin and Wedderburn Roads to the West Cliff Coal Preparation Plant (CPP). ROM coal from the West Cliff Mine is delivered directly to the CPP by winder and conveyor. Processed coal (clean coal product) from the CPP is transported by road to the Port Kembla Coal Terminal (PKCT) for shipping to domestic and international customers, or to BlueScope Steel or other local customers.

All truck movements into and out of the West Cliff site are via Wedderburn Road which runs along the eastern boundary of the West Cliff surface lease. On average, there are approximately 800 truck movements entering or exiting the West Cliff site per day.

Objective/s

The objectives of the program of works detailed in this report were to:

- Understand the current dust levels associated with the West Cliff site;
- Quantify the amount of track out from the West Cliff site;
- Assess and compare the effectiveness of potential dust management controls in relation to drag out;
- Identify the most effective dust control solution for Wedderburn Road; and
- Identify further works or activities required to reduce the level of track-out from the West Cliff.

And in doing so, fulfil the requirements of Pollution Reduction Program 22 (PRP22) - see below.

PRP22 Requirements

PRP22 was incorporated into Environment Protection Licence 2504 via a Section 58 notice on the 25th February 2014. The PRP required ICHPL to undertake an investigation into measures to reduce the amount of dust that is tracked out from the West Cliff site onto Wedderburn and Appin Roads.

The specific requirements of the PRP (as it appears in the licence) are provides below for ease of reference.

U5 PRP 22 - Investigation to reduce Coal Dust Tracked onto Roads from West Cliff Colliery

U5.1 The licensee must undertake an investigation to:

- quantify the amount of dust tracked out;
- the success of present measures in reducing track out; and
- any further options to reduce the amount of coal dust that is tracked out on to Webberburrn and Appin Roads by trucks leaving the West Cliff Coal Mine.

A report outlining the results of the investigation must be prepared and submitted to the EPA by the due date.

DUE DATE: 31 JANUARY 2015

2. Air Quality Management and Monitoring

Air Quality Criteria

The Air Quality Criteria relevant to the West Cliff operations (as prescribed in Schedule 4, Condition 9 of the BSOP Part 3A Approval) is provided in the tables below. Criterion is not to be exceeded at any residence on privately owned land.

Table 1: Long Term Criteria for Particulate Matter

Pollutant	*Averaging period*	[d] *Criterion*
Total suspended particulate (TSP) matter	Annual	[a] 90 µg/m^3
Particulate matter < 10 µm (PM_{10})	Annual	[a] 30 µg/m^3

Table 2: Short Term Criteria for Particulate Matter

Pollutant	*Averaging period*	[d] *Criterion*
Particulate matter < 10 µm (PM_{10})	24 hour	[a] 50 µg/m^3

Table 3: Long Term Criteria for Deposited Dust

Pollutant	*Averaging period*	*Maximum increase in deposited dust level*	*Maximum total deposited dust level*
[c] Deposited dust	Annual	[b] 2 g/m^2/month	[a] 4 g/m^2/month

Notes for Table 1, 2 and 3

- [a] Total impact (i.e. incremental increase in concentrations due to the project plus background concentrations due to other sources);
- [b] Incremental impact (i.e. incremental increase in concentrations due to the project on its own);
- [c] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method; and
- [d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agreed to by the Director-General in consultation with OEH.

Dust Management Controls

The following table provide a summary of the air emission management measures in use at the West Cliff site to control fugitive dust emissions.

Table 4: Dust Management Control – West Cliff

Area and/or Source	Air Emission Management Measure/Control
Internal Haulage Roads / Coal Bins	Water carts Road Sweeper Truckwash facility
Emplacement (Active)	Water carts Moisture content of coal wash product Compaction
Emplacement (Rehab)	Progressive Rehabilitation / Vegetation Cover
Stockpile/s (ROM and Clean)	Water carts
Yard Area/s	Water carts

Air Quality Management and Monitoring continued

Area and/or Source	Air Emission Management Measure/Control
	Road Sweeper
Conveyors / Transfer Points	Enclosed Transfer Points (within the CPP footprint) Suppression system at some tripper locations
Site External Road	Water cart Road Sweeper Designated Truck Tarping/Cleaning Area
Pit Top (internal roads and yard area)	Road Sweeper
Transport of Coal on Public Roads	Truck wash facilities for all outbound truck movements Designated Load Inspection and Tarping Areas All loads covered (outbound movements)

Further details on these controls are available in the approved 'Bulli Seam Operations Project Air Quality and Greenhouse Gas Management Plan' which is available on the BHPB website via the following link: http://www.bhpbilliton.com/home/society/regulatory/Documents/_coal/illawarra/bulliseam/141202_coal_illawarra_bulliseam_BulliSeamOperationsProjectAirQualityandGreenhouseGasManagementPlan.pdf

Dust Monitoring Program

Dust Deposition

The fugitive dust emissions in the vicinity of the West Cliff site are monitored via a series of dust deposition gauges located around the perimeter of the surface lease and within operational areas. The gauges located along the perimeter are used to assess the potential impact on community amenity from the site whilst the gauges positioned within the operational precinct are used to identify, understand and address potential dust issues specifically related to the operation. The position of the dust deposition gauges are provided in Plan 1 and summarised in the table below for ease of reference.

Table 5: Dust Deposition Monitoring Locations – West Cliff Site

Monitoring ID	Location	Amenity / Operational
W – DD1	Southern extent of surface lease - located in close proximity to the Wedderburn Rd and-Appin Rd junction.	Amenity
W – DD3	Located adjacent to the West Cliff Irrigation Area – situated between the Pit Top site and product stockpile 3.	Operational
W – DD8	Northern extent of surface lease – located on close proximity to Brennans Creek Dam.	Amenity
W – DD10	Located near the intersection of Middle Road and Wedderburn Road – in the vicinity of the fuel facility and product stockpiles.	Operational

The results from the dust deposition monitoring program (amenity gauges) are analysed against the EPA amenity goal of 4 g/m^2/month (for Total Insoluble Matter). Although the amenity goal is not directly applicable to the West Cliff gauges (as they are located on site) it does provide an ndication of compliance.

Total Insoluble Matter is comprised of Ash and Combustible Matter. A summary of the two and how to interpret the results is provided below:

Ash: If a reading was high in 'Ash' it would suggest that the sample is high in mineral content (dirt, sand etc) and hence may not be attributable to mining and related surface activities.

Combustible Matter: If a reading was high in 'Combustible Matter' it would suggest that the sample contained elevated levels of organic material (vegetation, insects and coal fines etc) and hence could be attributable to mining and/or related surface activities.

The figures below provide a summary of the dust deposition results for the gauges located on the West Cliff site that are relevant to the amenity goal. The results show that deposition levels at the perimeter of the site are well within the EPA amenity goal. A tabulated data summary for the gauges is provided as Appendix A, copies of the lab issued 'Certificate of Analysis' reports can be provided upon request.

The ash material (non-coal) with the deposited dust ranges from 49% at W-DD1 up to 62% at W-DD8. The relatively high levels of Ash in the deposition samples suggests that the dust in the vicinity of the West Cliff site are influenced to some extent by external (non-mining related) factors. Such factors include vehicle movements on Appin Road and the nearby Appin Township.

