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APPENDIX 13.2 GLOSSARY

Term	Definition
AADT Annual Average Daily Traffic	A daily total traffic flow (24 hrs), expressed as a mean daily flow across all 365 days of the year.
Adjustment	Application of a correction factor to modelled results to account for uncertainties in the model
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year.
AQMA	Air Quality Management Area.
AURN	Automatic Urban and Rural (air quality monitoring) Network, managed by contractors on behalf of Defra
Conservative	Tending to over-predict the impact rather than under-predict.
Defra	Department for Environment, Food and Rural Affairs.
DfT	Department for Transport
Dust	Dust comprises particles typically in the size range 1-75 micrometres (µm) in aerodynamic diameter and is created through the action of crushing and abrasive forces on materials
Emission rate	The quantity of a pollutant released from a source over a given period of time.
Exceedance	A period of time where the concentrations of a pollutant is greater than the appropriate air quality standard.
HDV/HGV	Heavy Duty Vehicle/Heavy Goods Vehicle.
LAQM	Local Air Quality Management.
Model adjustment	Following model verification, the process by which modelled results are amended. This corrects for systematic error.
N	Nitrogen
NH_3	Ammonia
NO_2	Nitrogen dioxide.

Term	Definition
NO_x	Nitrogen oxides.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.
Road link	A length of road which is considered to have the same flow of traffic along it. Usually, a link is the road from one junction to the next.
Trackout	The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when heavy duty vehicles (HDVs) leave the construction / demolition site with dusty materials, which may then spill onto the road, and/or when HDVs transfer dust and dirt onto the road having travelled over muddy ground on site.
$\mu g/m^3$ microgrammes per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of $1ug/m^3$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

APPENDIX 13.3: AIR QUALITY LEGISLATION AND POLICY

UK AIR QUALITY STRATEGY

The Government's policy on air quality within the UK is set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS)[1]. The AQS provides a framework for reducing air pollution in the UK with the aim of meeting the requirements of European Union legislation[2].

The AQS also sets standards and objectives for nine key air pollutants to protect health, vegetation and ecosystems. These are benzene (C_6H_6), 1,3 butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), sulphur dioxide (SO_2), ozone (O_3), and polycyclic aromatic hydrocarbons (PAHs).

The AQS contains a framework for considering the effects of a finer group of particles known as '$PM_{2.5}$' as there is increasing evidence that this size of particles can be more closely associated with observed adverse health effects than PM_{10}. Local Authorities are required to work towards reducing emissions/concentrations of particulate matter within their administrative area. However, there is no statutory objective given in the AQS for $PM_{2.5}$ at this time.

AIR QUALITY REGULATIONS

Many of the objectives in the AQS have been made statutory in England with the Air Quality (England) Regulations 2000[3] and the Air Quality (England) (Amendment) Regulations 2002[4] for the purpose of Local Air Quality Management (LAQM).

These Regulations require that likely exceedances of the AQS objectives are assessed in relation to:

"…the quality of air at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present…"

The Air Quality Standards Regulations 2010[5] transpose the European Union Ambient Air Quality Directive (2008/50/EC) into law in England. This Directive sets legally binding limit values for concentrations in outdoor air of major air pollutants that impact public health such as PM_{10}, $PM_{2.5}$ and NO_2. The limit values for NO_2 and PM_{10} are the same concentration levels as the relevant AQS objectives and the limit value for $PM_{2.5}$ is a concentration of 25µg/m^3.

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[1] Department for Environment, Food and Rural Affairs (Defra) and the Devolved Administrations (2007). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2)

[2] The UK formally left the EU on 31st January 2020 and new air quality legislation for the UK will be brought forward in due course.

[3] The Air Quality (England) Regulations 2000 - Statutory Instrument 2000 No.928

[4] The Air Quality (England) (Amendment) Regulations 2002- Statutory Instrument 2002 No.3043

[5] The Air Quality Standards Regulations 2010 - Statutory Instrument 2010 No. 1001

CLEAN AIR STRATEGY

Defra published the Government's Clean Air Strategy in 2019[6]. This sets out measures, which aim to reduce emissions from all sources of air pollution, making air healthier to breathe, protecting nature and boosting the economy. The Strategy also proposes tough new goals to cut public exposure to airborne particulate matter, as per the recommendation made by the World Health Organisation.

Furthermore, the Strategy confirms that the Government will set new legislation to 'create a stronger and a more coherent framework for action to tackle air pollution. This will be underpinned by new England-wide powers to control major sources of air pollution, in line with the risk they pose to public health and the environment, plus new local powers to take action in areas with an air pollution problem. These will support the creation of Clean Air Zones to lower emissions from all sources of air pollution, backed up with clear enforcement mechanism.' New enforcement powers will also be given at a national and local level, across all sectors of society.

ENVIRONMENTAL PROTECTION ACT 1990 - CONTROL OF DUST AND PARTICULATES ASSOCIATED WITH CONSTRUCTION

Section 79 of the Environmental Protection Act 1990 gives the following definitions of statutory nuisance relevant to dust and particles:

"Any dust, steam, smell or other effluvia arising from industrial, trade or business premises or smoke, fumes or gases emitted from premises so as to be prejudicial to health or a nuisance"; and

"Any accumulation or deposit which is prejudicial to health or a nuisance".

Following this, Section 80 says that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.

There are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist. Nuisance is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred.

ENVIRONMENT ACT 1995

Under Part IV of the Environment Act 1995, local authorities must review and document local air quality within their area by way of staged appraisals and respond accordingly, with the aim of meeting the air quality objectives defined in the Regulations. Where the objectives are not likely to be achieved, an authority is required to designate an Air Quality Management Area (AQMA). For each AQMA the local authority is required to draw up an Air Quality Action Plan (AQAP) to secure improvements in air quality and show how it intends to work towards achieving air quality standards in the future.

[6] Defra (January, 2019). Clean Air Strategy 2019

PLANNING POLICY

NATIONAL PLANNING POLICY

National Planning Policy Framework

The Government's overall planning policies for England are described in the National Planning Policy Framework[7]. The core underpinning principle of the Framework is the presumption in favour of sustainable development, defined as:

'… meeting the needs of the present without compromising the ability of future generations to meet their own needs'

One of the three overarching objectives of the NPPF is that planning should *'to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.'*

In relation to air quality, the following paragraphs in the document are relevant:

- Paragraph 54, which states *'Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition.'*
- Paragraph 102, which relates to the need to consider transport related issues at the earliest stages of plan making and development proposals, so that *'…c) opportunities to promote walking, cycling and public transport use are identified and pursued; d) the environmental impacts of traffic and transport infrastructure can be identified, assessed and taken into account – including appropriate opportunities for avoiding and mitigating any adverse effects, and for net environmental gains...'*
- Paragraph 103, which states *'Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health.'*
- Paragraph 170, which states *'Planning policies and decisions should contribute to and enhance the natural and local environment by: …e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans.'*
- Paragraph 180, which states *'Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as*

[7] Ministry of Housing, Communities and Local Government (February 2019). National Planning Policy Framework.

the potential sensitivity of the site or the wider area to impacts that could arise from the development.'

- Paragraph 181, which states *'Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.'*
- Paragraph 183, which states *'The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.'*

LOCAL PLANNING POLICY

Lancaster Local Plan

The Local Plan[8] is LCC's primary planning document which directs planning permission in the district. The Local Plan includes the following air quality specific policy:

"Policy DM31: Air Quality Management & Pollution

All development proposals must demonstrate that they have sought to minimise the levels of air polluting emissions generated and adequately protect their new users, and existing users, from the effects of poor air quality.

Development which is located within an Air Quality Management Area (AQMA), or any development which has the potential to, individually or cumulatively, contribute to increasing levels of air pollution, will be required to demonstrate how either on-site or off-site mitigation measures will be put in place to reduce the air quality impact. Any proposal must not significantly worsen any emissions or air pollutants in areas where pollution levels are close to objective / limit value levels.

Proposals should contribute towards delivering the actions detailed within the Lancaster District Air Quality Action Plan, once in place.

Any proposal must not worsen any emissions or air pollutants in areas that could result in a breach of, or worsen site-level critical loads for ecosystems within relevant Internationally designated nature

[8] Lancaster City Council. A Local Plan for Lancaster District 2011-2031. Part Two: Review of the Development Management DPD. July 2020

conservation sites during both construction and operational phases. Air Quality Assessments must be submitted for relevant development proposals, as outlined in the Council's Validation Guide.

All development proposals will be expected to take account of the Council's forthcoming SPD on Low Emissions and Air Quality."

APPENDIX 13.4 – IAQM CONSTRUCTION ASSESSMENT METHODOLOGY

IAQM CONSTRUCTION GUIDANCE METHODOLOGY

STEP 1 – SCREENING THE NEED FOR A DETAILED ASSESSMENT

An assessment will normally be required where there are:

- 'Human receptors' within 350m of the site boundary; or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s); and/or
- 'Ecological receptors' within 50m of the site boundary; or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is "negligible".

STEP 2A – DEFINE THE POTENTIAL DUST EMISSION MAGNITUDE

The following are examples of how the potential dust emission magnitude for different activities can be defined. (Note that not all the criteria need to be met for a particular class). Other criteria may be used if justified in the assessment.

Table 13.4-1 - Examples of Human Receptor Sensitivity to Construction Phase Impacts

Dust Emission Magnitude	Activity
Large	Demolition >50,000m^3 building demolished, dusty material (e.g. concrete), on-site crushing/screening, demolition >20m above ground level
	Earthworks >10,000m^2 site area, dusty soil type (e.g. clay), >10 earth moving vehicles active simultaneously, >8m high bunds formed, >100,000 tonnes material moved
	Construction >100,000m^3 building volume, on site concrete batching, sandblasting
	Trackout >50 HDVs out / day, dusty surface material (e.g. clay), >100m unpaved roads
Medium	Demolition 20,000 - 50,000m^3 building demolished, dusty material (e.g. concrete) 10-20m above ground level
	Earthworks 2,500 - 10,000m^2 site area, moderately dusty soil (e.g. silt), 5-10 earth moving vehicles active simultaneously, 4m - 8m high bunds, 20,000 -100,000 tonnes material moved

Dust Emission Magnitude	Activity
	Construction 25,000 - 100,000m^3 building volume, dusty material e.g. concrete, on site concrete batching
	Trackout 10 - 50 HDVs out / day, moderately dusty surface material (e.g. clay), 50 -100m unpaved roads
Small	Demolition <20,000m^3 building demolished, non-dusty material (e.g metal cladding), <10m above ground level, work during wetter months
	Earthworks <2,500m^2 site area, soil with large grain size (e.g. sand), <5 earth moving vehicles active simultaneously, <4m high bunds, <20,000 tonnes material moved, earthworks during wetter months
	Construction <25,000m^3, non-dusty material (e.g. metal cladding or timber)
	Trackout <10 HDVs out / day, non-dusty soil, < 50m unpaved roads

STEP 2B – DEFINE THE SENSITIVITY OF THE AREA

The tables below present the IAQM assessment methodology to determine the sensitivity of the area to dust soiling, human health and ecological impacts respectively. The IAQM guidance provides guidance to allow the sensitivity of individual receptors to dust soiling and health effects to assist in the assessment of the overall sensitivity of the study area.

Table 13.4-2 - Sensitivity of the Area to Dust Soiling Effects

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 13.4-3 - Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table 13.4-4 - Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Sources (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

STEP 2C – DEFINE THE RISK OF IMPACTS

The dust emissions magnitude determined at Step 2A should be combined with the sensitivity of the area determined at Step 2B to determine the risk of impacts without mitigation applied. For those cases where the risk category is 'negligible' no mitigation measures beyond those required by legislation will be required.

Table 13.3-5 – Risk of Dust Impacts

Sensitivity of surrounding area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks and Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

STEP 3 –SITE SPECIFIC MITIGATION

Having determined the risk categories for each of the four activities it is possible to determine the site-specific measures to be adopted. These measures will be related to whether the site is considered to be a low, medium or high risk site. The IAQM guidance details the mitigation measures required for high, medium and low risk sites as determined in Step 2C.

STEP 4 – DETERMINE SIGNIFICANT EFFECTS

Once the risk of dust impacts has been determined in Step 2C and the appropriate dust mitigation measures identified in Step 3, the final step is to determine whether there are significant effects arising from the construction phase. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effect will normally be negligible.

APPENDIX 13.5 - PROPOSED DEVELOPMENT CONSTRUCTION PHASE ASSESSMENT

DUST AND PM_{10} FROM CONSTRUCTION ACTIVITIES ONSITE

Construction activities that have the potential to generate and/or re-suspend dust and PM_{10} include:

- Site clearance and preparation including demolition activities;
- Preparation of temporary access/egress to the site and haulage routes;
- Earthworks;
- Materials handling, storage, stockpiling, spillage and disposal;
- Movement of vehicles and construction traffic within the site;
- Use of crushing and screening equipment/plant;
- Exhaust emissions from site plant, especially when used at the extremes of their capacity and during mechanical breakdown;
- Construction of buildings, roads and areas of hardstanding alongside fabrication processes;
- Internal and external finishing and refurbishment; and
- Site landscaping after completion.

The majority of the releases are likely to occur during the 'working week'. However, for some potential release sources (e.g. exposed soil produced from significant earthwork activities) in the absence of dust control mitigation measures, dust generation has the potential to occur 24 hours per day over the period during which such activities are to take place.

ASSESSMENT OF POTENTIAL DUST EMISSION MAGNITUDE

The Construction Guidance[9] methodology has been used to determine the potential dust emission magnitude for the following four different dust and PM_{10} sources: demolition; earthworks; construction; and trackout. The findings of the assessment are presented below.

Demolition

There are a number of existing small structures, redundant retaining walls and hard pavings at the site which are scheduled for demolition. The total volume of material that will be demolished at the site is expected to be well below 20,000m^3, which is classed as ‘small’, with reference to the Construction Guidance[9]. It is understood that an onsite crusher will not be used, rather material will be removed from the application site over a number of weeks during the demolition period.

Therefore, the potential dust emission magnitude is considered to be **small** for demolition activities.

Earthworks

The total area of the proposed development is more than 10,000m^2. It is understood that the intention is to reuse all materials at the application site, with the exception of trees, shrubbery and

[9] Holman et al (2014). IAQM Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London. www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf.

surface materials that cannot be re-used. A cut and fill operation will be carried out within the confines of the site and there is an estimated cut volume of 11,300m^3 and fill volume of 23,900m^3. Therefore, the potential dust emission magnitude is considered to be **large** for earthwork activities.

Construction

The total volume of buildings to be constructed on the application site will be more than 100,000m^3. At this stage, it is not known if on-site concrete batching and sand blasting activities will be undertaken. Therefore, the potential dust emission magnitude is conservatively considered to be **large** for construction activities.

Trackout

The total number of HDVs accessing the site per day is expected to vary greatly during the course of the construction program. A maximum of 60 vehicle movements (in and out of the site) per day is expected during the piling and concrete phase (estimated to last approximately 12 weeks). However, the average number of HDVs per day throughout the remaining construction phase period is expected to fall below 50. However, taking the maximum number of vehicle movements per day, the potential dust emission magnitude is considered to be **large** for trackout activities.

A summary of the potential dust emission magnitude determined for each construction activity is presented in **Table 13.5-1**.

Table Error! No text of specified style in document.**3.5-1 - Potential Dust Emission Magnitude**

Activity	Dust Emission Magnitude
Demolition	Small
Earthworks	Large
Construction	Large
Trackout	Large

ASSESSMENT OF THE SENSITIVITY OF THE STUDY AREA

The prevailing wind direction at the Application Site is from the west. Therefore, receptors located to the east of the proposed development are more likely to be affected by dust and particulate matter emitted and re-suspended during the construction phase. The land to the east of the proposed development comprises mixed use developments off Marine Road Central and the Morecambe Bay designated site.

Under low wind speed conditions, it is likely that the majority of dust would be deposited in the area immediately surrounding the site. There are few high sensitive human receptors (e.g. residential dwellings) nearby the site. There are some medium sensitive receptors, such as the Midland Hotel, which is within 20m of the site Boundary. Furthermore, there is one ecological receptor (Morecambe Bay designated site) which falls within 20m of the site boundary. With reference to the IAQM construction guidance[9], Morecambe Bay is considered to be a high sensitivity receptor.

The areas that are most sensitive to construction dust deposition are highlighted in **Figure 13.2**, which depicts 20 m, 50 m, 100 m and 350 m distance bands (buffer zones) around the proposed development.

Taking the above into account and following the construction guidance, the sensitivity of the area to changes in dust and PM_{10} has been derived for each of the construction activities considered. The results are shown in **Table 13.5-2**.

Table Error! No text of specified style in document.**3.5-2 - Sensitivity of the Study Area**

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium	Medium	Medium	Medium
Human Health	Low	Low	Low	Low
Ecological	High	High	High	High

Risk of Impacts

The predicted dust emission magnitude has been combined with the defined sensitivity of the area to determine the risk of impacts during the construction phase, prior to mitigation. **Table 13.5-3** below provides a summary of the risk of dust impacts for the proposed development.

The risk category identified for each construction activity has been used to determine the level of mitigation required.

Overall, there is a **High Risk** of dust impacts relating to the expected construction phase activities, prior to mitigation being applied.

Table 13.5-3 - Summary Dust Risk Table to Define Site Specific Mitigation

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low Risk	Medium Risk	Medium Risk	Medium Risk
Human Health	Negligible	Low Risk	Low Risk	Low Risk
Ecological	Medium Risk	High Risk	High Risk	High Risk

CONSTRUCTION PLANT ONSITE

In regard to plant equipment (including onsite generators) and Non-Road Mobile Machinery (NRMM), the following is noted from the construction guidance[9]:

"Experience of assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed. For site plant and on-site traffic, consideration should be given to the number of plant/vehicles and their operating hours and locations to assess whether a significant effect is likely to occur."

Furthermore, the LAQM.TG16 guidance[10] states that:

"Experience of assessing the exhaust emissions from on-site plant (NRMM) and site traffic suggests that, with suitable controls and site management, they are unlikely to make a significant impact on local air quality. In the vast majority of cases they will not need to be quantitatively assessed – qualitative consideration to the above points will likely provide sufficient screening."

During enabling works, there will be between 5 and 10 large plant at the application site, consisting of a mix of excavators, dumpers and a compaction plant, over a period of 16 weeks. The main construction period at the site is expected to last for 104 weeks. The exact number of large plant at the site during this period is not known; however, it is expected to include mobile cranes, cherry pickers, tower cranes and mobile crawlers.

Based on the relevant guidance, the variable number of plant and NRMM at the application site during the entirety of the construction period and based on the relatively low existing background levels of relevant pollutants (NO_2, PM_{10} and $PM_{2.5}$, see **Table 13-5** of main report) the local air quality impact associated with emissions from plant and NRMM is expected to be negligible.

CONSTRUCTION VEHICLES ON THE PUBLIC HIGHWAY

The greatest impact on air quality due to emissions from vehicles and plant associated with the construction phase will be in the areas immediately adjacent to the site access. It is anticipated that construction traffic will access the site via the A589 (Marine Road Central). The traffic data shows (**Appendix 13.6**) that the baseline (2019) flows on this road are 2,286 AADT.

