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Air Quality Assessment for Construction Impacts – Proposed Gunns Pulp Mill

July 2006

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Executive Summary

The assessment for construction impacts has focussed upon dust emissions from the site bulk earthworks, as these represent the largest source of dust emissions during the mill construction activities, occurring during the first six months of a nine-month program.

Impacts of dust as PM10 (particle size of ≤10 micron) at the Rowella Township, and other residential areas in the vicinity, as a result of to the site bulk earthworks are below DPIWE design criteria levels. The only areas where this may not apply are within, or immediately adjacent to, the work site; however, sensitive receptors are not located in this area.

Measures such as the use of water carts, directional canon sprays and regular maintenance of unsealed haul roads will, if applied with vigilance, reduce dust emissions so that it will be unlikely that the DPIWE criterion level will be exceeded at sensitive receptors as the result of dust contributions from the works alone.

Exceedances of the DPIWE 24-hour average criterion level (150 $\mu g/m^3$), including an indicative worst-case background PM10 contribution, are confined to the area around the works site, and rapidly decrease with distance from this area.

Worst-case 24-hour average incremental signal concentrations, emitted from the works site, at the location of the nearest sensitive receptor are less than the DPIWE criterion level .

This assessment is an accompaniment to the GHD report prepared for Gunns Limited: Proposed Pulp Mill – Bell Bay: Impact on Air Quality – Interim IIS, and includes recommendations to the site EMP as to reduce PM10 concentrations. Consideration of the NEPM (National Environment Protection Measure) is not applicable as this assessment refers to the non-ongoing site bulk earthworks phase of the mill construction.

1. Introduction

This assessment of the impact of dust emissions to air from the bulk earthworks associated with the construction of the Gunns Pulp Mill project comprised the following components of work:

» Compilation of a quantified emissions inventory for identified activities that are likely to result in the emission of significant sources of dust to the air environment;

» Meteorological modelling in the complex geographical area surrounding the works location and within the Tamar Valley itself (for details see GHD report prepared for Gunns Limited: Proposed Pulp Mill – Bell Bay: Impact on Air Quality – Interim IIS, Chapters 3 and 5).

» 3D dispersion modelling of the significant sources of dust and comparison with DPIWE design level criteria.

This assessment focuses upon dust (as PM10) emitted to air from the proposed pulp mill site bulk earthwork construction activities that include:

» blasting, excavation and infilling of cut rock and clay;

» grader, bulldozer and truck loading / dumping activity;

» haul route location and frequency of use; and

» ancillary activities including crushing and spoil dumping.

Contour plots indicating the highest predicted impacts of PM10 are shown for the bulk earthworks generated dust without ambient background levels.

The worst-case PM10 margins with regard to compliance levels for the bulk earthworks are gauged by comparison with DPIWE design levels. The margins indicate the minimum level required for compliance including any contributions from ambient background sources. These ambient sources of dust are expected to consist of smoke particles from domestic wood heating, that typically occur during the night and early morning in autumn / winter, and particulates from local heavy industry, dust from agricultural activities, and motor vehicles.

GHD have allowed an indicative PM10 background concentration of 50 $\mu g/m^3$, for discussion purposes, during the main construction period. This value is considerably greater than the 24-hour maximum PM10 concentrations as measured at Gunns Air Quality Monitoring Site (AQMS) during a winter / spring period (July 2005 – July 2006; 34.2 $\mu g/m^3$) and accordingly GHD consider this assessment to be conservative.

2. Air Quality Standards

Particles of dust with an effective aerodynamic equivalent diameter of 10 microns or less and are otherwise known as PM10. The relevant design levels for PM10 (applicable to this broad-scale works) within environmental policy as stated by DPIWE (Department of Primary Industries, Water and Environment) Tasmania are:

» 150 µg/m^3, expressed as a 24-hour average design criterion. Compliance with this criterion will require that the highest predicted 24-hour average ground level concentrations of dust (as PM10) do not exceed this level at sensitive sites.

Note that the DPIWE standard applies to predicted PM10 levels including ambient background PM10 in addition to the 'signal' from the site bulk earthwork activities.

Note that the NEPM criterion of 50 µg/m^3, 24-hour average is not relevant to apply to emissions from construction activities, as by their nature they are temporary and do not form an ongoing load to the airshed.