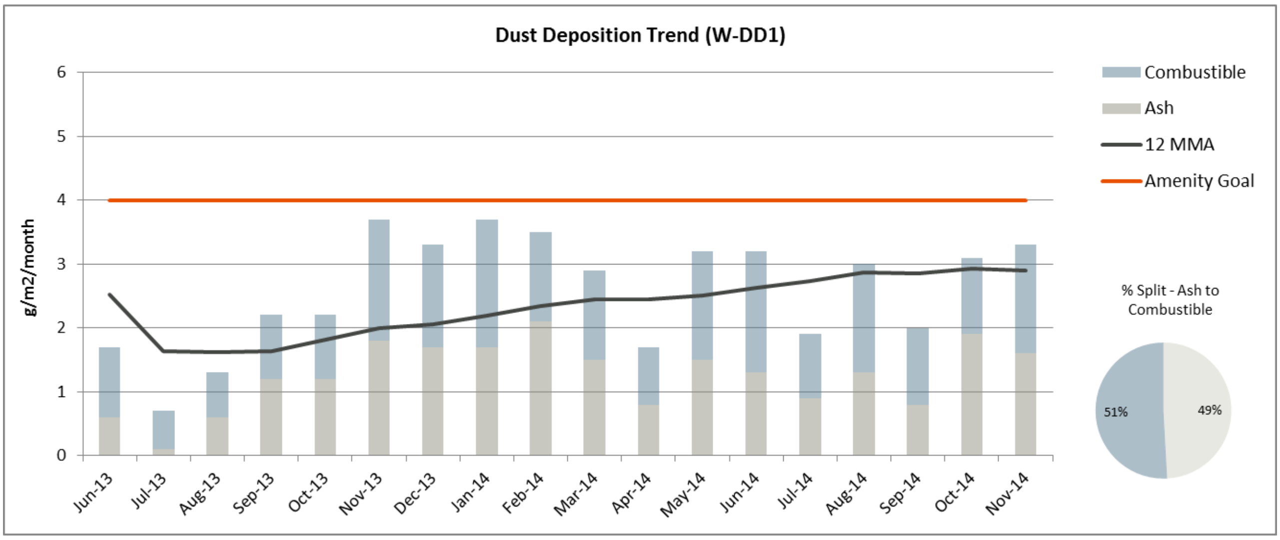

Figure 1: Dust Deposition Trend for W-DD1

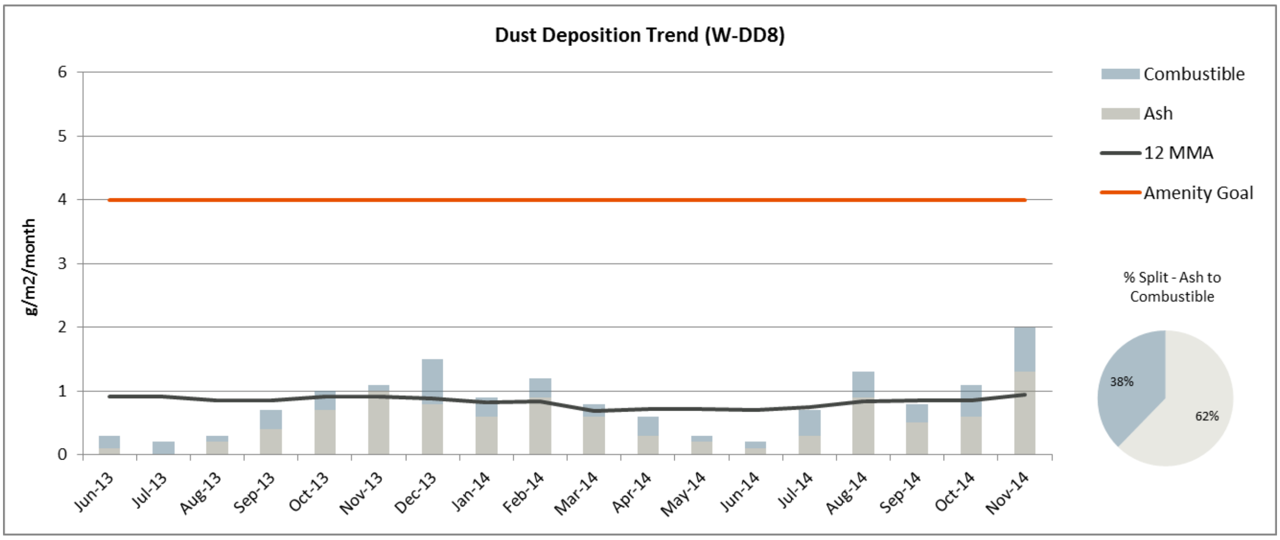

Figure 2: Dust Deposition Trend for W-DD8

Data summaries from the operational gauges are provided as Appendix A. The results from these gauges indicate that there are emissions sources within the site however they are localised. The deposition monitoring location adjacent to middle road (W-DD10) has a 12 month moving average in the order of 30 g/m2/month however a review of the results indicates that the majority of this deposited is ash (69%). The high level of ash within the sample is likely to be related to the intersection of Middle Road and Wedderburn Road where there is potential for build up of pulverized mineral content to be built (gravel, sand etc). The issue is exacerbated by the high volumes of truck using the intersection as it is part of the main haulage route on site.

Particulate Matter < 10um (PM_{10})

In April 2014, a real time 'PM_{10}' monitoring station (W-P35) was incorporated into the West Cliff dust monitoring network. The monitoring station is positioned adjacent to Wedderburn Road approximately 100 metres to the north of the Appin Road intersection (refer to Plan 1). The location of the monitoring station provides an indication of the dust levels associated with the haulage operations and is also used to monitor the effectiveness of the dust controls utilised on Wedderburn Road.

The PM10 levels recorded at the Wedderburn Road monitoring station are compared to both the:

- short air quality criteria (to provide an indication of compliance); and
- the data generated from the OEH PM_{10} monitoring network which provides an indication of the incremental PM10 increase from the West Cliff compared to regional levels. Note: The PM_{10} station used as the background indicator for the West Cliff site is the Campbeltlown monitoring station, data has been sourced from the OEH website (link: http://www.environment.nsw.gov.au/AQMS/search.htm).

A graphical representation of the Wedderburn Road PM_{10} results compared to the short term criteria and the baseline levels (Campbeltlown West) is provided below. A summary of the dataset is provided as Appendix B.

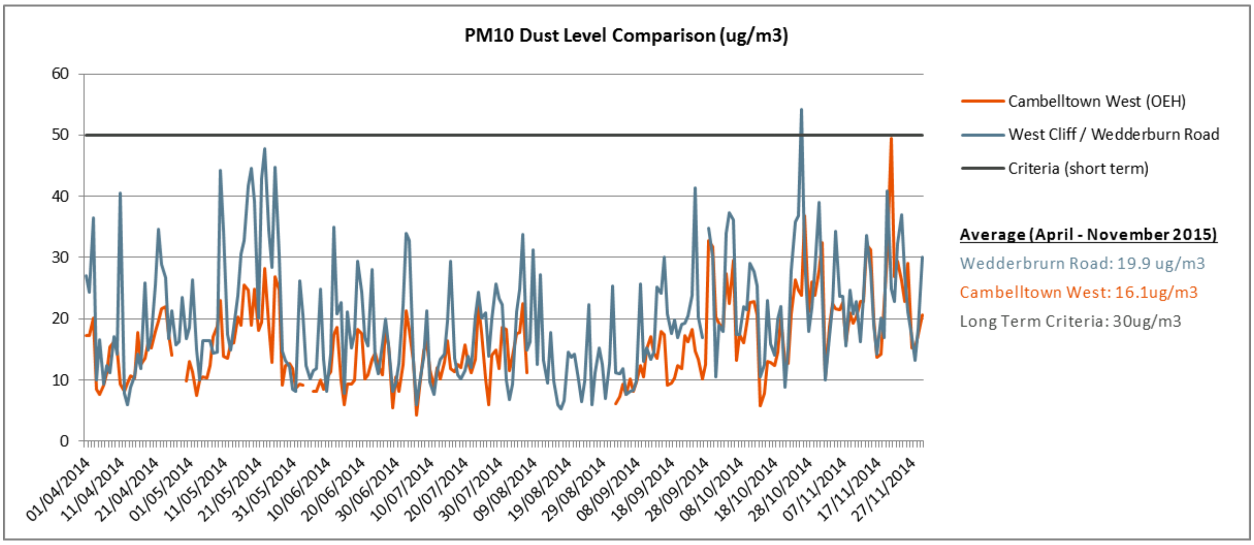

Figure 3: PM10 Monitoring Comparison – West Cliff and Campbelltown West

The data shows that Wedderburn Road PM_{10} levels are on average 3.8 µg/m^3 higher than the PM_{10} levels experienced within the Campbeltlown area. This indicates that there is a level of dust track out from the West Cliff site however the PM10 levels recorded at the Wedderburn Road are generally within both the short and long term criteria which suggests that the dust track out is relatively minor and not at levels that are likely affect the amenity of the receiving environment.

Air Quality Management and Monitoring continued

The data also shows that a clear correlation between increased and decreased PM_{10} levels between the two monitoring sites. This correlation suggests the PM10 levels measured at the West Cliff site are also influenced heavily by regional dust levels which supports the deposition data analysis which confirmed that the deposition gauges located on the perimeter of the site are relatively high in 'ash' content.

It should be noted that on the 26th of October 2014 when the daily average PM_{10} level was recorded at 54 $\mu g/m^3$, that the morning site conditions were reported as foggy and the relative humidity reported at Campbeltlown West at 78% (during the morning) which may contribute to higher PM_{10} particle levels being reported.

3. Program Design

The monitoring program associated with PRP22 was based on a combination of Dust Deposition, PM_{10} and truck movement data.

The dust deposition monitoring was used to quantify the level of dust within the Wedderburn Road corridor (compared to the surrounding area) and hence provide an indicative coal dust track out volume. Details of this method are provided below.

The PM10 monitoring was used to assess the effectiveness of different dust control methods. This type of monitoring was determined to be a more useful tool for this part of the investigation due to the high number of measurements collected (every 10 minutes) compared to the monthly deposition sampling. In addition, the PM10 could be better assessed against truck movements.

The below sections provide an outline of the program that was implemented to address the requirements of PRP22.

Coal Dust Track-Out Calculation

Dust drag out on Wedderburn Road was quantified using two different techniques as summarised below.

Emission Estimate Method

This commonly used approach is based on the theoretical emission estimate calculation referenced in the National Pollutant Inventory 'Emission Estimation Technique Manual' and was also used in the Katestone Benchmarking Study (2011).

The equation is provided below.

$$E = EF_{i,j} \times A \times (1 - (CF_{i,j,k} / 100)$$

Where;
E = Emission Rate in units per unit time
$EF_{i,j}$ = Uncontrolled Emission Factor for the source (i) and the pollutant (j) in units of mass per unit activity rate.
A = Activity Intensity/Rate
$CF_{i,j,k}$ = Control Factor achieved for the source (i) and the pollutant (j) by applying control (k) as a percent.

To align with the methods used in PRP17, the same approach has been used to derive the factors relevant to the above equation. More detail on these factors, and the other calculation inputs, is provided in Appendix C.

Dust Deposition Method

This approach used data from dust deposition monitoring sites to determine the incremental coal dust fall out on Wedderburn Road (which could be attributed to haulage movements along Wedderburn Road). In order to facilitate the calculation, three additional 'operational' dust deposition gauges were located along Wedderburn Road for the duration of the PRP22 monitoring program (gauages removed in January 2015). The gauge ID numbers and monitoring locations are provided in the table. The locations of the gauges are also shown in Plan 2.

