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Moorebank Precinct West Intermodal Terminal Facility - Modification

Air Quality Assessment

SIMTA

SYDNEY INTERMODAL TERMINAL ALLIANCE

Part 4, Division 4.1, State Significant Development

June 2016

Intended for
Arcadis

Document type
Report

Date
May 2016

Project Number
AS121964b

MODIFICATION PROPOSAL
ASSESSMENT OF AIR QUALITY IMPACTS

RAMBOLL ENVIRON

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Revision	Date	Made by	Checked by	Approved by	Signed
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1. INTRODUCTION

The Moorebank Intermodal Company (MIC) has received Concept Plan Approval, under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act* 1979 (EP&A Act), to develop the Moorebank Intermodal Terminal Project (MPW Project) on the western side of Moorebank Avenue, Moorebank, in south-western Sydney (the MPW site).

On 4 June 2015, the MIC, with the approval of the Commonwealth Government, entered an agreement with the Sydney Intermodal Terminal Alliance (SIMTA) under which SIMTA will obtain approvals, build and operate all stages of the MPW Project at Moorebank. SIMTA is seeking approval to modify the Moorebank Intermodal Company (MIC) Concept Proposal and Early Works (Stage 1) approval (SSD_5066) (MPW Concept Plan Approval).

The Environmental Impact Assessment (EIS) prepared for the Concept Plan Approval identified that fill material required for the development of the MPW site would be largely sourced from excavation within the MPW site and hence imported fill volumes for the project would be small. Subsequent civil design development for the MPW Project has identified that fill required to be imported to the MPW site is estimated at 1,600,000 cubic metres (m^3). It is proposed to undertake additional site preparatory works, including the import, placement and stockpiling of clean fill, as a modification to the approved Stage 1 (Early Works).

This Air Quality Assessment (AQA) has been prepared to support an application made under section (s) 96(2) of the EP&A Act to modify the MPW Concept Plan Approval (SSD_5066).

1.1 Proposed works

It is proposed to undertake additional site preparatory works, including the import, placement and stockpiling of clean fill, as a modification to the approved Early Works. The proposed modification would result in an intensification of activity associated with the approved Early Works. The works, for which a modification is sought (the Modification Proposal), include the following:

- Minor vegetation removal (not Endangered Ecological Communities, slightly above that provided within Early Works).
- Import, by truck, of approximately 1,600,000m^3 of fill (from offsite locations).
- Crushing and screening of oversized materials and demolition materials stockpiled during Early Works, for direct placement on site.
  Stripping and stockpiling of topsoil within the area of impact, cut and fill (within the primary earthworks areas) and stockpiling of clean fill within the primary earthworks areas (see **Figure 1**: Location and extent of modification).
- Temporary sediment and erosion control works, including onsite detention basins (greater than those envisaged within the Early Works).
- Establishment of temporary internal haulage routes, construction compounds (including, but not limited to, a materials crusher and other plant and equipment) (additional to those included within Early Works).

It is anticipated that the Modification Proposal works would be undertaken during the hours identified in **Table 1-1**. These hours extend those identified in the MPW Concept Plan documentation to include the evening period between 6pm-10pm on weekdays and Saturday afternoons between 1pm and 6pm.

Table 1-1: Proposed working hours

Day	Proposed Hours	Activities
Weekdays	6:00am – 7:00am	• Material Delivery.
	7:00am – 6:00pm	• Material Delivery • Direct Placement; and

Day	Proposed Hours	Activities
		• Stockpiling; and • Crushing.
	6:00pm – 10:00pm	• Material Delivery; and • Direct Placement; or • Stockpiling.
Saturdays	7:00am – 8:00am	• Material Delivery; and • Direct Placement; or • Stockpiling.
	8:00am – 1:00pm	• Material Delivery • Direct Placement; and • Stockpiling; and • Crushing.
	1:00PM – 6:00PM	• Material Delivery; and • Direct Placement; or • Stockpiling.

Figure 1 shows the location and extent of the Modification Proposal, which would occur largely within the footprint of the approved Early Works.

1.2 Assessment purpose

This air quality assessment report has been prepared to provide further information on, and environmental assessment of, the Modification Proposal. The Modification Proposal has been reviewed against the documentation prepared for the MPW Concept Plan Approval, the Secretary's Environmental Assessment Requirements (SEARs) issued for the MPW Concept Plan (SSD_5066) and applicable legislation and guidelines to determine whether the works and associated impacts of the Modification Proposal are 'substantially the same development' as that proposed under the MPW Concept Plan Approval.

The assessment builds on previous air quality impact assessment (AQIA) prepared for the MPW Concept Plan and Supplementary Response to Submissions (SRtS) revised project report (ENVIRON, 2014; ENVIRON, 2015a).