3. Emissions Inventory

The general site preparation activities, their timings, and the individual processes within them were identified by GHD based upon documentation prepared by Gunns Limited and Jaakko Poyry. The individual processes that generate significant amounts of dust (as PM10) were then identified and their emission rates characterised using referenced emission factors with reasonable levels of control. In general, these processes are:

» Vehicle induced dust emissions on haul routes used for the transport of earth / rock from its source, through any processing points or temporary stockpiles to its final destination;

» Vehicle induced dust emissions on haul routes used for the transport of water from the local reservoir;

» Material handling, i.e. loading, blasting, excavation, loading, dumping and spreading;

» Static material processing, i.e. crushing / screening plants; and

» Wind erosion.

Jaakko Poyry estimate that the bulk earthworks will be completed in six months with minor work to continue for a further three months. From this information, it has been assumed that 90% of the total tonnage to be redistributed will occur during the initial six-month period. Note that on-site activity will comprise two daily shifts, seven days per week (excluding public holidays).

Activities unlikely to emit significant amounts of dust have not been included, e.g. drilling (as this is controlled by the direct application of water).

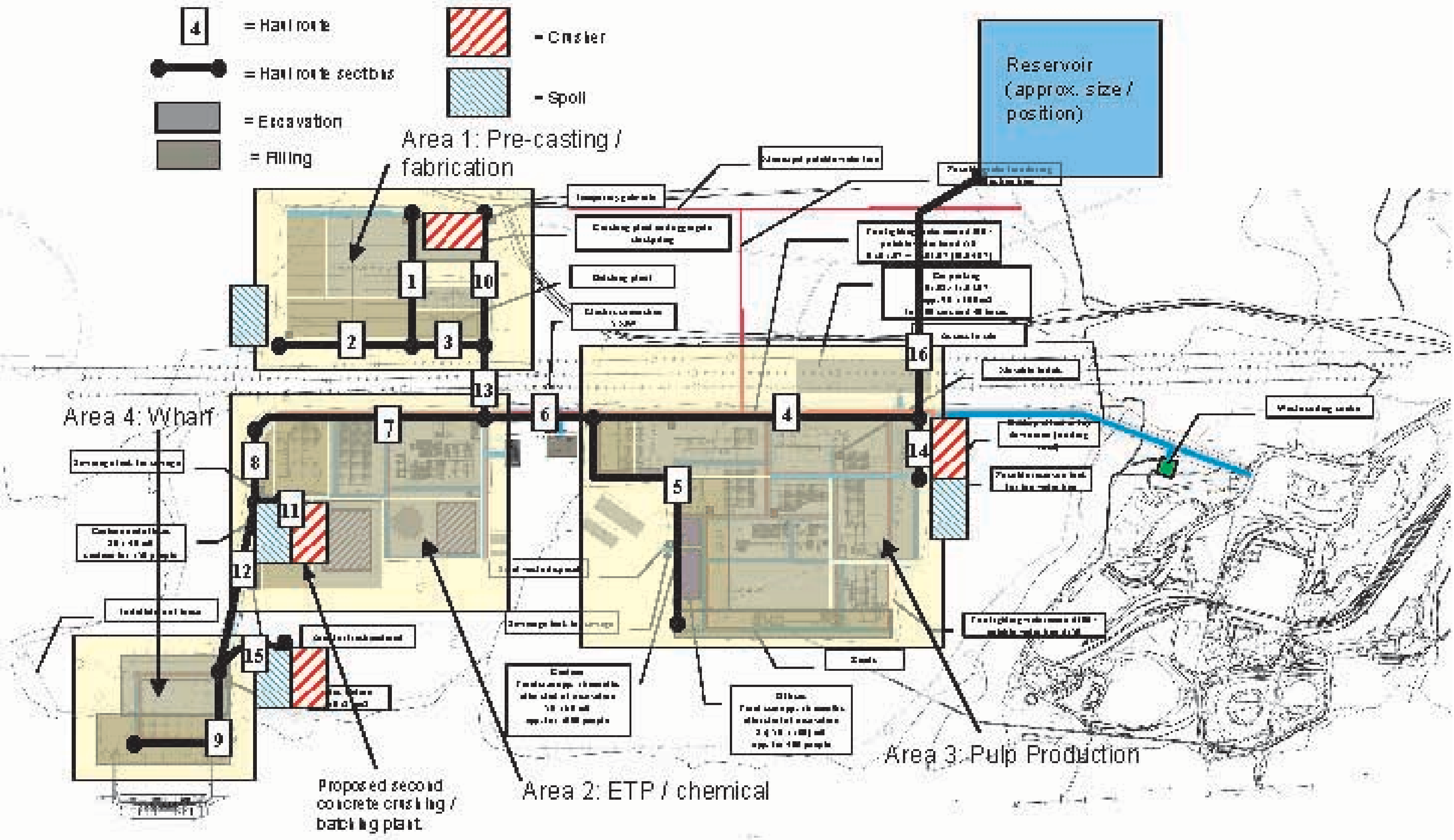
Note that diesel exhaust emissions from vehicles or machinery are included in the presented emission factors.