Table 6: Dust Deposition Monitoring Locations – Wedderburn Road

Monitoring ID	Location
PRP – DDG1	Located adjacent to Wedderburn Road, between CCP Admin Entry Road and Middle Road intersections
PRP – DDG2	Located adjacent to Wedderburn Road, opposite mine carpark entry road
PRP – DDG3	Located adjacent to Wedderburn Road, approximately 250m from the Appin Road intersection
W-DD10	Located near the intersection of Middle Road and Wedderburn Road

Program Design continued

These gauges were used to determine the dust deposition directly adjacent to Wedderburn Road and allow a comparison to be made against the deposition levels recorded in the site dust deposition gauges. As indicated in the above table, 'W – DD10' was included as a Wedderburn Road gauge due to its location and proximity to Wedderburn Road.

The equation used to estimate the incremental dust fall out on Wedderburn Road is provided below:

$$D_{IW} = [D_{S(Ave)} - D_{R(Ave)}] \times Area_{(R)}$$

Where;

D_{IW} = Estimated volume coal dust tracked out onto Wedderburn Road

$D_{S(Ave)}$ = Average of the Dust Deposition Data (combustible portion only – as this would include the 'coal fines' portion of the total deposition) collected from Gauges W-DD1 and W-DD3 (represent the average site deposition).

$D_{R(Ave)}$ = Average of the Dust Deposition Data (combustible portion only) collected from Deposition Gauges located along Wedderburn Road

$Area_{(R)}$ = the surface area of Wedderburn Road corridor, inclusive of the road shoulder.

More detail on this method, included data summaries for the deposition gauges, are provided in Appendix D.

Dust Control Effectiveness

In order to address performance requirements 2 and 3 of the PRP, trials were conducted over a nominal six month period to determine the effectiveness of the existing dust control method in reducing dust track out and also to assess different types of dust control solutions. The trials used different combinations of the road sweeper and watercart to assess which combination was optimal in reducing the level of coal dust track out. Detail of the trials are summarised below.

Table 7: Dust Control Method Trials – Summary Information

Trial ID	Dust Control Method	Timing (2014)
A (baseline)	**Wet** Full Watercart Application – entire length of Wedderburn Road	April – May
B	**Wet / Dry** Combination of Watercart and Road Sweeper: — Watercart: from Truck Tarping Area to Middle Road. — Road Sweeper: from Middle Road to Appin Road.	July – August
C	**Dry** Full Road Sweeper Application	September – 13th October

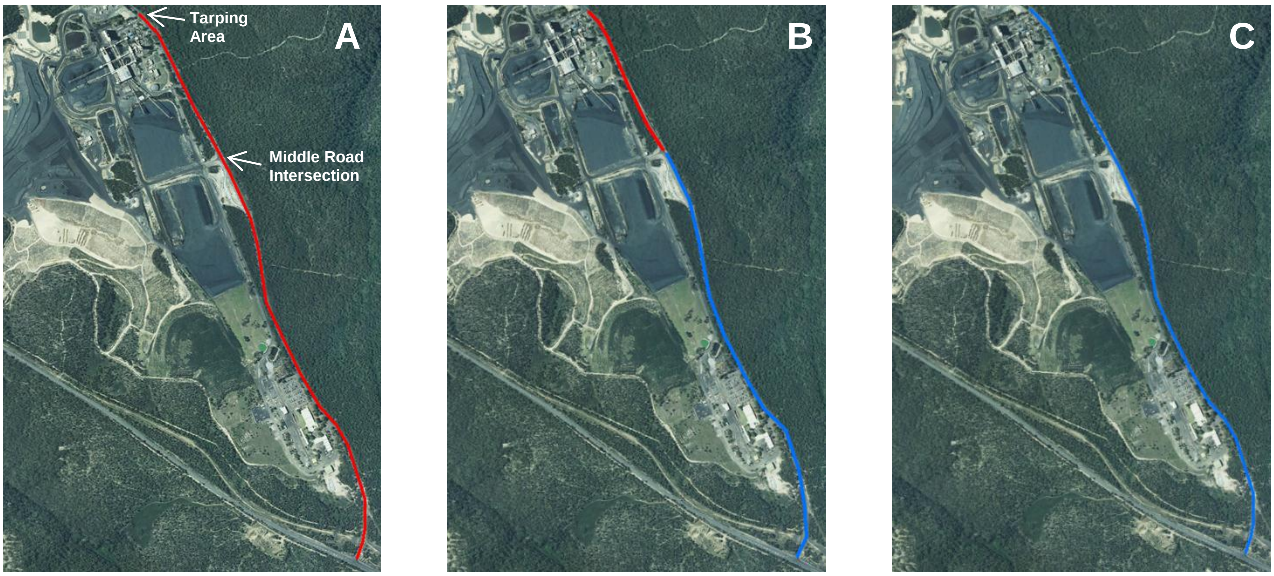

Figure 4: Dust Control Method Trials – Summary Information

Program Design continued

Data from the PM_{10} monitoring station was used to assess the effectiveness of the different types of dust control methods. Data from truck movements exiting the West Cliff site and internal truck movements (which both use Wedderburn Road) were also used as part of the effectiveness assessment in order to calculate the weighted PM10 value (see details below).

Data that was analysed as part of the effectiveness assessment included:
- Average PM10 (24hr)
- Maximum PM10 (24hr)
- Weighted PM10 (24hr)

The equation used to calculate the Weighted PM10 is provided below:

$$PM10_{(w)} = PM10_{(ave)} / (TM_{(out)} + TM_{(int)})$$

Where;
PM10 (w) = Weighted PM10
PM10 (ave) = Average PM10 level (24hr) recorded during the trial period
TM(out) = Number of outbound truck movements during the trial period
TM(int) = Number of internal truck movements during the trial period

4. Results and Analysis

Coal Dust Track-out Quantification

The results from the 'coal dust track-out' quantification techniques are summarised in the table below.

Table 8: Estimated Coal Dust Track out Levels – Wedderburn Road

Method	Indicative Coal Track-out Quantity (Wedderburn Road) – kg/year	
	PM10	Deposition (combustible)
Emission Estimate Method	2,734	----
Dust Deposition Method	----	3,629

The calculations and factors used to derive the above indicative track-out volumes are provided as Appendix C (Emissions Estimate Method) and Appendix D (Dust Deposition Method).

Dust Control Effectiveness Trial Results

Summary

The results from the dust control trials are summarised in the table and supporting commentary below. The traffic light indicatators embedded within the table indicate the ranking (green = best, red = worst).

Table 9: Dust Control Method Trials – Summary of Results

Trial ID and Description		Average PM10 (ug/m3)	Maximum PM10 (ug/m3)	Weighted PM10 (ug/m3 per outbound truck)
A	**Full Wet** Watercart Application from Tarping Area to Appin Road	22.1 (red)	47.8 (red)	0.052 (orange)
B	**Wet / Dry** Combination of Watercart and Road Sweeper	15.6 (green)	34.0 (green)	0.027 (green)
C	**Full Dry** Road Sweeper Application from Tarping Area to Appin Road	20.6 (orange)	41.4 (orange)	0.053 (red)

The results clearly indicate that the dust control method using a combination of watercart and road sweeper (Trial B) is the optimal dust control method for managing dust on Wedderburn Road and ultimately reducing track-out potential.

The average PM10 (24hr) level recorded during Trial B (15.6 ug/m3) which was at least 25% lower than that of the other two dust control trials. The maximum PM10 levels recorded during Trial B were also significantly lower (>15%) than the other two trials. The maximum PM10 level (34ug/m3) recorded during Trial B was also well the Part 3A approval air quality criteria of 50ug/m3 (which was the case for all three of the trial periods).

The figure below provides a graphical representation of the Daily and Maximum PM10 levels across the three trial periods.

Results and Analysis continued

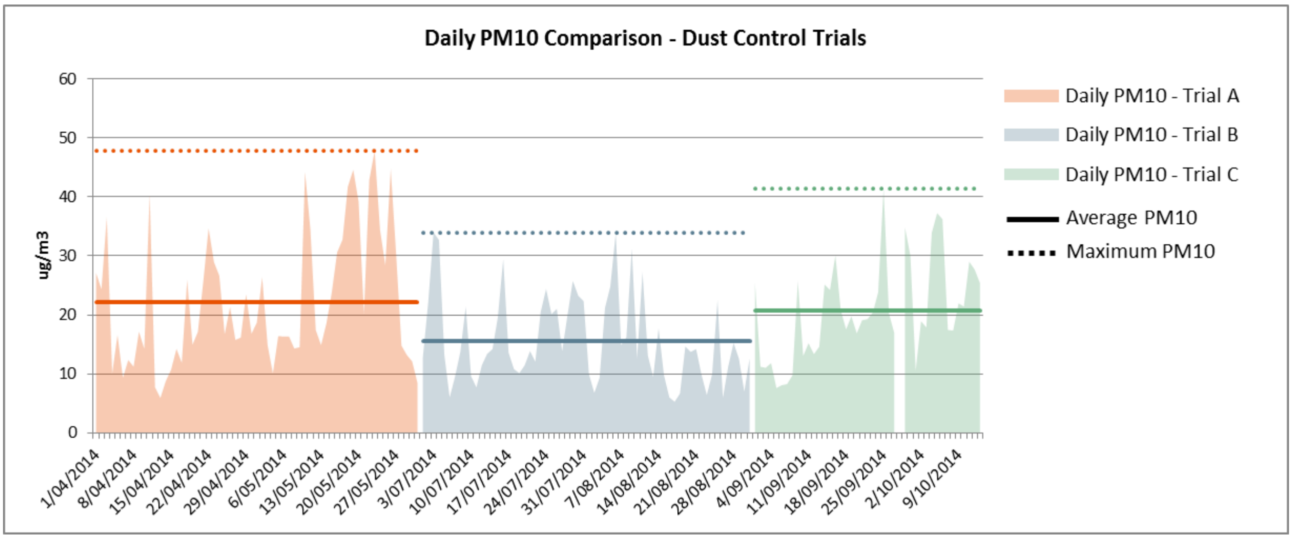

Figure 5: Dust Control Trials – Daily PM10 Results Comparison

Average daily truck movements loaded at the West Cliff site during Trial B was 798, which was equivalent to the numbers recorded during Trial C (average of 808 movements). There were significantly less truck movements during Trial A (baseline) with a daily average of 589 movements. When this truck movement data was combined with the average PM10 results (to produce the weighted PM10 values) it showed that the weighted PM10 average for Trial B was in the order of 50% lower than the other two dust control trials. This provides further evidence to suggest that using a combination of watercart and road sweeper for dust control on Wedderburn Road significantly reduces the potential for dust track-out to occur.

