POWERFUEL

Portland energy recovery facility

Environmental statement

Technical appendix D:

Air quality

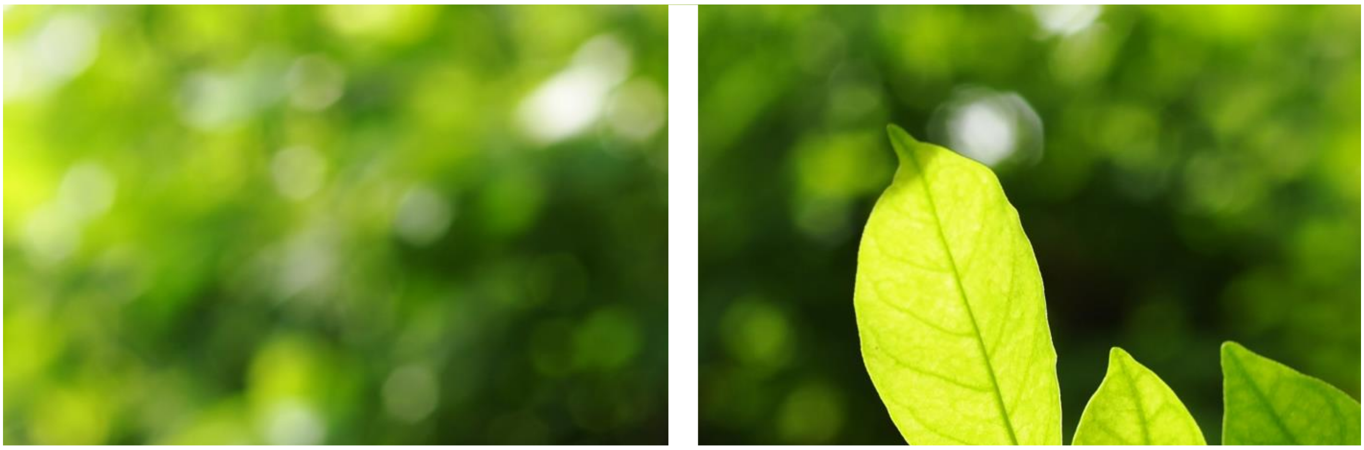
(part 3 of 3)

D3

D3

Roads emissions modelling

FICHTNER
Consulting Engineers Limited



Portland ERF

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Appendix D.3 Roads Emissions Modelling

ENGINEERING + CONSULTING

Document approval

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Contents

1 Introduction

This Appendix sets out the approach taken to modelling road traffic emissions during the operational phase of the Proposed Development. This includes all model inputs and justifications where appropriate. Finally, this Appendix presents the results of the modelling, which are drawn upon in the Air Quality ES chapter. When calculating the total impact this also includes the contribution from process emissions. For full details of the process emissions modelling methodology, reference should be made to Appendix D.2 of the ES.

2 Sensitive Receptors

2.1 Human sensitive receptors

As set out in the ES chapter the trip generation rate for the Proposed Development does not exceed the screening criteria set out in the EPUK and Institute of Air Quality Management (IAQM) guidance document “Guidance of land-use planning and development control: Planning for air quality 2017” outside of an Air Quality Management Area (AQMA). As such the need for a detailed assessment has been screened out.

However, the Boot Hill area of Weymouth has been identified as being particularly sensitive to additional traffic emissions. Although not declared as an AQMA, the EPUK and IAQM screening threshold for an AQMA has been applied in this area. The trip generation rate is just above the screening threshold and as such detailed modelling of traffic through the Boot Hill area of Weymouth has been carried out.

As part of this assessment, the predicted contribution from road traffic exhaust emissions has been calculated at a number of sensitive receptors along each of the local roads. This has focussed on the Boot Hill area of Weymouth.

34 receptors have been selected which are representative of the residential properties along the A354 Boot Hill. These are displayed in Figure 1 in Annex A.

2.2 Ecological sensitive receptors

The Design Manual for Roads and Bridges (DMRB) considers any receptor within 200 m of a road source to be potentially affected by that operation. Natural England guidance document “Natural England’s approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations” explains that it is widely accepted that imperceptible impacts are those which are less than 1% of the Critical Level or Load which is considered to be roughly equivalent to 1,000 AADT for cars and 200 AADT for HGVs. The guidance draws upon the DMRB and states that the initial screening is to determine if there are any sites within 200 m of a road impacted by the proposals.

The trip generation rate for the Proposed Development is well below the 200 HGV screening threshold, but the routing of traffic is along Main Road and Portland Beach Road which both run adjacent to designated ecological sites. The process emissions modelling has shown that impacts are restricted to the Portland area and as such the in-combination impact with road traffic emissions has just focussed on the Isle of Portland (SSSI and SAC) and Chesil and The Fleet (SAC, SPA, SSSI).

To assess the impact at these sites a transect has been modelled from the road as shown in Figure 1 in Annex A.

3 Modelling Methodology

3.1 Selection of model

Detailed dispersion modelling was undertaking using the model ADMS-Roads 5.0, developed and supplied by Cambridge Environmental Research Consultants (CERC). This model is routinely used for modelling of emissions for environmental assessment purposes to the satisfaction of local authorities.

3.2 Input data

The model requires input data that details the following parameters:

- Traffic flow data;
- Vehicle emission factors;
- Spatial co-ordinates of emissions;
- Discrete receptor points;
- Meteorological data;
- Roughness length; and,
- Monin-Obukhov length.

3.2.1 Traffic flow data

24-hour AADT flows and HDV numbers have been provided by AWP, the transport consultant, for the following scenarios:

- 2019 Baseline
- 2023 operational phase
  - Do-minimum
  - Do-something

The do-minimum scenarios include traffic flows from several committed developments in the area, as well as a Tempro growth factor to represent general traffic growth due to a number of additional smaller committed developments. The do-something scenarios are the do minimum plus the additional traffic from the Proposed Development.

The traffic data used in the assessment is presented in Tables 2 to 6.

LDVs have been modelled at the speed limit and HDVs have been modelled at 5 kph below the speed limit, with the exception of junction approaches and queue zones as detailed in the following section. Reference should be made to Figure 2 in Annex A which shows the vehicle speeds used and queuing sections.

3.2.1.1 Junction approaches and queue zones

In accordance with the guidance outlined in LAQM.TG(16), road junctions have been modelled with the assumption of approximately a 50 m slow-down phase, prior to the junction line. These slow-down phases have been modelled at a speed of 20 km/h.

A review of typical traffic conditions has been undertaken using Google Maps. This has indicated that queuing occurs close to major junctions during peak periods. Representative queue zone have been modelled. Guidance has been taken from CERC guidance note 60 – Modelling queuing traffic[1]. This note recommends the following approach:

1. Assume a representative average vehicle length - 5.75 m which is the highways industry standard.
2. Assume that the vehicles are travelling at the slowest speed it is possible to model (5 kph).
3. Calculate a representative AADT for the queue zones. The AADT can be calculated as:

   AADT = [speed(m/hour)/vehicle length(m] x 24
4. Using the assumed values from (1) and (2), this gives a representative AADT of 20,870 vehicles.

In addition to the above methodology, the following points should be noted:

1. Emissions from the queue zones have been applied to the hours when queuing is most common based on the review of traffic using Google Maps, which are the AM and PM weekday peaks and during weekend afternoons. The queues have been factored to be present 25%, 50% or 75% of the hours during which queueing has been determined to be present, based on the severity of the congestion.
2. The emissions from the slow-down phase that overlaps the queue zone are always on. Whilst this has the potential to over-predict emissions during hours of queuing, it is important to retain these emissions as they will capture the increase in emissions due to development-generated traffic. Queue zones always have the same speed (5 kph) and AADT (20,870 per queue lane), therefore there would be no difference in emissions between scenarios on these road sections for the hours with queuing traffic, unless the emissions from baseline and development traffic were also included.
3. The split between LDVs and HDVs in the queue zone is assumed not to change from 2019 levels. A slight increase in HDV percentage due to the introduction of HDV movements would result in lower emissions from the queue zone. Also, the addition of more vehicles would likely result in higher emissions due to longer queues. However, it is not possible to represent this in the model as there is no information available as to how the queue lengths will change in future.

Reference should be made Figure 2 in Annex A for a graphical representation of all road links used in the dispersion modelling.