As summarised above, the maximum number of construction vehicles accessing the site per day is predicted to be 60 during the piling and concrete phase (estimated to last approximately 12 weeks). This makes up just 2.26% of the total number of baseline flows on the A589. However, the average number of HDVs per day across the construction phase period (104 weeks) is expected to fall below 50 AADT. Travel routes will be minimised as far as possible through use of the neighbouring (off-site) logistics hub, providing an approximate travel distance of 600m to the application site.

In terms of commuter traffic, construction workers will travel to the site via a mix of public transport, crew buses, car sharing and single user cars. No car parking will be provided on site. It is understood that the contractor will produce a Construction Logistics Plan to help manage construction vehicle access to the site.

Furthermore, existing background levels of relevant pollutants (NO_2, PM_{10} and $PM_{2.5}$, see **Table 13-5** of the main report) are predicted to be well under the respective annual mean objectives.

[10] Defra (2016) Part IV The Environment Act 1995 and Environment (Northern Ireland) Order 2002 Part III, Local Air Quality Management Technical Guidance LAQM.TG16 (Updated February 2018)

Therefore, based on the available information and professional judgement, the local air quality impact associated with emissions from construction vehicles is expected to be negligible (in accordance with the Construction Guidance and Land-use Planning Guidance[11]).

CONSTRUCTION PHASE MITIGATION RECOMMENDATIONS

Mitigation measures have been compiled for recommendation commensurate to the level of risk of impact based on the outcome of the construction phase assessment. These are typical mitigation and management techniques adopted for a development of this nature, and are consistent with Construction Guidance[9]:

General Communication

- A stakeholder communications plan that includes community engagement before work commences on site should be developed and implemented.
- The name and contact details of person(s) accountable for air quality and dust issues should be displayed on the site boundary. This may be the environment manager/engineer or the site manager. The head or regional office contact information should also be displayed.

General Dust Management

- A Dust Management Plan (DMP), which may include measures to control other emissions, in addition to the dust and PM_{10} mitigation measures given in this report, should be developed and implemented, and approved by the Local Authority. The DMP may include a requirement for monitoring of dust deposition, dust flux, real-time PM_{10} continuous monitoring and/or visual inspections.

Site Management

- All dust and air quality complaints should be recorded and causes identified. Appropriate remedial action should be taken in a timely manner with a record kept of actions taken including of any additional measures put in-place to avoid reoccurrence.
- The complaints log should be made available to the local authority on request.
- Any exceptional incidents that cause dust and/or air emissions, either on- or offsite should be recorded, and then the action taken to resolve the situation recorded in the log book.
- Regular liaison meetings with other high risk construction sites within 500m of the site boundary should be held, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes.

Monitoring

- Daily on-site and off-site inspections should be undertaken, where receptors (including roads) are nearby to monitor dust. The inspection results should be recorded and made available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street

[11] Moorcroft and Barrowcliffe. et al. (2017) Land-use Planning & Development Control: Planning for Air Quality. v1.2. Institute of Air Quality Management, London.

furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.
- Regular site inspections to monitor compliance with the DMP should be carried out, inspection results recorded, and an inspection log made available to the local authority when asked.
- The frequency of site inspections should be increased when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- Dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations should be agreed with the Local Authority. Where possible baseline monitoring should start at least three months before work commences on site or, if it a large site, before work on a phase commences.

Preparing and maintaining the site

- Plan the site layout so that machinery and dust causing activities are located away from receptors, as far as is practicable.
- Where practicable, erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- Where practicable, fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover appropriately.
- Where practicable, cover, seed or fence stockpiles to prevent wind whipping.

Operating vehicle/machinery and sustainable travel

- Ensure all vehicle operators switch off engines when stationary - no idling vehicles.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
- A maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas should be imposed (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
- A Construction Logistics Plan should be produced to manage the sustainable delivery of goods and materials.
- A Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing) should be considered.

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.

- Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste management

- Avoid bonfires and burning of waste materials.

Measures Specific to Demolition

- Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
- Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
- Avoid explosive blasting, using appropriate manual or mechanical alternatives.
- Bag and remove any biological debris or damp down such material before demolition.

Measures Specific to Earthworks

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- Use Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.
- Where practicable, only remove the cover in small areas during work and not all at once.
- Stockpile surface areas should be minimised (subject to health and safety and visual constraints regarding slope gradients and visual intrusion) to reduce area of surfaces exposed to wind pick-up.
- Where practicable, windbreak netting/screening should be positioned around material stockpiles and vehicle loading/unloading areas, as well as exposed excavation and material handling operations, to provide a physical barrier between the Application Site and the surroundings.
- Where practicable, stockpiles of soils and materials should be located as far as possible from sensitive properties, taking account of the prevailing wind direction.
- During dry or windy weather, material stockpiles and exposed surfaces should be dampened down using a water spray to minimise the potential for wind pick-up.

Measures Specific to Construction

- Avoid scabbling (roughening of concrete surfaces) if possible.
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
- For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.
- All construction plant and equipment should be maintained in good working order and not left running when not in use.

Measures Specific to Trackout

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being in frequent use.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
- Record all inspections of haul routes and any subsequent action in a site log book.
- Where practicable, hard surfaced haul routes should be installed, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
- Access gates to be located at least 10m from receptors where possible.

11.1.1. Detailed mitigation measures to control construction traffic should be discussed with LCC to establish the most suitable access and haul routes for the site traffic. The most effective mitigation will be achieved by ensuring that construction traffic does not pass along sensitive roads (residential roads, congested roads, via unsuitable junctions, etc.) where possible, and that vehicles are kept clean (through the use of wheel washers, etc.) and sheeted when on public highways. Timing of large-scale vehicle movements to avoid peak hours on the local road network will also be beneficial.

APPENDIX 13.6 - DISPERSION MODEL APPROACH & VERIFICATION

INTRODUCTION

Air pollution in urban areas is dominated by emissions from road vehicles. The main pollutants of concern from road traffic are oxides of nitrogen (NO_x/NO_2) and fine particulate matter (PM_{10} & $PM_{2.5}$), since these pollutants are most likely to approach their relevant air quality limit values in proximity to major road links.

The introduction of the proposed development has the potential to change the total flow, distribution and characteristics of traffic movements on the affected road links, which would result in changes to emissions of the aforementioned pollutants. The local air quality assessment was completed to predict the potential impacts of these changes on ambient pollutant concentrations at identified sensitive receptors within proximity to affected roads.

The changes in local traffic related pollution levels predicted at the receptor locations were assessed by comparing the predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ with the current air quality objectives and considering the change (adverse or beneficial) between the 'without' and 'with' proposed development scenarios.

ATMOSPHERIC DISPERSION MODEL SELECTION

The predicted impacts on local air quality associated with changes to vehicle emissions as a result of the operation of the proposed development were assessed using Cambridge Environmental Research Consultants (CERC) atmospheric dispersion modelling system for roads (ADMS-Roads v5).

ADMS-Roads applies advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions of air pollutant concentrations within the given model domain. It can predict long-term and short-term concentrations, as well as calculations of percentile concentrations.

ADMS-Roads is a validated model, developed in the UK by CERC. The model validation process includes comparisons with data from the UK's Automatic Urban Rural Network (AURN) and specific verification exercises using standard field, laboratory and numerical data sets. CERC is also involved in European programmes on model harmonisation, and their models were compared favourably against other EU and U.S. EPA systems. Further information in relation to this is available from the CERC web site at http://www.cerc.co.uk/environmental-software/model-validation.html

ATMOSPHERIC DISPERSION MODELLING PROCESS

The procedures involved in undertaking the dispersion modelling assessment are outlined below:

- Collation of input data – traffic data (flows, speeds, percentage of Heavy-Duty Vehicles (HDVs)), road network mapping, sensitive receptor coordinates and meteorological data;
- Input of data in to the ADMS-Roads model for the scenarios to be modelled;

- Development of emissions inventories for each pollutant to be assessed, using Defra's emission factor toolkit (EFT v10.1)[12] and the Calculator for Road Emissions of Ammonia (CREAM v1A) vehicle emissions toolkit[13];
- Running the ADMS-Roads model for each considered scenario;
- Conversion of modelled NO_X concentrations to NO_2 concentrations using Defra's NO_x-NO_2 calculator v8.1[14];
- Verification and adjustment of modelled road-NOx contributions from the assessed road network through analysing the ADMS-Roads modelled road-NO_x outputs versus site specific monitored road-NO_x for the base year scenario (2019);
- Conversion of NO_2 and NH_3 modelled road contributions to dry nitrogen (N) deposition rates;
- Addition of Defra[15] and APIS[16] backgrounds to the modelled concentrations and deposition rates, respectively;
- Comparison of predicted NO_X, NO_2, NH_3, PM_{10} and $PM_{2.5}$ concentrations and N deposition rates at the relevant receptors to the applicable air quality objectives, critical levels and critical loads (as appropriate) in each scenario; and
- Analysis of changes in pollutant concentrations and deposition levels between the 'without' and 'with' scenarios to assess the significance of impacts associated with the proposed development on local air quality.

TRAFFIC DATA

Traffic flows for the proposed development were produced by the projects transport consultant (WSP) using the validated SATURN model. The model was developed using base traffic flows (2018) extracted from the 1402_M6 J33 New Housing Infrastructure Fund (HIF) bid Saturn model prepared by Lancashire County Council, and traffic surveys undertaken across Lancaster in October and November 2018. The proposed development traffic model outputs reported 2018 and 2025 AM (08:00-09:00), interpeak (average of 10:00-16:00) and PM (17:00-18:00) traffic flows, which were converted to annual average daily traffic (AADT) flows using Table TRA0307 from the Department of Transport (DfT)[17].

TEMPro growth factors were applied to 2018 and 2025 Saturn flow outputs to calculate 2019 (air quality assessment base year), 2024 (opening year) and 2039 (future year) traffic flows. Whilst, it is

[12] Defra (2020) Emissions Factors Toolkit, Version 10.1. [online] https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html

[13] Air Quality Consultants (2020) Calculator for Road Emissions of Ammonia, Version 1A [online] https://www.aqconsultants.co.uk/resources/calculator-for-road-emissions-of-ammonia

[14] Defra NOX to NO2 Calculator v8.1 [online] https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

[15] Department for Environment, Food and Rural Affairs (Defra) (2020) Background Mapping Data for Local Authorities – 2018 [online] https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

[16] Air Pollution Information Systems [online] http://www.apis.ac.uk/

[17] Department for Transport (DfT) (2021) Road Traffic Statistics (TRA) [online] https://www.gov.uk/government/statistical-data-sets/road-traffic-statistics-tra

anticipated that the number of vehicles driving into Morecambe will reduce significantly by 2039 due to the Eden Transport Strategy[18] (see Chapter 6: Highways, Traffic and Transport), 2039 traffic flows were conservatively calculated assuming no reduction as a result the Eden Transport Strategy initiatives.

Opening year (2024) and future year (2039) traffic flows provided are representative of cumulative road traffic impact generated by the following surrounding committed developments:

- Luneside East - residential;
- Luneside West - residential;
- Lancaster Moor Hospital - residential;
- Moor Park, Campbell Drive - residential;
- Bowerham Lane - residential;
- Former Pontin's Holiday Camp - residential;
- Broadway Hotel - residential;
- Trumacar Lane - residential;
- Low Road – residential;
- Land between Low Road and Fore Lane – residential;
- TNT Garage, Hornby Road – residential;
- Land opposite 26-48 Lancaster Road – residential;
- Land to rear of Pointer Grove – residential;
- Former Filter House – student accommodation;
- St Leonards House – student accommodation;
- Gillow Building – student accommodation;
- Luneside East – student accommodation;
- Land adjacent to Bulk Road – student accommodation;
- 5 & 6 Cable Street – student accommodation;
- 5-11A Brock Street – student accommodation;
- Galgate Mill – student accommodation;
- 47-51 North Road – student accommodation;
- 85-90 Penny Street – student accommodation;
- Luneside East, New Quay Road – retail;
- Land off Lawsons Quay – retail;
- Land at Aldcliffe Road – retail;
- Land of Kellet Road - employment;
- Land of Imperial Road – employment;
- Hillside Farm – employment; and

[18] The Eden Transport Strategy aims to position Eden Project North (the proposed development) as a leading example for progressive, healthy and sustainable transport methods in the UK. The Eden Project North Team have worked alongside both Lancaster City Council and Lancashire County Council to ensure the existing transport network is optimised and aligned with the anticipated growth of the wider region and the Eden Transport Vision. The Eden Transport Strategy is aligned with government and policies and guidance, and provides a dynamic and proactive approach to manage the evolving demand on the transport network through alternative transport modes and innovative management systems.

- Lancaster Volkswagen – employment.

Furthermore, the following HIF committed development have also been included in the traffic data:

- A1 – Land West of BGV North Area – residential;
- A2 – BGV North – residential;
- A3 – BGV North – residential;
- A4 – BGV South – residential, small business space, retail and food and drink;
- C1 – Lancaster University – student accommodation;
- C2 – Lancaster University – student accommodation;
- C3 – Lancaster University – hotel commercial;
- D1 – South Lancaster Growth (post 2035) – residential;
- DOS2 – Canal Quarter – residential, student accommodation, hotel, retail and office;
- SG7 – Cuckoo Farm – residential;
- SG9 – North Lancaster Strategic Site – residential; and
- D2 – Health Innovation Campus – R & D and business space.

The proposed development will operate at peak capacity (maximum of 3,750 visitors per day) during the school holidays, summer months, and at weekends, with interpeak periods (maximum of 2,500 visitors per day) during spring and autumn months and off-peak periods during winter months. In order to provide a conservative impact assessment, development generated traffic flows associated with the peak operational period were assumed to remain constant throughout the assessment years (opening year 2024 and future year 2039). The proposed visitor flows were calculated based on the latest trip generation, parking strategy and building capacity design. Whilst some of these variables are potentially subject to change, the calculated traffic flows are robust enough to consider any future changes imperceptible in terms of AADT.

Peak AADT flows were based on:

- Base traffic data converted for a weekend day during a summer month using DfT Tables TRA0305 and TRA0306[17];
- Peak number of visitors being a maximum of 3,750 per day, which translates into approximately 800 AADT per day.
    - Of the 800 AADT, 400 AADT are expected to travel to and from the existing Morecambe Bay Park and Ride via the M6. Thereafter, visitors will be transported between the park and ride and the proposed development by 40 – 50 shuttle busses (likely to be electric vehicles) per day.
    - The remaining 400 AADT are expected to travel to and from five existing Morecambe carparks earmarked for the proposed development, via the A589 and B5321.

Traffic flow data comprising AADT flows, traffic composition (percentage HDVs) and average link speeds (km/h) were used in the modelling as provided for the assessed road network. Appropriate assumptions were made with respect to traffic speeds on approach to and progress through junctions (i.e. lower speeds on approach and progress through junction).

Traffic data used in the dispersion modelling assessment is included in **Tables 13.6-1** to **13.6-5** below.

Table 13.6-1 – 2019 Baseline Traffic Data

Road Link ID	Road Link Name	AADT	Speed (kph)	HGV%
1 EB	A683 Bay Gateway EB (3-arm Rdbt to M6 J34)	7,593	64	5%
1 WB	A683 Bay Gateway WB (M6 J34 to 3-arm Rdbt)	5,108	64	6%
2 EB	A683 Bay Gateway EB (Morecambe Rd TO3-arm Rdbt)	7,250	64	5%
2 WB	A683 Bay Gateway WB (3-arm Rdbt to Morecambe Rd)	6,120	64	7%
3	A589 Morecambe Rd (Bay Gateway to Gyratory)	15,473	48	2%
4	A589 Broadway (Gyratory to Promenade)	3,304	48	1%
5	Marine Rd Central (Broadway to Central Dr)	2,286	48	1%
6	B5321 Lancaster Rd (Gyratory to Euston Rd)	11,193	48	1%
7	B5321 Euston Rd (Euston Rd to Central Dr railway station)	7,027	48	1%
8	B5321 Central Drive (railway station to Promenade)	3,102	48	1%

Table 13.6-2 – 2024 Without Development Traffic Data

Road Link ID	Road Link Name	AADT	Speed (kph)	HGV%
1 EB	A683 Bay Gateway EB (3-arm Rdbt to M6 J34)	8,010	64	5%
1 WB	A683 Bay Gateway WB (M6 J34 to 3-arm Rdbt)	6,174	64	6%
2 EB	A683 Bay Gateway EB (Morecambe Rd TO3-arm Rdbt)	7,741	64	5%
2 WB	A683 Bay Gateway WB (3-arm Rdbt to Morecambe Rd)	6,845	64	7%
3	A589 Morecambe Rd (Bay Gateway to Gyratory)	16,122	48	2%
4	A589 Broadway (Gyratory to Promenade)	2,283	48	1%
5	Marine Rd Central (Broadway to Central Dr)	2,426	48	1%
6	B5321 Lancaster Rd (Gyratory to Euston Rd)	11,290	48	1%
7	B5321 Euston Rd (Euston Rd to Central Dr railway station)	6,780	48	1%
8	B5321 Central Drive (railway station to Promenade)	2,943	48	1%

Table 13.6-3 – 2024 With Development Traffic Data

Road Link ID	Road Link Name	AADT	Speed (kph)	HGV%
1 EB	A683 Bay Gateway EB (3-arm Rdbt to M6 J34)	8,308	64	5%
1 WB	A683 Bay Gateway WB (M6 J34 to 3-arm Rdbt)	6,472	64	6%
2 EB	A683 Bay Gateway EB (Morecambe Rd TO3-arm Rdbt)	8,039	64	5%
2 WB	A683 Bay Gateway WB (3-arm Rdbt to Morecambe Rd)	7,143	64	7%
3	A589 Morecambe Rd (Bay Gateway to Gyratory)	16,420	48	2%
4	A589 Broadway (Gyratory to Promenade)	2,331	48	1%
5	Marine Rd Central (Broadway to Central Dr)	2,474	48	1%
6	B5321 Lancaster Rd (Gyratory to Euston Rd)	11,588	48	1%
7	B5321 Euston Rd (Euston Rd to Central Dr railway station)	7,078	48	1%
8	B5321 Central Drive (railway station to Promenade)	2,943	48	1%

Table 13.6-4 – 2039 Without Development Traffic Data

Road Link ID	Road Link Name	AADT	Speed (kph)	HGV%
1 EB	A683 Bay Gateway EB (3-arm Rdbt to M6 J34)	8,862	64	5%
1 WB	A683 Bay Gateway WB (M6 J34 to 3-arm Rdbt)	6,447	64	6%
2 EB	A683 Bay Gateway EB (Morecambe Rd TO3-arm Rdbt)	8,364	64	5%
2 WB	A683 Bay Gateway WB (3-arm Rdbt to Morecambe Rd)	7,395	64	7%
3	A589 Morecambe Rd (Bay Gateway to Gyratory)	17,415	48	2%
4	A589 Broadway (Gyratory to Promenade)	2,467	48	1%
5	Marine Rd Central (Broadway to Central Dr)	2,621	48	1%
6	B5321 Lancaster Rd (Gyratory to Euston Rd)	12,204	48	1%
7	B5321 Euston Rd (Euston Rd to Central Dr railway station)	7,329	48	1%
8	B5321 Central Drive (railway station to Promenade)	3,182	48	1%

Table 13.6-5 – 2039 With Development Traffic Data

Road Link ID	Road Link Name	AADT	Speed (kph)	HGV%
1 EB	A683 Bay Gateway EB (3-arm Rdbt to M6 J34)	9,160	64	5%
1 WB	A683 Bay Gateway WB (M6 J34 to 3-arm Rdbt)	6,745	64	6%
2 EB	A683 Bay Gateway EB (Morecambe Rd TO3-arm Rdbt)	8,662	64	5%
2 WB	A683 Bay Gateway WB (3-arm Rdbt to Morecambe Rd)	7,693	64	7%
3	A589 Morecambe Rd (Bay Gateway to Gyratory)	17,713	48	2%
4	A589 Broadway (Gyratory to Promenade)	2,515	48	1%
5	Marine Rd Central (Broadway to Central Dr)	2,669	48	1%
6	B5321 Lancaster Rd (Gyratory to Euston Rd)	12,502	48	1%
7	B5321 Euston Rd (Euston Rd to Central Dr railway station)	7,627	48	1%
8	B5321 Central Drive (railway station to Promenade)	3,182	48	1%

CAR PARK EMISSIONS

As summarised in **Section 13.3** of the main Air Quality Chapter, emissions from several car park within Morecambe have been included in the modelling assessment.