The figure below provides a graphical representation of the weighted PM10 levels and the truck movements across the three trials periods. Tabulated truck data is provided as Appendix E.

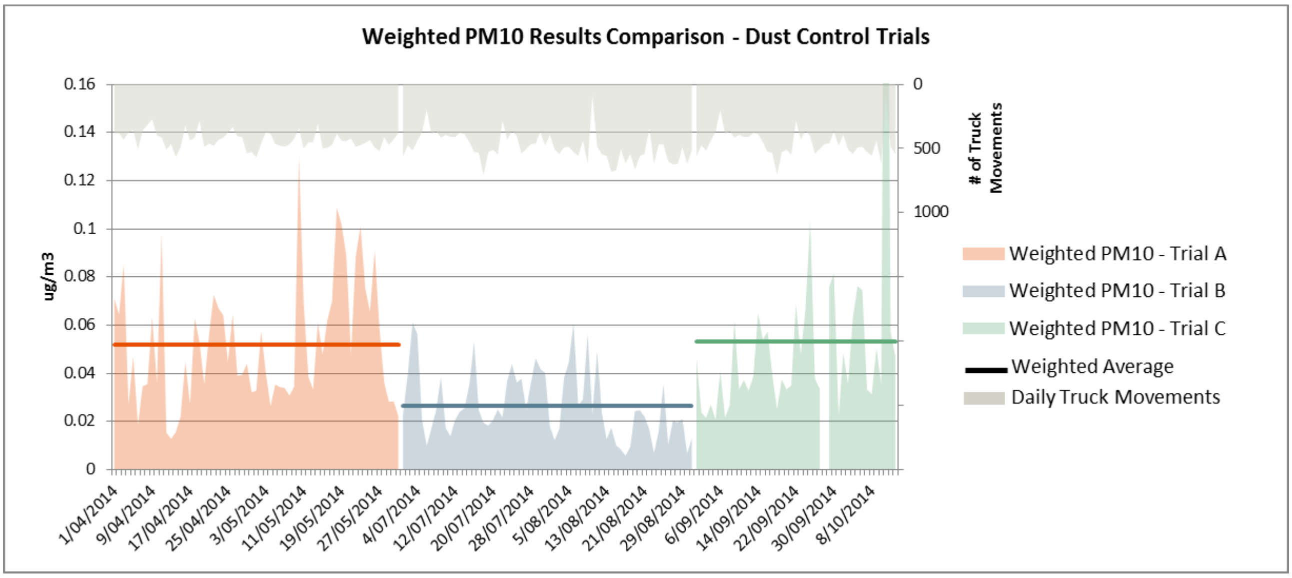

Figure 6: Dust Control Trials – Weighted PM10 Results Comparison

Further details on the trials are provided in the sub-sections below.

Results and Analysis continued

Trial A (Baseline) – Full Wet

The baseline monitoring was undertaken during an eight week period from April 2014 to May 2014. The dust control method utilised during the baseline monitoring period was a full watercart application on Wedderburn Road from the truck tarping area to the Appin Road intersection.

A total of 35,941 inbound/outbound truck movements were recorded during the period with a daily average of 589. An additional 4,207 internal truck movements' (ie. trucks transporting clean coal from the bins to one of the stockpiles located on the West Cliff site) occurred during the period. A graphical representation of the truck data is provided below.

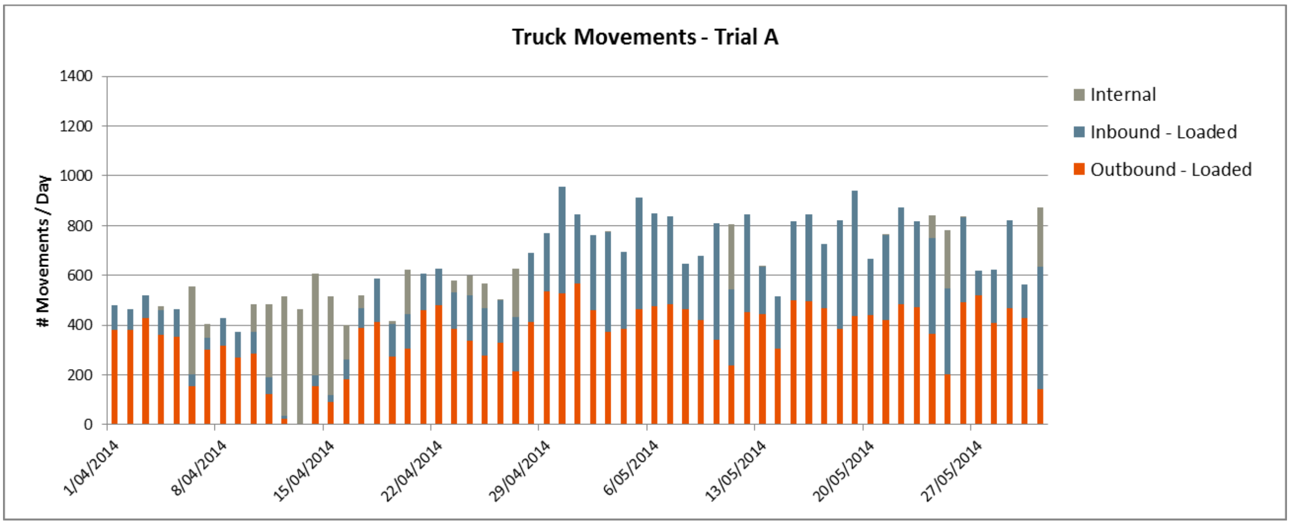

Figure 7: Dust Control Trial A – Truck Movement Data

The average PM10 level recorded during this period was 22.1ug/m3 with a maximum daily average of 47.8ug/m3. The average PM10 level recorded during this trial was approximately 15% higher than the average PM10 level recorded during the entire PRP22 monitoring period (ie. from April to November).

The figure below provides the average PM10 data recorded during the baseline period and the weighted PM10 data (weight on outbound truck movements).

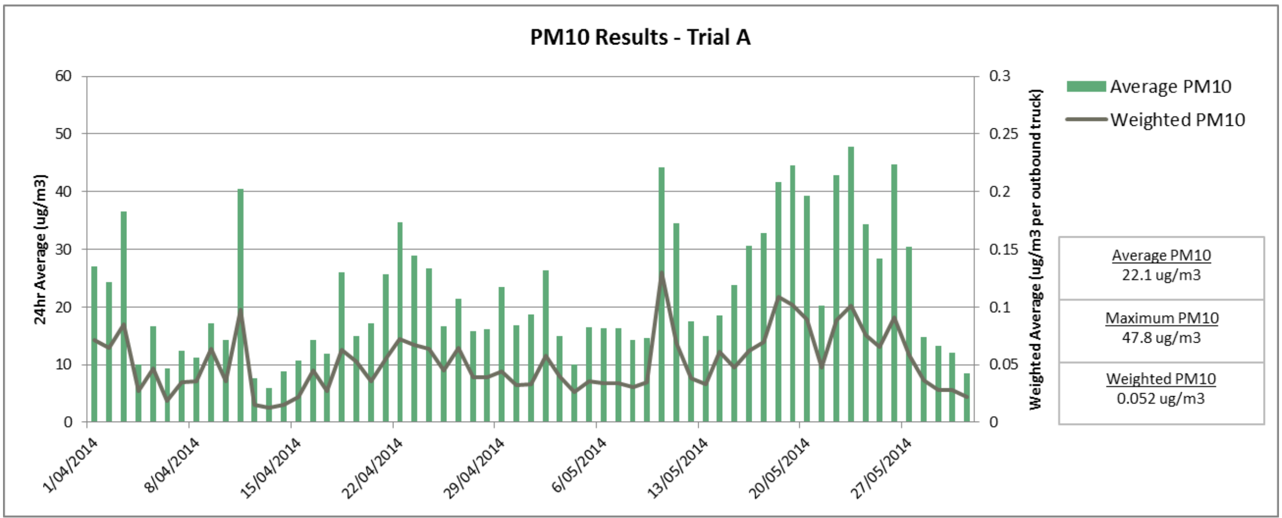

Figure 8: Dust Control Trial A – PM10 Monitoring Results

Trial B – Wet/Dry Combination

The monitoring associated with Trial B was undertaken during an eight week period from July 2014 to August 2014. The dust control method utilised during this monitoring period was a combination of watercart application (from tarping area to Middle Road) and road sweeper (from middle road to the Appin Road intersection).

A total of 49,473 inbound/outbound truck movements were recorded during the period with a daily average of 798. An additional 3,820 internal truck movements' occurred during the period. A graphical representation of the truck data is provided below.