[1] Cambridge Environmental Research Consultants – CERC note 60, Modelling queuing traffic, August 2004

Table 1: Traffic Data – 24-hour AADT – Operational Phase

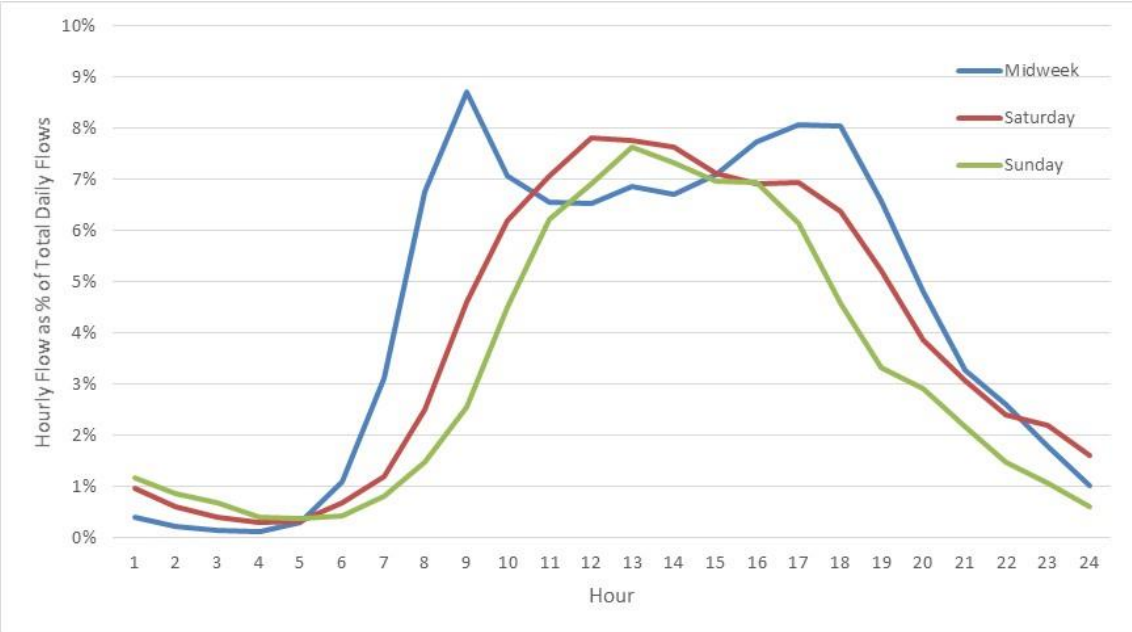
Road Link		2019 baseline		Do minimum 2023		Do something 2023		Development trips	
		Cars	HGVs	Cars	HGVs	Cars	HGVs	Cars	HGVs
A	Port – Lichen Beds	-	-	0	1,111	46	1,191	46	80
B	Portland Beach Road	14,859	1,836	16,710	7,306	16,722	7,386	12	80
C	Boot Hill Buxton Road	18,634	1,843	20,472	4,554	20,478	4,594	6	40
D	A354 opp Radipole Lake	14,563	1,440	16,127	4,140	16,133	4,180	6	40
E	A354 Weymouth Relief Road	26,256	2,597	27,915	8,172	27,917	8,252	2	80
F	Granby Way	16,222	854	17,336	3,567	17,342	3,607	6	40

Source: AWP

3.2.1.2 Time varying emission profile

The traffic count data shows that flows are not evenly distributed throughout the day. To account for this a time varying emission profile was applied to traffic data. The following graph shows the diurnal profile from Boot Hill. A review has been undertaken for the other count points in the study which showed a similar profile.

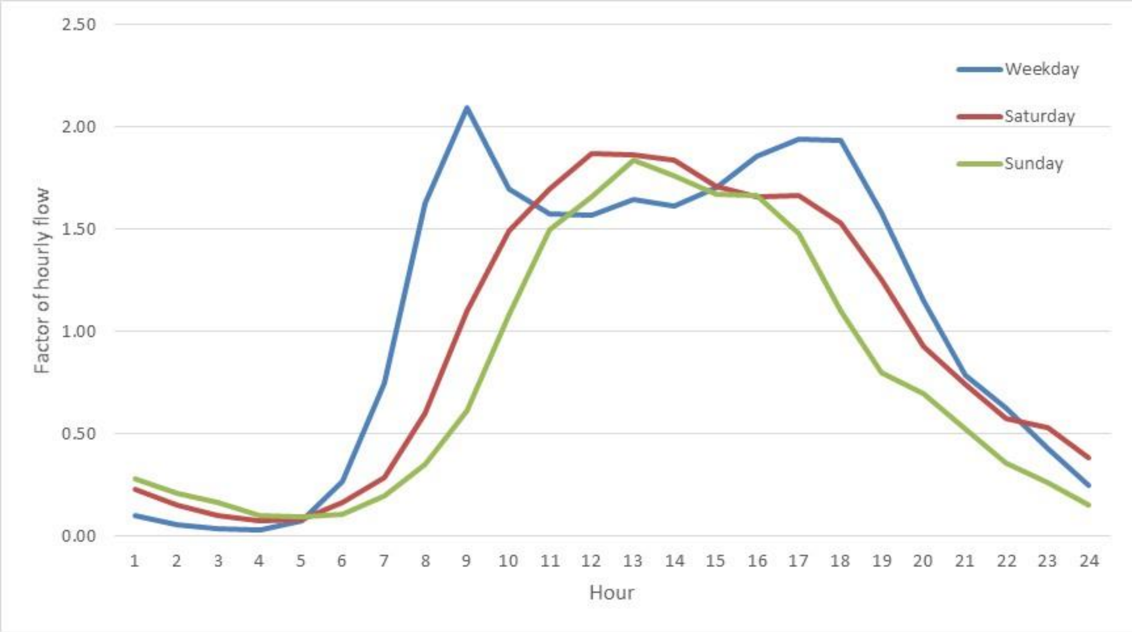
Graph 1: Baseline – Traffic Flows (Diurnal Profile)



For the purpose of the dispersion modelling the above profile was applied to all the baseline and do-minimum flows.

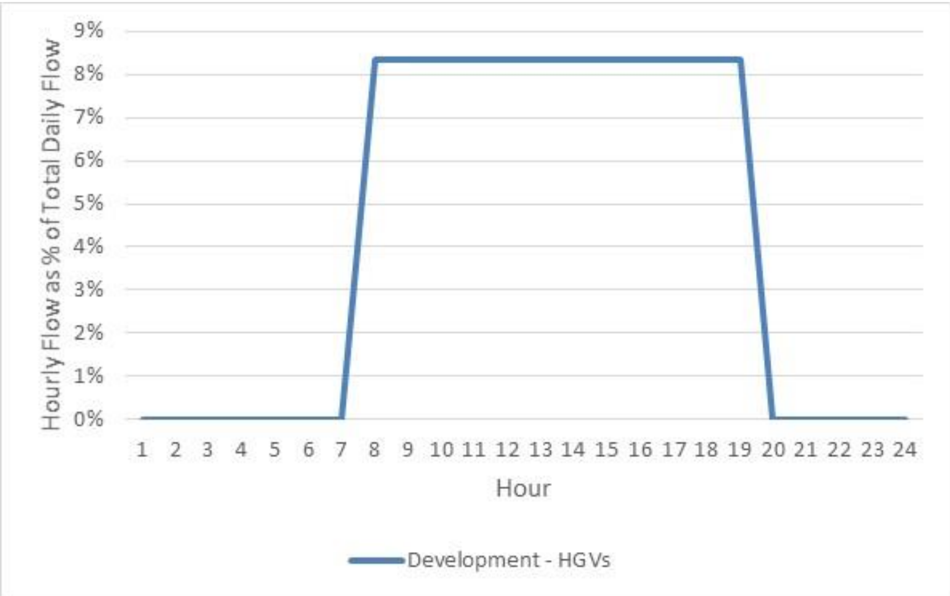
The following graphs show the diurnal profile as entered into the model using the .fac file function. The ADMS model takes the hourly flow entered into the model and then factors this flow to determine the profile over the day. The graphs present this factor as used in the model.

Graph 2: Baseline and Do Minimum fac file



The following graph shows the daily profile for the HGV development traffic.