Emissions from vehicle movements within these car parks and from stationary vehicles, due to 'cold starts' when leaving the car park can give rise to increased levels of pollutants, including oxides of nitrogen (NO_x), PM_{10} and $PM_{2.5}$. In accordance with CERC guidance[19], the car park areas of were modelled as an area source within ADMS Roads.

The dimensions of the car parks were ascertained from scaled plans. The total number of LDV trips generated each day has been calculated by taking the total number of spaces in each car park and assuming that each space will generate two trips per day (in and out of the car park).

In the baseline and without development scenarios the following car parks have been included:

- Morecambe Bay Car Park; and
- Caton Road Park & Ride.

In the with development scenarios the following car parks have been included:

- Caton Road Park & Ride;

[19] Cambridge Environmental Research Consultants Note 54: Modelling Car Parks [online] http://www.cerc.co.uk/userarea/assets/data/helpdesknotes/CERC_note_54_Modelling_car_parks.pdf

- Goods Yard Car Park;
- F & B's Car Park;
- Telephone Exchange Car Park;
- Billy Hill Car Park; and
- Town Hall Car Park.

The National Atmospheric Emission Inventory (NAEI) website was accessed to obtain the characteristic petrol and diesel vehicle split[20]. The NAEI also provided the indicative cold start emissions of NO_x, NH_3, PM_{10} and $PM_{2.5}$ for both petrol and diesel vehicles which were incorporated into the calculations[21].

The distance travelled within each car park was conservatively taken as being the distance to reach the furthest corner of the car park and back.

Emission factors for NO_X, PM_{10}, $PM_{2.5}$ and NH_3 were applied for all vehicle movements in and out of each car park. The relevant calculations for each car park element are detailed in **Table 13.6-6** to **Table 13.6-12**. Car parks were modelled based on the assumption of 24-hour operation, and as a source of continuous emissions.

The relevant emission factors assume a maximum speed of 10kph within each car park. These emission factors were applied by the model to provide an emission concentration for NO_x, PM_{10}, $PM_{2.5}$ and NH_3 from the car park.

Table 13.6-6 – Morecambe Bay Car Park Emissions

Calculation Process	2019 Baseline	2024 Without Development	2039 With Development
Vehicle Split (based on NAEI national fleet, inclusive of all vehicle types)	47.3% petrol, 33.4% diesel	48.9% petrol, 30.6% diesel	45.8% petrol, 20.6% diesel
Vehicle Split in Car Park (assuming 100% cars)	58.3% petrol, 41.7% diesel	61.0% petrol, 39.0% diesel	66.8% petrol, 33.2% diesel
Cold Start NO_x	0.049 g/trip petrol, 0.431g/trip diesel	0.049 g/trip petrol, 0.431g/trip diesel	0.049 g/trip petrol, 0.431g/trip diesel
Cold Start PM_{10} (diesel only)	0.032 g/trip	0.032 g/trip	0.032 g/trip
Cold Start $PM_{2.5}$ (diesel only)	0.032 g/trip	0.032 g/trip	0.032 g/trip
Cold Start NH_3	0.017 g/trip petrol, 0.005 g/trip diesel	0.017 g/trip petrol, 0.005 g/trip diesel	0.017 g/trip petrol, 0.005 g/trip diesel
Car Park Trips	312 trips per day	312 trips per day	312 trips per day

[20] www.naei.defra.gov.uk/resources/rtp_fleet_projection_NAEI_2017_Base_2019_v1.1.xlsx

[21] www.naei.defra.gov.uk/resources/RoadtransportEFs_NAEI19_v1.1.xlsx

Average Distance Travelled Within Car Park	0.27km	0.27km	0.27km
Total NOx Emissions Rate from EFT v10.0 (g/km/s)	0.00181	0.00191	0.00060
Total PM_{10} Emissions Rate from EFT v10.0 (g/km/s)	0.00013	0.00020	0.00012
Total $PM_{2.5}$ Emissions Rate from EFT v10.0 (g/km/s)	0.00008	0.00012	0.00007
Total NH_3 Emission Rate from CREAM V1A (g/km/s)	0.00008	0.00015	0.00010
Total Parking Area (m^2)	4,744	4,744	4,744
Total Car NO_x Car Pak Emission Rate ($g/m^2/sec$)	1.818E-07	5.131E-08	1.008E-07
Total Car PM_{10} Car Pak Emission Rate ($g/m^2/sec$)	1.233E-08	4.358E-09	1.064E-08
Total Car $PM_{2.5}$ Car Pak Emission Rate ($g/m^2/sec$)	9.502E-09	3.183E-09	7.802E-09
Total Car NH_3 Car Pak Emission Rate ($g/m^2/sec$)	9.356E-09	3.668E-09	1.061E-08

Table 13.6-7 – Canton Road Park & Ride Emissions

Calculation Process	2019 Baseline	2024 Without Development	2024 With Development	2039 With Development	2039 With Development
Vehicle Split (based on NAEI national fleet, inclusive of all vehicle types)	47.3% petrol, 33.4% diesel	48.9% petrol, 30.6% diesel	48.9% petrol, 30.6% diesel	45.8% petrol, 20.6% diesel	45.8% petrol, 20.6% diesel
Vehicle Split in Car Park (assuming 100% cars)	58.3% petrol, 41.7% diesel	61.0% petrol, 39.0% diesel	61.0% petrol, 39.0% diesel	66.8% petrol, 33.2% diesel	66.8% petrol, 33.2% diesel
Cold Start NO_x	0.049 g/trip petrol, 0.431g/trip diesel	0.049 g/trip petrol, 0.431g/trip diesel	0.049 g/trip petrol, 0.431g/trip diesel	0.049 g/trip petrol, 0.431g/trip diesel	0.049 g/trip petrol, 0.431g/trip diesel
Cold Start PM_{10} (diesel only)	0.032 g/trip	0.032 g/trip	0.032 g/trip	0.032 g/trip	0.032 g/trip
Cold Start $PM_{2.5}$ (diesel only)	0.032 g/trip	0.032 g/trip	0.032 g/trip	0.032 g/trip	0.032 g/trip
Cold Start NH_3	0.017 g/trip petrol, 0.005 g/trip diesel	0.017 g/trip petrol, 0.005 g/trip diesel	0.017 g/trip petrol, 0.005 g/trip diesel	0.017 g/trip petrol, 0.005 g/trip diesel	0.017 g/trip petrol, 0.005 g/trip diesel
Car Park Trips	522 trips per day	522 trips per day	1,300 trips per day	522 trips per day	1,300 trips per day
Average Distance Travelled Within Car Park	0.34km	0.34km	0.34km	0.34km	0.34km
Total NOx Emissions Rate from EFT v10.0 (g/km/s)	0.003035	0.00191	0.00474	0.00101	0.00250
Total PM_{10} Emissions Rate from EFT v10.0 (g/km/s)	0.000215	0.00020	0.00050	0.00020	0.00049

Total $PM_{2.5}$ Emissions Rate from EFT v10.0 (g/km/s)	0.000131	0.00012	0.00029	0.00011	0.00028
Total NH_3 Emission Rate from CREAM V1A (g/km/s)	0.000142	0.00015	0.00038	0.00017	0.00042
Total Parking Area (m^2)	24,271	24,271	24,271	24,271	24,271
Total Car NO_x Car Pak Emission Rate ($g/m^2/sec$)	6.844E-08	5.131E-08	1.278E-07	3.595E-08	8.953E-08
Total Car PM_{10} Car Pak Emission Rate ($g/m^2/sec$)	4.670E-09	4.358E-09	1.085E-08	4.059E-09	1.011E-08
Total Car $PM_{2.5}$ Car Pak Emission Rate ($g/m^2/sec$)	3.496E-09	3.183E-09	7.926E-09	2.882E-09	7.177E-09
Total Car NH_3 Car Pak Emission Rate ($g/m^2/sec$)	3.480E-09	3.668E-09	9.135E-09	3.967E-09	9.881E-09

Table 13.6-8 – Goods Yard Car Park Emissions

Calculation Process	2024 With Development	2039 With Development
Vehicle Split (based on NAEI national fleet, inclusive of all vehicle types)	48.93% petrol, 30.6% diesel	45.8% petrol, 33.6% diesel
Vehicle Split in Car Park (assuming 100% cars)	61.0% petrol, 39.0% diesel	66.8% petrol, 33.2% diesel
Cold Start NO_x	0.049 g/trip petrol, 0.431 g/trip diesel	0.049 g/trip petrol, 0.431 g/trip diesel
Cold Start PM_{10} (diesel only)	0.032 g/trip	0.032 g/trip
Cold Start $PM_{2.5}$ (diesel only)	0.032 g/trip	0.032 g/trip
Cold Start NH_3	0.017 g/trip petrol, 0.005 g/trip diesel	0.017 g/trip petrol, 0.005 g/trip diesel
Car Park Trips	138 trips per day	138 trips per day
Average Distance Travelled Within Car Park	0.11km	0.11km
Total NOx Emissions Rate from EFT v10.0 (g/km/s)	0.00050	0.00027
Total PM_{10} Emissions Rate from EFT v10.0 (g/km/s)	0.00005	0.00005
Total $PM_{2.5}$ Emissions Rate from EFT v10.0 (g/km/s)	0.00003	0.00003
Total NH_3 Emission Rate from CREAM V1A (g/km/s)	0.00004	0.00004
Total Parking Area (m^2)	1,580	1,580

Total Car NO_x Car Pak Emission Rate ($g/m^2/sec$)	1.351E-07	1.073E-07
Total Car PM_{10} Car Pak Emission Rate ($g/m^2/sec$)	9.991E-09	8.962E-09
Total Car $PM_{2.5}$ Car Pak Emission Rate ($g/m^2/sec$)	8.446E-09	7.506E-09
Total Car NH_3 Car Pak Emission Rate ($g/m^2/sec$)	9.034E-09	9.666E-09

Table 13.6-9 – F & B's Car Park Emissions

Calculation Process	2024 With Development	2039 With Development
Vehicle Split (based on NAEI national fleet, inclusive of all vehicle types)	48.93% petrol, 30.6% diesel	45.8% petrol, 33.6% diesel
Vehicle Split in Car Park (assuming 100% cars)	61.0% petrol, 39.0% diesel	66.8% petrol, 33.2% diesel
Cold Start NO_x	0.049 g/trip petrol, 0.431 g/trip diesel	0.049 g/trip petrol, 0.431 g/trip diesel
Cold Start PM_{10} (diesel only)	0.032 g/trip	0.032 g/trip
Cold Start $PM_{2.5}$ (diesel only)	0.032 g/trip	0.032 g/trip
Cold Start NH_3	0.017 g/trip petrol, 0.005 g/trip diesel	0.017 g/trip petrol, 0.005 g/trip diesel
Car Park Trips	88 trips per day	88 trips per day
Average Distance Travelled Within Car Park	0.1km	0.1km
Total NOx Emissions Rate from EFT v10.0 (g/km/s)	0.00032	0.00017
Total PM_{10} Emissions Rate from EFT v10.0 (g/km/s)	0.00003	0.00003
Total $PM_{2.5}$ Emissions Rate from EFT v10.0 (g/km/s)	0.00002	0.00002
Total NH_3 Emission Rate from CREAM V1A (g/km/s)	0.00003	0.00003
Total Parking Area (m^2)	1,625	1,625
Total Car NO_x Car Pak Emission Rate ($g/m^2/sec$)	8.175E-08	6.547E-08
Total Car PM_{10} Car Pak Emission Rate ($g/m^2/sec$)	5.985E-09	5.352E-09
Total Car $PM_{2.5}$ Car Pak Emission Rate ($g/m^2/sec$)	5.114E-09	4.480E-09
Total Car NH_3 Car Pak Emission Rate ($g/m^2/sec$)	5.442E-09	5.818E-09

Table 13.6-10 – Telephone Exchange Car Park Emissions

Calculation Process	2024 With Development	2039 With Development
Vehicle Split (based on NAEI national fleet, inclusive of all vehicle types)	48.93% petrol, 30.6% diesel	45.8% petrol, 33.6% diesel
Vehicle Split in Car Park (assuming 100% cars)	61.0% petrol, 39.0% diesel	66.8% petrol, 33.2% diesel
Cold Start NO_x	0.049 g/trip petrol, 0.431 g/trip diesel	0.049 g/trip petrol, 0.431 g/trip diesel
Cold Start PM_{10} (diesel only)	0.032 g/trip	0.032 g/trip
Cold Start $PM_{2.5}$ (diesel only)	0.032 g/trip	0.032 g/trip
Cold Start NH_3	0.017 g/trip petrol, 0.005 g/trip diesel	0.017 g/trip petrol, 0.005 g/trip diesel
Car Park Trips	352 trips per day	352 trips per day
Average Distance Travelled Within Car Park	0.23km	0.23km
Total NOx Emissions Rate from EFT v10.0 (g/km/s)	0.00128	0.00068
Total PM_{10} Emissions Rate from EFT v10.0 (g/km/s)	0.00014	0.00013
Total $PM_{2.5}$ Emissions Rate from EFT v10.0 (g/km/s)	0.00008	0.00008
Total NH_3 Emission Rate from CREAM V1A (g/km/s)	0.00010	0.00011
Total Parking Area (m^2)	4,878	4,878
Total Car NO_x Car Pak Emission Rate ($g/m^2/sec$)	1.432E-07	1.053E-07
Total Car PM_{10} Car Pak Emission Rate ($g/m^2/sec$)	1.158E-08	1.065E-08
Total Car $PM_{2.5}$ Car Pak Emission Rate ($g/m^2/sec$)	8.907E-09	7.974E-09
Total Car NH_3 Car Pak Emission Rate ($g/m^2/sec$)	9.990E-09	1.076E-08

Table 13.6-11 – Billy Hill Car Park Emissions

Calculation Process	2024 With Development	2039 With Development
Vehicle Split (based on NAEI national fleet, inclusive of all vehicle types)	48.93% petrol, 30.6% diesel	45.8% petrol, 33.6% diesel
Vehicle Split in Car Park (assuming 100% cars)	61.0% petrol, 39.0% diesel	66.8% petrol, 33.2% diesel
Cold Start NO_x	0.049 g/trip petrol, 0.431 g/trip diesel	0.049 g/trip petrol, 0.431 g/trip diesel

Cold Start PM_{10} (diesel only)	0.032 g/trip	0.032 g/trip
Cold Start $PM_{2.5}$ (diesel only)	0.032 g/trip	0.032 g/trip
Cold Start NH_3	0.017 g/trip petrol, 0.005 g/trip diesel	0.017 g/trip petrol, 0.005 g/trip diesel
Car Park Trips	88 trips per day	88 trips per day
Average Distance Travelled Within Car Park	0.1km	0.1km
Total NOx Emissions Rate from EFT v10.0 (g/km/s)	0.00032	0.00017
Total PM_{10} Emissions Rate from EFT v10.0 (g/km/s)	0.00003	0.00003
Total $PM_{2.5}$ Emissions Rate from EFT v10.0 (g/km/s)	0.00002	0.00002
Total NH_3 Emission Rate from CREAM V1A (g/km/s)	0.00003	0.00003
Total Parking Area (m^2)	1,176	1,176
Total Car NO_x Car Pak Emission Rate ($g/m^2/sec$)	1.130E-07	9.052E-08
Total Car PM_{10} Car Pak Emission Rate ($g/m^2/sec$)	8.275E-09	7.400E-09
Total Car $PM_{2.5}$ Car Pak Emission Rate ($g/m^2/sec$)	7.071E-09	6.195E-09
Total Car NH_3 Car Pak Emission Rate ($g/m^2/sec$)	7.524E-09	8.044E-09

Table 13.6-12 – Town Hall Car Park Emissions

Calculation Process	2024 With Development	2039 With Development
Vehicle Split (based on NAEI national fleet, inclusive of all vehicle types)	48.93% petrol, 30.6% diesel	45.8% petrol, 33.6% diesel
Vehicle Split in Car Park (assuming 100% cars)	61.0% petrol, 39.0% diesel	66.8% petrol, 33.2% diesel
Cold Start NO_x	0.049 g/trip petrol, 0.431 g/trip diesel	0.049 g/trip petrol, 0.431 g/trip diesel
Cold Start PM_{10} (diesel only)	0.032 g/trip	0.032 g/trip
Cold Start $PM_{2.5}$ (diesel only)	0.032 g/trip	0.032 g/trip
Cold Start NH_3	0.017 g/trip petrol, 0.005 g/trip diesel	0.017 g/trip petrol, 0.005 g/trip diesel
Car Park Trips	200 trips per day	200 trips per day
Average Distance Travelled Within Car Park	0.12km	0.12km
Total NOx Emissions Rate from EFT v10.0 (g/km/s)	0.00073	0.00039
Total PM_{10} Emissions Rate from EFT v10.0 (g/km/s)	0.00008	0.00007

Total $PM_{2.5}$ Emissions Rate from EFT v10.0 (g/km/s)	0.00004	0.00004
Total NH_3 Emission Rate from CREAM V1A (g/km/s)	0.00006	0.00006
Total Parking Area (m^2)	2,476	2,476
Total Car NO_x Car Pak Emission Rate ($g/m^2/sec$)	1.283E-07	1.011E-07
Total Car PM_{10} Car Pak Emission Rate ($g/m^2/sec$)	9.582E-09	8.620E-09
Total Car $PM_{2.5}$ Car Pak Emission Rate ($g/m^2/sec$)	8.018E-09	7.054E-09
Total Car NH_3 Car Pak Emission Rate ($g/m^2/sec$)	8.620E-09	9.230E-09

CONVERSION OF NO_X TO NO_2

Oxides of nitrogen (NO_x) concentrations were predicted using the ADMS-Roads model. The modelled road contribution of NO_x at the modelled receptor locations was then converted to NO_2 using the NO_x to NO_2 calculator, in accordance with LAQM.TG16[10].

MODEL VALIDATION

The ADMS-Roads dispersion model has been validated for road traffic assessments and is considered to be fit for purpose. Model validation undertaken by the software developer CERC is unlikely to have included validation in the vicinity of the scheme considered in this assessment.