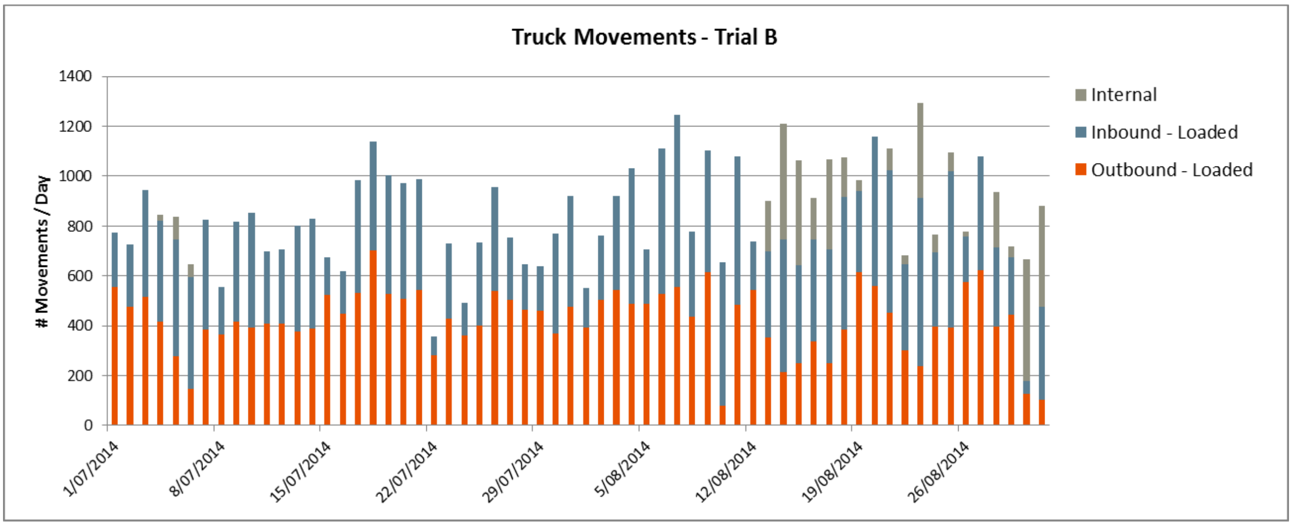

Figure 9: Dust Control Trial B – Truck Movement Data

The average PM10 level recorded during this period was 15.6ug/m3 with a maximum daily average of 34ug/m3. The average PM10 level recorded during this trial was approximately 20% lower than the average PM10 level recorded during the entire PRP22 monitoring period (ie. from April to November).

The figure below provides the average PM10 data recorded during the baseline period and the weighted PM10 data (weight on outbound truck movements).

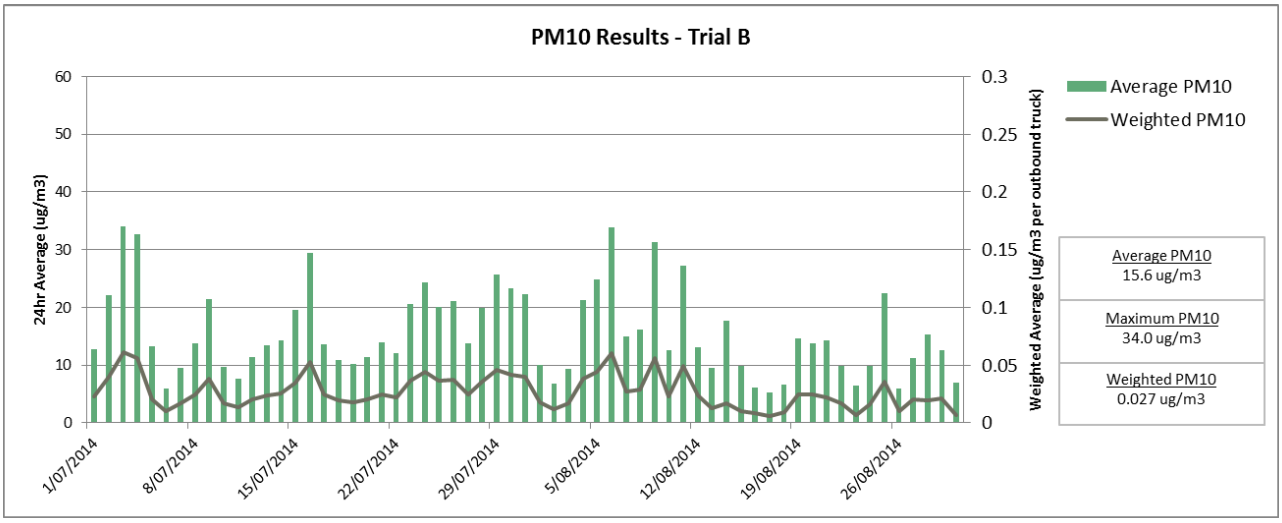

Figure 10: Dust Control Trial B – PM10 Monitoring Results

Trial C – Full Dry

The monitoring associated with Trial C was undertaken during a six week period from September 2014 to October 2014. The dust control method utilised during this monitoring period was a full road sweeper application from the truck tarping area to the Appin Road intersection.

A total of 34,749 inbound/outbound truck movements were recorded during the period with a daily average of 808. An additional 164 internal truck movements' occurred during the period which is signicantly lower than the previous two periods. The reduction is directly attributable to operational demand and customer delivery requirements. A graphical representation of the truck data is provided below.

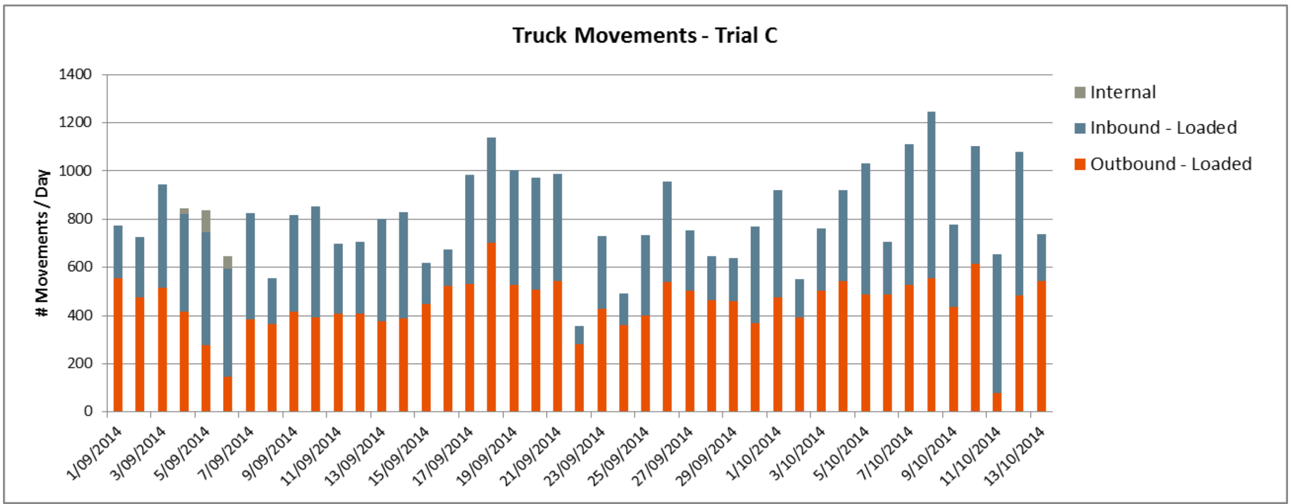

Figure 11: Dust Control Trial C – Truck Movement Data

The average PM10 level recorded during this period was 20.7ug/m3 with a maximum daily average of 41.4ug/m3. The average PM10 level recorded during this trial was approximately 7% higher than the average PM10 level recorded during the entire PRP22 monitoring period (ie. from April to November).

The figure below provides the average PM10 data recorded during the baseline period and the weighted PM10 data (weight on outbound truck movements). Note the spike in the weighted average which occurred on the 11th October 2014 is due to only small number of outbound truck movements that occurred on that day. There was also a minor system issue experienced between the 27th September and 29th September 2014, data during this period has been removed from the analysis.

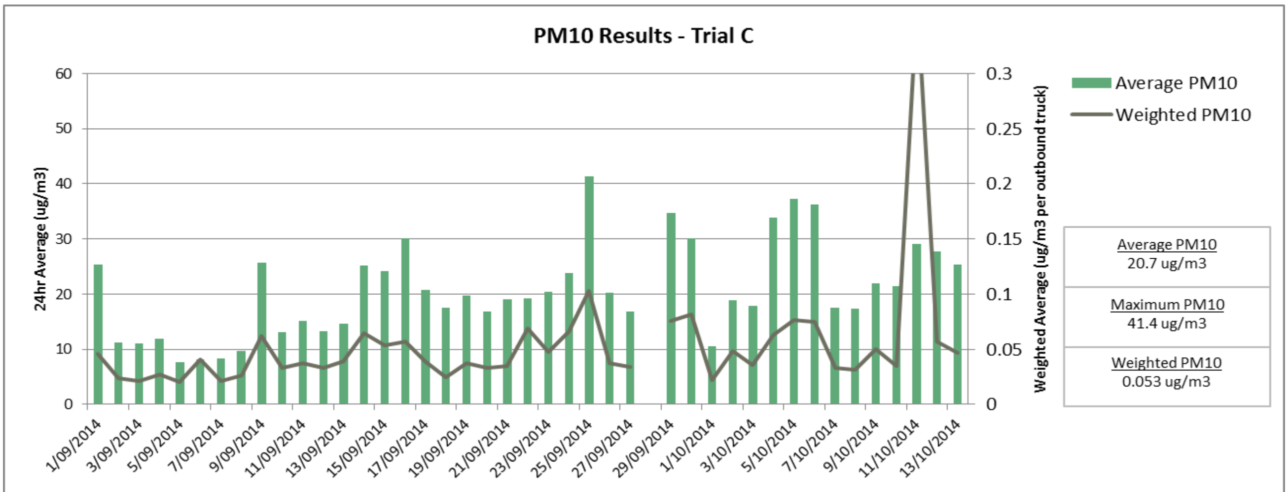

Figure 12: Dust Control C – PM10 Monitoring Results

5. Recommendations

Optimal Dust Control Method – Wedderburn Road

The results from the dust control trials completed as part of this PRP indicate that the most effective dust control method for managing dust track-out from the West Cliff site is through a combination of watercart and road sweeper.