The site was divided into four work areas as identified on Figure 3.1, and Table 3.1 below details the individual excavation volume for each area (after Jaakko Poyry).

Table 3.1: Excavation volume for site areas.

Area	Description	Percentage of total tonnage in first six months	Tonnage to be moved / transported (millions of tonnes)	Cut silty clay (millions of tonnes)	Cut rock (millions of tonnes)	Spoil (millions of tonnes)
1	Pre-casting / fabrication	13.7	0.8	0.4	0.4	0.04
2	ETP / chemical	9.5	0.6	0.3	0.3	0.02
3	Pulp production	63.5	3.7	1.7	1.9	0.09
4	Wharf	13.2	0.8	0.4	0.4	0.02
	Total:	100	5.8	2.7	3.0	0.2

Figure 3.1: Site detail for bulk earthworks dust emissions inventory



Jaakko Poyry has identified the following equipment as 'on-site' during the earthwork phase and such information has aided the preparation of this document: reasonable levels of control. In general, these processes are:

- Approximately 2 x excavators (each 120 tonnes capacity)
- Approximately 2 x dump trucks (each 100 tonnes capacity)
- Approximately 5 x dump trucks (each 50 tonnes capacity)
- Approximately 2 x bulldozers
- Approximately 2 x bulldozers
- Approximately 2 x graders

Operating over two daily shifts (7am – 6pm & 7pm – 6am); seven days per week excluding public holidays.

In addition, for the purpose of this document the following assumptions have been made:

- As stated by Jaakko Poyry, concrete batching will not be operational until approximately 6 months after site preparation begins and has therefore not been considered during the preparation of this document (at which point 90% of the on-site preparation work will have been completed).
- The numerical mean dump truck capacity has been calculated at 64 tonnes and obtained from the proposed on-site equipment of 2 x 100 tonne and 5 X 50 tonne dump trucks. Trucks are operational for 100% of the working hours (22hrs per day) with 75% abatement on haul route emissions (unsealed roads).
- A crushing plant has been located within each of the main site areas to reduce haul road kilometres travelled and intensive dust emissions i.e. 4 crushers on site.
- Four haul routes are identified with respect to bulk earth transfer as defined in Table 2.
- Five journeys per day were allocated for transportation of water from the reservoir to the site.
- Where material is excavated from one area and taken both to the same area and to a different area for in-filling, a 50% split to each location is assumed. However, regarding pulp production 10% of material is taken to the reservoir, and 45% to each of the other two specified in-filling areas.
- If material leaving a crushing facility is bound for two different locations, a 50% split is assumed. However, regarding pulp production 10% of material is taken to the reservoir, and 45% to each of the other two specified in-filling areas.
- Input / output tonnage to / from each crushing facility is assumed to be equal.
- 80% of the total excavated cut rock tonnage is to be subject to crushing (after Jaakko Poyry).
- Blasting will be undertaken once daily between 0900 to 1000 hours.

- Material to be shipped off-site after the bulk earthworks are completed is to be stored in the spoil stockpile in the wharf area.

Figure 3.1 illustrates the site bulk earthwork development and can be examined in conjunction with Appendix A to identify the road sections relevant to each haul route in each of the four site areas.

The emission rates and mitigation techniques discussed within this assessment have been obtained from the following sources:

- Emission Estimation Technique Manual for Mining, Ver. 2.3, National Pollutant Inventory, December 2001, Commonwealth of Australia.
- Particulate Matter and Mining (Interim Report), NSW Minerals Council and Holmes Air Sciences, July 2000.
- Air Pollution Engineering Manual, U. S. Air & Waste Management Association, Edited by Buonicore, A. J. and Davis, W. T. (1992).
- Compilation of Air Pollutant Emission Factors, AP. 42, 4th Edition 1998, USEPA, Research Triangle Park, North Carolina, 27711. See also: http://www.epa.gov/ttn/chief/ap42/index.html.

These publications detail a range of standard mitigation measures designed to minimise the emission of dusts to air so as to minimise the risk to public health and amenity. This emissions inventory, together with dispersion modelling, has been used to assess the potential short-term impacts at the works area, and at the residential areas in close proximity to the site.

Appendix A provides an explanation of site terminology used within this report in addition to a description of material movements.