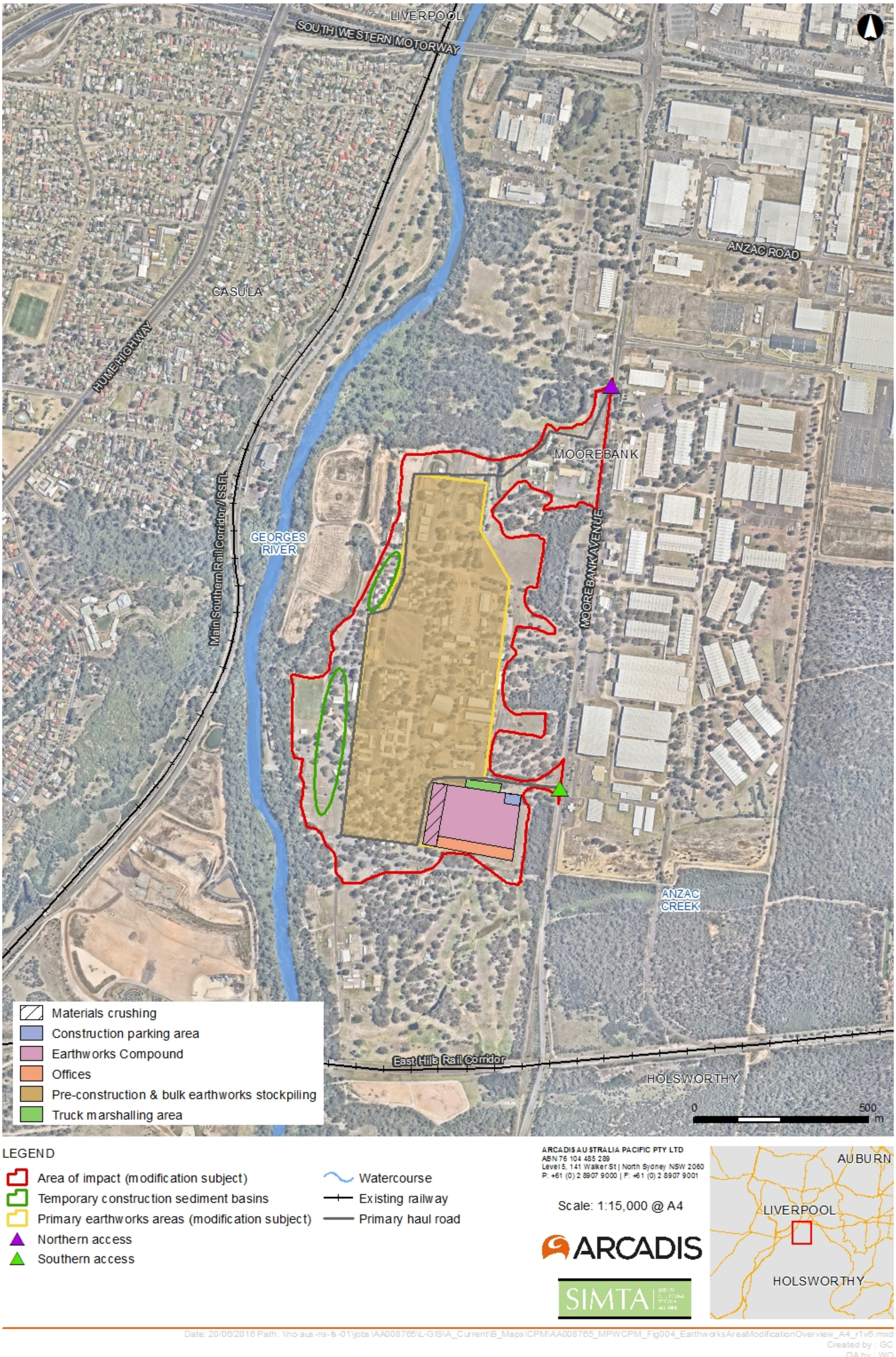

Figure 1: Location and extent of modification

2. STUDY APPROACH

2.1 Assessment approach

The air quality assessment follows guidelines recommended in the NSW Environment Protection Authority (EPA) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* ("the Approved Methods") (NSW EPA, 2005a).

Local air quality impacts are assessed using a Level 2 assessment approach, in general accordance with the Approved Methods, as follows:

- Emissions are estimated for all project related activities.
- Dispersion modelling using a regulatory dispersion model is used to predict ground level concentrations for key pollutants at surrounding sensitive receivers.
- Cumulative impacts are assessed, taking into account the combined effect of existing baseline air quality, other local sources of emissions, reasonably foreseeable future emissions and any indirect or induced effects.

The assessment approach is consistent with the AQIA prepared for the MPW Concept Plan (ENVIRON, 2014) and the SRtS revised project AQIA (ENVIRON, 2015a). It is noted that the Early Works were not modelled in either of these assessments, on the basis that the footprint was much smaller than the construction footprint for subsequent phases, which were assessed.

This assessment focuses on emissions of particulate matter (PM) from material handling, which is the key pollutant for activities associated with the Modification Proposal. The combustion of diesel in plant and equipment also results in combustion-related emissions including fine particles, oxides of nitrogen (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), carbon dioxide (CO_2), volatile organic compounds (VOCs) and poly-cyclic aromatic hydrocarbons (PAHs).

However, with the exception of fine particles, combustion emissions have not been quantitatively assessed for this report, as they would not result in significant off-site concentrations and compromise ambient air quality goals. This is supported by the modelling presented in the previous AQIA prepared for the MPW Concept Plan (ENVIRON, 2014) and the SRtS revised project report (ENVIRON, 2015a).

2.2 Assessment criteria

Air quality criteria for airborne particulate matter (PM) in Australia are given for particle size metrics including "total suspended particulate matter" (TSP), PM_{10} and $PM_{2.5}$[1]. Impact assessment criteria are prescribed by the NSW EPA for TSP and PM_{10}, but not for $PM_{2.5}$. Under the latest revision to the National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM), national reporting standards are prescribed for $PM_{2.5}$ and PM_{10} (NEPC, 2015).

It is noted that the purpose of the AAQ NEPM is to attain '*ambient air quality that allows for the adequate protection of human health and wellbeing*', and compliance with the AAQ NEPM is assessed through air quality monitoring data collected and reported by each state and territory. The AAQ NEPM standards are therefore not necessarily applicable to the assessment of impacts of emissions sources on individual sensitive receptors.

For the purpose of this report, impacts are preferentially assessed against the NSW EPA's impact assessment criteria. In the case of $PM_{2.5}$, where impact assessment criteria do not exist, impacts are reported against the latest AAQ NEPM standards.

The NSW EPA's impact assessment criteria and AAQ NEPM reporting standards for PM are presented in **Table 2-1**.

[1] Particulate matter with an aerodynamic diameter of less than 10 µm and 2.5 µm respectively.

Table 2-1: Impact assessment criteria for PM

PM metric	Averaging period	Concentration ($\mu g/m^3$)	Purpose
TSP	Annual	90	NSW EPA impact assessment criteria
PM_{10}	24 hour	50	NSW EPA impact assessment criteria
		50	AAQ NEPM national reporting standard
	Annual	30	NSW EPA impact assessment criteria
		25	AAQ NEPM national reporting standard
$PM_{2.5}$	24 hour	25	AAQ NEPM national reporting standard
		20	AAQ NEPM goal for 2025
	Annual	8	AAQ NEPM national reporting standard
		7	AAQ NEPM goal for 2025
The Approved Methods specifies that the impact assessment criteria for criteria pollutants are applied at the nearest existing or likely future off-site sensitive receptor and compared against the 100th percentile (i.e. the highest) dispersion modelling prediction. Both the incremental and cumulative impacts need to be considered (consideration of existing ambient background concentration is required).			

The Approved Methods also prescribes nuisance based goals for dust deposition, which relate to amenity type impacts such as soiling of exposed surfaces. The NSW EPA impact assessment criteria for dust deposition are summarised in **Table 2-2**, illustrating the maximum increase and total dust deposition rates which would be acceptable so that dust nuisance can be avoided.

Table 2-2: Dust deposition criteria

Pollutant	Maximum Increase in Dust Deposition	Maximum Total Dust Deposition Level
Deposited dust (assessed as insoluble solids)	2 g/m^2/month	4 g/m^2/month

2.3 Dispersion model selection

Local air quality impacts are modelled using AERMOD. AERMOD is the US EPA's recommended steady-state plume dispersion model for regulatory purposes and is designed to handle a variety of pollutant source types, including surface and buoyant elevated sources, in a wide variety of settings such as rural and urban as well as flat and complex terrain. AERMOD replaced the Industrial Source Complex (ISC) model for regulatory purposes in the US in December 2006. Ausplume, a steady state Gaussian plume dispersion model developed by the Victorian EPA and recommended in the Approved Methods for simple near-field applications, is largely based on the ISC model. Compared to ISC and Ausplume, AERMOD represents an advanced new-generation model, which requires additional meteorological and land use inputs to provide more refined predictions.

AERMOD has been approved by the EPA for use in NSW on a number of projects and is likely to be included in the EPA's impending review of the Approved Methods.

2.4 Cumulative impacts

The Modification Proposal would occur at the same time as the Early Works, identified and approved as part of the MPW Concept Plan Approval. Construction phases of the MPE Stage 1 Proposal would also occur during the Modification Proposal. Cumulative impacts are assessed, therefore, by combining the contribution from the Modification Proposal with the following sources:

- The existing ambient air quality environment, described based on baseline monitoring data obtained from the nearby Office of Environment and Heritage (OEH) Liverpool monitoring site.
- Other proposed future activity including aspects of the Early Works not included in the Modification Proposal and the relevant phase of the MPE Stage 1 Proposal.