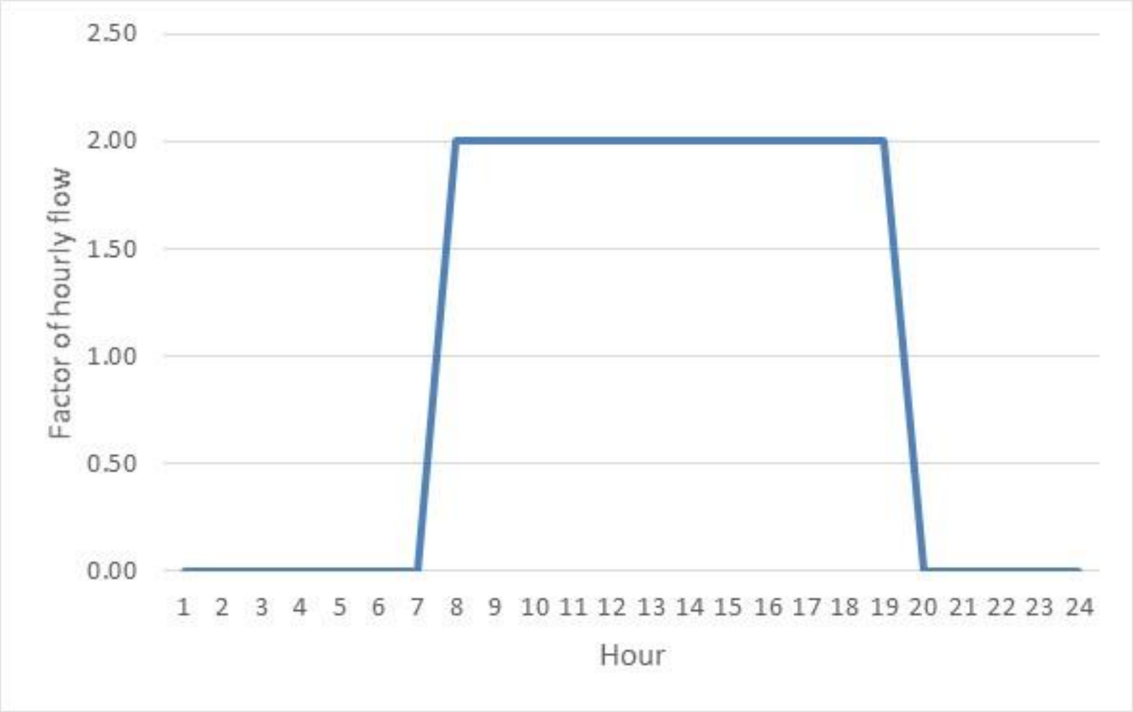
Graph 3: Proposed Development – HGV Flows (Diurnal Profile)



As shown, the development traffic flows do not follow the same daily profile as the baseline. Therefore, a separate daily profile has been calculated for the development flows. The modelled road network has been duplicated and the development traffic has been modelled on the duplicated road links using the profile. This is considered conservative, as the model will not apply the pollutant dispersing effects of turbulent wakes from the baseline traffic to emissions from the development-generated traffic.

The same profile has been applied for LDV and HGVs for the proposed development. It is noted that the LDVs would follow a slightly different pattern, but by far the greatest contributor to emissions would be HGVs so it is considered appropriate to include the same profile for LDVs as HGVs.

Graph 4: Proposed Development flows fac file



3.2.1.3 Vehicle emission factors

Emission factors for NO_X, PM_{10} and $PM_{2.5}$ have been determined for each scenario using the traffic data and the Emissions Factors Toolkit (EFT) v 9.0 (2VC) database[2] of road traffic emission factors within ADMS Roads. All roads were classified as "England (Urban)".

The EFT predicts that emissions from road vehicles will reduce in future years as newer cleaner vehicles enter the fleet. However, recent evidence has shown that the rate of this reduction may not be occurring in the real world. As such the assessment has considered the following scenarios:

- A worst-case which assumes there is no change to the fleet composition on the local road network from 2017 and the assessment year; and
- A best-case scenario in which the fleet composition changes in line with current projections which results in lower emissions along the road.

In line with the process emissions modelling as conservative measure, 2017 background concentrations have been applied to the future year scenarios.

This approach is in line with the interim position statement released by the IAQM in October 2016[3] relating to detailing with uncertainty in vehicle NOx emission factors. When presenting the results

[2] Available from https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html.

[3] IAQM, Dealing with Uncertainty in Vehicle NOx Emissions Within Air Quality Assessments, October 2016

at receptor locations, the best case and worst-case results for nitrogen dioxide have been presented.

For ammonia the emissions from traffic have been calculated using the CREAM toolkit (version 1A 14 February 2020, developed by Air Quality Consultants AQC).

3.2.2 Spatial co-ordinates of vehicle emissions

Street locations and widths were estimated from a desk-top mapping study and referenced to UK National Grid Reference (NGR) co-ordinates.

It is not possible to enter building dimension data into the ADMS-Roads dispersion modelling software to calculate building downwash. However, it is possible to define some roads as 'street canyons'. A desk-stop study has been carried out through a review of aerial photos. No roads have been identified as street canyons within the study area.

3.2.3 Meteorological data

To calculate pollutant concentrations at identified receptor locations, the model uses sequential hourly meteorological data, including wind direction, wind speed, temperature, cloud cover and stability, which exert significant influence over atmospheric dispersion.

Sequential 1-hour meteorological data used in this assessment were taken from Portland meteorological station, located approximately 5 km south-west of the site, for the period 1st January 2018 to 31st December 2018 (inclusive). Full details of the meteorological data can be found in Appendix D.3 Emissions Modelling. Typically, road assessments use one-year of meteorological data. The pollution monitoring data and meteorological data are all for the year 2018. This consistency of data allows for model verification to be undertaken.

A wind rose of the 2018 meteorological data used as input to the model is provided in Figure 4 of Annex A of the Process Emissions Modelling appendix to the ES (Appendix 13.3).

3.2.4 Surface roughness

The roughness length z_0 is an important variable for dispersion models. Many studies in the past into the derivation of aerodynamic roughness for urban areas have been based upon an analysis of the city's geometrical properties or morphology. In the Birmingham area, Rooney (2001) has shown that the roughness length z_0 was in the range 0.5 m to 2 m, which are typical of values used in dispersion models for urban areas. The study involved the analysis of the effects of wind direction, according to fetch and land-use type.

A roughness length z_0 of 0.5 m was used within the dispersion modelling study area. This value of z_0 is appropriate for 'parkland and open suburbia' and is considered appropriate for the nature of the dispersion modelling assessment area. A roughness length z_0 of 0.001 m was used for the meteorological site, which is considered appropriate for the surroundings of the Portland meteorological site.

3.2.5 Monin-Obukov length

The Monin-Obukhov length provides a measure of the stability of the atmosphere. In rural areas under very stable atmospheric conditions the Monin-Obukhov length would typically be in the range 2 m to 20 m. In urban areas, there is a significant amount of heat generated from buildings and traffic, which warms the air above the town/city. For large urban areas this is known as the urban heat island. It has the effect of preventing the atmosphere from ever becoming very stable. In general, the larger the area, the more heat is generated and the stronger this effect becomes. This means that in stable conditions the Monin-Obukhov length will never fall below some minimum value, the larger the city, the larger the minimum value.

A minimum Monin-Obukhov length of 10 m has been used for the dispersion site, which is suitable for small towns and is considered appropriate for the location of the study area. The model default of 1 m has been used for the meteorological site, which is appropriate for rural areas and is considered appropriate for the surroundings of Portland meteorological site.

3.3 Background data

For the purpose of the assessment the mapped background concentrations for each receptor point have been extracted from the DEFRA 2017 mapped background.

As presented in Appendix D.1 of the ES (Baseline Analysis), there is uncertainty as to how background pollutant concentrations will change in the future, so as a conservative measure the 2017 background pollutant concentrations have been applied to the future year scenarios – i.e. assuming no reduction in background pollutant concentrations.

3.4 Post modelling - conversion from NOx to nitrogen dioxide

The modelled road-NOx and the mapped background concentrations have been used as inputs in DEFRA's NOx to NO_2 calculator (V7.1)[4] to convert modelled NOx to NO_2 in accordance with the methodology outlined in LAQM.TG(16).

When converting from NOx to nitrogen dioxide the following inputs have been used:

- The year has been taken as the same as the emissions data used in the modelling (i.e. 2017 or 2023);
- The local authority has been selected as "Weymouth and Portland"; and
- The traffic mix has been selected as "All other urban UK traffic".

[4] Available from https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

4 Verification

The ADMS Roads model has been validated against real world monitoring, but LAQM.TG(16) recommends that the model output is verified. The verification process should involve the comparison between predicted and measured concentrations at one or more suitable local sites and forms an essential component of a detailed assessment for road traffic models. Part of the verification process involves improvements to the base model to provide a better representation of the monitored data. This includes checks on:

- Traffic data;
- Road widths;
- Distance between sources and monitoring locations;
- Speed estimates;
- Street canyons;
- Background concentrations; and
- Monitoring data.

All of these have been reviewed and the model refined to increase the accuracy as much as possible.

LAQM.TG(16) recommends that a number of points are used and the results plotted. The correlation co-efficient of the data should then be used as the verification factor. Analysis of a number of data points can be used to see if the model is not performing well in a given area and highlight issues within the modelling such as incorrect traffic data.

There are four monitoring locations suitable for model verification all of which are within the Boot Hill area. The results of the verification procedure are detailed below. In the first instance the monitored road-NOx contribution at each monitoring location has been calculated.

Table 2: Verification Procedure – Calculation of Monitored Road NOx

Monitoring site	2018 monitored nitrogen dioxide (µg/m^3)	Background nitrogen dioxide (µg/m^3)	Calculated road NOx (µg/m^3)
Boot Hill	39.6	10.5	60.7
10	32.8	10.5	45.0
32	31.8	10.5	42.7
51	36.3	10.5	52.9

The modelled road-NOx output is then compared to the calculated road-NOx concentration, and the modelled total nitrogen dioxide compared to the monitored nitrogen dioxide concentration.