Appendix A additionally provides the determined average vehicle transport induced dust emission rates for the site preparation phase with transport of material from excavation areas to filling areas, including crushing. Also detailed are the required material volumes and the period over which that material must be transported with vehicles of a specific capacity. This information has been utilised in Table 3.2.

Table 3.2 below details the average PM10 emission rate for all site activities including vehicle / haul road emissions, material handling, static material processing, and wind erosion. These are based upon the sequencing periods as provided by Jaakko Poyry.

Table 3.2: Emissions inventory for PM10 emissions from the site bulk earthworks.

Activity	Process	PM10 Emission Rate	Basis and Assumptions	Reference
Material transport	Vehicle induced dust along haul routes over unsealed surfaces	3.72 g/sec, 22 hr/day (294.6 kg/day)[1]	For unsealed surfaces, assume 75% control over uncontrolled emission rate of 0.96 kg/VKT (PM10). Requires Level 2 watering (>2 L/m^2/hr) (as a supplement to natural processes) to maintain a minimum moisture content of 3.5% on the unsealed surface. This will reduce proportionally for average vehicle speeds of less than 25 km/hour. Regular maintenance of haul routes.	2, 3, 4
Blasting / Excavation / In-filling	Blasting	3.31 g/sec, over 1 hour (11.9 kg/day over 1 hr)[2]	Assume maximum of one blast per day, over a max area of 0.03 Ha, with a drill depth of 5m, and a typical moisture content of 10%. Averaged over 2 hours (0900 – 1000h); 11.9 kg/blast.	1
	Grader	0.98 g/sec, 22 hr/day (77.4 kg/day)[1]	Screening level of 0.22 kg/VKT, with average speed of 8 km/hr, 22 hrs per day, 2 graders.	1, 3
	Bulldozer	4.44 g/sec, 22 hr/day (352.0 kg/day)[1]	Screening level of 4 kg/hr/dozer PM10, 4 dozers, 22 hrs per day Assumes 10% surface silt content and 2% surface moisture (by weight).	1
	Excavation / Front end loader / shovel into trucks	4.70 g/sec, 22 hr/day (371.9 kg/day)[1]	Screening level of 0.012 kg PM10 per ton of material loaded or unloaded – all excavated material.	1
	Truck dumping	1.68 g/sec, 22 hr/day (133.3 kg/day)[1]	Screening level of 0.0043 kg PM10 per ton of material dumped – all excavated material.	1, 3

Activity	Process	PM10 Emission Rate	Basis and Assumptions	Reference
Static processing plant operation	Crushing / screening plants	0.8 g/sec, 22 hr/day [1] (63.4kg/day)	Based on 4 plants with a maximum capacity of 150 ton/hr, with controlled emissions (i.e. water sprays on sprays).	4
	Loading stockpiles	0.29 g/sec, 22 hr/day [1] (22.9 kg/day)	Screening level of 0.0017 kg/t, based on all crushed and spoil material.	1
	Unloading stockpiles	2.07 g/sec, 22 hr/day [1] (164.15 kg/day)	Screening level of 0.013 kg/t, based on all crushed material.	1
Wind	Erosion of disturbed soil in excavation / in-filling areas	0.14 g/sec, 24 hr/day [3] (12.0 kg/day)	Screening level of 0.2 kg/ha/day, excavation / in-filling disturbed area of ~60 ha.	1

Total: 1503.6 kg/day

[1] 22 hr/day, 2 x shifts: 0700 – 1800 hours and 1900 – 0600 hours.

[2] 1 hr/day

[3] All time (24 hr)

References:

1. Particulate Matter and Mining (Interim Report), NSW Minerals Council and Holmes Air Sciences, July 2000.
2. Air Pollution Engineering Manual, U.S. Air & Waste Management Association, Ed. Buonicore, A. J. and Davis, W. T. (1992).
3. Emission Estimation Technique Manual for Mining, Ver. 2.3, National Pollutant Inventory, December 2001, Commonwealth of Australia.
4. Compilation of Air Pollutant Emission Factors, AP. 42, 4th Edition 1998, USEPA, Research Triangle Park, North Carolina, 27711. See also: http://www.epa.gov/ttn/chief/ap42/index.html.

4. Ambient Background Sources of Dust

Ambient sources of particulate matter originate from local heavy industry, domestic wood heating (typically during the night and early morning in autumn / winter), dust from agricultural activities, and motor vehicles.