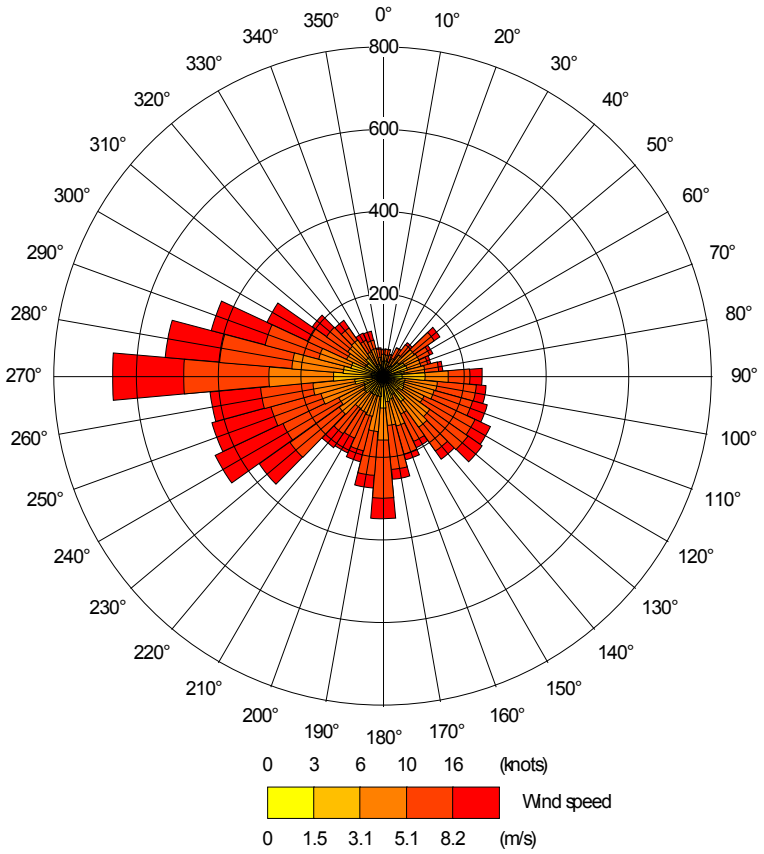
It is therefore necessary to perform a comparison of model results with local monitoring data at relevant locations.

METEOROLOGICAL DATA

ADMS-Roads utilises hourly sequential meteorological data; including wind direction, wind speed, temperature, precipitation and cloud cover, to facilitate the prediction of pollution dispersion between source and receptor. Numerical Weather Predictions (NWP) data were input to the model representative of 2019 hourly meteorological variables over a 4 x 4 km grid at Morecambe.

The 2019 data was used to be consistent with the base/verification traffic year and were applied to the remaining scenarios for the air quality assessment. The 2019 wind rose is presented as **Figure 13.6-1**.

Figure 13.6-1 – 2019 Wind Rose for Morecambe



MODEL VERIFICATION

The comparison of modelled concentrations with local monitored concentrations is a process termed ‘verification’. Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions.

The following are examples of potential causes of such discrepancy:

- Estimates of background pollutant concentrations;
- Meteorological data uncertainties;
- Traffic data uncertainties;
- Model input parameters such as ‘roughness length; and
- Overall limitations of the dispersion model

Full details of the model verification process specific to the proposed development modelling assessment are provided in the ‘Assessment Verification Methodology’ section below.

MODEL PRECISION

Residual uncertainty may remain after systematic error or ‘model accuracy’ has been accounted for in the final predictions. Residual uncertainty may be considered synonymous with the ‘precision’ of the model predictions, i.e. how wide the scatter or residual variability of the predicted values compare with the monitored true value, once systematic error has been allowed for. The

quantification of model precision provides an estimate of how the final predictions may deviate from true (monitored) values at the same location over the same period. Suitable local monitoring data for the purpose of verification is used for model verification.

An evaluation of model performance has been undertaken to establish confidence in model results. LAQM.TG16[10] identifies a number of statistical procedures that are appropriate to evaluate model performance and assess the uncertainty. The statistical parameters used in this assessment are:

- Root mean square error (RMSE);
- Fractional bias (FB); and
- Correlation coefficient (CC).

A brief explanation of each statistic is provided in **Table 13.6-13**.

Table 13.6-13 – Model Performance Statistics

Statistical Parameter	Comments	Ideal value
Root Mean Square Error (RMSE)	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared. If the RMSE values are higher than 25% of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. For example, if the model predictions are for the annual mean NO_2 objective of 40µg/m^3, if an RMSE of 10µg/m^3 or above is determined for a model it is advised to revisit the model parameters and model verification. Ideally an RMSE within 10% of the air quality objective would be derived, which equates to 4µg/m^3 for the annual mean NO_2 objective.	0.00
Correlation Coefficient (CC)	It is used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship. This statistic can be particularly useful when comparing a large number of model and observed data points.	1.00
Fractional Bias (FB)	It is used to identify if the model shows a systematic tendency to over or under predict. FB values vary between +2 and -2 and has an ideal value of zero. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.	0.00

ASSESSMENT VERIFICATION METHODOLOGY

The verification process involves a review of the modelled pollutant concentrations against corresponding monitoring data to determine how well the air quality model has performed. Depending on the outcome it may be considered that the model has performed adequately and that there is no need to adjust any of the modelled results, as per LAQM.TG16[10].

Alternatively, the model may perform outside of the ideal performance limits as stated by LAQM.TG16[10] (for instance, model disagrees outside of +/- 25% of monitored equivalent). There is then a need to check all the input data to ensure that it is reasonable and accurately represented in the air quality modelling process.

Where all input data, such as traffic data, emissions rates, and background concentrations have been checked and considered as reasonable, then the modelled results require adjustment to best align with the monitoring data. This may either be a single verification adjustment factor to be applied to the modelled concentrations across the study area, or a range of different adjustment factors to account for different zones in the study area e.g. major roads, local roads.

The air quality model has been run to predict the 2019 annual mean road-NOx contribution at six annualised roadside diffusion tubes (from the site-specific monitoring study) adjacent to the modelled road network, based on traffic data provided for the 2019 baseline scenario. In total, seven of the site-specific monitors were located in the study area; however, monitor EPN9 was removed from the verification study due as it was located next to a junction for which we had incomplete coverage (road links).

The model outputs of road-NO_x have been compared with the 'measured' road-NO_x, which was determined from the NO_2 concentrations measured using annualised diffusion tubes at the monitoring locations (more info in **Appendix 13.7**), utilising the NO_x from NO_2 calculator[14] provided by Defra and the NO_2 background concentration (from the Defra background pollutant mapping[15]).

As discussed in the methodology section, the most recent suitable data available for model verification purposes is 2019 data.

The tables and figure below present the data used in the verification exercise.

Table 13.6-14 – Data Used in Model Verification Before Adjustment

Monitoring Site	2019 Measured Data ($\mu g/m^3$)	Measured Road-NO_x ($\mu g/m^3$) (from NO_x:NO_2 calculator	Modelled Road-NO_x ($\mu g/m^3$) – before adjustment	Modelled Annual Mean NO_2 Concentration ($\mu g/m^3$) – before adjustment	% Difference (Measured vs Monitored NO_2)
EPN4	21.17	20.71	6.23	13.53	-36.10
EPN5	24.43	27.17	7.99	14.48	-40.73
EPN6	30.24	39.74	11.36	16.00	-47.10
EPN7	22.76	24.41	7.48	13.91	-38.90
EPN8	17.58	13.61	2.01	11.32	-35.62
EPN10	19.67	18.34	3.18	11.57	-41.17

Table 13.6-14 shows that the model is under predicting at all locations. Therefore, verification of the model was progressed to derive an appropriate road-NO_x adjustment factor.

The road-NO_x adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (see **Figure 13.6-2**). This factor (3.53) was then applied to the modelled road-NO_x concentration for each monitoring site to provide adjusted modelled road-NO_x concentrations (as shown in **Table 13.6-15**). The total NO_2 concentrations were then determined by inputting the adjusted modelled road-NO_x concentrations and the background NO_2 concentration into the NO_x to NO_2 calculator.

Figure 13.6-2 – Comparison of Unadjusted Modelled Road-NO_x Versus Measured Road-NO_x

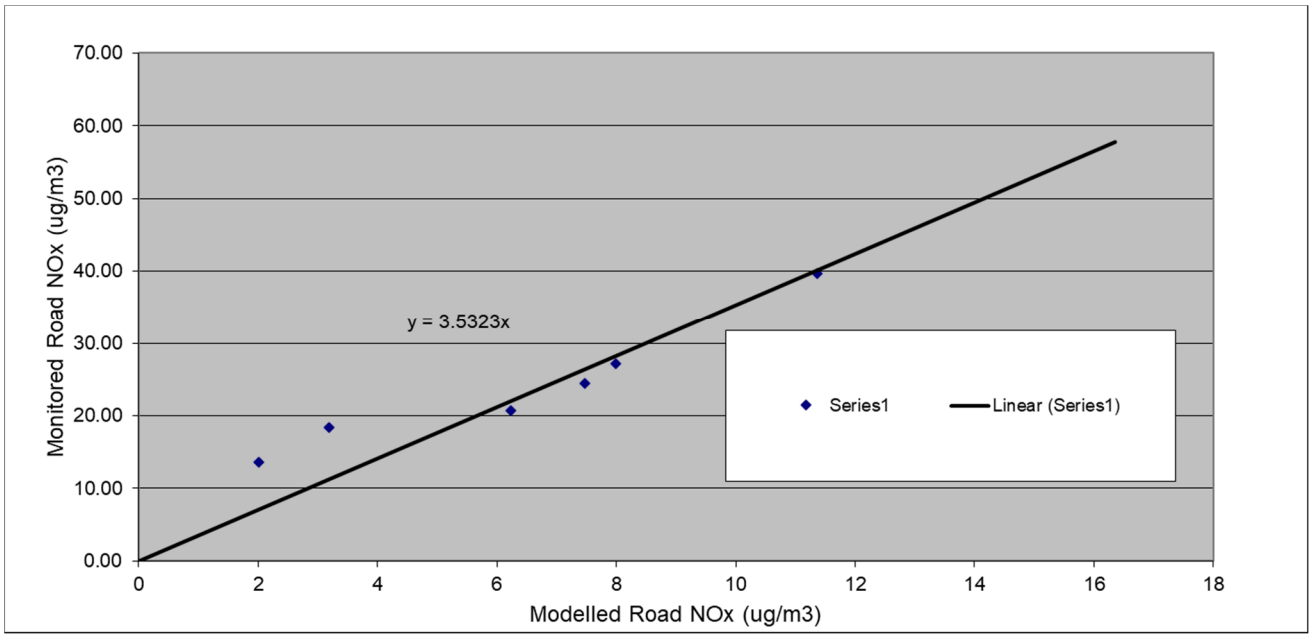


Table 13.6-15 – Post Adjustment Model Results

Monitoring Site	2019 Measured Data ($\mu g/m^3$)	Modelled Annual Mean NO_2 Concentration ($\mu g/m^3$) – after adjustment	% Difference (Measured vs Monitored NO_2)
EPN4	21.17	21.83	3.1
EPN5	24.43	24.95	2.1
EPN6	30.24	30.43	0.6
EPN7	22.76	23.77	4.4
EPN8	17.58	14.11	-19.8
EPN10	19.67	15.94	-18.9

With the adjustment of modelled road-NOx applied, the resulting annual mean NO_2 concentrations at each monitoring site were within +/- 20% of the monitored equivalents. Four of the monitoring sites (Monitors EPN4, 5, 6 & 7) are predicted to be within +/- 5% of the monitored equivalents once adjusted.

Statistical analyses undertaken for the results presented in **Table 13.4-6** demonstrates the following:

- An RMSE value equal to 2.1$\mu g/m^3$ is within the ideal 4$\mu g/m^3$ (10% of the annual mean Objective);
- A correlation coefficient of 1.0, which matches the ideal value of 1.0; and
- A fraction bias of 0.04 which is close to the ideal value of 0.0, indicating no significant tendency for the model to under or over predict when compared to monitored data.

PM_{10} AND $PM_{2.5}$ ADJUSTMENT

There are no local PM_{10} or $PM_{2.5}$ monitoring data against which the model could be verified.

Consequently, the verification factor determined above for adjusting the road-NO_x contribution has been applied to the predicted road-PM_{10} and road-$PM_{2.5}$ contributions, consistent with guidance set out in LAQM.TG16[10].

APPENDIX 13.7 - SITE SPECIFIC BASELINE MONITORING STUDY

MONITORING LOCATIONS

A site specific NO_2 passive diffusion tube monitoring programme was completed by WSP to supplement and extend local authority monitoring to establish baseline conditions within the vicinity of the proposed development. A six-month programme ran from August 2019 until February 2020 and consisted of eleven diffusion tube locations. Diffusion tubes were supplied and analysed by Gradko, prepared in a solution of 20% TEA (Triethanolamine) and water.

Details of the monitoring site locations are presented in **Table 13.7-1** and depicted in **Figure 13.1**. Where site conditions allowed, the monitoring locations were not located in proximity (within 10 m) to the following localised sources or sinks of air pollutants and areas that could cause undue disturbance to free flow air flow around the diffusion tubes:

- Flues (particularly low-level balanced flues);
- Trees and other vegetation;
- Extractor vents; and / or
- Underground ventilation shafts.

Table 13.7-1 – Site Specific Monitoring Locations

Site ID	Coordinates		Location
	X	Y	
EPN1	349543	464136	Caton Road Park & Ride
EPN2	345854	463147	Morecambe Road – Opposite Lancaster & Morecambe College
EPN3	345052	462333	A683 – Near roundabout with Mellishaw Lane
EPN4	345629	463353	A589 Morecambe Road
EPN5	345418	463545	A589 Morecambe Road
EPN6	344333	464047	B5321 Lancaster Road
EPN7	344319	464058	B5321 Lancaster Road
EPN8	343156	464191	B5321 Central Drive
EPN9	344610	464819	A589 Marine Road East
EPN10	345096	463841	A589 Broadway
EPN11	343095	463091	Westgate

NO_2 DIFFUSION TUBE MONITORING RESULTS

BIAS ADJUSTMENT

Diffusion tubes are affected by several sources of interference which can cause substantial under or over estimation of concentrations. This is often referred to as bias, when compared to concentrations measured by more accurate chemiluminescent analysers referred to as continuous monitors.

As a result, Defra advises applying an appropriate bias adjustment factor to measured diffusion tube concentrations. To ensure a conservative assessment, a decision was made to use the bias adjustment factor from Defra's National Diffusion Tubes Adjustment Spreadsheet[22]. Details of the monitoring results can be seen in **Table 13.7-2**.

ANNUALISATION

The monitored NO_2 concentrations presented in **Table 13.7-2** are representative of a period mean. However, period means are not directly comparable with the annual mean air quality objective, and therefore all monitoring results were adjusted based upon the methodology contained within Box 7.9 of LAQM.TG16[10].

In this procedure, data from nearby (within 30 miles) continuous monitoring sites with annual datasets are used to generate a factor to convert period data into annual data. The conversion into annual mean concentrations then provides a concentration that is directly comparable with the annual mean air quality objective for NO_2.

Three Defra Automatic Urban and Rural Network (AURN) 'Urban' sites were used for annualisation. These included:

- Blackpool Marton;
- Preston; and
- Blackburn Accrington Road.

The Blackpool Marton and Preston monitors are both urban background sites, while the Blackburn Accrington Road monitor is an urban traffic site. LAQM.TG16[10] states that if no background sites are available, and the sites to be annualised are urban centre, kerbside or roadside, then it is permissible to annualise using kerbside or roadside (urban traffic) sites. As such the three AURN sites used for annualisation are considered to be appropriate.

The annualisation factor was applied to all period mean results, thus providing annualised NO_2 concentrations at each monitoring site for 2019.

A summary of the bias adjusted, and annualised mean concentration data is displayed in **Table 11.7-2**.

Table 13.7-2 – Bias Adjusted Annual Mean Diffusion Tube Monitoring Results 2019 (µg/m^3)

Site ID	Monthly Measurement							2019 Annualised Value[1]	Final Value – National Bias[2]
	Aug - Sept	Sept - Oct	Oct - Nov	Nov - Dec	Dec - Jan	Jan - Feb	Weighted Average		
EPN1	14.3	18.3	26.3	27.5	29.1	10.9	20.7	18.9	17.2
EPN2	12.6	19.1	25.2	28.5	26.8	17.6	21.6	19.7	18.0
EPN3	11.4	20.3	32.5	32.9	28.1	20.7	24.3	22.2	20.2
EPN4	13.3	22.2	33.2	33.6	31.6	19.8	25.4	23.3	21.2

[22] Defra (2021) National bias adjustment factors [online] https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

EPN5	20.5	25.8	29.0	31.8	39.1	29.3	29.4	26.8	24.4
EPN6	26.3	34.2	38.7	39.7	45.0	34.2	36.3	33.2	30.2
EPN7	20.8	24.9	25.8	28.0	33.7	29.7	27.4	25.0	22.8
EPN8	15.9	19.6	21.9	27.0	-	20.6	21.1	19.3	17.6
EPN9	12.4	17.8	-	22.9	22.3	21.2	19.6	17.9	16.3
EPN10	13.3	20.5	25.1	29.3	30.1	22.9	23.6	21.6	19.7
EPN11	-	19.9	27.8	31.8	23.8	16.7	23.7	21.7	19.7

[1] Annualisation factor of 0.91 applied to weighted average. Factor based on period/annual mean at three AURN continuous monitoring sites in 2019.
[2] National bias factor 0.91 (2019) applied to 'annualised value'

APPENDIX 13.8 - ATMOSPHERIC DISPERSION MODEL RESULTS

Table 13.8-1 – 2024 Predicted Annual Mean NO_2 Concentrations (µg/m^3)

Receptor ID	2019 Base (µg/m^3)	2024 Without Development (µg/m^3)	2024 With Development (µg/m^3)	% of AQAL	Change (µg/m^3)	Change as a % of AQO	Impact
Human Receptors							
R1	12.8	9.8	10.0	25%	0.2	0.6%	Negligible
R2	14.7	11.2	11.4	28%	0.2	0.5%	Negligible
R3	15.9	12.0	12.1	30%	0.2	0.4%	Negligible
R4	17.8	13.2	13.4	33%	0.2	0.5%	Negligible
R5	17.7	12.9	13.2	33%	0.3	0.8%	Negligible
R6	16.2	12.1	12.3	31%	0.2	0.6%	Negligible
R7	16.1	12.1	12.2	31%	0.2	0.5%	Negligible
R8	16.8	12.5	12.7	32%	0.2	0.6%	Negligible
R9	19.7	14.5	14.8	37%	0.3	0.7%	Negligible
R10	16.6	12.5	12.7	32%	0.2	0.6%	Negligible
R11	16.3	12.2	12.5	31%	0.3	0.8%	Negligible
R12	11.7	9.5	9.6	24%	0.1	0.3%	Negligible
R13	11.9	9.6	9.8	24%	0.2	0.4%	Negligible
R14	11.4	9.2	9.4	24%	0.2	0.5%	Negligible
R15	11.4	8.9	9.1	23%	0.2	0.4%	Negligible
R16	12.4	9.5	9.7	24%	0.2	0.5%	Negligible
R17	15.4	11.4	11.7	29%	0.3	0.7%	Negligible
R18	16.7	12.4	12.8	32%	0.4	1.1%	Negligible
R19	10.1	8.1	8.2	20%	0.1	0.2%	Negligible
R20	18.3	13.5	13.7	34%	0.2	0.6%	Negligible
R21	18.0	13.1	13.4	34%	0.3	0.7%	Negligible
R22	17.6	12.8	13.1	33%	0.3	0.8%	Negligible