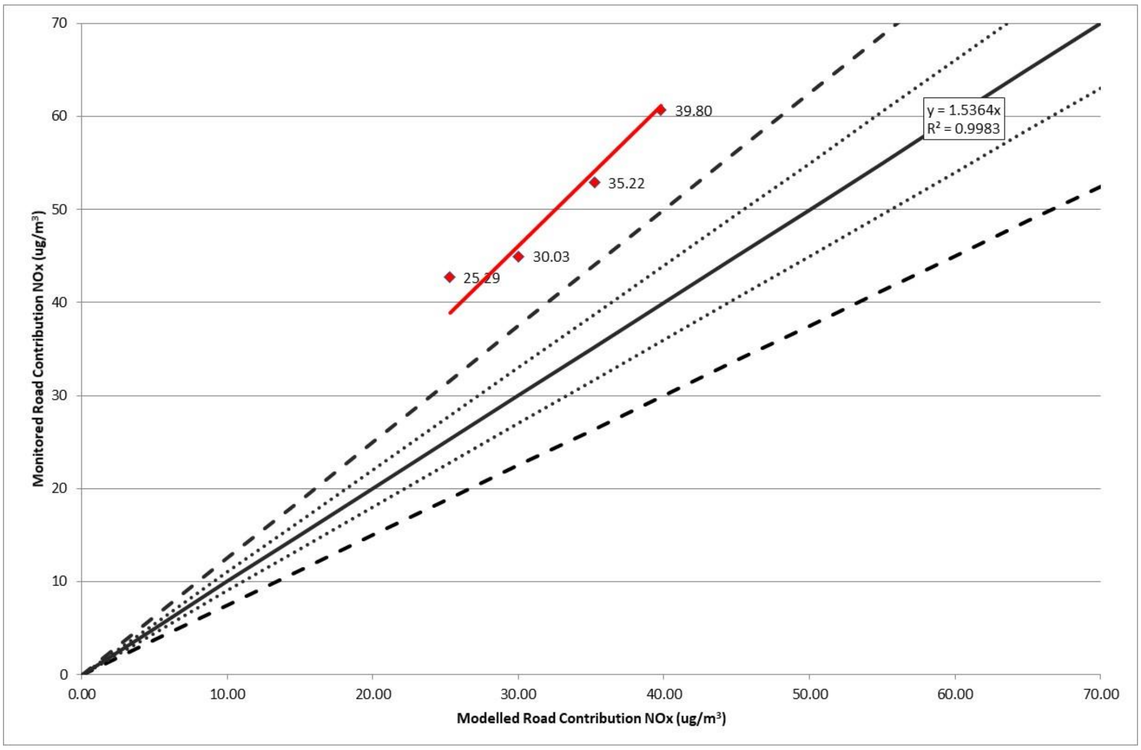
Table 3: Verification Procedure – Raw Model Results Comparison

Monitoring site	2018 modelled road NOx (µg/m^3)	Ratio of monitored to modelled road NOx	2018 modelled total nitrogen dioxide (µg/m^3)	Ratio of monitored to modelled total nitrogen dioxide
Boot Hill	39.80	1.52	30.39	1.30

Monitoring site	2018 modelled road NOx ($\mu g/m^3$)	Ratio of monitored to modelled road NOx	2018 modelled total nitrogen dioxide ($\mu g/m^3$)	Ratio of monitored to modelled total nitrogen dioxide
10	30.03	1.50	25.84	1.27
32	25.29	1.69	23.55	1.35
51	35.22	1.50	28.28	1.28

As shown, the model is generally under-predicting road-NOx and total nitrogen dioxide at all monitoring locations. In accordance with the procedure outlined in LAQM.TG(16), monitored road NOx has been plotted against modelled road NOx.

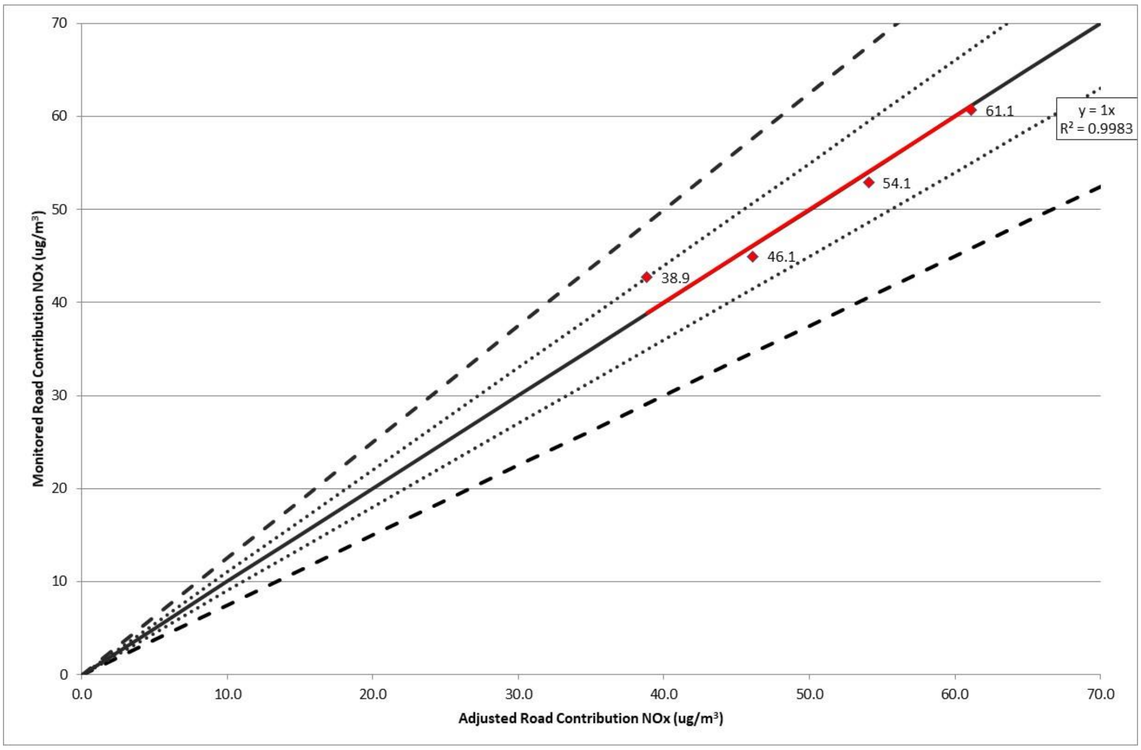
Graph 5: Comparison of Monitored against Modelled Road NOx



As shown the correlation coefficient is 1.5364, and the R2 value (a measure of the fit of the data points to the trendline, with a maximum value of 1.00) is 0.9983.

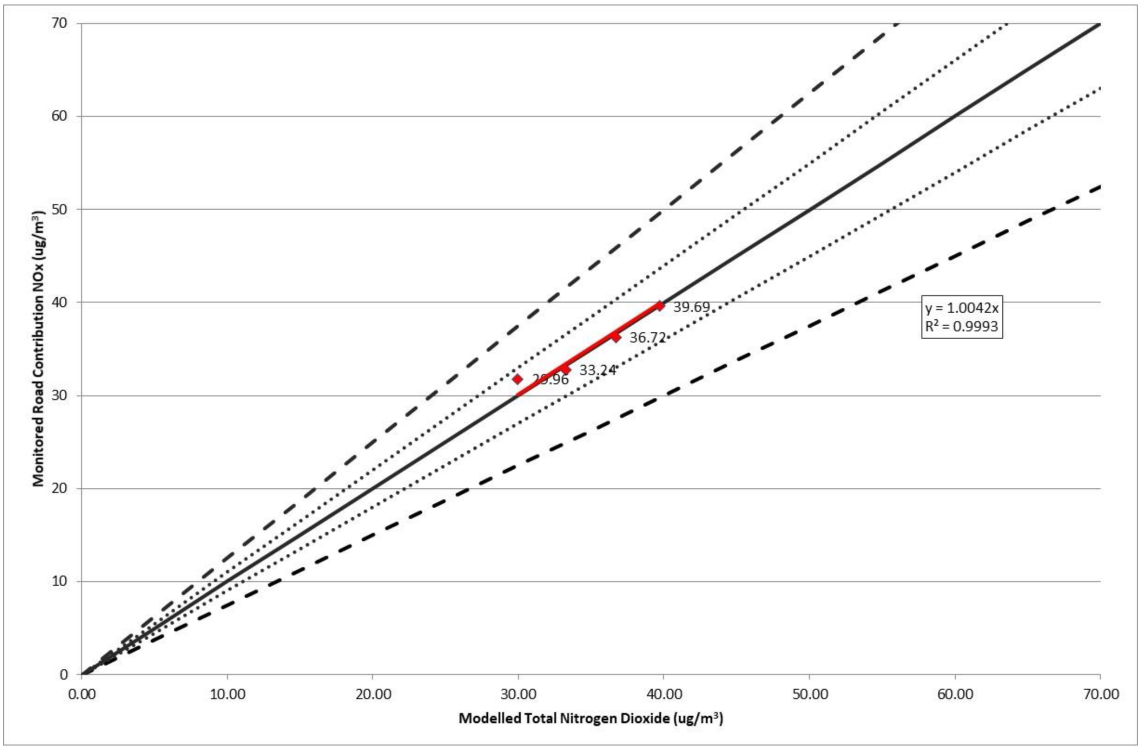
The adjustment factor of 1.5364 has been applied to the modelled road-NOx, and the monitored road-NOx has been plotted against adjusted modelled road-NOx, as shown in Graph 6.