Modelling of ambient background levels of PM10 have been conducted by GHD (for details see GHD report prepared for Gunns Limited: Proposed Pulp Mill – Bell Bay: Impact on Air Quality – Interim IIS) and reviewed by PAE (Pacific Air & Environment) (for details see Lawrence, K.. and Ormerod, R. 2005. Review of Air Dispersion Modelling and Background Monitoring data for the Proposed Bell Bay Pulp Mill).

Background PM10 levels at Gunns AQMS were found to be under-predicted for 2004 data and therefore 5 months of measured 2005 data (July – November) was utilised in preparing the ambient PM10 contribution.

The highest measured 24-hour PM10 concentration of 28.8 $\mu g/m^3$ at Gunns AQMS has been considered as a lower level to enable a conservative peak 24-hour average ambient background PM10 level of 50 $\mu g/m^3$ to be proposed for discussion purposes. Such a conservative estimation indicates that total PM10 levels are likely to be lower than those presented in this assessment since peak predicted levels would need to combine with a conservative estimation of peak background levels.

On the basis of this assumption discussion will be directed to the position of the 100 $\mu g/m^3$ contour on Figure 6.1 because when including a background PM10 level of 50 $\mu g/m^3$ this contour is now representative of the 150 $\mu g/m^3$ DPIWE design criterion.

5. Modelling

5.1 Meteorological Modelling

The regional and local scale three-dimensional meteorology used in the modelling process to prepare this document is fully described in the GHD report prepared for Gunns Limited (for details see GHD appendix report: Proposed Pulp Mill – Bell Bay: Impact on Air Quality – Interim IIS).

5.2 Emissions Modelling

The emissions for each activity detailed within the emissions inventory tabulated in Table 3.2 were characterised as area sources within the model, with initial release geometries representative of each activity. Similar co-existent activities were assigned to individual area sources (e.g. loading and dumping at crushers). Each emission was assigned a diurnal variance representative of the activity, typically 22 hours per day, 7 am to 6 pm and 7 pm to 6 am.

The model was then configured to run with the following main configuration features:

- The hourly 3D winds and spatially varying micrometeorological parameters generated by TAPM for the period 2004, in conjunction with the constant geophysical information used in that model, were used to characterise the transport and dispersion of the emissions to air.
- No wet or dry fallout has been included in the modelling. The emissions of PM10 have been assumed to be gaseous in manner. The emission controls implicit in the emissions inventory include watering to obtain required moisture levels. The moisture content of excavated material also includes contributions from natural processes as well as the in-situ material moisture contents upon excavation.
- Ground level concentrations were predicted on a 125 m resolution receptor grid throughout the area of interest.

The hourly model predictions for each emission scenario, at each receptor, were then used to create consecutive 24-hourly average predictions and these were then ranked from highest to lowest. The highest predictions were then contoured and these contours were overlaid upon a map of the area for interpretation.