2.5 Assessment locations

A number of residential suburbs are located in proximity to the MPW site. Locations representative of these residential areas and other sensitive receptors such as schools and day care centres have also been identified and selected as discrete sensitive receptors. The locations are consistent with those reported in the EIS for the MPW Concept Proposal and the MPE Stage 1 Proposal (ENVIRON, 2014; ENVIRON, 2015b).

The assessment locations are shown in **Figure 2** and listed in **Appendix 1**.

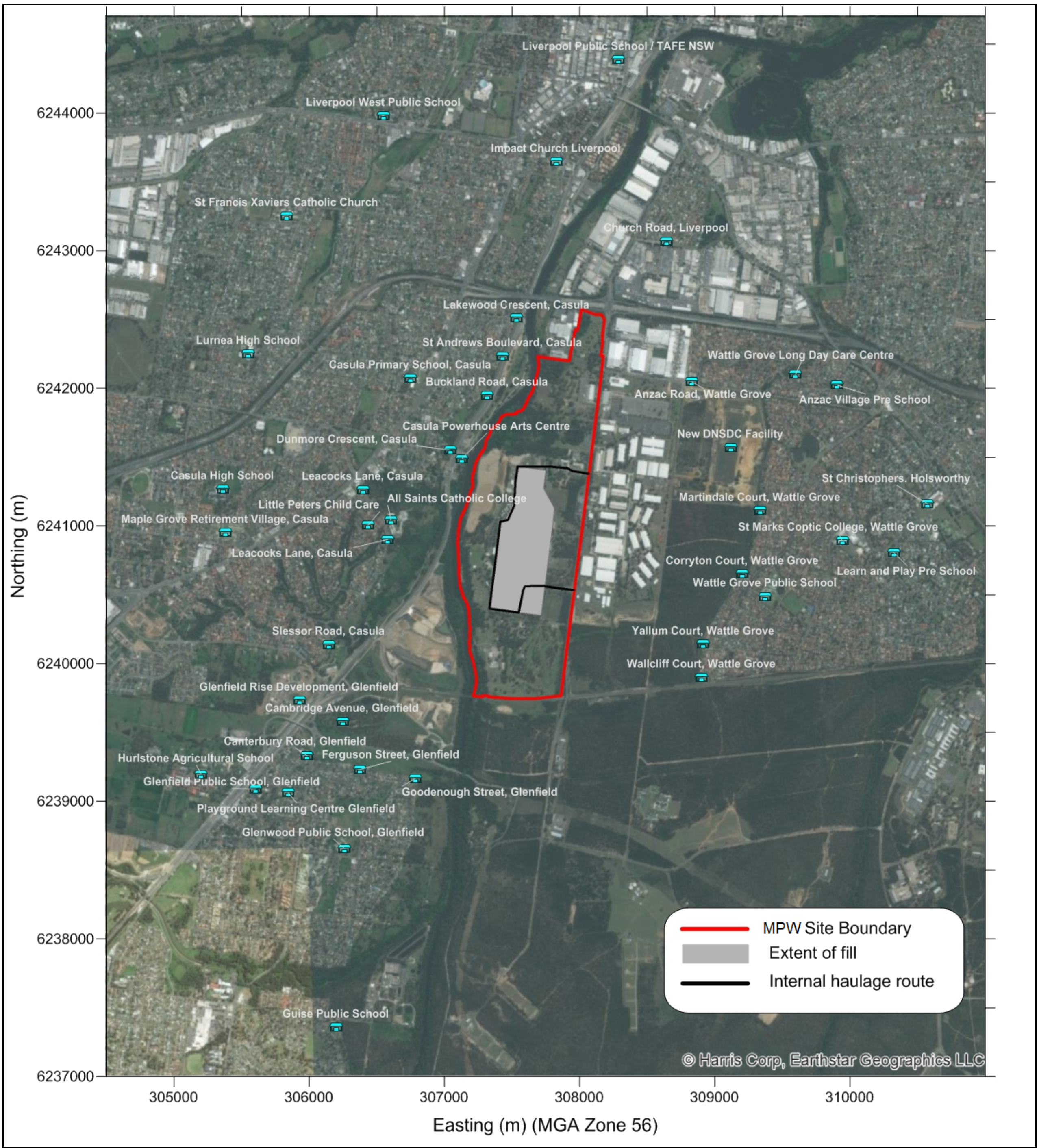

Figure 2: Receptor locations

3. EXISTING ENVIRONMENT

3.1 Meteorology

Meteorological mechanisms govern the generation, dispersion, transformation and eventual removal of pollutants from the atmosphere. To adequately characterise the dispersion meteorology of a region, information is needed on the prevailing wind regime, ambient temperature, rainfall, relative humidity, mixing depth and atmospheric stability.

Previous air quality assessments demonstrated that the OEH Liverpool data are representative of the local area, largely due to the proximity of the station to the site, the elevation at which it is sited and the uncomplicated intervening topography (ENVIRON, 2014; ENVIRON, 2015b).

An analysis of the most recent 5 years of wind data from the OEH Liverpool site shows relatively little inter-annual variability in wind speed and direction between 2011 and 2014, with a slight shift in 2015 from southwest to westerly flow (see **Appendix 2**). The 2013 meteorological dataset used in the SIMTA AQIA (ENVIRON, 2015b) remains a suitable representative dataset for modelling, and is adopted for this assessment. Further description of the meteorological input file can be found in ENVIRON (2015b).

3.2 Baseline ambient air quality

The baseline ambient air quality environment is described based on monitoring data obtained from the Office of Environment and Heritage (OEH) Liverpool monitoring site, located approximately 2.5 km northwest of the site. A summary of the monitoring data for the previous five years is presented in **Table 3-1**.

Annual mean PM_{10} concentrations range from 18 µg/m³ to 21 µg/m³ and on average over the past 5 years baseline concentrations are 77% of the AAQ NEPM standard. Annual mean $PM_{2.5}$ concentrations range from 6 µg/m³ to 9 µg/m³ and on average over the past 5 years baseline concentrations are 103% of the AAQ NEPM standard. Exceedances of the 24-hour average reporting standards for both PM_{10} and $PM_{2.5}$ occur in most years, as shown in **Table 3-1**.

Table 3-1: Summary statistics for PM_{10} and $PM_{2.5}$

Year	PM_{10} (µg/m³)			$PM_{2.5}$ (µg/m³)		
	Annual mean	Daily maximum	Number of days over goal	Annual mean	Daily maximum	Number of days over goal
2011	18.2	68.8	1	5.9	38.0	2
2012	19.8	42.5	0	8.5	24.9	0
2013	21.1	98.5	3	9.5	73.8	2
2014	19.1	40.8	0	8.7	24.3	0
2015	18.6	68.6	1	8.5	32.2	2

Existing concentrations of PM_{10} and $PM_{2.5}$ for the Liverpool area are strongly influenced by vehicle emissions and wood heaters. Evidence of this can be seen by plotting the mean hourly PM_{10} and $PM_{2.5}$ by hour of the day and by month of the year for the previous 5 years. **Figure 3** shows the mean hourly concentration by hour of the day (left panel), month of the year (middle panel) and day of the week (right panel).