Graph 6: Comparison of Monitored against Adjusted Modelled Road NOx



Finally, the total monitored nitrogen dioxide has been plotted against the adjusted modelled total nitrogen dioxide, as presented in Graph 7.

Graph 7: Comparison of Monitored against Adjusted Modelled Total Nitrogen Dioxide



A summary of a comparison between the adjusted modelled total nitrogen dioxide and monitored nitrogen dioxide is presented in Table 4.

Table 4: Verification Procedure – Monitored Road NOx

Monitoring site	2018 monitored total nitrogen dioxide (µg/m³)	2018 modelled total nitrogen dioxide (µg/m³)	% difference (modelled – monitored / monitored)
Boot Hill	39.6	39.7	0.23%
10	32.8	33.2	1.34%
32	31.8	30.0	-5.73%
51	36.3	36.7	1.18%

The verification procedure has shown that following adjustment the modelled total nitrogen dioxide is within 10% of monitored nitrogen dioxide at all monitoring locations, i.e. following adjustment the model is performing well.

Although the Boot Hill site continually analyses PM concentrations it is not appropriate to calculate a verification factor using a single point. Therefore, the adjustment factors calculated for nitrogen dioxide have also been applied to the modelled concentrations of road PM_{10} or $PM_{2.5}$.

5 Results – roads only

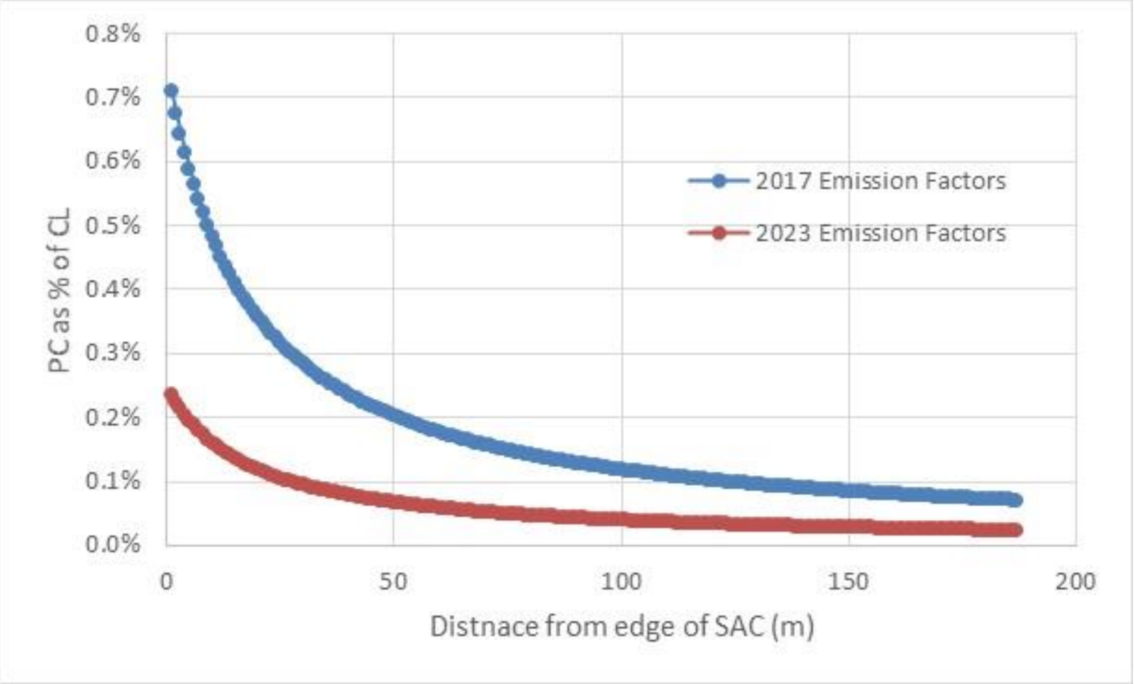
5.1 Impact on Boot Hill area

The detailed results tables provided in Annex B show that even if it is conservatively assumed that there is no improvement in emissions from vehicles, the maximum magnitude of change in nitrogen dioxide and particulate matter at all the identified receptors locations would be less than 0.5% of the AQAL.

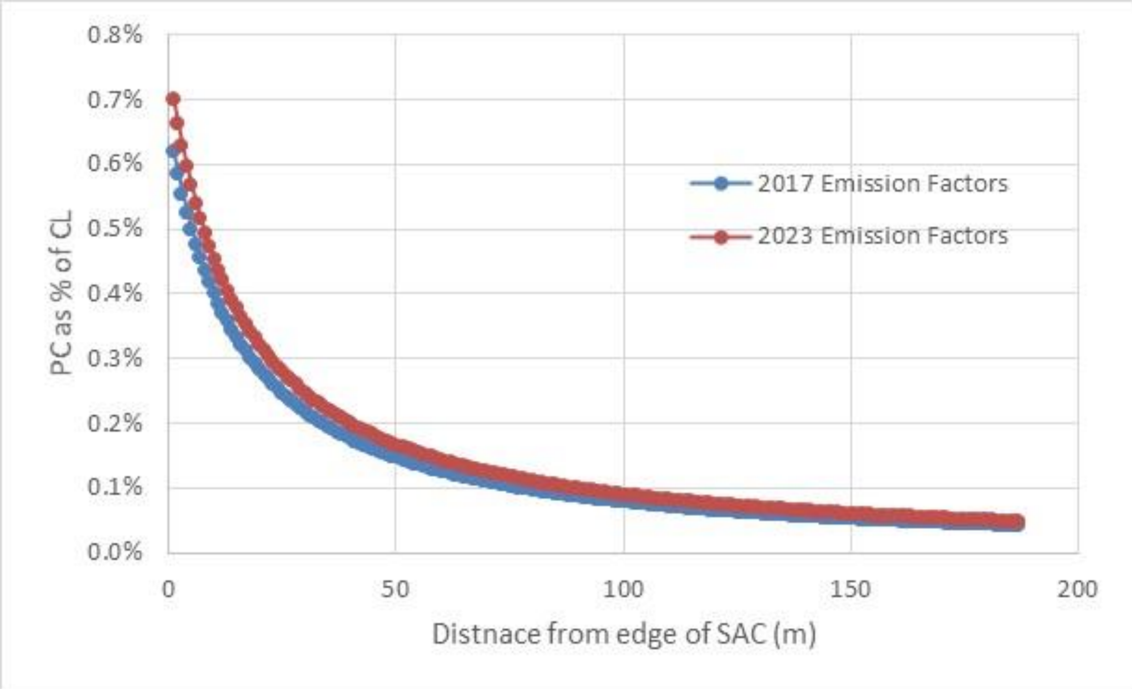
5.2 Impact at Isle of Portland SAC

The following graphs show the predicted annual mean oxides of nitrogen, ammonia and nitrogen deposition impact of road traffic emissions along the transect used to approximate impacts at the Isle of Portland SAC.

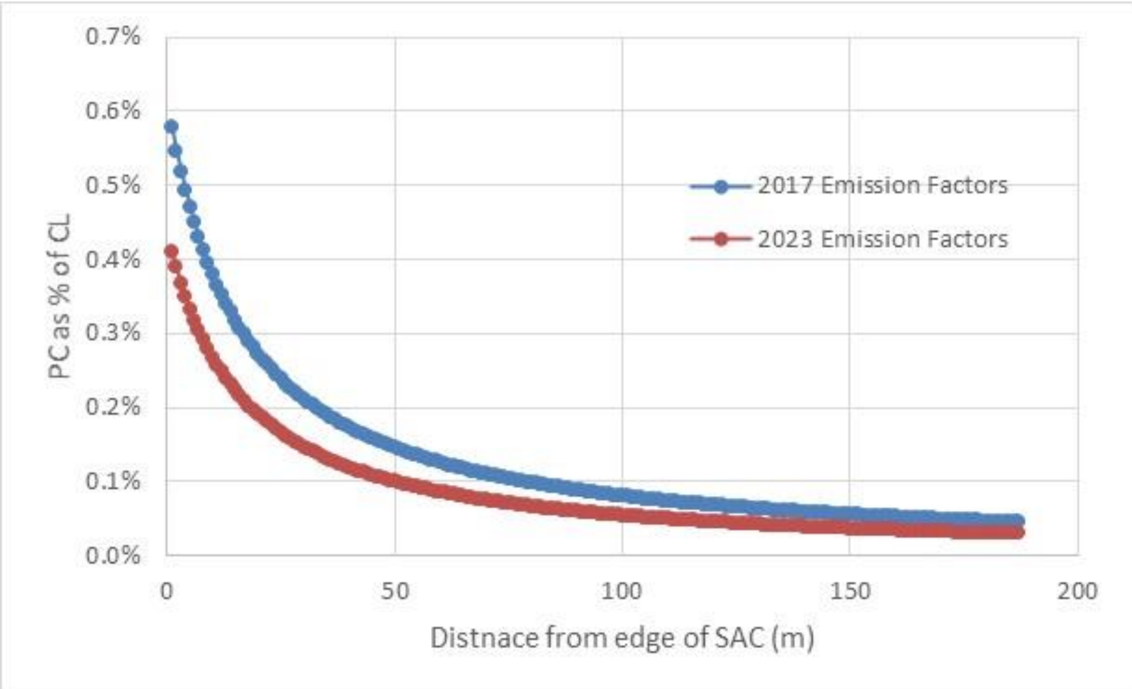
Graph 8: Annual mean oxides of nitrogen impact – Isle of Portland SAC