6. Results

6.1 Maximum Predicted PM10 Concentration

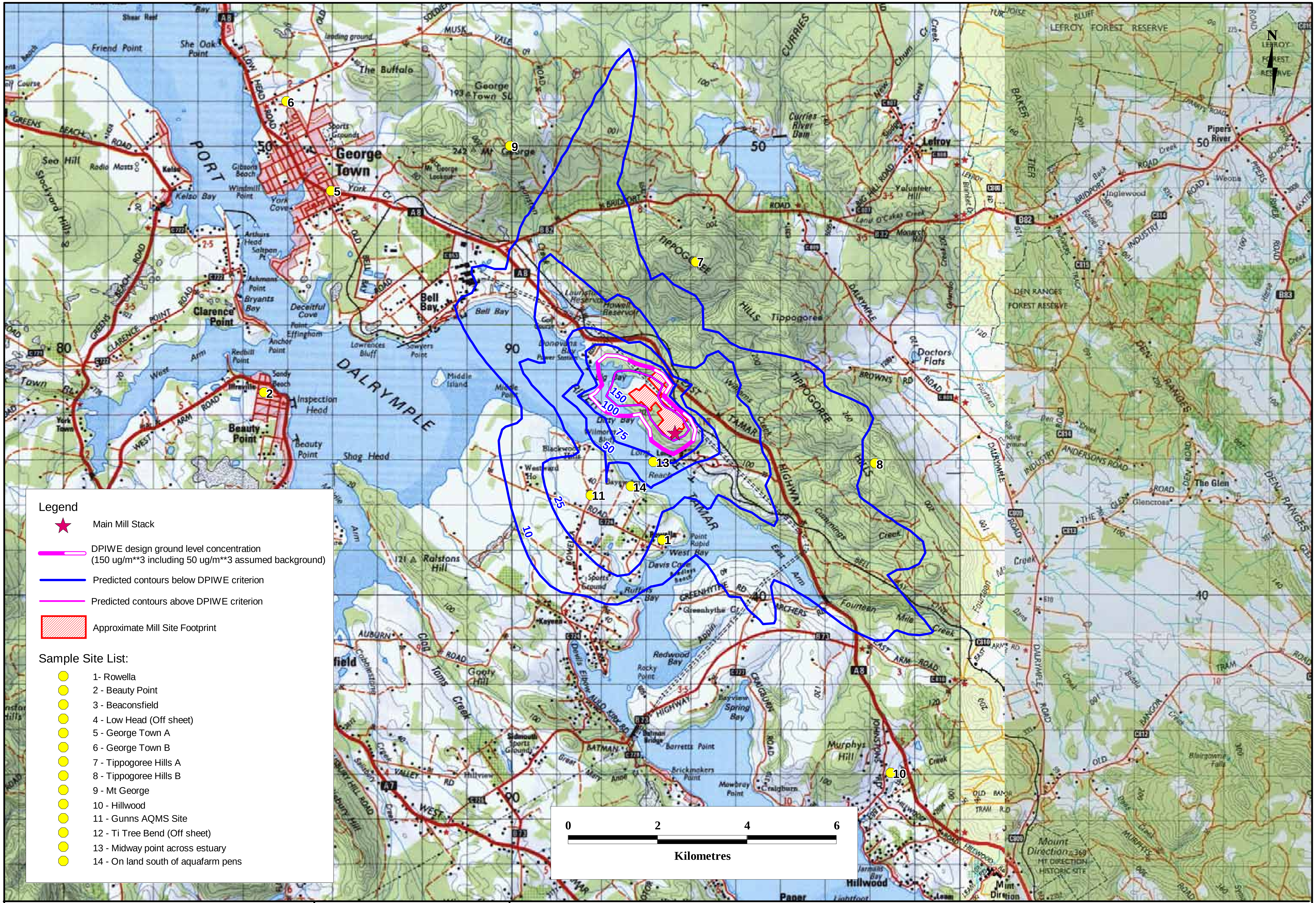
Figure 6.1 illustrates contours of the highest 24-hour average predicted ground level concentrations of PM10 arising from site bulk earthworks. That is, the contours represent the worst-case PM10 'signal' from the earthworks without the inclusion of the ambient background. The presented contour levels are 10, 25, 50, 75, 100 and 150 µg/m^3. As discussed in Section 4, for the purposes of this report the 100 µg/m^3 contour (shown bolded in Figure 6.1) is representative of the position of the 150 µg/m^3 criterion contour when a concurrent conservative background level of 50 µg/m^3 is assumed.

It can be seen that the criterion contour extends around the site but does not extend to the nearest townships of Rowella and Bell Bay whilst isolated sensitive receptors located at Donovans Bay and sites northwest of Rowella (on the peninsula) show levels of ≤100 µg/m^3. Therefore in both instances the DPIWE design criterion of 150 µg/m^3 is clearly achieved. It is evident that Bell Bay displays PM10 concentrations of <60 µg/m^3 and this is significantly lower than that required by DPIWE. Similarly, PM10 concentrations at Rowella of ~75 µg/m^3 are also identified as considerably under the design criterion of 150 µg/m^3.

A rapid 'drop-off' of dust (as PM10) is apparent with increasing distance from the site, particularly to the east. It is evident that the largest area off-site to indicate a concentration of greater than 150 µg/m^3 is to the northwest of the mill site in the vicinity of Big Bay; however there are no sensitive receptors located in this region. The closest receptor with a concentration >100 µg/m^3 and <150 µg/m^3 is that of the power station at Donovans Bay (125 µg/m^3) although this industrial site does not encompass any permanent dwellings and is not considered a 'sensitive site'.

Particulate matter impacts are elongated northwest - southeast as a result of the local topography whereby the Tippogoree Hills act to channel the flows and restrict PM10 concentrations to the north; this is apparent when inspecting the PM10 contour restrictions at the base of the elevated topography to the northeast of the mill site. Greater expansion of the PM10 contours is apparent south of the site across the estuary, when compared to those north of the site, although concentrations of ≤100 µg/m^3 are within allowable levels.

In summary, airborne PM10 concentrations >150 µg/m^3 are confined to a region of ~2 km^2 centred on the proposed pulp mill site.