For PM_{10} there is a morning peak around 7am-8am, an afternoon inter-peak at 2-3pm and an evening peak at 6pm, most likely driven by vehicle emissions. PM_{10} concentrations are also clearly lower on Saturdays and Sundays and generally higher in warmer months. For $PM_{2.5}$ the monthly profile shows that $PM_{2.5}$ concentrations are highest in cooler months, which is evidence of the influence of wood heater emissions. The evening peak occurs later than PM_{10}, around 9pm and the morning peak occurs earlier, prior to 6am, again evidence of the influence of wood heaters. Although $PM_{2.5}$ concentrations for the Liverpool area are currently non-compliant with the NEPM AAQ standards, regulatory initiatives such as wood heater compliance programs and improvements in vehicle emission standards are expected to play a role in driving down ambient concentrations in the medium term.

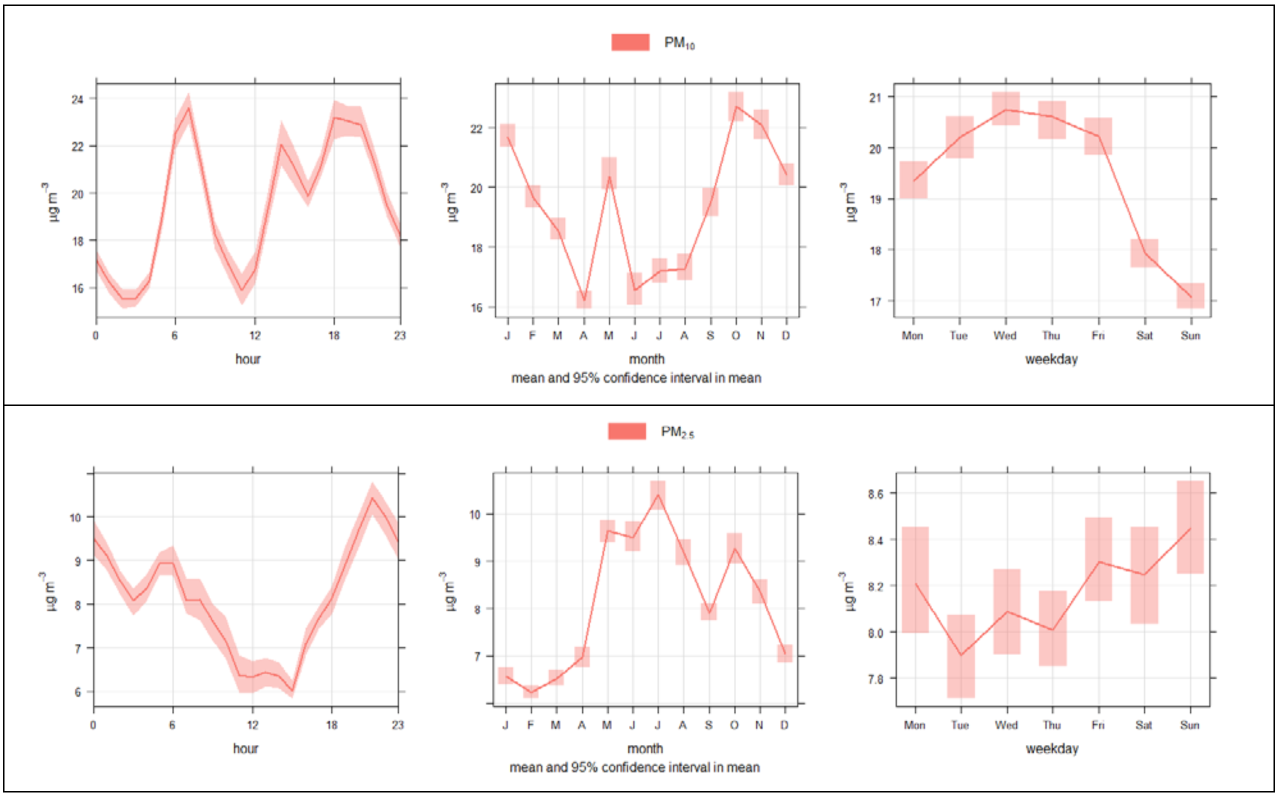

Figure 3: Time variation plot of PM_{10} and $PM_{2.5}$

3.3 Adopted background for assessment

To assess the cumulative impacts for criteria pollutants, annual average background PM concentrations are taken as a 5-year average, to account for any inter-annual variation in background due to different climate conditions. The most recent 5 year period is selected for background (2011-2015). Daily varying background concentrations for the same period 2011-2015 are used to predict cumulative 24-hour PM_{10} and $PM_{2.5}$ impacts, described further in **Section 5.1**.

Table 3-2: Adopted background for cumulative assessment

Pollutant	Averaging period	Adopted background concentration	Source / notes
TSP	Annual	41.2 µg/m³	Derived from OEH Liverpool 5 Year Average (2011-2015) for PM_{10} and a PM_{10}/TSP ratio of 0.47
PM_{10}	24-hour	Daily varying	OEH Liverpool 2011-2015
	Annual	19.4 µg/m³	OEH Liverpool 5 Year Average (2011-2015)
$PM_{2.5}$	24-hour	Daily varying	OEH Liverpool 2011-2015
	Annual	8.2 µg/m³	OEH Liverpool 5 Year Average (2011-2015)
Dust Deposition	Annual	1 g/m²/month	Based on monitoring presented in MPW EIS

4. EMISSION INVENTORY

Emission factors developed by the US EPA[2] have been applied to estimate the amount of dust produced by each construction activity, as follows:

- Hauling of imported fill along unsealed haulage routes onsite.
- Trucks unloading fill material.
- Material re-handle using dozers and excavators.
- Crushing of oversize material.
- Wind erosion from exposed surfaces and stockpiles.

An estimated 1,600,000 m^3 of fill would be imported for a duration of approximately 6 months (converted to 3,520,000 tonnes based on a density of 2.2 t/m^3). A maximum of approximately 22,000 tonnes (with a ramp up and ramp down period) of fill would be imported per day and approximately 745 heavy vehicles would be required at this maximum daily rate.

For assessment of 24-hour average PM_{10} and $PM_{2.5}$, a worst-case emissions scenario has been developed, based on this daily maximum imported fill of 22,000 tonnes per day. For annual averages, emissions are estimated based on the total fill amount (not the daily maximum rate).

The following assumptions have been made for daily activities associated with the Modification Proposal:

- Emissions from hauling are estimated based on an internal haul route travel distance of 2 km for each trip. Each trip is assumed to transport 30 tonnes with a maximum of 745 trips per day.
- Emissions from material handling is based on the maximum of 22,000 tonnes being re-handled up to 3 times (i.e. trucks unloading, front end loaders (FEL) or excavators re-handling).
- A maximum of two dozers would operate 16 hours per day at 70% utilisation.
- A maximum of two graders would operate 16 hours per day at 70% utilisation.
- Approximately 30% of the imported fill would be crushed / screened.
- A total area of 36 hectares is assumed as exposed for wind erosion.
- Water carts are used to control emissions from hauling, graders and for dozers pushing fill material. A control of 75% is assumed for watering on haul roads and 50% for graders and dozers.
- An additional control of 40% is applied to hauling, to account for speed limits keeping average vehicle travel speeds to 40km/hr (Foley et al, 1996) (combined control of 85%).

Emissions from onsite diesel consumption are based on a combined daily diesel consumption of 1,630 litres per hour and all equipment is assumed to operate for 16 hours per day at 70% utilisation. US EPA Tier 1 emission factors (kg/kL) for non-road equipment are used to estimate emissions.