R23	12.8	9.7	9.9	25%	0.2	0.5%	Negligible
R24	11.6	9.1	9.2	23%	0.2	0.4%	Negligible
R25	19.8	14.4	14.7	37%	0.3	0.8%	Negligible
R26	24.4	17.3	17.9	45%	0.6	1.4%	Negligible
R27	15.5	11.8	12.0	30%	0.2	0.5%	Negligible
R28	18.8	13.8	14.2	36%	0.4	1.0%	Negligible
PCM Receptors							
PCM1	24.8	17.5	18.2	45%	0.6	1.6%	Negligible
PCM2	18.9	13.8	14.2	35%	0.4	0.9%	Negligible
PCM3	22.0	15.9	16.2	41%	0.3	0.7%	Negligible
PCM4	21.6	15.7	15.9	40%	0.3	0.7%	Negligible
PCM5	21.4	15.5	15.8	40%	0.3	0.7%	Negligible
PCM6	21.4	15.5	15.8	39%	0.3	0.6%	Negligible
PCM7	21.3	15.5	15.7	39%	0.3	0.6%	Negligible
PCM8	21.3	15.5	15.7	39%	0.3	0.6%	Negligible
PCM9	21.3	15.5	15.7	39%	0.3	0.6%	Negligible
PCM10	21.4	15.5	15.8	39%	0.3	0.6%	Negligible
PCM11	21.5	15.6	15.9	40%	0.3	0.6%	Negligible
PCM12	21.9	15.9	16.1	40%	0.3	0.7%	Negligible
PCM13	25.1	17.9	18.3	46%	0.4	0.9%	Negligible
PCM14	24.5	17.5	17.8	45%	0.3	0.8%	Negligible
PCM15	24.3	17.4	17.7	44%	0.3	0.8%	Negligible
PCM16	24.2	17.3	17.7	44%	0.3	0.8%	Negligible
PCM17	24.2	17.3	17.7	44%	0.3	0.8%	Negligible
PCM18	24.1	17.3	17.6	44%	0.3	0.8%	Negligible
PCM19	24.2	17.4	17.7	44%	0.3	0.8%	Negligible
PCM20	24.3	17.4	17.7	44%	0.3	0.8%	Negligible
PCM21	24.4	17.5	17.8	45%	0.3	0.8%	Negligible
PCM22	24.8	17.8	18.1	45%	0.3	0.9%	Negligible

PCM23	22.6	16.3	16.6	42%	0.3	0.8%	Negligible
PCM24	21.3	15.3	15.7	39%	0.3	0.8%	Negligible
PCM25	19.2	14.0	14.3	36%	0.3	0.6%	Negligible
PCM26	20.9	15.1	15.4	39%	0.3	0.7%	Negligible
PCM27	26.3	18.6	19.1	48%	0.5	1.2%	Negligible
PCM28	27.9	19.7	20.1	50%	0.4	1.0%	Negligible
PCM29	17.1	12.3	12.7	32%	0.4	1.0%	Negligible
PCM30	15.7	11.4	11.7	29%	0.3	0.9%	Negligible
PCM31	14.9	10.9	11.2	28%	0.3	0.8%	Negligible
PCM32	14.3	10.6	10.9	27%	0.3	0.7%	Negligible
PCM33	13.4	10.0	10.3	26%	0.3	0.7%	Negligible
PCM34	13.5	10.0	10.3	26%	0.3	0.7%	Negligible
PCM35	13.3	9.9	10.2	26%	0.3	0.7%	Negligible
PCM36	13.2	9.9	10.1	25%	0.3	0.6%	Negligible
PCM37	13.1	9.8	10.0	25%	0.3	0.7%	Negligible
PCM38	13.0	9.7	10.0	25%	0.3	0.6%	Negligible
PCM39	12.9	9.7	9.9	25%	0.3	0.6%	Negligible
PCM40	12.8	9.6	9.9	25%	0.3	0.7%	Negligible
PCM41	12.8	9.6	9.8	25%	0.3	0.6%	Negligible
PCM42	12.7	9.6	9.8	25%	0.3	0.6%	Negligible
PCM43	12.7	9.5	9.8	24%	0.3	0.6%	Negligible
PCM44	12.6	9.5	9.8	24%	0.3	0.6%	Negligible
PCM45	12.6	9.5	9.7	24%	0.2	0.6%	Negligible
PCM46	12.5	9.5	9.7	24%	0.3	0.6%	Negligible
PCM47	12.5	9.4	9.7	24%	0.2	0.6%	Negligible
PCM48	12.5	9.4	9.7	24%	0.3	0.6%	Negligible
PCM49	12.5	9.4	9.7	24%	0.3	0.6%	Negligible
PCM50	12.5	9.4	9.7	24%	0.3	0.6%	Negligible
PCM51	12.5	9.4	9.7	24%	0.3	0.6%	Negligible

PCM52	12.5	9.4	9.7	24%	0.3	0.7%	Negligible
PCM53	12.9	9.6	9.9	25%	0.3	0.8%	Negligible
PCM54	12.9	9.6	9.9	25%	0.3	0.7%	Negligible
PCM55	12.8	9.6	9.9	25%	0.3	0.7%	Negligible
PCM56	12.9	9.6	9.9	25%	0.3	0.7%	Negligible
PCM57	12.9	9.6	9.9	25%	0.3	0.7%	Negligible
PCM58	12.9	9.6	9.9	25%	0.3	0.7%	Negligible
PCM59	13.0	9.6	9.9	25%	0.3	0.7%	Negligible
PCM60	13.0	9.7	10.0	25%	0.3	0.7%	Negligible
PCM61	13.1	9.7	10.0	25%	0.3	0.8%	Negligible
PCM62	13.1	9.7	10.0	25%	0.3	0.8%	Negligible
PCM63	13.2	9.8	10.1	25%	0.3	0.8%	Negligible
PCM64	13.3	9.8	10.1	25%	0.3	0.8%	Negligible
PCM65	13.3	9.8	10.2	25%	0.3	0.8%	Negligible
PCM66	13.4	9.9	10.2	25%	0.3	0.8%	Negligible
PCM67	13.5	9.9	10.3	26%	0.3	0.8%	Negligible
PCM68	13.6	10.0	10.3	26%	0.3	0.8%	Negligible
PCM69	13.7	10.1	10.4	26%	0.3	0.8%	Negligible
PCM70	13.8	10.2	10.5	26%	0.3	0.8%	Negligible
PCM71	14.0	10.3	10.6	26%	0.3	0.8%	Negligible
PCM72	14.5	10.6	10.9	27%	0.4	0.9%	Negligible
PCM73	14.9	10.8	11.2	28%	0.4	0.9%	Negligible
PCM74	15.3	11.1	11.4	29%	0.4	0.9%	Negligible
PCM75	16.0	11.5	11.9	30%	0.4	1.0%	Negligible
PCM76	17.2	12.2	12.7	32%	0.4	1.1%	Negligible
PCM77	18.5	13.1	13.5	34%	0.4	1.1%	Negligible
PCM78	19.6	13.7	14.2	36%	0.5	1.3%	Negligible
PCM79	19.2	13.3	13.9	35%	0.6	1.4%	Negligible
PCM80	12.7	9.6	9.9	25%	0.3	0.8%	Negligible

PCM81	12.3	9.7	10.0	25%	0.3	0.8%	Negligible
PCM82	12.2	9.7	10.0	25%	0.3	0.7%	Negligible
PCM83	12.2	9.7	10.0	25%	0.3	0.7%	Negligible
PCM84	12.1	9.7	10.0	25%	0.3	0.7%	Negligible
PCM85	12.1	9.7	9.9	25%	0.3	0.7%	Negligible
PCM86	12.1	9.6	9.9	25%	0.3	0.7%	Negligible
PCM87	12.1	9.7	10.0	25%	0.3	0.8%	Negligible
PCM88	12.5	10.1	10.4	26%	0.3	0.7%	Negligible
PCM89	12.5	10.0	10.3	26%	0.3	0.8%	Negligible
PCM90	12.5	10.0	10.3	26%	0.3	0.8%	Negligible
PCM91	12.6	10.1	10.4	26%	0.3	0.7%	Negligible
PCM92	12.6	10.1	10.4	26%	0.3	0.8%	Negligible
PCM93	12.6	10.1	10.4	26%	0.3	0.7%	Negligible
PCM94	12.7	10.2	10.5	26%	0.3	0.7%	Negligible
PCM95	12.8	10.2	10.5	26%	0.3	0.8%	Negligible
PCM96	13.0	10.4	10.7	27%	0.3	0.8%	Negligible
PCM97	13.1	10.4	10.8	27%	0.3	0.8%	Negligible
PCM98	13.1	10.4	10.7	27%	0.3	0.8%	Negligible
PCM99	12.9	10.3	10.6	27%	0.3	0.8%	Negligible
PCM100	12.9	10.3	10.6	26%	0.3	0.8%	Negligible
PCM101	12.8	10.2	10.5	26%	0.3	0.8%	Negligible
PCM102	12.7	10.2	10.5	26%	0.3	0.8%	Negligible
PCM103	9.1	7.2	7.5	19%	0.4	0.9%	Negligible
PCM104	9.1	7.2	7.6	19%	0.4	1.0%	Negligible
PCM105	9.0	7.1	7.5	19%	0.4	0.9%	Negligible
PCM106	9.0	7.1	7.5	19%	0.3	0.8%	Negligible
PCM107	9.1	7.2	7.5	19%	0.3	0.8%	Negligible
PCM108	9.1	7.2	7.5	19%	0.4	0.9%	Negligible
PCM109	9.2	7.3	7.6	19%	0.4	1.0%	Negligible

PCM110	9.3	7.3	7.7	19%	0.4	1.0%	Negligible
PCM111	13.0	10.4	10.7	27%	0.4	0.9%	Negligible
PCM112	13.1	10.4	10.8	27%	0.4	0.9%	Negligible
PCM113	13.1	10.4	10.8	27%	0.4	0.9%	Negligible
PCM114	13.3	10.5	10.9	27%	0.4	0.9%	Negligible
PCM115	13.3	10.6	10.9	27%	0.4	0.9%	Negligible
PCM116	13.3	10.6	10.9	27%	0.4	0.9%	Negligible
PCM117	13.1	10.4	10.7	27%	0.3	0.8%	Negligible
PCM118	12.9	10.3	10.6	27%	0.3	0.8%	Negligible
PCM119	12.9	10.3	10.6	27%	0.3	0.8%	Negligible
PCM120	12.8	10.3	10.6	26%	0.3	0.8%	Negligible
PCM121	12.8	10.2	10.5	26%	0.3	0.8%	Negligible
PCM122	12.7	10.2	10.5	26%	0.3	0.8%	Negligible
PCM123	12.7	10.2	10.5	26%	0.3	0.8%	Negligible
PCM124	12.6	10.1	10.5	26%	0.3	0.8%	Negligible
PCM125	12.7	10.2	10.5	26%	0.3	0.8%	Negligible
PCM126	12.7	10.2	10.5	26%	0.3	0.8%	Negligible
PCM127	12.3	9.8	10.1	25%	0.3	0.8%	Negligible
PCM128	12.5	9.9	10.3	26%	0.4	0.9%	Negligible
PCM129	12.5	9.9	10.3	26%	0.4	0.9%	Negligible
PCM130	12.6	9.9	10.3	26%	0.4	0.9%	Negligible
PCM131	12.6	9.9	10.3	26%	0.4	0.9%	Negligible
PCM132	12.6	9.9	10.3	26%	0.4	0.9%	Negligible
PCM133	12.7	10.0	10.3	26%	0.4	0.9%	Negligible
PCM134	12.8	10.0	10.3	26%	0.4	0.9%	Negligible
PCM135	9.4	7.3	7.7	19%	0.4	1.0%	Negligible
PCM136	9.0	7.1	7.4	19%	0.3	0.8%	Negligible
PCM137	9.4	7.3	7.7	19%	0.4	0.9%	Negligible

Table 13.8-2 – 2039 Predicted Annual Mean NO_2 Concentrations (µg/m^3)

Receptor ID	2019 Base (µg/m^3)	2039 Without Development (µg/m^3)	2039 With Development (µg/m^3)	% of AQAL	Change (µg/m^3)	Change as a % of AQO	Impact
Human Receptors							
R1	12.8	7.8	7.9	20%	0.1	0.3%	Negligible
R2	14.7	8.9	9.0	22%	0.1	0.3%	Negligible
R3	15.9	9.3	9.4	24%	0.1	0.2%	Negligible
R4	17.8	10.0	10.1	25%	0.1	0.3%	Negligible
R5	17.7	9.9	10.0	25%	0.1	0.3%	Negligible
R6	16.2	9.5	9.6	24%	0.1	0.3%	Negligible
R7	16.1	9.4	9.5	24%	0.1	0.3%	Negligible
R8	16.8	9.7	9.8	24%	0.1	0.3%	Negligible
R9	19.7	11.0	11.2	28%	0.2	0.4%	Negligible
R10	16.6	9.9	10.0	25%	0.1	0.3%	Negligible
R11	16.3	9.7	9.9	25%	0.2	0.4%	Negligible
R12	11.7	8.2	8.2	20%	>0.1	>0.1%	Negligible
R13	11.9	8.2	8.3	21%	>0.1	0.1%	Negligible
R14	11.4	7.8	7.8	19%	>0.1	0.1%	Negligible
R15	11.4	7.6	7.6	19%	>0.1	>0.1%	Negligible
R16	12.4	7.9	8.0	20%	>0.1	0.1%	Negligible
R17	15.4	9.0	9.1	23%	0.1	0.2%	Negligible
R18	16.7	9.4	9.6	24%	0.3	0.7%	Negligible
R19	10.1	6.8	6.8	17%	>0.1	0.1%	Negligible
R20	18.3	10.2	10.3	26%	0.1	0.3%	Negligible
R21	18.0	10.0	10.1	25%	0.1	0.4%	Negligible
R22	17.6	9.8	9.9	25%	0.1	0.3%	Negligible
R23	12.8	8.1	8.1	20%	>0.1	0.1%	Negligible
R24	11.6	7.7	7.7	19%	>0.1	0.1%	Negligible
R25	19.8	10.7	10.9	27%	0.2	0.4%	Negligible

R26	24.4	12.7	13.0	33%	0.3	0.8%	Negligible
R27	15.5	9.5	9.6	24%	0.1	0.3%	Negligible
R28	18.8	10.6	10.9	27%	0.2	0.6%	Negligible
PCM Receptors							
PCM1	24.8	12.7	13.0	33%	0.4	0.9%	Negligible
PCM2	18.9	10.4	10.7	27%	0.2	0.5%	Negligible
PCM3	22.0	11.6	11.8	29%	0.2	0.4%	Negligible
PCM4	21.6	11.4	11.6	29%	0.2	0.4%	Negligible
PCM5	21.4	11.4	11.5	29%	0.2	0.4%	Negligible
PCM6	21.4	11.4	11.5	29%	0.2	0.4%	Negligible
PCM7	21.3	11.3	11.5	29%	0.2	0.4%	Negligible
PCM8	21.3	11.3	11.5	29%	0.1	0.4%	Negligible
PCM9	21.3	11.3	11.5	29%	0.2	0.4%	Negligible
PCM10	21.4	11.4	11.5	29%	0.2	0.4%	Negligible
PCM11	21.5	11.4	11.6	29%	0.2	0.4%	Negligible
PCM12	21.9	11.6	11.7	29%	0.2	0.4%	Negligible
PCM13	25.1	12.8	13.0	32%	0.2	0.5%	Negligible
PCM14	24.5	12.5	12.7	32%	0.2	0.4%	Negligible
PCM15	24.3	12.5	12.6	32%	0.2	0.5%	Negligible
PCM16	24.2	12.4	12.6	31%	0.2	0.4%	Negligible
PCM17	24.2	12.4	12.6	31%	0.2	0.4%	Negligible
PCM18	24.1	12.4	12.6	31%	0.2	0.5%	Negligible
PCM19	24.2	12.4	12.6	32%	0.2	0.5%	Negligible
PCM20	24.3	12.5	12.6	32%	0.2	0.5%	Negligible
PCM21	24.4	12.5	12.7	32%	0.2	0.5%	Negligible
PCM22	24.8	12.7	12.9	32%	0.2	0.5%	Negligible
PCM23	22.6	11.8	12.0	30%	0.2	0.4%	Negligible
PCM24	21.3	11.3	11.5	29%	0.2	0.5%	Negligible
PCM25	19.2	10.5	10.7	27%	0.2	0.4%	Negligible

PCM26	20.9	11.2	11.3	28%	0.2	0.4%	Negligible
PCM27	26.3	13.2	13.5	34%	0.3	0.7%	Negligible
PCM28	27.9	13.8	14.0	35%	0.2	0.6%	Negligible
PCM29	17.1	9.5	9.6	24%	0.1	0.3%	Negligible
PCM30	15.7	9.0	9.1	23%	0.1	0.2%	Negligible
PCM31	14.9	8.7	8.8	22%	0.1	0.1%	Negligible
PCM32	14.3	8.5	8.6	21%	0.1	0.2%	Negligible
PCM33	13.4	8.3	8.3	21%	0.1	0.1%	Negligible
PCM34	13.5	8.2	8.3	21%	>0.1	0.1%	Negligible
PCM35	13.3	8.2	8.2	21%	>0.1	0.1%	Negligible
PCM36	13.2	8.1	8.2	20%	>0.1	0.1%	Negligible
PCM37	13.1	8.1	8.1	20%	>0.1	0.1%	Negligible
PCM38	13.0	8.1	8.1	20%	>0.1	0.1%	Negligible
PCM39	12.9	8.0	8.1	20%	>0.1	0.1%	Negligible
PCM40	12.8	8.0	8.0	20%	>0.1	0.1%	Negligible
PCM41	12.8	8.0	8.0	20%	>0.1	0.1%	Negligible
PCM42	12.7	8.0	8.0	20%	>0.1	0.1%	Negligible
PCM43	12.7	7.9	8.0	20%	>0.1	0.1%	Negligible
PCM44	12.6	7.9	8.0	20%	>0.1	0.1%	Negligible
PCM45	12.6	7.9	8.0	20%	>0.1	0.1%	Negligible
PCM46	12.5	7.9	7.9	20%	>0.1	0.1%	Negligible
PCM47	12.5	7.9	7.9	20%	>0.1	0.1%	Negligible
PCM48	12.5	7.9	7.9	20%	>0.1	0.1%	Negligible
PCM49	12.5	7.9	7.9	20%	>0.1	0.1%	Negligible
PCM50	12.5	7.9	7.9	20%	>0.1	0.1%	Negligible
PCM51	12.5	7.9	7.9	20%	>0.1	0.1%	Negligible
PCM52	12.5	7.9	7.9	20%	>0.1	0.1%	Negligible
PCM53	12.9	8.0	8.0	20%	>0.1	0.1%	Negligible
PCM54	12.9	8.0	8.0	20%	>0.1	0.1%	Negligible