Graph 9: Annual mean ammonia impact – Isle of Portland SAC



Graph 10: Annual mean nitrogen deposition impact – Isle of Portland SAC

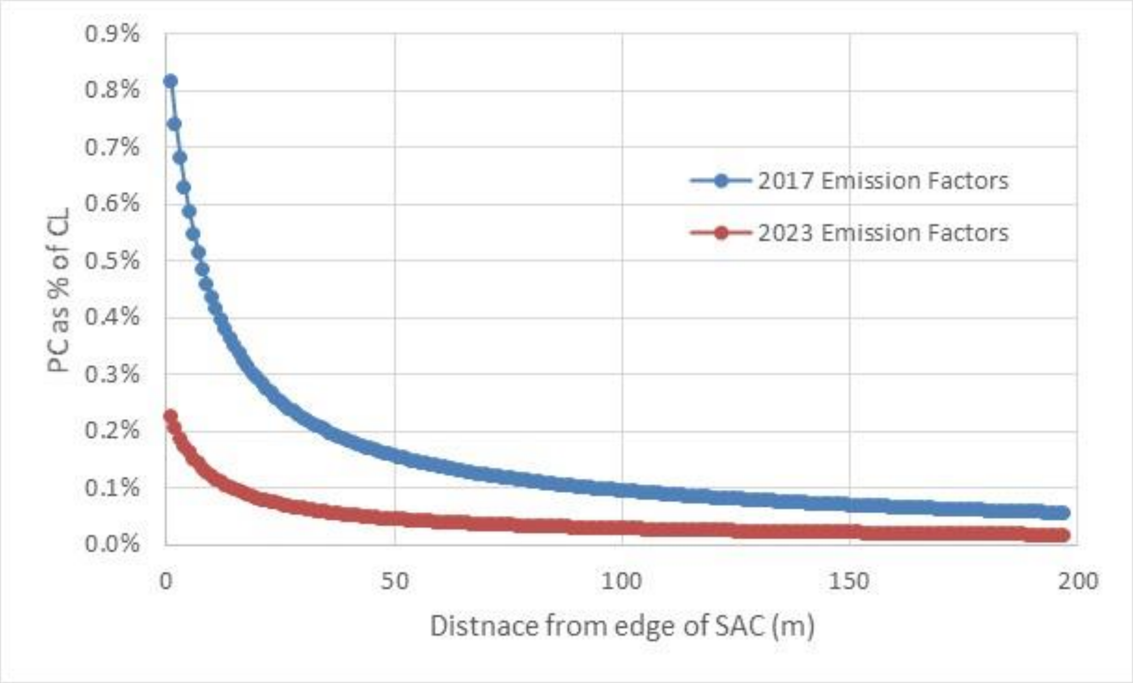


As shown the impacts are less than 1% of the relevant Critical Level and Critical Load at all points along the transect.

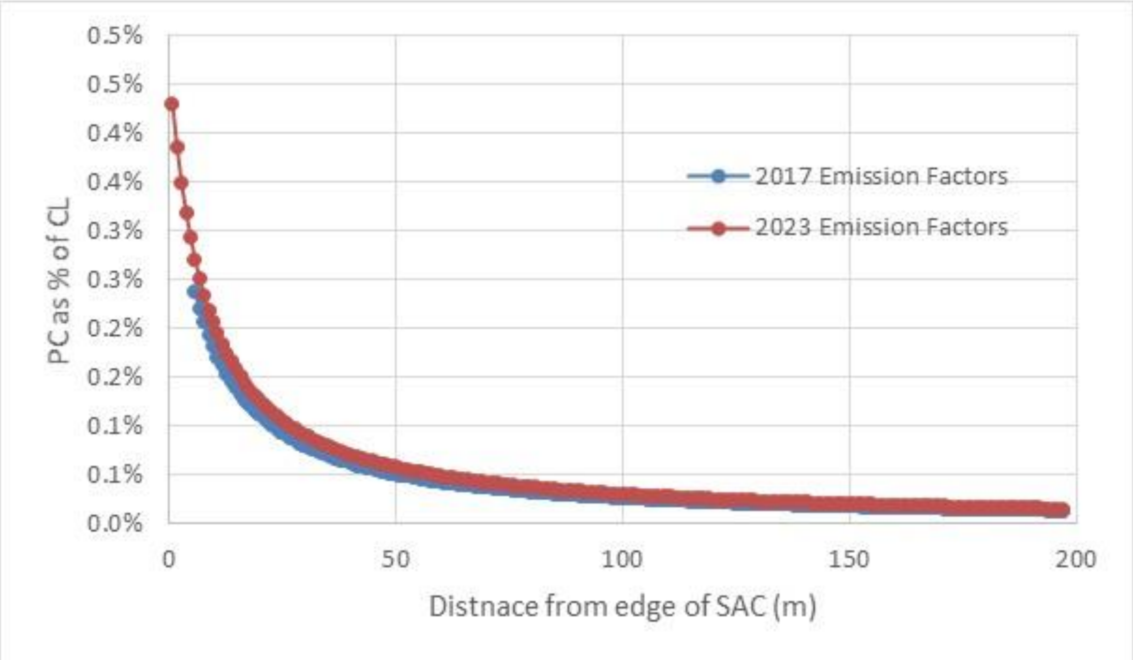
5.3 Impact at Chesil and The Fleet SAC

The following graphs show the predicted annual mean oxides of nitrogen, ammonia and nitrogen deposition impact of road traffic emissions along the transect used to approximate impacts at Chesil and The Fleet SAC.

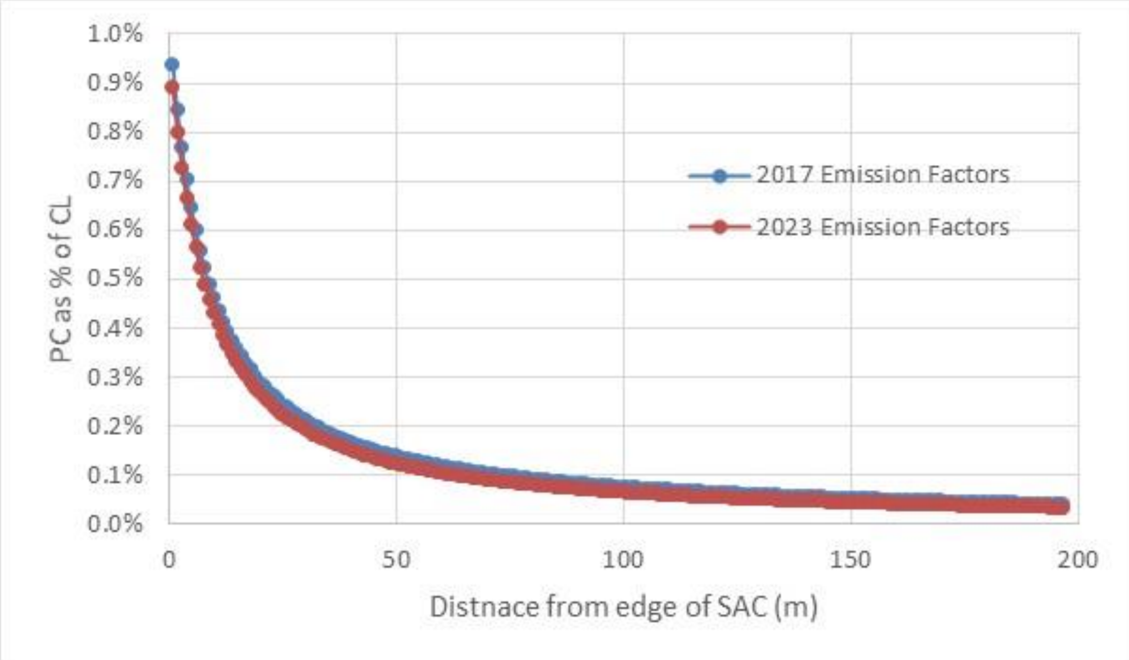
Graph 11: Annual mean oxides of nitrogen impact – Chesil and The Fleet



Graph 12: Annual mean ammonia impact – Chesil and The Fleet



Graph 13: Annual mean nitrogen deposition impact – Chesil and The Fleet



The impact of oxides of nitrogen emissions are projected to reduce in future years but ammonia impacts are predicted to increase as there is a greater proportion of vehicles in the fleet with catalytic converters. Whilst these reduce emissions of oxides of nitrogen, they introduce tailpipe emissions of ammonia. As a result, although oxides of nitrogen emissions are significantly reduced the nitrogen deposition and ammonia reduce but not to the same extent. This is especially true of nitrogen deposition impacts as ammonia contributes over 60% of the total nitrogen deposited.