The watercart operation is targeted at the northern end of Wedderburn Road from the tarping area through to the Middle Road intersection (refer to Figure 13). This section of road is where the majority of the larger coal material is likely to build up as a result of activities associated with the tarp inspection area (ie. inspection and cleaning of gunnels and tailgates) and the acceleration of the truck away from the tarping area. The watercart is better suited to cleaning this section of road due to the nature of the coal build up in the area.

The road sweeper operation is targeted at the southern end of Wedderburn from the Middle Road intersection through to the Appin Road intersection (refer to Figure 13). This section of road is where there is potential for finer coal material to build up as it is tracked from the northern end and pulverised due to the high number of truck movements. The road sweeper is better suited to the cleaning of a dry road and targeting finer particles.

The change to the dust control method has been introduced in January 2015. The effectiveness of this method will continue to be monitored through the PM10 monitoring station located adjacent to Wedderburn Road. Results from the PM10 monitoring station (used to determine the effective of dust control effectiveness) will be reported in the Annual Environmental Management Report.

Figure 13: Preferred Dust Control Method

Identified Further Actions

Wedderburn Road Drainage

An analysis of the PM10 data and deposition data collected as part of the PRP22 monitoring program confirmed that the dust levels immediately adjacent to Wedderburn Road are higher than background levels. As discussed earlier in this report, the dust levels recorded at Wedderburn Road are approximatelty 30% higher than those recorded at the OEH monitoring station Cambelltown West. In addition, a comparison with the PM10 monitoring data collected at the Appin East mine site (adjacent to the exit gate) also confirmed that dust levels recorded at Wedderburn Road were on average 25% higher than the levels recorded at Appin East (see Figure 14 below).

The increase in dust levels suggests that the haulage movements on Wedderburn Road are resulting in dust drag out from the West Cliff site. It should be noted that although the dust levels at Wedderburn Road are

Recommendations continued

higher than background levels they are still within the air quality criteria (short and long term) which suggests that the current level of drag out is unlikely to have an impact on the amenity of the receiving environment.

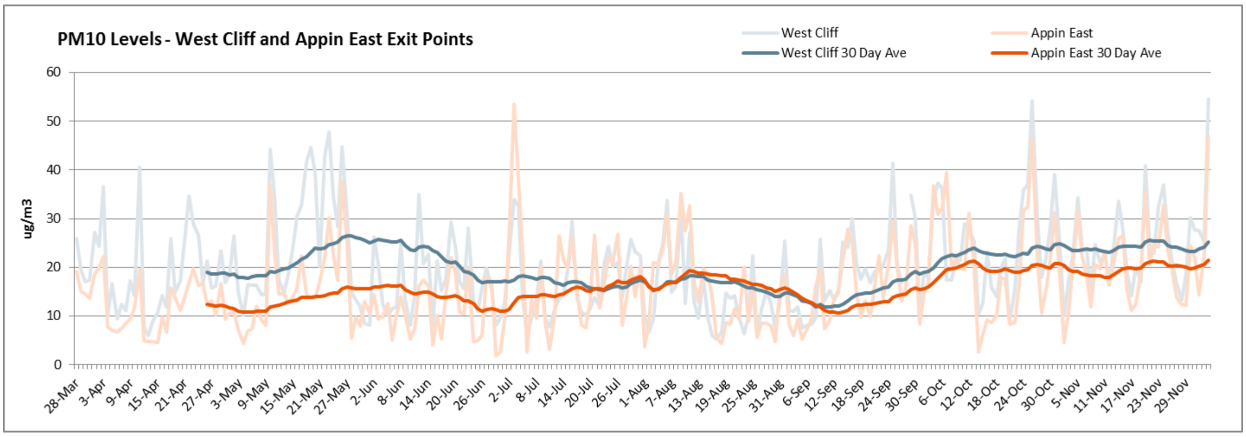

Figure 14: PM10 Comaparson – Appin East vs West Cliff

The data also clearly suggests that the most appropriate method for controlling potential drag out along Wedderburn Road is a combination of water cart (between the tarping area and Middle Road) and road sweeper (from Middle Road to the intersection with Appin Road).

Visual inspections of Wedderburn Road indicate that a significant contributor to the elevated drag out potential from West Cliff originates from the section of Wedderburn Road from the truck tarping area to the Middle Road intersection as this section of road has a poor drainage system. As a result, dirty water flows across the road at both the northern and southern end of the truck tarping area. The coal fines within the dirty water are constantly picked up in the tyre treads of our outbound haulage fleet hence can be tracked further towards Appin Road.

Figure 15: Drainage Issues at Northern end of Wedderburn Road (near Tarping Area)

Recommendations continued

Rainfall is the most significant contributor to the water that drains across the road and the resulting drag-out. Notwithstanding this, the use of a water cart is the most effective dust control method for the area (as demonstrated in the dust results below); however this addition of water increases the drag out potential where the drainage is poor on the road. The scope of the identified further actions aims to remove this conflicting aspect, enabling best-practise water-cart use without subsequent drag-out.

The identified 'further actions', likely to be implemented by the end of FY15, are summarised below. Progressed will be reported in the FY15 Annual Environmental Management Report.

Installation of an additional Under-Road Drainage Pipe
An under-road drainage pipe will be installed at the southern end of the tarping area (indicative location provided in Figure 16). The road surface immediately above the pipes will be resurfaced using concrete to minimise potential for future maintenance given the nature of vehicle movements in the area (truck turning).

Figure 16: Indicative Location – sub-surface drainage pipe

The western ends of the pipe will be 'open ended' to allow periodic visual assessment to be made. The ability to undertaken visual 'end of pipe' inspections will minimise the potential for silt build and blockages.

Road Resurfacing – Northern end of Tarping Area
It is proposed to resurface a section of Wedderburn Road at the northern of the truck tarping area (indicative location provided in Figure 17). The road will be resurfaced using concrete (currently asphalt) which is a more suitable (and durable) road surface for this area of site (ie. high volumes of truck and truck turning area). As part of the resurfacing work, this section of the road will be re-graded to allow sufficient fall for the surface water to report to the existing drainage system located midway along the tarping area.

Recommendations continued

Figure 17: Area of Road Resurfacing – Northern end of Truck Tarping Area

The re-grading of this area is expected to minimise water pooling across the road at the northern end of the tarping area and also minimise future maintenance costs (replacing asphalt with concrete).

<u>Road Shoulder and Road Drainage Improvements</u>
The existing road shoulder between the truck tarping area and the Middle Road intersection will be re-graded and sealed (refer to Figure 19). A designated drainage channel will be integrated with the road shoulder improvements (see indicative cross section below).

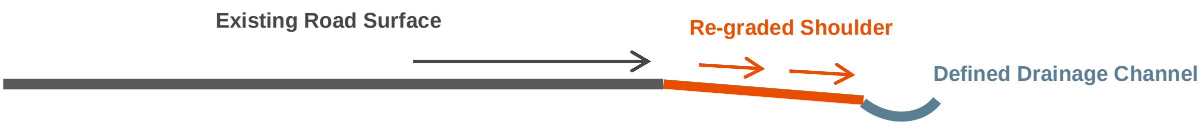

Figure 18: Indicative Profile – Road Shoulder and Drainage Channel

The drainage channel will be constructed using the same material as the road shoulder but will also contain silt and flow arrestors. The silt arrestors will enable some silt to be progressively captured and minimise silt build further downstream.

Recommendations continued

Figure 19: Extent of Road Shoulder and Drainage Improvements

6. References

Donnelly S-J, Balch A, Wiebe A, Shaw N, Welchman S, Schloss A, Castillo E, Henville K, Vernon A and Planner J (2011). *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and / or Minimise Emissions of Particulate Matter from Coal Mining*. Prepared by Katestone Environmental Pty Ltd for NSW Office of Environment and Heritage June 2011.