DATA SOURCE				
Prepared.	DP	15/02/06	Workspace	Air Quality Sample Sites PM10_v2.WOR
Checked.	AML	15/02/06	Location	M:\31\16408\GIS\Workspaces
Approved.	AML	15/02/06	Map Grid	MGA 94 (Zone 55)

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Project: **Gunns Pulp Mill**

Title: **Figure 6.1: Maximum predicted dust impacts (as PM10) during bulk earthwork construction activities (excluding background contribution) over a 6 month period (meteorology for 2004 used).**

Project No: **31 / 16408** Date: **15/02/06** **A3** Scale: **1:75000** Sh **1** of **1** Rev. **0**

7. Conclusions and Recommendations

An assessment of the impact on nearby residential areas of dust emissions (as PM10) to air from the civil works associated with the Gunns Pulp Mill construction project has been conducted. The assessment has focused on the potential short-term (24-hour average) impact of dust as a supplement to an indicative existing background level.

The 24-hour average predictions of ground level concentrations of PM10 particulates indicate that:

» the DPIWE design criterion for dust (as PM10) of 150 µg/m^3 is unlikely to be exceeded at the nearest dwelling or other sensitive site;

» the DPIWE design level (including 50 µg/m^3 background PM10 contribution) is predicted:

  - o to approach no closer than ~2 km from Rowella to the southeast of the works;
  - o to approach no closer than ~3 km from Bell Bay to the northwest of the works;

A separate Strategic Environmental Management Plan (EMP) will be prepared for the pulp mill as detailed in Volume 4 of the draft IIS, and this will discuss in greater detail the pertinent PM10 remediation activities.

The use of directional water cannons and other moisture controls across the site (for the relevant processes) to reduce PM10 concentrations will be described in the EMP.

One activity has been identified as having significant potential to contribute to the impact of PM10 dust particulates at nearby receptors. This is:

» vehicle movements along unsealed haul roads. Required actions, as noted in Table 3.2, will include maintaining sufficient moisture content through level 2 watering (>2 L/m^2/hour inclusive of natural processes). The quoted PM10 dust emission rates will reduce proportionally for average vehicle speeds of less than 25 km/hour.

In general, for the material haul routes, the modelling conducted has assumed high levels of dust control. As a minimum, this level of control will be defined in the EMP (as discussed above) with follow-up compliance checking. If vigilance is not taken to consistently and promptly reduce visible dust emissions from the unsealed haul routes then it is likely that the frequency of exceedance of the criterion level concentrations will increase.

Over a general 24-hour period wind erosion is not considered to be a problem. However, the sudden onset of frontal systems that involve sharp increases in wind speed have the effect of quickly stripping the fine surface silt content from exposed non-vegetated or non-rehabilitated soil, particularly if the silt content on that soil is high through pulverisation from recent mechanical activity. This results in short-term (in the order of minutes) peaks in PM10 dust concentrations. It is recommended that the EMP will contain conditions that the Works Manager is provided with daily weather updates that will contain warnings of the sudden onset of strong winds. The Works Manager could then take steps to ensure that all exposed soil areas that could reasonably be subject to wind erosion are consolidated by the timely application of water sprays.

The Gunns AQMS, that records concurrent wind direction and concentrations of PM10, will provide a measure of the compliance status of the civil works with respect to the DPIWE criterion.

Appendix A

Explanation of Site Terminology

Description of Material Movement

Calculation of Vehicle Induced PM10 Emission Rates

Table A.1: Site terminology and material movement

Area of site	Haul route	Material origination	Material final destination
Area 1	A	Pre-casting / fabrication	Pre-casting / fabrication
Pre-casting / fabrication	B	Pre-casting / fabrication	Pre-casting / fabrication
	C	Pre-casting / fabrication	Pre-casting / fabrication
	D	Pre-casting / fabrication	Pre-casting / fabrication
Area 2	A	ETP / chemical	ETP / chemical
ETP / chemical	B	ETP / chemical	ETP / chemical & Wharf
	C	ETP / chemical	ETP / chemical & Wharf
	D	ETP / chemical	ETP / chemical
Area 3	A	Pulp production	Pulp production
Pulp production	B	Pulp production	Pulp production, ETP / Chemical & Reservoir
	C	Pulp production	Pulp production, ETP / Chemical & Reservoir
	D	Pulp production	Pulp production
	E	Water from reservoir	Pulp production
Area 4	A	Wharf	Wharf
Wharf	B	Wharf	Wharf
	C	Wharf	Wharf
	D	Wharf	Wharf

Haul route	Haul route description
A	Transport of material from excavation to crushing
B	Transport of material from crushing to in-filling
C	Transport of material directly from excavation to in-filling
D	Transport of spoil material to stockpile
E	Transport of water from reservoir to site

Table A.2 below illustrates the average dust (as PM10) emission rate for each haul route section as the result of the required vehicle transits.