6 Results – in combination with process emissions

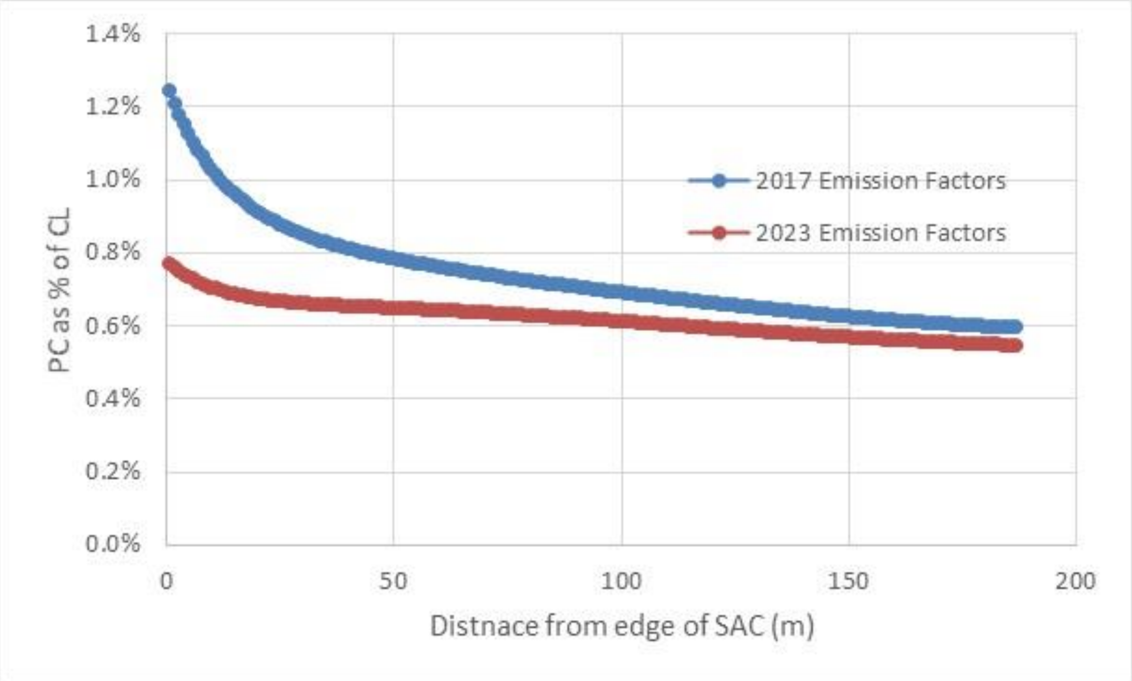
6.1 Impact on Boot Hill area

The dispersion modelling plot files have shown that predicted impacts of process emissions are extremely small in the Boot Hill area. As such it is not considered necessary to combine the impact from process and traffic emissions in this area and the results of the assessment contained in section 5.1are not expected to change.

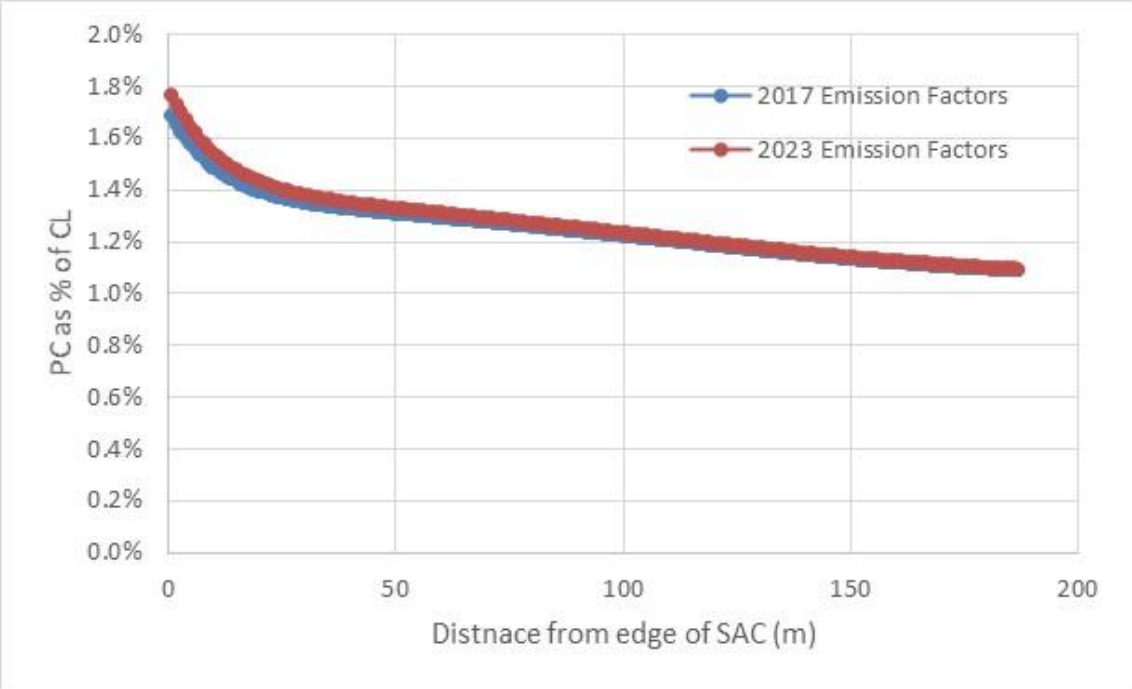
6.2 Impact at Isle of Portland SAC

The following graphs show the predicted annual mean oxides of nitrogen, ammonia and nitrogen deposition impact of road traffic emissions and process emissions along the transect used to approximate impacts at the Isle of Portland SAC.

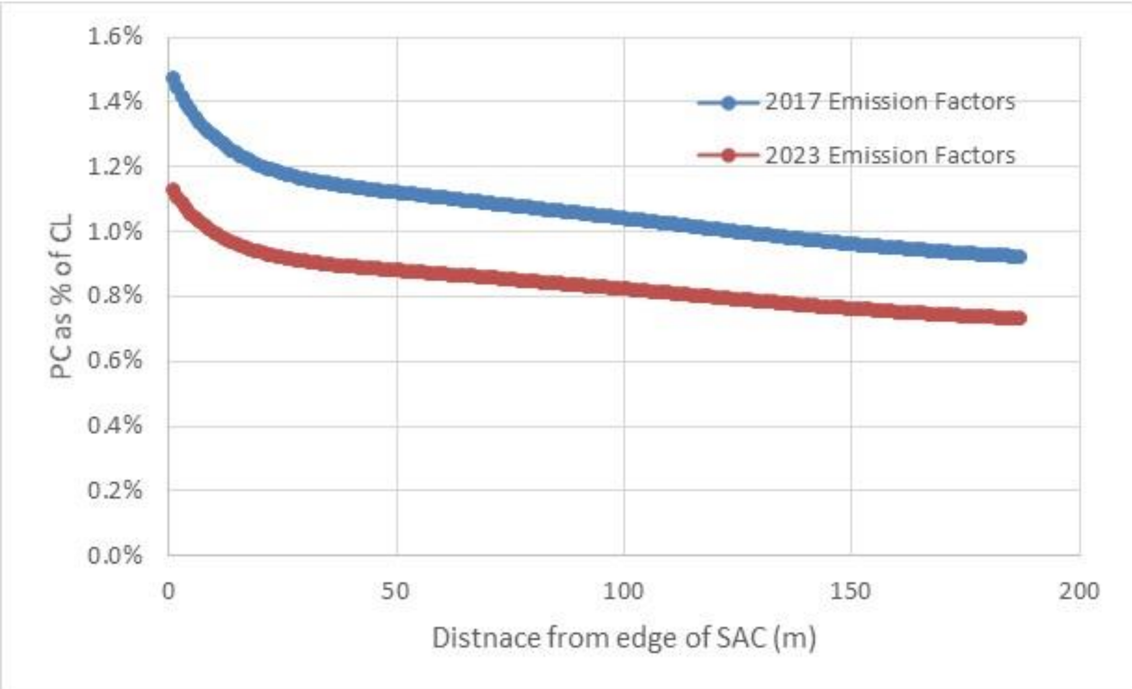
Graph 14: Annual mean oxides of nitrogen impact – Isle of Portland SAC