Diesel exhaust emissions associated with on-road trucks are also estimated using aggregated emission factors developed by the NSW EPA for the 2008 Greater Metropolitan Region (GMR) emissions inventory (NSW EPA, 2012b) which are incorporated into the EPA's Air Quality Appraisal Tool (PAEHolmes, 2013). A return trip distance of 5.5 km is assumed (starting from the junction of Moorebank Avenue and the M5) and 745 heavy vehicles per day.

Emissions associated with Early Works are included for cumulative assessment. Emissions are estimated based on an additional 46,134 m^3 (~800 tonnes per day) of material handling (excavators), an additional 2 dozers operating for 16 hours at 70% utilisation and an additional 21 hectares of exposed area for wind erosion.

[2] United States Environmental Protection Agency (US EPA) AP-42 Compilation of Air Pollutant Emission Factors (US EPA, 1998b, US EPA, 2004, US EPA, 2006)

It is noted that the Early Works were not modelled in the AQIA for the MPW Concept Plan or SRtS revised project, as the impacts were expected to be negligible.

A summary of the estimated emissions for the duration of the Modification Proposal is presented in **Table 4-1**. It is likely that the Modification Proposal would coincide with the Engineering Fill phase of the MPE Stage 1 Proposal. Therefore, emissions from this phase are included in the cumulative assessment, based on the information presented in ENVIRON (2015b).

Table 4-1: Emissions estimates for Modification Proposal (kg)

Source / Activity	TSP	PM_{10}	$PM_{2.5}$
Modification Proposal			
Hauling on unsealed roads - fill	86,740	22,288	2,229
Trucks unloading fill	1,217	575	87
Material handling (re-handle with excavators, FEL, stockpile loading)	1,217	2,302	87
Dozers - on fill	7,950	1,676	835
Crushing	634	285	52.8
Screening	1,162	391	26.4
Grader	7,527	2,630	233.3
Diesel exhaust (onsite equipment)	6,408	6,408	6,052
On-road trucks diesel exhaust	278	278	220
Wind erosion (area of fill)	15,254	7,627	1,144
Total	**128,387**	**44,461**	**10,966**
Early Works			
Material handling (excavators on EW)	70	66	5
Dozers - on EW	29,761	6,276	3,125
Wind erosion (additional area for Early Works)	18,199	9,099	1,365
Total			
MPE Stage 1 Engineering Fill Phase	**20,828**	**7,524**	**4,159**

5. IMPACT ASSESSMENT

The modelling results presented for maximum 24-hour average PM_{10} and $PM_{2.5}$ represent the worst case daily emissions combined with potential worst case dispersion conditions for a complete modelling year. For annual average concentrations, the modelling predictions are based on emissions estimates for a full year and scaled by a factor of 0.5 to account for a proposed construction schedule of approximately 6 months.

The modelling results are presented in **Table 5-1**, with the predicted increment representing all modelled sources (Modification Proposal, Early Works and MPE Stage 1).

The predicted increase in annual average PM_{10} is generally less than 1 µg/m³ at all receptors. The highest predicted increase in annual average PM_{10} (1.3 µg/m³) occurs at Casula Powerhouse Arts Centre (R38). When combined with background, there are no cumulative exceedances of the impact assessment criteria for annual PM_{10}.

The maximum predicted 24-hour PM_{10} (13.7 µg/m³) also occurs at Casula Powerhouse Arts Centre. Cumulative 24-hour impacts and comparison with the impact assessment criteria are discussed in **Section 5.1**.

The predicted increase in annual average $PM_{2.5}$ is generally less than 0.5 µg/m³ at all receptors. The highest predicted increase in annual average $PM_{2.5}$ (0.6 µg/m³) occurs at Casula Powerhouse Arts Centre (R38). Background concentrations of $PM_{2.5}$ already exceed the NEPM AAQ reporting standard, therefore cumulative predictions are also above the standard at all receptors. However, it is noted that the Modification Proposal results in a relatively minor increase in $PM_{2.5}$ at all sensitive receptors. The maximum predicted 24-hour $PM_{2.5}$ (6.8 µg/m³) also occurs at Casula Powerhouse Arts Centre. Cumulative 24-hour impacts and comparison with the reporting standards are discussed in **Section 5.1**.

There are no predicted exceedances of the annual average TSP or dust deposition impact assessment criteria.

Table 5-1: MPW Concept modification modelling predictions for selected sensitive receptors

	PM10 (µg/m³)			PM2.5 (µg/m³)			TSP (µg/m³)		Dust Deposition	
	24-Hour Max	Annual Ave		24-Hour Max	Annual Ave		Annual Ave		Annual Ave	
	Increment	Increment	Cumulative	Increment	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative
Goal	50 µg/m³	30 µg/m³		25 µg/m³	8 µg/m³		90 µg/m³		2 g/m²/mth	4 g/m²/mth
Receptor Max	**13.7**	**1.3**	**20.7**	**6.8**	**0.6**	**8.8**	**1.4**	**42.6**	**0.2**	**1.2**
R1	3.6	0.4	19.8	2.5	0.2	8.4	0.4	41.6	0.1	1.1
R2	5.5	0.5	19.9	3.6	0.3	8.5	0.5	41.7	0.1	1.1
R3	8.2	0.8	20.2	4.1	0.4	8.6	0.9	42.1	0.1	1.1
R4	10.8	0.9	20.3	4.2	0.4	8.6	1.4	42.6	0.2	1.2
R5	3.0	0.2	19.6	1.0	0.1	8.3	0.4	41.6	0.1	1.1
R6	4.5	0.4	19.8	1.8	0.2	8.4	0.7	41.9	0.2	1.2
R7	2.9	0.3	19.7	2.1	0.2	8.4	0.3	41.5	0.0	1.0
R8	2.8	0.2	19.6	1.2	0.1	8.3	0.1	41.3	0.0	1.0
R9	4.1	0.2	19.6	1.7	0.1	8.3	0.2	41.4	0.0	1.0
R10	2.3	0.2	19.6	1.6	0.1	8.3	0.2	41.4	0.0	1.0
R11	3.4	0.3	19.7	2.4	0.2	8.4	0.3	41.5	0.0	1.0
R12	3.5	0.4	19.8	2.9	0.2	8.4	0.3	41.5	0.1	1.1
R13	3.1	0.4	19.8	2.6	0.2	8.4	0.3	41.5	0.1	1.1
R14	4.1	0.4	19.8	3.1	0.3	8.5	0.4	41.6	0.1	1.1
R15	3.7	0.2	19.6	1.5	0.1	8.3	0.2	41.4	0.0	1.0
R16	2.1	0.1	19.5	1.2	0.0	8.2	0.0	41.2	0.0	1.0
R17	3.7	0.4	19.8	2.7	0.2	8.4	0.3	41.5	0.1	1.1
R18	2.4	0.2	19.6	1.2	0.1	8.3	0.2	41.4	0.0	1.0
R19	3.8	0.1	19.5	1.5	0.1	8.3	0.1	41.3	0.0	1.0
R20	2.6	0.1	19.5	1.0	0.1	8.3	0.1	41.3	0.0	1.0