PCM55	12.8	8.0	8.0	20%	>0.1	0.1%	Negligible
PCM56	12.9	8.0	8.0	20%	>0.1	0.1%	Negligible
PCM57	12.9	8.0	8.0	20%	>0.1	0.1%	Negligible
PCM58	12.9	8.0	8.0	20%	>0.1	0.1%	Negligible
PCM59	13.0	8.0	8.0	20%	>0.1	0.1%	Negligible
PCM60	13.0	8.0	8.1	20%	>0.1	0.1%	Negligible
PCM61	13.1	8.0	8.1	20%	>0.1	0.1%	Negligible
PCM62	13.1	8.1	8.1	20%	>0.1	0.1%	Negligible
PCM63	13.2	8.1	8.1	20%	>0.1	0.1%	Negligible
PCM64	13.3	8.1	8.1	20%	>0.1	0.1%	Negligible
PCM65	13.3	8.1	8.2	20%	>0.1	0.1%	Negligible
PCM66	13.4	8.2	8.2	20%	>0.1	0.1%	Negligible
PCM67	13.5	8.2	8.2	21%	>0.1	0.1%	Negligible
PCM68	13.6	8.2	8.3	21%	>0.1	0.1%	Negligible
PCM69	13.7	8.3	8.3	21%	>0.1	0.1%	Negligible
PCM70	13.8	8.3	8.4	21%	>0.1	0.1%	Negligible
PCM71	14.0	8.4	8.4	21%	0.1	0.1%	Negligible
PCM72	14.5	8.5	8.6	21%	0.1	0.1%	Negligible
PCM73	14.9	8.7	8.7	22%	0.1	0.2%	Negligible
PCM74	15.3	8.8	8.9	22%	0.1	0.2%	Negligible
PCM75	16.0	9.0	9.1	23%	0.1	0.2%	Negligible
PCM76	17.2	9.5	9.6	24%	0.1	0.2%	Negligible
PCM77	18.5	10.0	10.1	25%	0.1	0.3%	Negligible
PCM78	19.6	10.3	10.5	26%	0.2	0.4%	Negligible
PCM79	19.2	10.1	10.2	26%	0.1	0.4%	Negligible
PCM80	12.7	8.0	8.0	20%	>0.1	0.1%	Negligible
PCM81	12.3	8.0	8.1	20%	>0.1	0.1%	Negligible
PCM82	12.2	8.0	8.1	20%	>0.1	0.1%	Negligible
PCM83	12.2	8.0	8.1	20%	>0.1	0.1%	Negligible

PCM84	12.1	8.0	8.1	20%	>0.1	0.1%	Negligible
PCM85	12.1	8.0	8.1	20%	>0.1	0.1%	Negligible
PCM86	12.1	8.0	8.0	20%	>0.1	0.1%	Negligible
PCM87	12.1	8.0	8.1	20%	>0.1	0.1%	Negligible
PCM88	12.5	8.5	8.5	21%	>0.1	0.1%	Negligible
PCM89	12.5	8.5	8.5	21%	>0.1	0.1%	Negligible
PCM90	12.5	8.5	8.5	21%	>0.1	0.1%	Negligible
PCM91	12.6	8.5	8.5	21%	>0.1	0.1%	Negligible
PCM92	12.6	8.5	8.6	21%	>0.1	0.1%	Negligible
PCM93	12.6	8.5	8.6	21%	>0.1	0.1%	Negligible
PCM94	12.7	8.6	8.6	21%	>0.1	0.1%	Negligible
PCM95	12.8	8.6	8.6	22%	>0.1	0.1%	Negligible
PCM96	13.0	8.7	8.7	22%	0.1	0.1%	Negligible
PCM97	13.1	8.7	8.8	22%	>0.1	0.1%	Negligible
PCM98	13.1	8.7	8.7	22%	>0.1	0.1%	Negligible
PCM99	12.9	8.6	8.7	22%	>0.1	0.1%	Negligible
PCM100	12.9	8.6	8.7	22%	>0.1	0.1%	Negligible
PCM101	12.8	8.6	8.6	22%	>0.1	0.1%	Negligible
PCM102	12.7	8.6	8.6	22%	>0.1	0.1%	Negligible
PCM103	9.1	6.0	6.0	15%	0.1	0.1%	Negligible
PCM104	9.1	5.9	6.0	15%	0.1	0.2%	Negligible
PCM105	9.0	5.9	6.0	15%	0.1	0.2%	Negligible
PCM106	9.0	5.9	6.0	15%	>0.1	0.1%	Negligible
PCM107	9.1	6.0	6.0	15%	>0.1	0.1%	Negligible
PCM108	9.1	6.0	6.0	15%	>0.1	0.1%	Negligible
PCM109	9.2	6.0	6.1	15%	0.1	0.2%	Negligible
PCM110	9.3	6.0	6.1	15%	0.1	0.1%	Negligible
PCM111	13.0	8.7	8.7	22%	0.1	0.1%	Negligible
PCM112	13.1	8.7	8.7	22%	>0.1	0.1%	Negligible

PCM113	13.1	8.7	8.7	22%	>0.1	0.1%	Negligible
PCM114	13.3	8.8	8.8	22%	>0.1	0.1%	Negligible
PCM115	13.3	8.8	8.8	22%	0.1	0.1%	Negligible
PCM116	13.3	8.8	8.8	22%	0.1	0.1%	Negligible
PCM117	13.1	8.7	8.7	22%	0.1	0.1%	Negligible
PCM118	12.9	8.6	8.7	22%	>0.1	0.1%	Negligible
PCM119	12.9	8.6	8.7	22%	>0.1	0.1%	Negligible
PCM120	12.8	8.6	8.6	22%	>0.1	0.1%	Negligible
PCM121	12.8	8.6	8.6	22%	>0.1	0.1%	Negligible
PCM122	12.7	8.6	8.6	22%	>0.1	0.1%	Negligible
PCM123	12.7	8.6	8.6	22%	>0.1	0.1%	Negligible
PCM124	12.6	8.5	8.6	21%	>0.1	0.1%	Negligible
PCM125	12.7	8.6	8.6	21%	>0.1	0.1%	Negligible
PCM126	12.7	8.6	8.6	21%	>0.1	0.1%	Negligible
PCM127	12.3	8.1	8.1	20%	>0.1	0.1%	Negligible
PCM128	12.5	8.2	8.2	21%	>0.1	0.1%	Negligible
PCM129	12.5	8.2	8.2	21%	>0.1	0.1%	Negligible
PCM130	12.6	8.2	8.2	21%	>0.1	0.1%	Negligible
PCM131	12.6	8.2	8.2	21%	>0.1	0.1%	Negligible
PCM132	12.6	8.2	8.2	21%	>0.1	0.1%	Negligible
PCM133	12.7	8.2	8.2	21%	>0.1	0.1%	Negligible
PCM134	12.8	8.2	8.2	21%	>0.1	0.1%	Negligible
PCM135	9.4	6.0	6.1	15%	>0.1	0.1%	Negligible
PCM136	9.0	5.9	6.0	15%	>0.1	0.1%	Negligible
PCM137	9.4	6.0	6.1	15%	>0.1	0.1%	Negligible

Table 13.8-3 – 2024 Predicted Annual Mean PM_{10} Concentrations (µg/m^3)

Receptor ID	2019 Base (µg/m^3)	2024 Without Development (µg/m^3)	2024 With Development (µg/m^3)	% of AQAL	Change (µg/m^3)	Change as a % of AQO	Impact
Human Receptors							
R1	10.0	9.5	9.6	24%	0.1	0.2%	Negligible
R2	11.8	11.2	11.3	28%	0.1	0.1%	Negligible
R3	12.1	11.5	11.6	29%	>0.1	0.1%	Negligible
R4	12.4	11.8	11.9	30%	0.1	0.1%	Negligible
R5	12.4	11.7	11.8	29%	0.1	0.2%	Negligible
R6	12.1	11.5	11.6	29%	0.1	0.2%	Negligible
R7	12.1	11.5	11.5	29%	0.1	0.2%	Negligible
R8	12.2	11.6	11.7	29%	0.1	0.2%	Negligible
R9	12.0	11.3	11.4	29%	0.1	0.2%	Negligible
R10	11.2	10.6	10.6	27%	0.1	0.1%	Negligible
R11	11.2	10.6	10.6	27%	0.1	0.2%	Negligible
R12	10.3	9.8	9.8	25%	>0.1	0.1%	Negligible
R13	10.4	9.8	9.9	25%	0.1	0.1%	Negligible
R14	11.2	10.6	10.7	27%	0.1	0.2%	Negligible
R15	11.2	10.5	10.6	26%	>0.1	0.1%	Negligible
R16	11.4	10.7	10.7	27%	0.1	0.1%	Negligible
R17	11.9	11.2	11.3	28%	0.1	0.2%	Negligible
R18	12.3	11.8	11.9	30%	0.1	0.2%	Negligible
R19	9.6	9.0	9.1	23%	>0.1	0.1%	Negligible
R20	12.5	11.9	12.0	30%	0.1	0.2%	Negligible
R21	12.2	11.5	11.6	29%	0.1	0.2%	Negligible
R22	12.1	11.5	11.5	29%	0.1	0.2%	Negligible
R23	11.4	10.7	10.8	27%	0.1	0.2%	Negligible
R24	11.2	10.5	10.6	26%	>0.1	0.1%	Negligible

R25	12.8	12.2	12.3	31%	0.1	0.2%	Negligible
R26	12.2	11.5	11.6	29%	0.1	0.3%	Negligible
R27	10.9	10.3	10.3	26%	0.1	0.1%	Negligible
R28	11.4	10.8	10.8	27%	0.1	0.2%	Negligible
PCM Receptors							
PCM1	13.0	12.4	12.6	31%	0.1	0.4%	Negligible
PCM2	12.2	11.6	11.7	29%	0.1	0.2%	Negligible
PCM3	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM4	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM5	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM6	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM7	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM8	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM9	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM10	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM11	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM12	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM13	13.9	13.3	13.4	33%	0.1	0.3%	Negligible
PCM14	13.8	13.2	13.3	33%	0.1	0.3%	Negligible
PCM15	13.8	13.2	13.3	33%	0.1	0.3%	Negligible
PCM16	13.8	13.2	13.3	33%	0.1	0.3%	Negligible
PCM17	13.8	13.2	13.3	33%	0.1	0.3%	Negligible
PCM18	13.8	13.2	13.3	33%	0.1	0.3%	Negligible
PCM19	13.8	13.2	13.3	33%	0.1	0.3%	Negligible
PCM20	13.8	13.2	13.3	33%	0.1	0.3%	Negligible
PCM21	13.8	13.2	13.4	33%	0.1	0.3%	Negligible
PCM22	13.9	13.3	13.4	33%	0.1	0.3%	Negligible
PCM23	13.3	12.7	12.8	32%	0.1	0.2%	Negligible
PCM24	12.6	12.0	12.1	30%	0.1	0.2%	Negligible

PCM25	12.4	11.8	11.9	30%	0.1	0.2%	Negligible
PCM26	12.8	12.3	12.3	31%	0.1	0.2%	Negligible
PCM27	13.4	12.8	12.9	32%	0.1	0.3%	Negligible
PCM28	14.1	13.5	13.6	34%	0.1	0.3%	Negligible
PCM29	12.2	11.5	11.6	29%	0.1	0.3%	Negligible
PCM30	12.0	11.3	11.4	28%	0.1	0.2%	Negligible
PCM31	11.9	11.1	11.2	28%	0.1	0.2%	Negligible
PCM32	11.8	11.1	11.1	28%	0.1	0.2%	Negligible
PCM33	11.6	10.9	10.9	27%	0.1	0.2%	Negligible
PCM34	11.6	10.8	10.9	27%	0.1	0.2%	Negligible
PCM35	11.5	10.8	10.9	27%	0.1	0.2%	Negligible
PCM36	11.5	10.8	10.9	27%	0.1	0.2%	Negligible
PCM37	11.5	10.8	10.8	27%	0.1	0.2%	Negligible
PCM38	11.5	10.7	10.8	27%	0.1	0.2%	Negligible
PCM39	11.5	10.7	10.8	27%	0.1	0.2%	Negligible
PCM40	11.4	10.7	10.8	27%	0.1	0.2%	Negligible
PCM41	11.4	10.7	10.8	27%	0.1	0.2%	Negligible
PCM42	11.4	10.7	10.8	27%	0.1	0.2%	Negligible
PCM43	11.4	10.7	10.8	27%	0.1	0.2%	Negligible
PCM44	11.4	10.7	10.8	27%	0.1	0.2%	Negligible
PCM45	11.4	10.7	10.8	27%	0.1	0.2%	Negligible
PCM46	11.4	10.7	10.7	27%	0.1	0.2%	Negligible
PCM47	11.4	10.7	10.7	27%	0.1	0.2%	Negligible
PCM48	11.4	10.7	10.7	27%	0.1	0.2%	Negligible
PCM49	11.4	10.7	10.7	27%	0.1	0.2%	Negligible
PCM50	11.4	10.7	10.7	27%	0.1	0.2%	Negligible
PCM51	11.4	10.7	10.7	27%	0.1	0.2%	Negligible
PCM52	11.4	10.7	10.7	27%	0.1	0.2%	Negligible
PCM53	11.4	10.7	10.8	27%	0.1	0.2%	Negligible

PCM54	11.4	10.7	10.8	27%	0.1	0.2%	Negligible
PCM55	11.4	10.7	10.8	27%	0.1	0.2%	Negligible
PCM56	11.5	10.7	10.8	27%	0.1	0.2%	Negligible
PCM57	11.5	10.7	10.8	27%	0.1	0.2%	Negligible
PCM58	11.5	10.7	10.8	27%	0.1	0.2%	Negligible
PCM59	11.5	10.7	10.8	27%	0.1	0.2%	Negligible
PCM60	11.5	10.7	10.8	27%	0.1	0.2%	Negligible
PCM61	11.5	10.7	10.8	27%	0.1	0.2%	Negligible
PCM62	11.5	10.7	10.8	27%	0.1	0.2%	Negligible
PCM63	11.5	10.8	10.9	27%	0.1	0.2%	Negligible
PCM64	11.5	10.8	10.9	27%	0.1	0.2%	Negligible
PCM65	11.5	10.8	10.9	27%	0.1	0.2%	Negligible
PCM66	11.6	10.8	10.9	27%	0.1	0.2%	Negligible
PCM67	11.6	10.8	10.9	27%	0.1	0.2%	Negligible
PCM68	11.6	10.8	10.9	27%	0.1	0.2%	Negligible
PCM69	11.6	10.8	10.9	27%	0.1	0.3%	Negligible
PCM70	11.6	10.9	11.0	27%	0.1	0.3%	Negligible
PCM71	11.7	10.9	11.0	28%	0.1	0.3%	Negligible
PCM72	11.8	11.1	11.2	28%	0.1	0.3%	Negligible
PCM73	11.9	11.1	11.2	28%	0.1	0.3%	Negligible
PCM74	12.0	11.2	11.3	28%	0.1	0.3%	Negligible
PCM75	12.1	11.3	11.4	29%	0.1	0.3%	Negligible
PCM76	12.2	11.5	11.6	29%	0.1	0.3%	Negligible
PCM77	12.4	11.6	11.7	29%	0.1	0.3%	Negligible
PCM78	12.5	11.7	11.8	30%	0.1	0.3%	Negligible
PCM79	12.4	11.6	11.7	29%	0.1	0.3%	Negligible
PCM80	11.3	10.6	10.7	27%	0.1	0.2%	Negligible
PCM81	11.3	10.7	10.8	27%	0.1	0.2%	Negligible
PCM82	11.3	10.7	10.8	27%	0.1	0.2%	Negligible

PCM83	11.3	10.7	10.8	27%	0.1	0.2%	Negligible
PCM84	11.3	10.7	10.8	27%	0.1	0.2%	Negligible
PCM85	11.3	10.7	10.8	27%	0.1	0.2%	Negligible
PCM86	11.3	10.7	10.8	27%	0.1	0.2%	Negligible
PCM87	11.3	10.7	10.8	27%	0.1	0.2%	Negligible
PCM88	10.5	10.0	10.1	25%	0.1	0.2%	Negligible
PCM89	10.5	10.0	10.1	25%	0.1	0.2%	Negligible
PCM90	10.5	10.0	10.0	25%	0.1	0.2%	Negligible
PCM91	10.5	10.0	10.1	25%	0.1	0.2%	Negligible
PCM92	10.5	10.0	10.1	25%	0.1	0.2%	Negligible
PCM93	10.5	10.0	10.1	25%	0.1	0.2%	Negligible
PCM94	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM95	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM96	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM97	10.6	10.1	10.1	25%	0.1	0.2%	Negligible
PCM98	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM99	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM100	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM101	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM102	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM103	9.0	8.5	8.6	21%	0.1	0.2%	Negligible
PCM104	9.0	8.5	8.6	21%	0.1	0.3%	Negligible
PCM105	9.0	8.5	8.6	21%	0.1	0.2%	Negligible
PCM106	9.0	8.4	8.5	21%	0.1	0.2%	Negligible
PCM107	9.0	8.5	8.6	21%	0.1	0.2%	Negligible
PCM108	9.0	8.5	8.6	21%	0.1	0.2%	Negligible
PCM109	9.0	8.5	8.6	22%	0.1	0.3%	Negligible
PCM110	9.0	8.5	8.6	22%	0.1	0.3%	Negligible
PCM111	10.6	10.0	10.2	25%	0.1	0.3%	Negligible

PCM112	10.6	10.1	10.2	25%	0.1	0.3%	Negligible
PCM113	10.6	10.1	10.2	25%	0.1	0.3%	Negligible
PCM114	10.7	10.1	10.2	26%	0.1	0.3%	Negligible
PCM115	10.7	10.1	10.2	26%	0.1	0.3%	Negligible
PCM116	10.7	10.1	10.2	25%	0.1	0.3%	Negligible
PCM117	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM118	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM119	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM120	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM121	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM122	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM123	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM124	10.6	10.0	10.1	25%	0.1	0.2%	Negligible
PCM125	10.6	10.0	10.1	25%	0.1	0.3%	Negligible
PCM126	10.6	10.0	10.1	25%	0.1	0.3%	Negligible
PCM127	11.3	10.8	10.9	27%	0.1	0.3%	Negligible
PCM128	11.4	10.8	10.9	27%	0.1	0.3%	Negligible
PCM129	11.4	10.8	10.9	27%	0.1	0.3%	Negligible
PCM130	11.4	10.8	10.9	27%	0.1	0.3%	Negligible
PCM131	11.4	10.8	10.9	27%	0.1	0.3%	Negligible
PCM132	11.4	10.8	10.9	27%	0.1	0.3%	Negligible
PCM133	11.4	10.8	10.9	27%	0.1	0.3%	Negligible
PCM134	11.4	10.8	10.9	27%	0.1	0.3%	Negligible
PCM135	8.9	8.4	8.5	21%	0.1	0.2%	Negligible
PCM136	8.9	8.4	8.5	21%	0.1	0.2%	Negligible
PCM137	8.9	8.4	8.5	21%	0.1	0.2%	Negligible

Table 13.8-4 – 2039 Predicted Annual Mean PM_{10} Concentrations (µg/m^3)