NSW Environment and Heritage, *Air Quality Data:* http://www.environment.nsw.gov.au/AQMS/search.htm

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PAE Holmes (2012)*, Appin Mine and West Cliff Colliery Particulate Matter Control Best Practise Pollution Reduction Program*, Report prepared for BHP Billiton Illawarra Coal, September 2012

7. Appendices

Appendix A: Tabulated Data Summary - Dust Deposition

Units: g/m^2/month

Sample Period	W-DD1 (Amenity)			W-DD3 (Operational)			W-DD8 (Amenity)			W-DD10 (Operational)		
	Ash	Combustible Solids	Insoluble Matter	Ash	Combustible Solids	Insoluble Matter	Ash	Combustible Solids	Insoluble Matter	Ash	Combustible Solids	Insoluble Matter
Jun-13	0.6	1.1	1.7	0.6	0.4	1	0.1	0.2	0.3	9.3	4.4	13.7
Jul-13	0.1	0.6	0.7	0.2	0.8	1	0	0.2	0.2	7.6	3.3	10.9
Aug-13	0.6	0.7	1.3	1.5	0.5	2	0.2	0.1	0.2	8.8	4.7	13.5
Sep-13	1.2	1	2.2	1.6	1.1	2.7	0.4	0.3	0.7	13.7	7.5	21.2
Oct-13	1.2	1	2.2	3.8	1.9	5.7	0.7	0.3	1	33.7	14.9	48.6
Nov-13	1.8	1.9	3.7	3.2	1.5	4.7	1	0.1	1	47.7	21.3	69
Dec-13	1.7	1.6	3.3	2.3	1.3	3.6	0.8	0.7	1.5	34	13.4	47.4
Jan-14	1.7	2	3.7	2.1	1.2	3.3	0.6	0.3	0.9	29.5	10.4	39.9
Feb-14	2.1	1.4	3.5	3.4	1.5	4.9	0.9	0.3	1.2	21.2	8.7	29.9
Mar-14	1.5	1.4	2.9	1.9	1.1	3	0.6	0.2	0.8	22.1	9.5	31.6
Apr-14	0.8	0.9	1.7	0.9	0.7	1.6	0.3	0.3	0.6	22.8	9.1	31.9
May-14	1.5	1.7	3.2	1.4	0.8	2.2	0.2	0.1	0.2	22.4	9.7	32.1
Jun-14	1.3	1.9	3.2	1	0.8	1.8	0.1	0.1	0.2	13.4	6.8	20.2
Jul-14	0.9	1	1.9	0.9	0.5	1.4	0.3	0.4	0.7	18.1	9.7	27.8
Aug-14	1.3	1.7	3	0.1	0.1	0.1	0.9	0.4	1.3	22.7	11.4	34.1
Sep-14	0.8	1.2	2	1.2	0.9	2.1	0.5	0.3	0.8	14.5	8.2	22.7
Oct-14	1.9	1.2	3.1	2.5	1.9	4.4	0.6	0.5	1.1	18.9	9.5	28.4
Nov-14	1.6	1.7	3.3	2.6	1.6	4.2	1.3	0.7	2	21.9	11	32.9
Dec-14	1.6	1.4	3.0	3.0	1.5	4.5	0.8	0.5	1.3	23.4	10.8	34.2

Appendix B: Tabulated Data Summary – PM_{10}

Date	Average PM10 (ug/m3)
1/04/2014	27.1
2/04/2014	24.3
3/04/2014	36.5
4/04/2014	10.0
5/04/2014	16.6
6/04/2014	9.3
7/04/2014	12.4
8/04/2014	11.2
9/04/2014	17.2
10/04/2014	14.2
11/04/2014	40.5
12/04/2014	7.7
13/04/2014	5.9
14/04/2014	8.8
15/04/2014	10.7
16/04/2014	14.2
17/04/2014	11.9
18/04/2014	25.9
19/04/2014	14.9
20/04/2014	17.1
21/04/2014	25.6
22/04/2014	34.7
23/04/2014	28.9
24/04/2014	26.7
25/04/2014	16.7
26/04/2014	21.4
27/04/2014	15.8
28/04/2014	16.2
29/04/2014	23.5
30/04/2014	16.8
1/05/2014	18.7
2/05/2014	26.4
3/05/2014	14.9
4/05/2014	10.1
5/05/2014	16.4
6/05/2014	16.3
7/05/2014	16.4
8/05/2014	14.3
9/05/2014	14.5
10/05/2014	44.2
11/05/2014	34.5
12/05/2014	17.4
13/05/2014	14.9
14/05/2014	18.6
15/05/2014	23.8
16/05/2014	30.6
17/05/2014	32.8
18/05/2014	41.7
19/05/2014	44.6
20/05/2014	39.2
21/05/2014	20.2
22/05/2014	42.8
23/05/2014	47.8
24/05/2014	34.4
25/05/2014	28.4
26/05/2014	44.7
27/05/2014	30.4

Date	Average PM10 (ug/m3)
28/05/2014	14.8
29/05/2014	13.2
30/05/2014	12.1
31/05/2014	8.4
1/07/2014	12.8
2/07/2014	22.1
3/07/2014	34.0
4/07/2014	32.7
5/07/2014	13.2
6/07/2014	6.0
7/07/2014	9.5
8/07/2014	13.7
9/07/2014	21.4
10/07/2014	9.6
11/07/2014	7.7
12/07/2014	11.5
13/07/2014	13.4
14/07/2014	14.2
15/07/2014	19.6
16/07/2014	29.4
17/07/2014	13.6
18/07/2014	10.8
19/07/2014	10.1
20/07/2014	11.5
21/07/2014	13.9
22/07/2014	12.1
23/07/2014	20.5
24/07/2014	24.4
25/07/2014	20.1
26/07/2014	21.0
27/07/2014	13.8
28/07/2014	20.0
29/07/2014	25.7
30/07/2014	23.3
31/07/2014	22.3
1/08/2014	10.0
2/08/2014	6.8
3/08/2014	9.4
4/08/2014	21.2
5/08/2014	24.8
6/08/2014	33.8
7/08/2014	14.9
8/08/2014	16.2
9/08/2014	31.2
10/08/2014	12.6
11/08/2014	27.2
12/08/2014	13.1
13/08/2014	9.5
14/08/2014	17.7
15/08/2014	9.8
16/08/2014	6.0
17/08/2014	5.3
18/08/2014	6.7
19/08/2014	14.6
20/08/2014	13.7
21/08/2014	14.2
22/08/2014	9.9

Date	Average PM10 (ug/m3)
23/08/2014	6.4
24/08/2014	9.9
25/08/2014	22.4
26/08/2014	5.9
27/08/2014	11.3
28/08/2014	15.3
29/08/2014	12.6
30/08/2014	7.0
31/08/2014	12.6
1/09/2014	25.4
2/09/2014	11.2
3/09/2014	11.0
4/09/2014	11.8
5/09/2014	7.6
6/09/2014	8.1
7/09/2014	8.3
8/09/2014	9.8
9/09/2014	25.7
10/09/2014	13.0
11/09/2014	15.2
12/09/2014	13.3
13/09/2014	14.6
14/09/2014	25.1
15/09/2014	24.2
16/09/2014	30.1
17/09/2014	20.8
18/09/2014	17.5
19/09/2014	19.8
20/09/2014	16.9
21/09/2014	19.1
22/09/2014	19.3
23/09/2014	20.4
24/09/2014	23.8
25/09/2014	41.4
26/09/2014	20.3
27/09/2014	16.9
28/09/2014	*
29/09/2014	34.8
30/09/2014	30.0
1/10/2014	10.5
2/10/2014	18.9
3/10/2014	17.9
4/10/2014	33.9
5/10/2014	37.3
6/10/2014	36.2
7/10/2014	17.5
8/10/2014	17.4
9/10/2014	22.0
10/10/2014	21.4
11/10/2014	29.0
12/10/2014	27.7
13/10/2014	25.4

* System Outage – no PM10 data available

Appendix C: Coal Dust Track out Estimation – Emission Estimate Method

Data Inputs:

Input	Value	Units
Intensity: Clean Coal Hauled from West Cliff (CY2014)	4,865,145	Tonnes/Period
Tonnes per load (Average for CY2014)	38.2	Tonnes/Load
Vehicle Gross Mass: VGM (Average for CY2014)	59.6	Tonnes
Length of Trip (Wedderburn Road)	2.35	kilometres
Silt Content (as per PRP17)	1.010	%
Assumed Control Effectiveness (paved surface, road sweeper, watercart)	95	%

Calculations:

Base Emission Factor = (0.4536/1.6093) x 1.5 x ((‘Silt Content’ / 12) ^ 0.9)) x ((‘VGM’ x 1.1023)/3))

(for hauling product coal on road) = (0.4536/1.6093) x 1.5 x ((1.010 / 12) ^ 0.9)) x ((59.6 x 1.1023)/3))

= 0.1827 kg / VKT

Emission Factor = ‘Base Emission Factor’ x (‘Length of Trip’ / ‘Tonnes per load’)

= 0.1827 x (2.35 / 38.2)

= 0.01124 kg / tonnes

PM10 Emissions / Year = ‘Intensity’ x ‘Emission Factor’ x ((100 – ‘% Control Effectiveness’) / 100)

= 4,865,145 x 0.01124 x ((100 – 95)/100)

= 2,734 kg / year

Appendix D: Coal Dust Track out Estimation – Dust Deposition Method

Data Inputs

Combustible Matter Level – Amenity Dust Deposition Gauges

Month	W-DD1	W-DD3	Average
July	1.0	0.5	0.8
August	1.7	0.1	0.9
September	1.2	0.9	1.1
October	1.2	1.9	1.6
November	1.7	1.6	1.7
December	1.4	1.5	1.5
		Overall Average	**1.2**

Combustible Matter Level – PRP22 Dust Deposition Gauges (Operational)

Month	PRP22-1	PRP22-2	PRP22-3	W-DD10	Average
July	6.3	6.1	19.3	9.7	10.6
August	9.0	10.0	19.3	11.4	12.8
September	10.7	9.4	20.1	8.2	13.4
October	8.8	7.3	14.5	9.5	10.2
November	8.1	6.6	10.6	11.0	8.4
December	6.2	5.5	11.6	10.8	8.5
				Overall Average	**10.4**

Other Inputs:

- Dwi: Incremental Dust Increase (Wedderburn Road) = 9.2 g/m^2/month
- Length of Wedderburn Road = 2,350 metres
- Width of Wedderburn Road (including road shoulder) = 14 metres
- SA: Calculated Surface Area of Wedderburn Road = 32,900 m^2