	PM10 (µg/m³)			PM2.5 (µg/m³)			TSP (µg/m³)		Dust Deposition	
	24-Hour Max	Annual Ave		24-Hour Max	Annual Ave		Annual Ave		Annual Ave	
	Increment	Increment	Cumulative	Increment	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative
Goal	50 µg/m³	30 µg/m³		25 µg/m³	8 µg/m³		90 µg/m³		2 g/m²/mth	4 g/m²/mth
Receptor Max	**13.7**	**1.3**	**20.7**	**6.8**	**0.6**	**8.8**	**1.4**	**42.6**	**0.2**	**1.2**
R21	2.2	0.1	19.5	0.9	0.1	8.3	0.1	41.3	0.0	1.0
R22	2.9	0.3	19.7	2.3	0.2	8.4	0.3	41.5	0.1	1.1
R23	2.1	0.2	19.6	1.9	0.1	8.3	0.2	41.4	0.0	1.0
R24	2.9	0.1	19.5	1.2	0.1	8.3	0.2	41.4	0.0	1.0
R25	4.1	0.3	19.7	1.6	0.1	8.3	0.7	41.9	0.2	1.2
R26	2.0	0.1	19.5	0.9	0.1	8.3	0.2	41.4	0.0	1.0
R27	6.5	0.3	19.7	2.4	0.1	8.3	0.5	41.7	0.1	1.1
R28	3.1	0.1	19.5	1.4	0.1	8.3	0.2	41.4	0.0	1.0
R29	2.1	0.1	19.5	1.0	0.1	8.3	0.1	41.3	0.0	1.0
R30	1.3	0.1	19.5	1.0	0.1	8.3	0.1	41.3	0.0	1.0
R31	1.0	0.1	19.5	0.6	0.1	8.3	0.1	41.3	0.0	1.0
R32	1.5	0.1	19.5	0.7	0.1	8.3	0.1	41.3	0.0	1.0
R34	2.2	0.2	19.6	1.4	0.1	8.3	0.2	41.4	0.0	1.0
R35	3.6	0.4	19.8	2.7	0.3	8.5	0.4	41.6	0.1	1.1
R36	4.0	0.1	19.5	1.6	0.1	8.3	0.1	41.3	0.0	1.0
R37	2.0	0.2	19.6	1.6	0.1	8.3	0.2	41.4	0.0	1.0
R38	13.7	1.3	20.7	6.8	0.6	8.8	1.4	42.6	0.2	1.2
R39	4.3	0.3	19.7	1.7	0.1	8.3	0.6	41.8	0.1	1.1
R40	1.7	0.2	19.6	1.4	0.1	8.3	0.2	41.4	0.0	1.0
R41	1.4	0.1	19.5	1.3	0.1	8.3	0.1	41.3	0.0	1.0
R42	1.8	0.1	19.5	1.5	0.1	8.3	0.1	41.3	0.0	1.0

5.1 Cumulative short term impacts

The potential for cumulative short term impacts for 24-hour average PM_{10} and $PM_{2.5}$ are assessed using a statistical approach which presents the likelihood of additional exceedances of the 24-hour average impact assessment criterion and reporting standards.

A frequency distribution of cumulative impact is presented showing every possible combination of predicted increment plus background concentration (i.e. every daily modelling prediction is added to all available daily background from five years of background data, resulting in over 600,000 combinations).

The frequency distribution of cumulative PM_{10} concentrations is presented in **Figure 4** for the five most affected sensitive receptor locations. The analysis shows that additional exceedances of the 24-hour PM_{10} impact assessment criteria, beyond what is caused by background, is limited to one sensitive receptor (R38) and the risk would be 0.3% or 1 additional exceedance day per year.

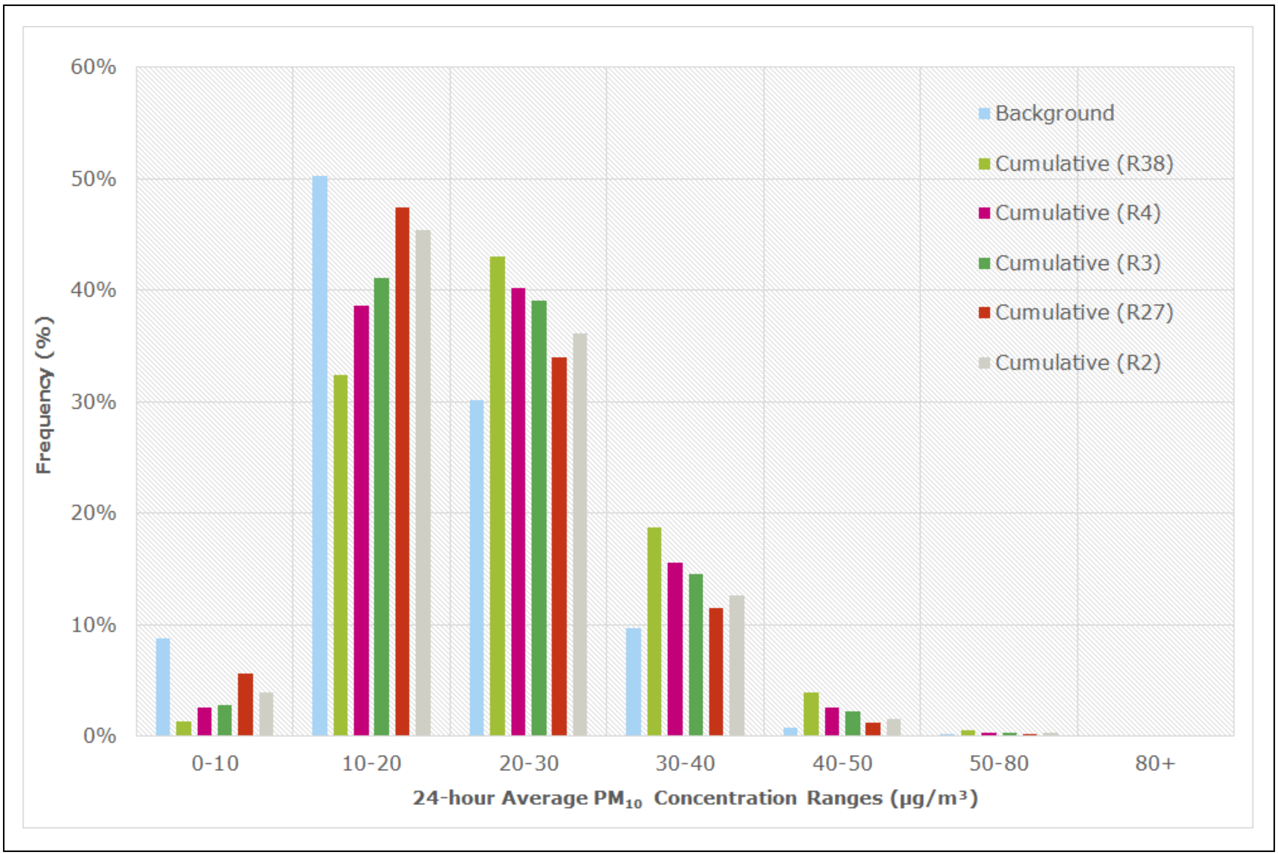

Figure 4: Frequency distribution of cumulative 24-hour average PM_{10} concentration

The frequency distribution of cumulative $PM_{2.5}$ concentrations is presented in **Figure 5** for the five most affected sensitive receptor locations. The analysis shows that additional exceedances of the 24-hour $PM_{2.5}$ NEPM AAQ reporting standard, beyond what is caused by background, would be limited to 1-2 additional days per year.