Receptor ID	2019 Base (µg/m^3)	2024 Without Development (µg/m^3)	2024 With Development (µg/m^3)	% of AQAL	Change (µg/m^3)	Change as a % of AQO	Impact
Human Receptors							
R1	10.0	9.4	9.5	24%	0.1	0.2%	Negligible
R2	11.8	11.1	11.2	28%	0.1	0.1%	Negligible
R3	12.1	11.4	11.5	29%	>0.1	0.1%	Negligible
R4	12.4	11.8	11.8	30%	0.1	0.1%	Negligible
R5	12.4	11.6	11.7	29%	0.1	0.2%	Negligible
R6	12.1	11.5	11.5	29%	0.1	0.2%	Negligible
R7	12.1	11.4	11.5	29%	0.1	0.2%	Negligible
R8	12.2	11.5	11.6	29%	0.1	0.2%	Negligible
R9	12.0	11.3	11.4	28%	0.1	0.2%	Negligible
R10	11.2	10.5	10.5	26%	0.1	0.1%	Negligible
R11	11.2	10.5	10.6	26%	0.1	0.2%	Negligible
R12	10.3	9.6	9.7	24%	>0.1	>0.1%	Negligible
R13	10.4	9.7	9.7	24%	>0.1	>0.1%	Negligible
R14	11.2	10.5	10.5	26%	>0.1	>0.1%	Negligible
R15	11.2	10.4	10.4	26%	>0.1	>0.1%	Negligible
R16	11.4	10.6	10.6	26%	>0.1	>0.1%	Negligible
R17	11.9	11.1	11.1	28%	>0.1	0.1%	Negligible
R18	12.3	11.7	11.8	29%	0.1	0.3%	Negligible
R19	9.6	8.9	8.9	22%	>0.1	0.1%	Negligible
R20	12.5	11.9	11.9	30%	0.1	0.2%	Negligible
R21	12.2	11.4	11.5	29%	0.1	0.1%	Negligible
R22	12.1	11.4	11.4	29%	0.1	0.1%	Negligible
R23	11.4	10.6	10.6	27%	>0.1	0.1%	Negligible
R24	11.2	10.4	10.4	26%	>0.1	>0.1%	Negligible
R25	12.8	12.1	12.2	31%	0.1	0.2%	Negligible

R26	12.2	11.5	11.6	29%	0.1	0.3%	Negligible
R27	10.9	10.2	10.2	26%	>0.1	0.1%	Negligible
R28	11.4	10.7	10.8	27%	0.1	0.2%	Negligible
PCM Receptors							
PCM1	13.0	12.4	12.5	31%	0.2	0.4%	Negligible
PCM2	12.2	11.5	11.6	29%	0.1	0.2%	Negligible
PCM3	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM4	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM5	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM6	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM7	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM8	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM9	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM10	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM11	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM12	13.2	12.6	12.7	32%	0.1	0.2%	Negligible
PCM13	13.9	13.3	13.4	34%	0.1	0.3%	Negligible
PCM14	13.8	13.3	13.4	33%	0.1	0.3%	Negligible
PCM15	13.8	13.2	13.4	33%	0.1	0.3%	Negligible
PCM16	13.8	13.2	13.3	33%	0.1	0.3%	Negligible
PCM17	13.8	13.2	13.4	33%	0.1	0.3%	Negligible
PCM18	13.8	13.2	13.4	33%	0.1	0.3%	Negligible
PCM19	13.8	13.3	13.4	33%	0.1	0.3%	Negligible
PCM20	13.8	13.3	13.4	33%	0.1	0.3%	Negligible
PCM21	13.8	13.3	13.4	33%	0.1	0.3%	Negligible
PCM22	13.9	13.3	13.4	34%	0.1	0.3%	Negligible
PCM23	13.3	12.7	12.8	32%	0.1	0.2%	Negligible
PCM24	12.6	11.9	12.0	30%	0.1	0.2%	Negligible
PCM25	12.4	11.8	11.8	30%	0.1	0.2%	Negligible

PCM26	12.8	12.2	12.3	31%	0.1	0.2%	Negligible
PCM27	13.4	12.7	12.9	32%	0.1	0.3%	Negligible
PCM28	14.1	13.5	13.6	34%	0.1	0.3%	Negligible
PCM29	12.2	11.4	11.4	29%	0.1	0.1%	Negligible
PCM30	12.0	11.2	11.2	28%	>0.1	0.1%	Negligible
PCM31	11.9	11.0	11.1	28%	>0.1	0.1%	Negligible
PCM32	11.8	10.9	11.0	27%	>0.1	0.1%	Negligible
PCM33	11.6	10.8	10.8	27%	>0.1	0.1%	Negligible
PCM34	11.6	10.7	10.8	27%	>0.1	0.1%	Negligible
PCM35	11.5	10.7	10.7	27%	>0.1	0.1%	Negligible
PCM36	11.5	10.7	10.7	27%	>0.1	0.1%	Negligible
PCM37	11.5	10.6	10.7	27%	>0.1	0.1%	Negligible
PCM38	11.5	10.6	10.7	27%	>0.1	0.1%	Negligible
PCM39	11.5	10.6	10.6	27%	>0.1	0.1%	Negligible
PCM40	11.4	10.6	10.6	27%	>0.1	0.1%	Negligible
PCM41	11.4	10.6	10.6	27%	>0.1	>0.1%	Negligible
PCM42	11.4	10.6	10.6	26%	>0.1	>0.1%	Negligible
PCM43	11.4	10.6	10.6	26%	>0.1	>0.1%	Negligible
PCM44	11.4	10.6	10.6	26%	>0.1	>0.1%	Negligible
PCM45	11.4	10.6	10.6	26%	>0.1	>0.1%	Negligible
PCM46	11.4	10.5	10.6	26%	>0.1	>0.1%	Negligible
PCM47	11.4	10.5	10.6	26%	>0.1	>0.1%	Negligible
PCM48	11.4	10.5	10.6	26%	>0.1	>0.1%	Negligible
PCM49	11.4	10.5	10.6	26%	>0.1	>0.1%	Negligible
PCM50	11.4	10.5	10.6	26%	>0.1	>0.1%	Negligible
PCM51	11.4	10.5	10.6	26%	>0.1	>0.1%	Negligible
PCM52	11.4	10.5	10.6	26%	>0.1	>0.1%	Negligible
PCM53	11.4	10.6	10.6	27%	>0.1	>0.1%	Negligible
PCM54	11.4	10.6	10.6	27%	>0.1	>0.1%	Negligible

PCM55	11.4	10.6	10.6	27%	>0.1	>0.1%	Negligible
PCM56	11.5	10.6	10.6	27%	>0.1	>0.1%	Negligible
PCM57	11.5	10.6	10.6	27%	>0.1	>0.1%	Negligible
PCM58	11.5	10.6	10.6	27%	>0.1	>0.1%	Negligible
PCM59	11.5	10.6	10.6	27%	>0.1	>0.1%	Negligible
PCM60	11.5	10.6	10.6	27%	>0.1	>0.1%	Negligible
PCM61	11.5	10.6	10.6	27%	>0.1	0.1%	Negligible
PCM62	11.5	10.6	10.7	27%	>0.1	0.1%	Negligible
PCM63	11.5	10.6	10.7	27%	>0.1	0.1%	Negligible
PCM64	11.5	10.7	10.7	27%	>0.1	0.1%	Negligible
PCM65	11.5	10.7	10.7	27%	>0.1	0.1%	Negligible
PCM66	11.6	10.7	10.7	27%	>0.1	0.1%	Negligible
PCM67	11.6	10.7	10.7	27%	>0.1	0.1%	Negligible
PCM68	11.6	10.7	10.7	27%	>0.1	0.1%	Negligible
PCM69	11.6	10.7	10.8	27%	>0.1	0.1%	Negligible
PCM70	11.6	10.8	10.8	27%	>0.1	0.1%	Negligible
PCM71	11.7	10.8	10.8	27%	>0.1	0.1%	Negligible
PCM72	11.8	11.0	11.0	27%	>0.1	0.1%	Negligible
PCM73	11.9	11.0	11.1	28%	>0.1	0.1%	Negligible
PCM74	12.0	11.1	11.1	28%	>0.1	0.1%	Negligible
PCM75	12.1	11.2	11.2	28%	>0.1	0.1%	Negligible
PCM76	12.2	11.4	11.4	29%	0.1	0.1%	Negligible
PCM77	12.4	11.5	11.6	29%	0.1	0.2%	Negligible
PCM78	12.5	11.6	11.7	29%	0.1	0.2%	Negligible
PCM79	12.4	11.5	11.6	29%	0.1	0.1%	Negligible
PCM80	11.3	10.5	10.5	26%	>0.1	>0.1%	Negligible
PCM81	11.3	10.6	10.6	27%	>0.1	>0.1%	Negligible
PCM82	11.3	10.6	10.6	27%	>0.1	>0.1%	Negligible
PCM83	11.3	10.6	10.6	27%	>0.1	>0.1%	Negligible

PCM84	11.3	10.6	10.6	27%	>0.1	>0.1%	Negligible
PCM85	11.3	10.6	10.6	27%	>0.1	>0.1%	Negligible
PCM86	11.3	10.6	10.6	27%	>0.1	>0.1%	Negligible
PCM87	11.3	10.6	10.6	27%	>0.1	>0.1%	Negligible
PCM88	10.5	9.8	9.9	25%	>0.1	>0.1%	Negligible
PCM89	10.5	9.8	9.9	25%	>0.1	>0.1%	Negligible
PCM90	10.5	9.8	9.9	25%	>0.1	>0.1%	Negligible
PCM91	10.5	9.9	9.9	25%	>0.1	>0.1%	Negligible
PCM92	10.5	9.9	9.9	25%	>0.1	>0.1%	Negligible
PCM93	10.5	9.9	9.9	25%	>0.1	>0.1%	Negligible
PCM94	10.6	9.9	9.9	25%	>0.1	0.1%	Negligible
PCM95	10.6	9.9	9.9	25%	>0.1	0.1%	Negligible
PCM96	10.6	9.9	9.9	25%	>0.1	0.1%	Negligible
PCM97	10.6	9.9	10.0	25%	>0.1	0.1%	Negligible
PCM98	10.6	9.9	10.0	25%	>0.1	0.1%	Negligible
PCM99	10.6	9.9	9.9	25%	>0.1	0.1%	Negligible
PCM100	10.6	9.9	9.9	25%	>0.1	0.1%	Negligible
PCM101	10.6	9.9	9.9	25%	>0.1	0.1%	Negligible
PCM102	10.6	9.9	9.9	25%	>0.1	0.1%	Negligible
PCM103	9.0	8.4	8.4	21%	>0.1	0.1%	Negligible
PCM104	9.0	8.4	8.4	21%	>0.1	0.1%	Negligible
PCM105	9.0	8.3	8.4	21%	>0.1	0.1%	Negligible
PCM106	9.0	8.3	8.4	21%	>0.1	>0.1%	Negligible
PCM107	9.0	8.4	8.4	21%	>0.1	>0.1%	Negligible
PCM108	9.0	8.4	8.4	21%	>0.1	0.1%	Negligible
PCM109	9.0	8.4	8.4	21%	>0.1	0.1%	Negligible
PCM110	9.0	8.4	8.4	21%	>0.1	0.1%	Negligible
PCM111	10.6	9.9	10.0	25%	>0.1	0.1%	Negligible
PCM112	10.6	10.0	10.0	25%	>0.1	0.1%	Negligible

PCM113	10.6	10.0	10.0	25%	>0.1	0.1%	Negligible
PCM114	10.7	10.0	10.0	25%	>0.1	0.1%	Negligible
PCM115	10.7	10.0	10.0	25%	>0.1	0.1%	Negligible
PCM116	10.7	10.0	10.0	25%	>0.1	0.1%	Negligible
PCM117	10.6	9.9	10.0	25%	>0.1	0.1%	Negligible
PCM118	10.6	9.9	9.9	25%	>0.1	0.1%	Negligible
PCM119	10.6	9.9	9.9	25%	>0.1	0.1%	Negligible
PCM120	10.6	9.9	9.9	25%	>0.1	0.1%	Negligible
PCM121	10.6	9.9	9.9	25%	>0.1	0.1%	Negligible
PCM122	10.6	9.9	9.9	25%	>0.1	0.1%	Negligible
PCM123	10.6	9.9	9.9	25%	>0.1	0.1%	Negligible
PCM124	10.6	9.9	9.9	25%	>0.1	>0.1%	Negligible
PCM125	10.6	9.9	9.9	25%	>0.1	>0.1%	Negligible
PCM126	10.6	9.9	9.9	25%	>0.1	>0.1%	Negligible
PCM127	11.3	10.7	10.7	27%	>0.1	>0.1%	Negligible
PCM128	11.4	10.7	10.7	27%	>0.1	0.1%	Negligible
PCM129	11.4	10.7	10.7	27%	>0.1	0.1%	Negligible
PCM130	11.4	10.7	10.7	27%	>0.1	0.1%	Negligible
PCM131	11.4	10.7	10.7	27%	>0.1	0.1%	Negligible
PCM132	11.4	10.7	10.7	27%	>0.1	0.1%	Negligible
PCM133	11.4	10.7	10.7	27%	>0.1	0.1%	Negligible
PCM134	11.4	10.7	10.7	27%	>0.1	0.1%	Negligible
PCM135	8.9	8.3	8.3	21%	>0.1	>0.1%	Negligible
PCM136	8.9	8.3	8.3	21%	>0.1	>0.1%	Negligible
PCM137	8.9	8.3	8.3	21%	>0.1	>0.1%	Negligible

Table 13.8-5 – 2024 Predicted Annual Mean $PM_{2.5}$ Concentrations (µg/m^3)

Receptor ID	2019 Base (µg/m^3)	2024 Without Development (µg/m^3)	2024 With Development (µg/m^3)	% of AQAL	Change (µg/m^3)	Change as a % of AQO	Impact
Human Receptors							
R1	6.7	6.3	6.4	25%	>0.1	0.1%	Negligible
R2	7.6	7.1	7.2	29%	>0.1	0.1%	Negligible
R3	7.8	7.3	7.3	29%	>0.1	0.1%	Negligible
R4	8.0	7.5	7.5	30%	>0.1	0.1%	Negligible
R5	7.9	7.4	7.5	30%	>0.1	0.2%	Negligible
R6	8.0	7.5	7.6	30%	>0.1	0.1%	Negligible
R7	7.9	7.5	7.5	30%	>0.1	0.1%	Negligible
R8	8.0	7.5	7.6	30%	>0.1	0.1%	Negligible
R9	7.9	7.4	7.5	30%	0.1	0.2%	Negligible
R10	7.5	7.0	7.0	28%	>0.1	0.1%	Negligible
R11	7.5	7.0	7.1	28%	>0.1	0.2%	Negligible
R12	7.0	6.6	6.6	26%	>0.1	0.1%	Negligible
R13	7.0	6.6	6.6	27%	>0.1	0.1%	Negligible
R14	7.4	7.0	7.0	28%	>0.1	0.1%	Negligible
R15	7.4	6.9	7.0	28%	>0.1	0.1%	Negligible
R16	7.5	7.0	7.1	28%	>0.1	0.1%	Negligible
R17	7.6	7.1	7.2	29%	>0.1	0.2%	Negligible
R18	7.8	7.4	7.4	30%	0.1	0.2%	Negligible
R19	6.5	6.1	6.1	24%	>0.1	0.1%	Negligible
R20	8.0	7.5	7.6	30%	>0.1	0.1%	Negligible
R21	7.8	7.3	7.4	29%	>0.1	0.2%	Negligible
R22	7.8	7.3	7.3	29%	>0.1	0.2%	Negligible
R23	7.6	7.1	7.1	28%	>0.1	0.1%	Negligible
R24	7.4	7.0	7.0	28%	>0.1	0.1%	Negligible

R25	8.4	7.9	7.9	32%	0.1	0.2%	Negligible
R26	8.1	7.6	7.6	31%	0.1	0.3%	Negligible
R27	7.3	6.9	6.9	28%	>0.1	0.1%	Negligible
R28	7.7	7.1	7.2	29%	0.1	0.2%	Negligible
PCM Receptors							
PCM1	8.3	7.8	7.9	32%	0.1	0.3%	Negligible
PCM2	7.8	7.4	7.4	30%	>0.1	0.2%	Negligible
PCM3	8.4	7.9	8.0	32%	>0.1	0.2%	Negligible
PCM4	8.4	7.9	8.0	32%	>0.1	0.2%	Negligible
PCM5	8.4	7.9	8.0	32%	>0.1	0.2%	Negligible
PCM6	8.4	7.9	8.0	32%	>0.1	0.2%	Negligible
PCM7	8.4	7.9	8.0	32%	>0.1	0.2%	Negligible
PCM8	8.4	7.9	8.0	32%	>0.1	0.2%	Negligible
PCM9	8.4	7.9	8.0	32%	>0.1	0.2%	Negligible
PCM10	8.4	7.9	8.0	32%	>0.1	0.2%	Negligible
PCM11	8.4	7.9	8.0	32%	>0.1	0.2%	Negligible
PCM12	8.4	7.9	8.0	32%	>0.1	0.2%	Negligible
PCM13	8.8	8.3	8.4	33%	0.1	0.2%	Negligible
PCM14	8.8	8.3	8.3	33%	0.1	0.2%	Negligible
PCM15	8.8	8.3	8.3	33%	0.1	0.2%	Negligible
PCM16	8.8	8.3	8.3	33%	0.1	0.2%	Negligible
PCM17	8.8	8.3	8.3	33%	0.1	0.2%	Negligible
PCM18	8.8	8.3	8.3	33%	0.1	0.2%	Negligible
PCM19	8.8	8.3	8.3	33%	0.1	0.2%	Negligible
PCM20	8.8	8.3	8.3	33%	0.1	0.2%	Negligible
PCM21	8.8	8.3	8.3	33%	0.1	0.2%	Negligible
PCM22	8.8	8.3	8.3	33%	0.1	0.2%	Negligible
PCM23	8.5	8.0	8.0	32%	0.1	0.2%	Negligible
PCM24	8.1	7.6	7.6	31%	>0.1	0.2%	Negligible

PCM25	8.0	7.5	7.5	30%	>0.1	0.1%	Negligible
PCM26	8.2	7.7	7.8	31%	>0.1	0.2%	Negligible
PCM27	8.6	8.0	8.1	32%	0.1	0.3%	Negligible
PCM28	9.0	8.4	8.5	34%	0.1	0.3%	Negligible
PCM29	7.8	7.3	7.4	29%	0.1	0.2%	Negligible
PCM30	7.7	7.2	7.2	29%	0.1	0.2%	Negligible
PCM31	7.6	7.1	7.2	29%	0.1	0.2%	Negligible
PCM32	7.6	7.0	7.1	28%	>0.1	0.2%	Negligible
PCM33	7.7	7.2	7.2	29%	>0.1	0.2%	Negligible
PCM34	7.6	7.1	7.2	29%	>0.1	0.2%	Negligible
PCM35	7.6	7.1	7.1	29%	>0.1	0.2%	Negligible
PCM36	7.6	7.1	7.1	29%	>0.1	0.2%	Negligible
PCM37	7.6	7.1	7.1	28%	>0.1	0.2%	Negligible
PCM38	7.6	7.1	7.1	28%	>0.1	0.2%	Negligible
PCM39	7.6	7.1	7.1	28%	>0.1	0.2%	Negligible
PCM40	7.6	7.0	7.1	28%	>0.1	0.2%	Negligible
PCM41	7.6	7.0	7.1	28%	>0.1	0.2%	Negligible
PCM42	7.6	7.0	7.1	28%	>0.1	0.2%	Negligible
PCM43	7.6	7.0	7.1	28%	>0.1	0.2%	Negligible
PCM44	7.6	7.0	7.1	28%	>0.1	0.2%	Negligible
PCM45	7.5	7.0	7.1	28%	>0.1	0.2%	Negligible
PCM46	7.5	7.0	7.1	28%	>0.1	0.2%	Negligible
PCM47	7.5	7.0	7.1	28%	>0.1	0.2%	Negligible
PCM48	7.5	7.0	7.1	28%	>0.1	0.2%	Negligible
PCM49	7.5	7.0	7.1	28%	>0.1	0.2%	Negligible
PCM50	7.5	7.0	7.1	28%	>0.1	0.2%	Negligible
PCM51	7.5	7.0	7.1	28%	>0.1	0.2%	Negligible
PCM52	7.5	7.0	7.1	28%	>0.1	0.2%	Negligible
PCM53	7.6	7.0	7.1	28%	0.1	0.2%	Negligible