Calculation

Dust Deposited /Year (kg)

$$= \frac{(12 \text{ months x Dwi) x SA}}{1000}$$

$$= \frac{(12 \times 10.4) \times 32{,}900}{1000}$$

= 3,629 kg / year

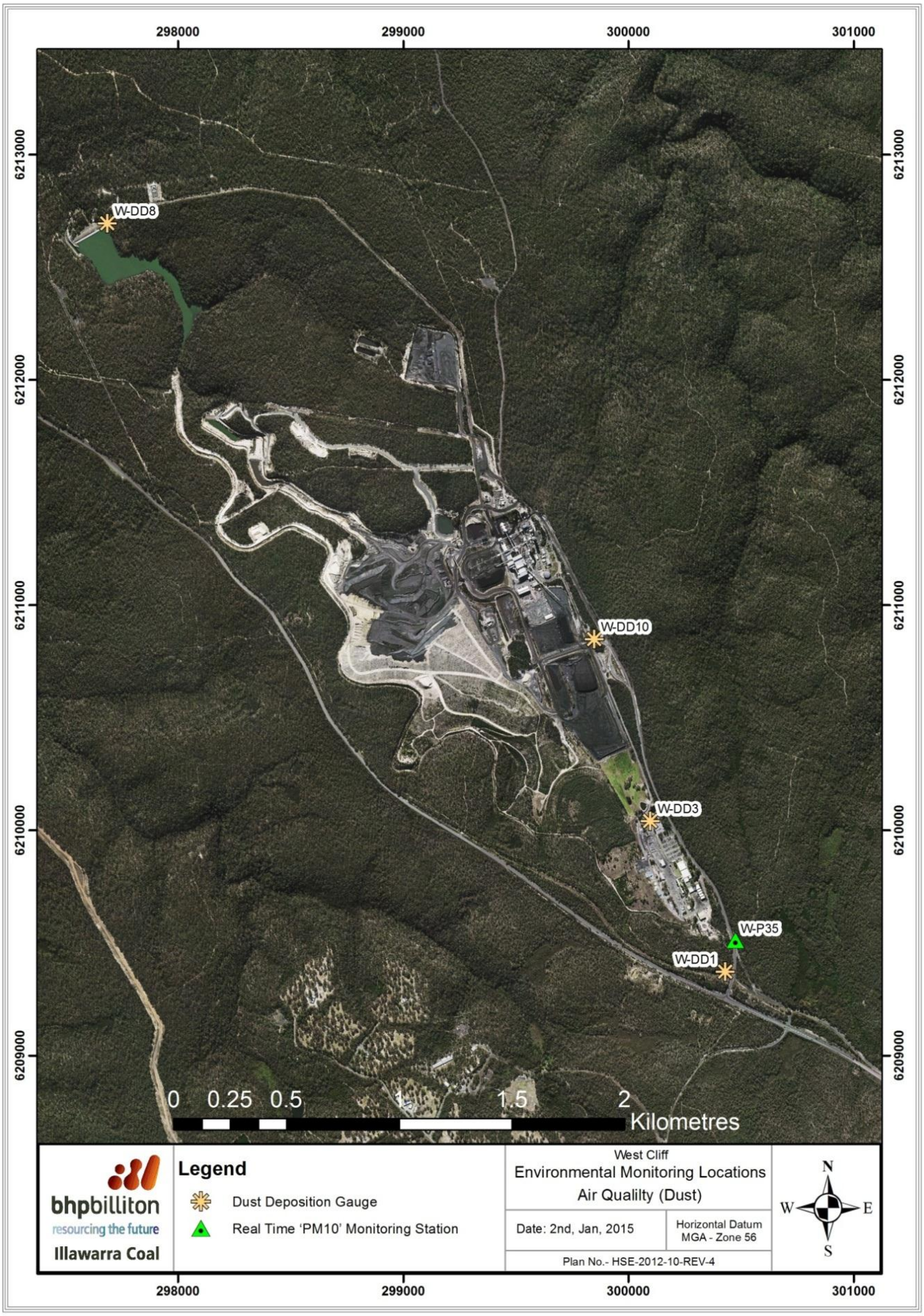
Appendix E: Tabulated Truck Movement Data Summary

Date	Outbound - Loaded	Inbound - Loaded	Internal Movement
1/04/2014	382	99	0
2/04/2014	379	87	0
3/04/2014	429	91	0
4/04/2014	362	99	14
5/04/2014	353	111	0
6/04/2014	153	51	353
7/04/2014	301	47	56
8/04/2014	317	112	0
9/04/2014	271	100	0
10/04/2014	286	86	112
11/04/2014	122	68	292
12/04/2014	25	11	481
13/04/2014	0	0	465
14/04/2014	154	43	411
15/04/2014	91	26	398
16/04/2014	181	80	138
17/04/2014	389	81	50
18/04/2014	413	173	0
19/04/2014	273	132	10
20/04/2014	307	136	179
21/04/2014	461	147	0
22/04/2014	478	150	0
23/04/2014	384	146	48
24/04/2014	336	184	80
25/04/2014	277	191	98
26/04/2014	330	170	1
27/04/2014	213	221	191
28/04/2014	411	280	0
29/04/2014	535	233	0
30/04/2014	526	432	0
1/05/2014	569	277	0
2/05/2014	459	302	0
3/05/2014	372	401	1
4/05/2014	384	311	0
5/05/2014	465	449	0
6/05/2014	477	371	0
7/05/2014	484	355	0
8/05/2014	466	179	0
9/05/2014	422	258	0
10/05/2014	341	468	0
11/05/2014	238	306	261
12/05/2014	453	391	0
13/05/2014	443	192	5
14/05/2014	305	212	0
15/05/2014	498	321	0
16/05/2014	495	350	0
17/05/2014	469	257	0
18/05/2014	384	439	0
19/05/2014	438	501	0
20/05/2014	441	227	0
21/05/2014	422	341	1
22/05/2014	485	389	0
23/05/2014	473	343	0
24/05/2014	364	387	92
25/05/2014	202	346	232
26/05/2014	491	344	1
27/05/2014	518	101	0
28/05/2014	410	212	0
29/05/2014	470	351	0
30/05/2014	428	134	0
31/05/2014	143	491	237
1/07/2014	557	216	0
2/07/2014	474	251	0
3/07/2014	514	431	0
4/07/2014	415	408	24
5/07/2014	279	468	89
6/07/2014	147	450	51
7/07/2014	385	440	0
8/07/2014	366	188	0
9/07/2014	415	403	0
10/07/2014	392	460	0
11/07/2014	409	289	0
12/07/2014	408	297	0
13/07/2014	378	423	0
14/07/2014	388	442	0
16/07/2014	449	170	0
15/07/2014	525	148	0
17/07/2014	533	451	0
18/07/2014	704	434	0
19/07/2014	528	474	0
20/07/2014	508	464	0
21/07/2014	545	441	0
22/07/2014	281	77	0
23/07/2014	430	298	0
24/07/2014	360	132	0
25/07/2014	401	331	0
26/07/2014	538	420	0
27/07/2014	503	251	0
28/07/2014	465	183	0
29/07/2014	460	179	0
30/07/2014	368	401	0
31/07/2014	475	445	0
1/08/2014	393	157	0
2/08/2014	505	258	0
3/08/2014	542	378	0
4/08/2014	489	544	0
5/08/2014	486	222	0
6/08/2014	526	585	0
7/08/2014	555	692	0
8/08/2014	436	341	0
9/08/2014	615	489	0
10/08/2014	79	577	0
11/08/2014	485	594	0
12/08/2014	544	192	0
13/08/2014	354	344	202
14/08/2014	215	529	465
15/08/2014	251	393	418
16/08/2014	336	408	167
17/08/2014	251	454	363
18/08/2014	384	534	158
19/08/2014	616	324	45
20/08/2014	559	601	0
21/08/2014	453	570	89
22/08/2014	300	346	37
23/08/2014	236	677	380
24/08/2014	397	299	71
25/08/2014	392	628	77
26/08/2014	577	179	22
27/08/2014	623	455	0
28/08/2014	398	316	222
29/08/2014	445	228	44
30/08/2014	126	51	491
31/08/2014	104	371	405
1/09/2014	557	216	0
2/09/2014	474	251	0
3/09/2014	514	431	0
4/09/2014	415	408	24
5/09/2014	279	468	89
6/09/2014	147	450	51
7/09/2014	385	440	0
8/09/2014	366	188	0
9/09/2014	415	403	0
10/09/2014	392	460	0
11/09/2014	409	289	0
12/09/2014	408	297	0
13/09/2014	378	423	0
14/09/2014	388	442	0
15/09/2014	449	170	0
16/09/2014	525	148	0
17/09/2014	533	451	0
18/09/2014	704	434	0
19/09/2014	528	474	0
20/09/2014	508	464	0
21/09/2014	545	441	0
22/09/2014	281	77	0
23/09/2014	430	298	0
24/09/2014	360	132	0
25/09/2014	401	331	0
26/09/2014	538	420	0
27/09/2014	503	251	0
28/09/2014	465	183	0
29/09/2014	460	179	0
30/09/2014	368	401	0
1/10/2014	475	445	0
2/10/2014	393	157	0
3/10/2014	505	258	0
4/10/2014	542	378	0
5/10/2014	489	544	0
6/10/2014	486	222	0
7/10/2014	526	585	0
8/10/2014	555	692	0
9/10/2014	436	341	0
10/10/2014	615	489	0
11/10/2014	79	577	0
12/10/2014	485	594	0
13/10/2014	544	192	0

8. Plans

Plans continued

Plan 1: Location of Dust Monitoring (Site)



Plan 2: Location of Dust Monitoring (PRP22 Specific)