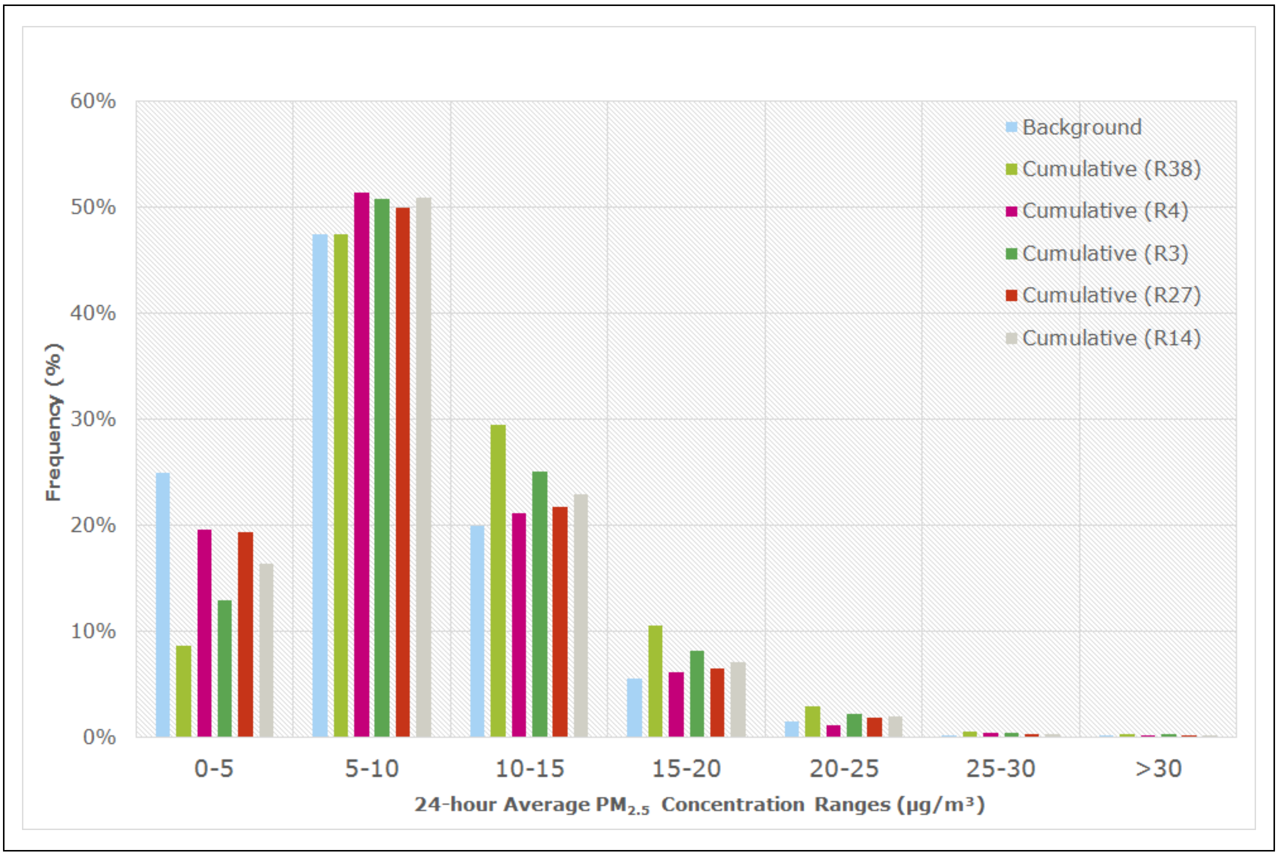

Figure 5: Frequency distribution of cumulative 24-hour average $PM_{2.5}$ concentration

6. MITIGATION AND MONITORING

The principal emissions during the Modification Proposal will be from the following activities:

- Material handling (loading / unloading / spreading of fill material).
- Crushing of oversize material.
- Movement of heavy plant and machinery within the site on unsealed areas.
- Wind erosion from exposed surfaces and stockpiles.

The air quality management measures for the Modification Proposal are consistent with the Revised Environmental Management Measures (REMMs) and recommended Conditions of Approval (CoA) for the Concept Plan and the applicable mitigation / management measures are outlined in **Table 6-1**.

In addition to those measures outlined in the REMMs and CoA, additional controls are proposed for the Modification Proposal. Due to the increased volume of trucks required to import fill and, it is recommended that increased watering rates are applied to the internal haul route to ensure minimal visible dust is generated. It is also recommended that wet suppression is applied to the crusher.

In accordance with REMM 10A and CoA D20 (e) a construction dust management plan will be prepared which will outline all proposed management measures, as well as monitoring requirements, key performance indicators, record keeping and reporting and responsibilities.

Table 6-1: Applicable mitigation measures consistent with REMMs and CoA

Mitigation Measure	Reference
A Dust Management Plan (DMP) (or equivalent) would be prepared as part of the CEMP.	REMM (10A) & CoA (D20 (e)).
Methods for management of emissions would be incorporated into Project inductions, training and pre-start talks.	REMM (10C) and CoA (D20 (e)).
Activities with the potential to cause significant emissions, such as material delivery and load out and bulk earthworks, would be identified in the CEMP. Work practices that minimise emissions during these activities would be investigated and applied where reasonable and feasible.	REMM (10D)
A mechanism for raising and responding to complaints would be put in place for the duration of the construction phase.	REMM (10E)
Vehicle movements would be limited to designated entries and exits, haulage routes and parking areas. Project site exits would be fitted with hardstand material, rumble grids or other appropriate measures to limit the amount of material transported offsite (where required).	REMM (10F)
Dust would be visually monitored during construction and the following measures would be implemented where necessary: Apply water (or alternative measures) to exposed surfaces that are causing dust generation. Surfaces may include any stockpiles, hardstand areas and other exposed surfaces (for example recently graded areas). Regular watering would ensure that the soil is moist to achieve 50% control of dust emissions from scrapers, graders and dozers. Appropriately cover loads on trucks transporting material to and from the construction site. Securely fix tailgates of road transport trucks before loading and immediately after unloading.	REMM (10H) & CoA B12 (b)

Prevent, where possible, or remove, mud and dirt being tracked onto sealed road. Apply water at a rate of >2 litres (L) per square metre per hour (L/m2/hr) to internal unsealed access roadways and work areas. Application rates would be related to atmospheric conditions (e.g. prolonged dry periods) and the intensity of construction operations. Paved roads should be regularly swept and watered when necessary.	
Where reasonable and feasible, dust generating activities (particularly clearing and excavating) would be avoided or minimised during dry and windy conditions.	REMM (10I)
Project site speed limits of 20 km/h would be imposed on all construction vehicles travelling within the Project site.	REMM (10J) & CoA B12 (a)
Graders would be limited to a speed of 8 km/h to reduce potential dust emissions.	REMM (10K)
Exposed areas and stockpiles would be limited in area and duration. For example, vegetation stripping or grading would be staged where possible, unconsolidated stockpiles would be covered, or hydro mulch or other revegetation applicant applied to stockpiles or surfaces left standing for extended periods.	REMM (10M)
Construction plant and equipment would be well maintained and regularly serviced so that vehicular emissions remain within relevant air quality guidelines and standards.	REMM (10O)
All construction vehicles would be tuned to avoid releasing excessive smoke from the exhaust and would be compliant with OEH Smokey Vehicles Program under the NSW Protection of the Environment and Operations Act 1997 (POEO Act) and POEO Regulations (NSW) (2010).	REMM (10R)

6.1 Construction dust monitoring

Daily visual checks will be made as follows:

- Daily visible inspection of excessive dust generated at source (wheel generated dust, scrapers/graders, dozers, excavators, wind erosion) and used to implement additional controls, such as increased watering.
- Daily visible inspection on water cart activity and effectiveness to supress haul road dust.
- Daily visible inspection too ensure no dust is leaving the site.