PCM54	7.6	7.0	7.1	28%	0.1	0.2%	Negligible
PCM55	7.6	7.0	7.1	28%	0.1	0.2%	Negligible
PCM56	7.6	7.0	7.1	28%	0.1	0.2%	Negligible
PCM57	7.6	7.0	7.1	28%	0.1	0.2%	Negligible
PCM58	7.6	7.0	7.1	28%	0.1	0.2%	Negligible
PCM59	7.6	7.1	7.1	28%	0.1	0.2%	Negligible
PCM60	7.6	7.1	7.1	28%	0.1	0.2%	Negligible
PCM61	7.6	7.1	7.1	28%	0.1	0.2%	Negligible
PCM62	7.6	7.1	7.1	28%	0.1	0.2%	Negligible
PCM63	7.6	7.1	7.1	29%	0.1	0.2%	Negligible
PCM64	7.6	7.1	7.1	29%	0.1	0.2%	Negligible
PCM65	7.6	7.1	7.1	29%	0.1	0.2%	Negligible
PCM66	7.6	7.1	7.1	29%	0.1	0.2%	Negligible
PCM67	7.6	7.1	7.2	29%	0.1	0.2%	Negligible
PCM68	7.7	7.1	7.2	29%	0.1	0.2%	Negligible
PCM69	7.7	7.1	7.2	29%	0.1	0.2%	Negligible
PCM70	7.7	7.1	7.2	29%	0.1	0.2%	Negligible
PCM71	7.7	7.2	7.2	29%	0.1	0.2%	Negligible
PCM72	7.6	7.1	7.1	28%	0.1	0.2%	Negligible
PCM73	7.6	7.1	7.1	29%	0.1	0.2%	Negligible
PCM74	7.7	7.1	7.2	29%	0.1	0.2%	Negligible
PCM75	7.8	7.2	7.2	29%	0.1	0.3%	Negligible
PCM76	7.9	7.3	7.3	29%	0.1	0.3%	Negligible
PCM77	7.9	7.4	7.4	30%	0.1	0.3%	Negligible
PCM78	8.0	7.4	7.5	30%	0.1	0.3%	Negligible
PCM79	8.0	7.4	7.4	30%	0.1	0.3%	Negligible
PCM80	7.5	7.0	7.1	28%	>0.1	0.2%	Negligible
PCM81	7.5	7.1	7.1	28%	0.1	0.2%	Negligible
PCM82	7.5	7.1	7.1	28%	0.1	0.2%	Negligible

PCM83	7.5	7.1	7.1	28%	0.1	0.2%	Negligible
PCM84	7.5	7.1	7.1	28%	0.1	0.2%	Negligible
PCM85	7.5	7.1	7.1	28%	0.1	0.2%	Negligible
PCM86	7.5	7.1	7.1	28%	0.1	0.2%	Negligible
PCM87	7.5	7.1	7.1	28%	0.1	0.2%	Negligible
PCM88	7.1	6.7	6.7	27%	0.1	0.2%	Negligible
PCM89	7.1	6.7	6.7	27%	0.1	0.2%	Negligible
PCM90	7.1	6.7	6.7	27%	0.1	0.2%	Negligible
PCM91	7.1	6.7	6.7	27%	0.1	0.2%	Negligible
PCM92	7.1	6.7	6.7	27%	0.1	0.2%	Negligible
PCM93	7.1	6.7	6.7	27%	0.1	0.2%	Negligible
PCM94	7.1	6.7	6.7	27%	0.1	0.2%	Negligible
PCM95	7.1	6.7	6.7	27%	0.1	0.2%	Negligible
PCM96	7.2	6.7	6.8	27%	0.1	0.2%	Negligible
PCM97	7.2	6.7	6.8	27%	0.1	0.2%	Negligible
PCM98	7.2	6.7	6.8	27%	0.1	0.2%	Negligible
PCM99	7.2	6.7	6.8	27%	0.1	0.2%	Negligible
PCM100	7.2	6.7	6.8	27%	0.1	0.2%	Negligible
PCM101	7.1	6.7	6.8	27%	0.1	0.2%	Negligible
PCM102	7.1	6.7	6.7	27%	0.1	0.2%	Negligible
PCM103	6.1	5.7	5.7	23%	0.1	0.2%	Negligible
PCM104	6.1	5.7	5.7	23%	0.1	0.3%	Negligible
PCM105	6.1	5.7	5.7	23%	0.1	0.2%	Negligible
PCM106	6.1	5.7	5.7	23%	0.1	0.2%	Negligible
PCM107	6.1	5.7	5.7	23%	0.1	0.2%	Negligible
PCM108	6.1	5.7	5.7	23%	0.1	0.2%	Negligible
PCM109	6.1	5.7	5.7	23%	0.1	0.2%	Negligible
PCM110	6.1	5.7	5.8	23%	0.1	0.2%	Negligible
PCM111	7.2	6.7	6.8	27%	0.1	0.2%	Negligible

PCM112	7.2	6.7	6.8	27%	0.1	0.2%	Negligible
PCM113	7.2	6.7	6.8	27%	0.1	0.2%	Negligible
PCM114	7.2	6.8	6.8	27%	0.1	0.2%	Negligible
PCM115	7.2	6.8	6.8	27%	0.1	0.2%	Negligible
PCM116	7.2	6.7	6.8	27%	0.1	0.2%	Negligible
PCM117	7.2	6.7	6.8	27%	0.1	0.2%	Negligible
PCM118	7.2	6.7	6.8	27%	0.1	0.2%	Negligible
PCM119	7.2	6.7	6.8	27%	0.1	0.2%	Negligible
PCM120	7.2	6.7	6.8	27%	0.1	0.2%	Negligible
PCM121	7.1	6.7	6.8	27%	0.1	0.2%	Negligible
PCM122	7.1	6.7	6.8	27%	0.1	0.2%	Negligible
PCM123	7.1	6.7	6.8	27%	0.1	0.2%	Negligible
PCM124	7.1	6.7	6.7	27%	0.1	0.2%	Negligible
PCM125	7.1	6.7	6.8	27%	0.1	0.2%	Negligible
PCM126	7.1	6.7	6.8	27%	0.1	0.2%	Negligible
PCM127	7.5	7.1	7.1	29%	0.1	0.2%	Negligible
PCM128	7.5	7.1	7.2	29%	0.1	0.2%	Negligible
PCM129	7.5	7.1	7.2	29%	0.1	0.3%	Negligible
PCM130	7.5	7.1	7.2	29%	0.1	0.3%	Negligible
PCM131	7.5	7.1	7.2	29%	0.1	0.3%	Negligible
PCM132	7.6	7.1	7.2	29%	0.1	0.3%	Negligible
PCM133	7.6	7.1	7.2	29%	0.1	0.3%	Negligible
PCM134	7.6	7.1	7.2	29%	0.1	0.3%	Negligible
PCM135	6.1	5.6	5.7	23%	>0.1	0.2%	Negligible
PCM136	6.1	5.6	5.7	23%	>0.1	0.2%	Negligible
PCM137	6.1	5.6	5.7	23%	>0.1	0.2%	Negligible

Table 13.8-6 – 2039 Predicted Annual Mean $PM_{2.5}$ Concentrations (µg/m^3)

Receptor ID	2019 Base (µg/m^3)	2024 Without Development (µg/m^3)	2024 With Development (µg/m^3)	% of AQAL	Change (µg/m^3)	Change as a % of AQO	Impact
Human Receptors							
R1	6.7	6.2	6.3	25%	>0.1	0.2%	Negligible
R2	7.6	7.0	7.1	28%	>0.1	0.1%	Negligible
R3	7.8	7.2	7.2	29%	>0.1	0.1%	Negligible
R4	8.0	7.4	7.4	30%	>0.1	0.1%	Negligible
R5	7.9	7.3	7.4	29%	>0.1	0.1%	Negligible
R6	8.0	7.5	7.5	30%	>0.1	0.1%	Negligible
R7	7.9	7.4	7.4	30%	>0.1	0.1%	Negligible
R8	8.0	7.5	7.5	30%	>0.1	0.2%	Negligible
R9	7.9	7.4	7.4	30%	0.1	0.2%	Negligible
R10	7.5	6.9	7.0	28%	>0.1	0.1%	Negligible
R11	7.5	6.9	7.0	28%	>0.1	0.2%	Negligible
R12	7.0	6.5	6.5	26%	>0.1	>0.1%	Negligible
R13	7.0	6.5	6.5	26%	>0.1	>0.1%	Negligible
R14	7.4	6.9	6.9	28%	>0.1	>0.1%	Negligible
R15	7.4	6.8	6.8	27%	>0.1	>0.1%	Negligible
R16	7.5	6.9	6.9	28%	>0.1	>0.1%	Negligible
R17	7.6	7.0	7.1	28%	>0.1	0.1%	Negligible
R18	7.8	7.3	7.3	29%	0.1	0.2%	Negligible
R19	6.5	6.0	6.0	24%	>0.1	0.1%	Negligible
R20	8.0	7.5	7.5	30%	>0.1	0.2%	Negligible
R21	7.8	7.2	7.3	29%	>0.1	0.1%	Negligible
R22	7.8	7.2	7.2	29%	>0.1	0.1%	Negligible
R23	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
R24	7.4	6.9	6.9	27%	>0.1	>0.1%	Negligible
R25	8.4	7.8	7.9	31%	0.1	0.2%	Negligible

R26	8.1	7.5	7.6	30%	0.1	0.3%	Negligible
R27	7.3	6.8	6.8	27%	>0.1	0.1%	Negligible
R28	7.7	7.1	7.1	28%	0.1	0.2%	Negligible
PCM Receptors							
PCM1	8.3	7.8	7.9	31%	0.1	0.3%	Negligible
PCM2	7.8	7.3	7.3	29%	>0.1	0.2%	Negligible
PCM3	8.4	7.9	7.9	32%	0.1	0.2%	Negligible
PCM4	8.4	7.9	7.9	32%	>0.1	0.2%	Negligible
PCM5	8.4	7.9	7.9	32%	>0.1	0.2%	Negligible
PCM6	8.4	7.9	7.9	32%	>0.1	0.2%	Negligible
PCM7	8.4	7.9	7.9	32%	>0.1	0.2%	Negligible
PCM8	8.4	7.9	7.9	32%	>0.1	0.2%	Negligible
PCM9	8.4	7.9	7.9	32%	>0.1	0.2%	Negligible
PCM10	8.4	7.9	7.9	32%	>0.1	0.2%	Negligible
PCM11	8.4	7.9	7.9	32%	>0.1	0.2%	Negligible
PCM12	8.4	7.9	7.9	32%	>0.1	0.2%	Negligible
PCM13	8.8	8.3	8.3	33%	0.1	0.2%	Negligible
PCM14	8.8	8.2	8.3	33%	0.1	0.2%	Negligible
PCM15	8.8	8.2	8.3	33%	0.1	0.2%	Negligible
PCM16	8.8	8.2	8.3	33%	0.1	0.2%	Negligible
PCM17	8.8	8.2	8.3	33%	0.1	0.2%	Negligible
PCM18	8.8	8.2	8.3	33%	0.1	0.2%	Negligible
PCM19	8.8	8.2	8.3	33%	0.1	0.2%	Negligible
PCM20	8.8	8.2	8.3	33%	0.1	0.2%	Negligible
PCM21	8.8	8.2	8.3	33%	0.1	0.2%	Negligible
PCM22	8.8	8.2	8.3	33%	0.1	0.3%	Negligible
PCM23	8.5	7.9	8.0	32%	0.1	0.2%	Negligible
PCM24	8.1	7.5	7.6	30%	>0.1	0.2%	Negligible
PCM25	8.0	7.4	7.5	30%	>0.1	0.1%	Negligible

PCM26	8.2	7.7	7.7	31%	>0.1	0.2%	Negligible
PCM27	8.6	8.0	8.0	32%	0.1	0.3%	Negligible
PCM28	9.0	8.4	8.4	34%	0.1	0.3%	Negligible
PCM29	7.8	7.2	7.2	29%	>0.1	0.1%	Negligible
PCM30	7.7	7.1	7.1	28%	>0.1	0.1%	Negligible
PCM31	7.6	7.0	7.0	28%	>0.1	0.1%	Negligible
PCM32	7.6	7.0	7.0	28%	>0.1	0.1%	Negligible
PCM33	7.7	7.1	7.1	28%	>0.1	0.1%	Negligible
PCM34	7.6	7.0	7.0	28%	>0.1	0.1%	Negligible
PCM35	7.6	7.0	7.0	28%	>0.1	0.1%	Negligible
PCM36	7.6	7.0	7.0	28%	>0.1	0.1%	Negligible
PCM37	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM38	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM39	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM40	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM41	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM42	7.6	6.9	7.0	28%	>0.1	>0.1%	Negligible
PCM43	7.6	6.9	6.9	28%	>0.1	>0.1%	Negligible
PCM44	7.6	6.9	6.9	28%	>0.1	>0.1%	Negligible
PCM45	7.5	6.9	6.9	28%	>0.1	>0.1%	Negligible
PCM46	7.5	6.9	6.9	28%	>0.1	>0.1%	Negligible
PCM47	7.5	6.9	6.9	28%	>0.1	>0.1%	Negligible
PCM48	7.5	6.9	6.9	28%	>0.1	>0.1%	Negligible
PCM49	7.5	6.9	6.9	28%	>0.1	>0.1%	Negligible
PCM50	7.5	6.9	6.9	28%	>0.1	>0.1%	Negligible
PCM51	7.5	6.9	6.9	28%	>0.1	>0.1%	Negligible
PCM52	7.5	6.9	6.9	28%	>0.1	>0.1%	Negligible
PCM53	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM54	7.6	6.9	7.0	28%	>0.1	>0.1%	Negligible

PCM55	7.6	6.9	7.0	28%	>0.1	>0.1%	Negligible
PCM56	7.6	6.9	7.0	28%	>0.1	>0.1%	Negligible
PCM57	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM58	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM59	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM60	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM61	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM62	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM63	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM64	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM65	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM66	7.6	7.0	7.0	28%	>0.1	0.1%	Negligible
PCM67	7.6	7.0	7.0	28%	>0.1	0.1%	Negligible
PCM68	7.7	7.0	7.0	28%	>0.1	0.1%	Negligible
PCM69	7.7	7.0	7.0	28%	>0.1	0.1%	Negligible
PCM70	7.7	7.0	7.1	28%	>0.1	0.1%	Negligible
PCM71	7.7	7.1	7.1	28%	>0.1	0.1%	Negligible
PCM72	7.6	7.0	7.0	28%	>0.1	0.1%	Negligible
PCM73	7.6	7.0	7.0	28%	>0.1	0.1%	Negligible
PCM74	7.7	7.0	7.1	28%	>0.1	0.1%	Negligible
PCM75	7.8	7.1	7.1	28%	>0.1	0.1%	Negligible
PCM76	7.9	7.2	7.2	29%	>0.1	0.1%	Negligible
PCM77	7.9	7.3	7.3	29%	>0.1	0.1%	Negligible
PCM78	8.0	7.3	7.4	30%	>0.1	0.1%	Negligible
PCM79	8.0	7.3	7.3	29%	>0.1	0.1%	Negligible
PCM80	7.5	6.9	6.9	28%	>0.1	>0.1%	Negligible
PCM81	7.5	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM82	7.5	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM83	7.5	7.0	7.0	28%	>0.1	>0.1%	Negligible

PCM84	7.5	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM85	7.5	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM86	7.5	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM87	7.5	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM88	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM89	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM90	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM91	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM92	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM93	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM94	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM95	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM96	7.2	6.6	6.6	27%	>0.1	0.1%	Negligible
PCM97	7.2	6.6	6.7	27%	>0.1	0.1%	Negligible
PCM98	7.2	6.6	6.6	27%	>0.1	0.1%	Negligible
PCM99	7.2	6.6	6.6	27%	>0.1	>0.1%	Negligible
PCM100	7.2	6.6	6.6	27%	>0.1	>0.1%	Negligible
PCM101	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM102	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM103	6.1	5.6	5.6	22%	>0.1	0.1%	Negligible
PCM104	6.1	5.6	5.6	22%	>0.1	0.1%	Negligible
PCM105	6.1	5.6	5.6	22%	>0.1	0.1%	Negligible
PCM106	6.1	5.6	5.6	22%	>0.1	>0.1%	Negligible
PCM107	6.1	5.6	5.6	22%	>0.1	>0.1%	Negligible
PCM108	6.1	5.6	5.6	22%	>0.1	>0.1%	Negligible
PCM109	6.1	5.6	5.6	22%	>0.1	0.1%	Negligible
PCM110	6.1	5.6	5.6	23%	>0.1	0.1%	Negligible
PCM111	7.2	6.6	6.6	27%	>0.1	0.1%	Negligible
PCM112	7.2	6.6	6.7	27%	>0.1	>0.1%	Negligible

PCM113	7.2	6.6	6.7	27%	>0.1	>0.1%	Negligible
PCM114	7.2	6.7	6.7	27%	>0.1	0.1%	Negligible
PCM115	7.2	6.7	6.7	27%	>0.1	0.1%	Negligible
PCM116	7.2	6.7	6.7	27%	>0.1	0.1%	Negligible
PCM117	7.2	6.6	6.6	27%	>0.1	0.1%	Negligible
PCM118	7.2	6.6	6.6	27%	>0.1	>0.1%	Negligible
PCM119	7.2	6.6	6.6	27%	>0.1	>0.1%	Negligible
PCM120	7.2	6.6	6.6	27%	>0.1	>0.1%	Negligible
PCM121	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM122	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM123	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM124	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM125	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM126	7.1	6.6	6.6	26%	>0.1	>0.1%	Negligible
PCM127	7.5	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM128	7.5	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM129	7.5	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM130	7.5	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM131	7.5	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM132	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM133	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM134	7.6	7.0	7.0	28%	>0.1	>0.1%	Negligible
PCM135	6.1	5.6	5.6	22%	>0.1	>0.1%	Negligible
PCM136	6.1	5.5	5.6	22%	>0.1	>0.1%	Negligible
PCM137	6.1	5.6	5.6	22%	>0.1	>0.1%	Negligible



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