Table A.2: Determined average vehicle transport induced dust emission rates for the site preparation phase with transport of material from excavation areas to filling areas, including crushing. Also detailed are the required material volumes and the period over which that material must be transported with vehicles of a specific capacity.

Area of site	Total earthwork tonnage to be transported (millions of tonnes)	Haul route	Percentage of tonnage for activity	Approximate number of working days	Approximate number of working hours
Area 1	0.8	A, B	80 (Cut rock)	188	4136
		C	20 (cut rock) + 100 (cut silt)	188	4136
		D	5	188	4136
Area 2	0.6	A, B	80 (Cut rock)	188	4136
		C	20 (cut rock) + 100 (cut silt)	188	4136
		D	3	188	4136
Area 3	3.7	A, B	80 (Cut rock)	188	4136
		C	20 (cut rock) + 100 (cut silt)	188	4136
		D	2	188	4136
Area 4	0.8	A, B	80 (Cut rock)	188	4136
		C	20 (cut rock) + 100 (cut silt)	188	4136
		D	2	188	4136

Area of site	Haul route	Capacity of vehicles (tonne unless stated)	Approximate number of work hours	Approximate number of trips	Trips per hour	Trips per day without percentage split
Area 1	A	64	4136	5092	1.2	27.1
	B	64	4136	5092	1.2	27.1
	C	64	4136	6788	1.6	36.1
	D	64	4136	620	0.2	3.3
Area 2	A	64	4136	3526	0.9	18.8
	B	64	4136	3526	0.9	18.8
	C	64	4136	4859	1.2	25.8
	D	64	4136	271	0.1	1.4
Area 3	A	64	4136	23560	5.7	125.3
	B	64	4136	23560	5.7	125.3
	C	64	4136	32885	8.0	174.9
	D	64	4136	1383	0.3	7.4
	E	25000 litres	4136	940	0.2	5.0
Area 4	A	64	4136	4913	1.2	26.1
	B	64	4136	4913	1.2	26.1
	C	64	4136	6874	1.7	36.6
	D	64	4136	275	0.1	1.5

Road section	Number of passages per trip for each activity																
	Area 1				Area 2				Area 3					Area 4			
	A	B	C	D	A	B	C	D	A	B	C	D	E	A	B	C	D
1	1	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
7	0	0	0	0	1	0	2	1	0	1	1	0	0	0	0	0	0
8	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0
10	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	1	2	0	1	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	1	2	0	1	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1
16	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0

Road section	Number of passages per day for each road section including percentage split																
	Area 1				Area 2				Area 3					Area 4			
	A	B	C	D	A	B	C	D	A	B	C	D	E	A	B	C	D
1	27.1	0.0	36.1	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	13.5	18.1	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	27.1	13.5	18.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	112.8	157.4	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.4	78.7	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.4	78.7	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	18.8	0.0	36.1	1.4	0.0	56.4	78.7	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	18.8	9.4	18.1	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	9.4	18.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.1	36.6	0.0
10	27.1	27.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	18.8	18.8	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	9.4	18.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	125.3	125.3	0.0	7.4	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.1	26.1	0.0	1.5
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5	17.5	0.0	5.0	0.0	0.0	0.0	0.0

Road section	Number of passages per day	Traverse length (km)	PM10 emission rate (kg/vkt)	Total daily PM10 (kg)	PM10 emission rate (g/sec)	75% Abatement
1	66	0.6	0.96	37.66	0.48	0.12
2	35	0.6	0.96	20.30	0.26	0.06
3	59	0.3	0.96	15.21	0.19	0.05
4	270	1.4	0.96	371.99	4.70	1.17
5	135	1.4	0.96	176.40	2.23	0.56
6	135	0.5	0.96	62.00	0.78	0.20
7	191	1.0	0.96	190.00	2.40	0.60
8	48	0.4	0.96	17.47	0.22	0.06
9	90	0.8	0.96	67.14	0.85	0.21
10	54	0.6	0.96	30.68	0.39	0.10
11	39	0.3	0.96	11.37	0.14	0.04
12	27	0.8	0.96	22.28	0.28	0.07
13	0	0.8	0.96	0.00	0.00	0.00
14	258	0.3	0.96	75.74	0.96	0.24
15	54	0.6	0.96	32.98	0.42	0.10
16	35	1.4	0.96	47.07	0.59	0.15

Total PM10 (g/sec) over 22 hours	14.88	3.72

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