7. CONCLUSION

Activities associated with the Modification Proposal have been assessed for potential impacts on local air quality, including cumulative effects from the combination of Early Works and the MPE Stage 1 construction.

The predicted increase in annual average PM_{10} is generally less than 1 µg/m³ at all receptors and when combined with background, there are no cumulative exceedances of the impact assessment criteria for annual PM_{10}. Background concentrations of $PM_{2.5}$ already exceed the NEPM AAQ reporting standard, therefore cumulative predictions are also above the standard at all receptors, however, the modelling shows a relatively minor increase in annual average $PM_{2.5}$ (less than 0.6 µg/m³) at all receptors. There are no predicted exceedances of the annual average TSP or dust deposition impact assessment criteria.

The maximum predicted 24-hour PM_{10} (13.7 µg/m³) and 24-hour $PM_{2.5}$ (6.8 µg/m³) occurs at Casula Powerhouse Arts Centre. The potential for cumulative short term impacts for 24-hour average PM_{10} and $PM_{2.5}$ are assessed using a statistical approach which presents the likelihood of additional exceedances of the 24-hour average impact assessment criterion and reporting standards. The analysis shows that additional exceedances of the 24-hour PM_{10} impact assessment criteria, beyond what is caused by background, is limited to one sensitive receptor and the risk would be 0.3% or 1 additional exceedance day per year. Additional exceedances of the 24-hour $PM_{2.5}$ NEPM AAQ reporting standard, beyond what is caused by background, would be limited to 1-2 additional days per year.

It is noted that the assessment of impact incorporates a level of conservativeness, for example, the emission estimates do not account for natural mitigation due to rainfall and the modelling does not incorporate removal of particles due to wet deposition. Furthermore, a complete year is modelled at the maximum daily rate of 22,000 tonnes, to combine worst case emission potential with worst case dispersion. Therefore, the results presented should be viewed with this in mind.

In summary, consistent with previous air quality assessments for the MPW Concept Plan, the potential air quality impacts are expected to be low risk and short term in nature. The proposed mitigation measures are considered sufficient to ensure off-site impacts from the Modification Proposal are effectively managed.

8. REFERENCES

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APPENDIX 1
ASSESSMENT LOCATIONS

Table A1-1: Assessment locations surrounding the project site

Name/Location	ID	Location (m MGA, Zone 55)	
		Easting	Northing
Lakewood Crescent, Casula	R1	307535	6242509
St Andrews Boulevard, Casula	R2	307430	6242235
Buckland Road, Casula	R3	307317	6241949
Dunmore Crescent, Casula	R4	307044	6241551
Leacocks Lane, Casula	R5	306397	6241264
Leacocks Lane, Casula	R6	306579	6240902
Slessor Road, Casula	R7	306145	6240139
Canterbury Road, Glenfield	R8	305986	6239330
Ferguson Street, Glenfield	R9	306378	6239233
Goodenough Street, Glenfield	R10	306783	6239167
Wallcliff Court, Wattle Grove	R11	308903	6239900
Corryton Court, Wattle Grove	R12	309206	6240651
Martindale Court, Wattle Grove	R13	309335	6241111
Anzac Road, Wattle Grove	R14	308829	6242049
Cambridge Avenue, Glenfield	R15	306246	6239580
Guise Public School	R16	306200	6237359
Yallum Court, Wattle Grove	R17	308916	6240141
Church Road, Liverpool	R18	308643	6243069
Glenwood Public School, Glenfield	R19	306259	6238659
Glenfield Public School, Glenfield	R20	305604	6239088
Hurlstone Agricultural School	R21	305200	6239198
Wattle Grove Public School	R22	309373	6240489
St Marks Coptic College, Wattle Grove	R23	309942	6240895
Maple Grove Retirement Village, Casula	R24	305381	6240952
All Saints Catholic College	R25	306606	6241042
Casula High School	R26	305360	6241268
Casula Primary School, Casula	R27	306749	6242073
Lurnea High School	R28	305552	6242252
St Francis Xaviers Catholic Church	R29	305834	6243254
Impact Church Liverpool	R30	307828	6243646
Liverpool West Public School	R31	306552	6243980
Liverpool Public School / TAFE NSW	R32	308289	6244388
Glenfield Rise Development, Glenfield	R34	305927	6239733
New DNSDC Facility	R35	309117	6241571
Playground Learning Centre Glenfield	R36	305845	6239063
Wattle Grove Long Day Care Centre	R37	309596	6242100
Casula Powerhouse Arts Centre	R38	307130	6241489

APPENDIX 2
WIND ROSES

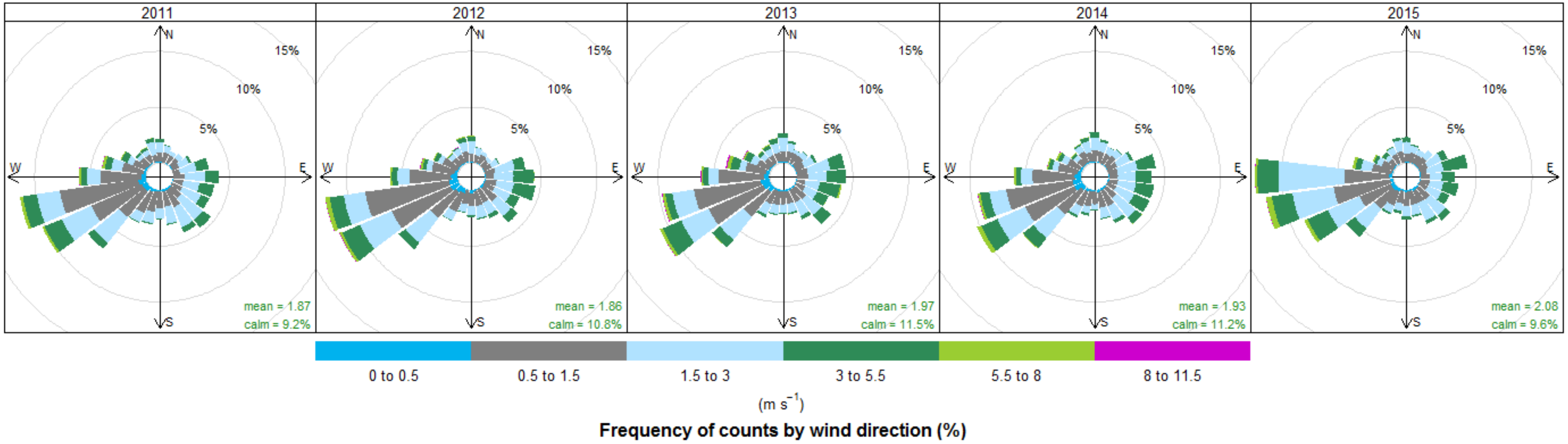

Figure A2-1: Annual wind roses for Liverpool OEH site