Graph 15: Annual mean ammonia impact – Isle of Portland SAC



Graph 16: Annual mean nitrogen deposition impact – Isle of Portland SAC

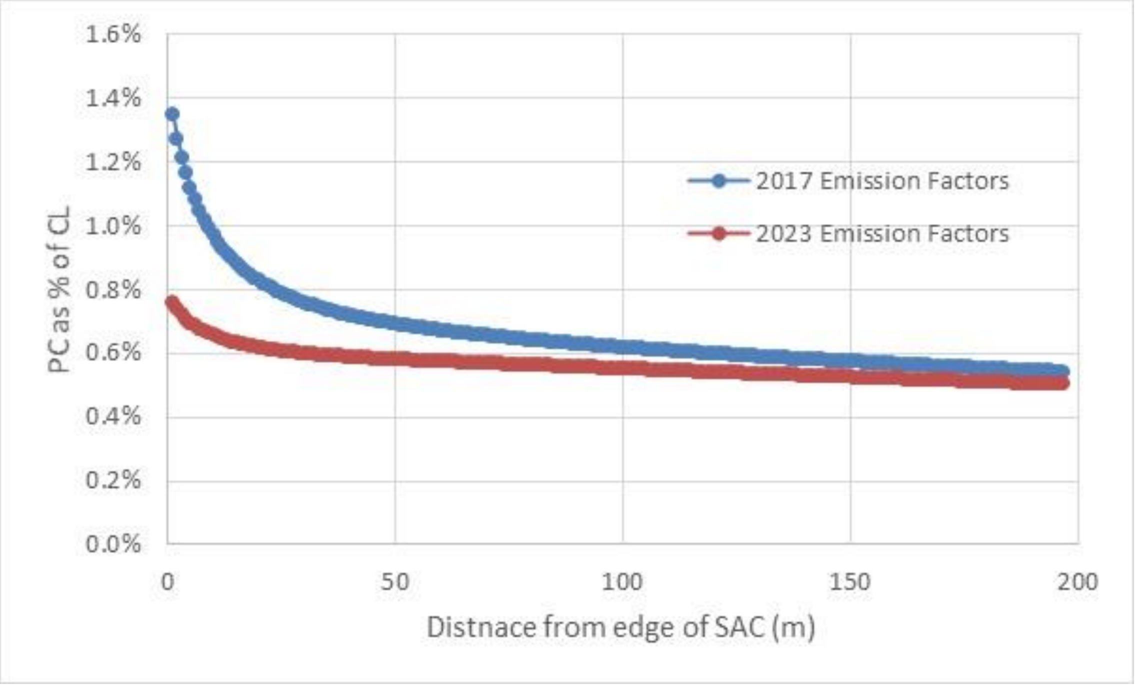


As shown, when combining the impacts from process and traffic emissions the impacts are less than 1% of the Critical Level for oxides of nitrogen and 1% of the Critical Load for nitrogen deposition within 25m of the edge of the SAC which is adjacent to the road. Further discussion of these impacts is provided in ES chapter 10 and the Habitats Regulations Assessment.

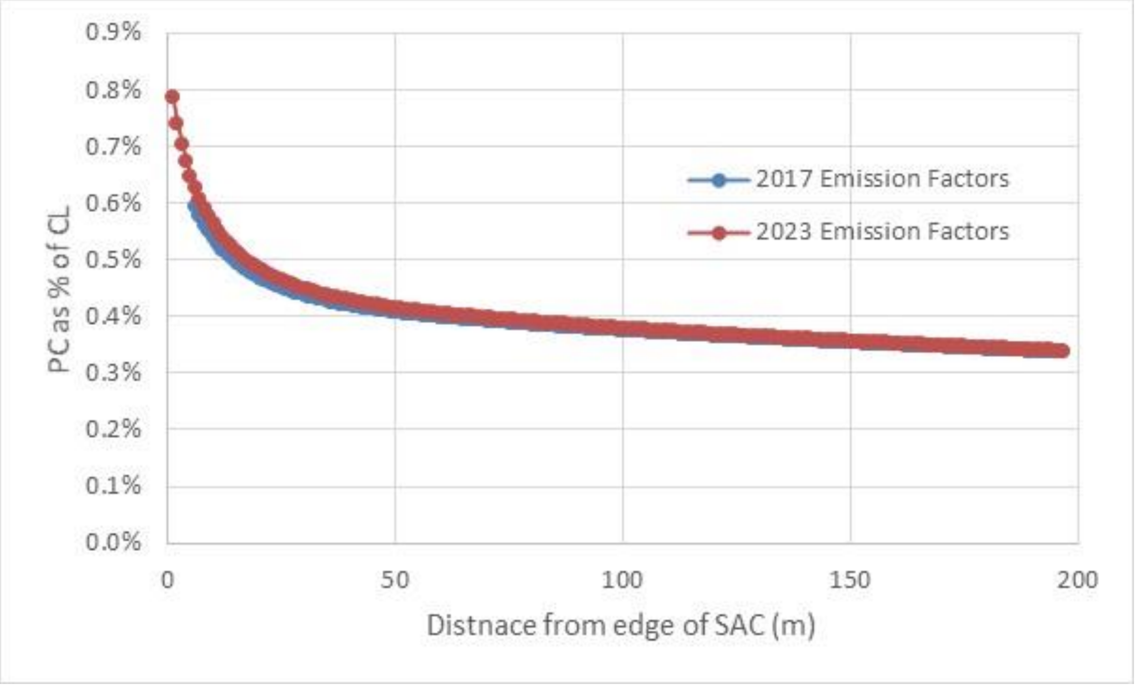
6.3 Impact at Chesil and The Fleet SAC

The following graphs show the predicted annual mean oxides of nitrogen, ammonia and nitrogen deposition impact of road traffic emissions and process emissions along the transect used to approximate impacts at Chesil and The Fleet SAC.

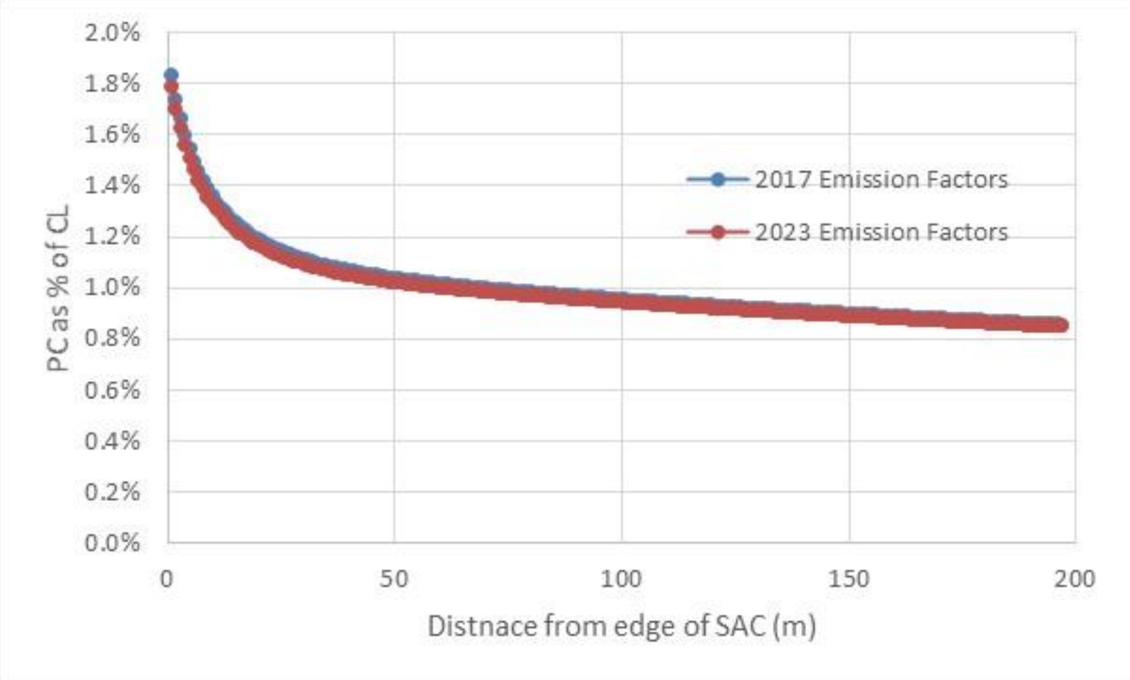
Graph 17: Annual mean oxides of nitrogen impact – Chesil and The Fleet



Graph 18: Annual mean ammonia impact – Chesil and The Fleet



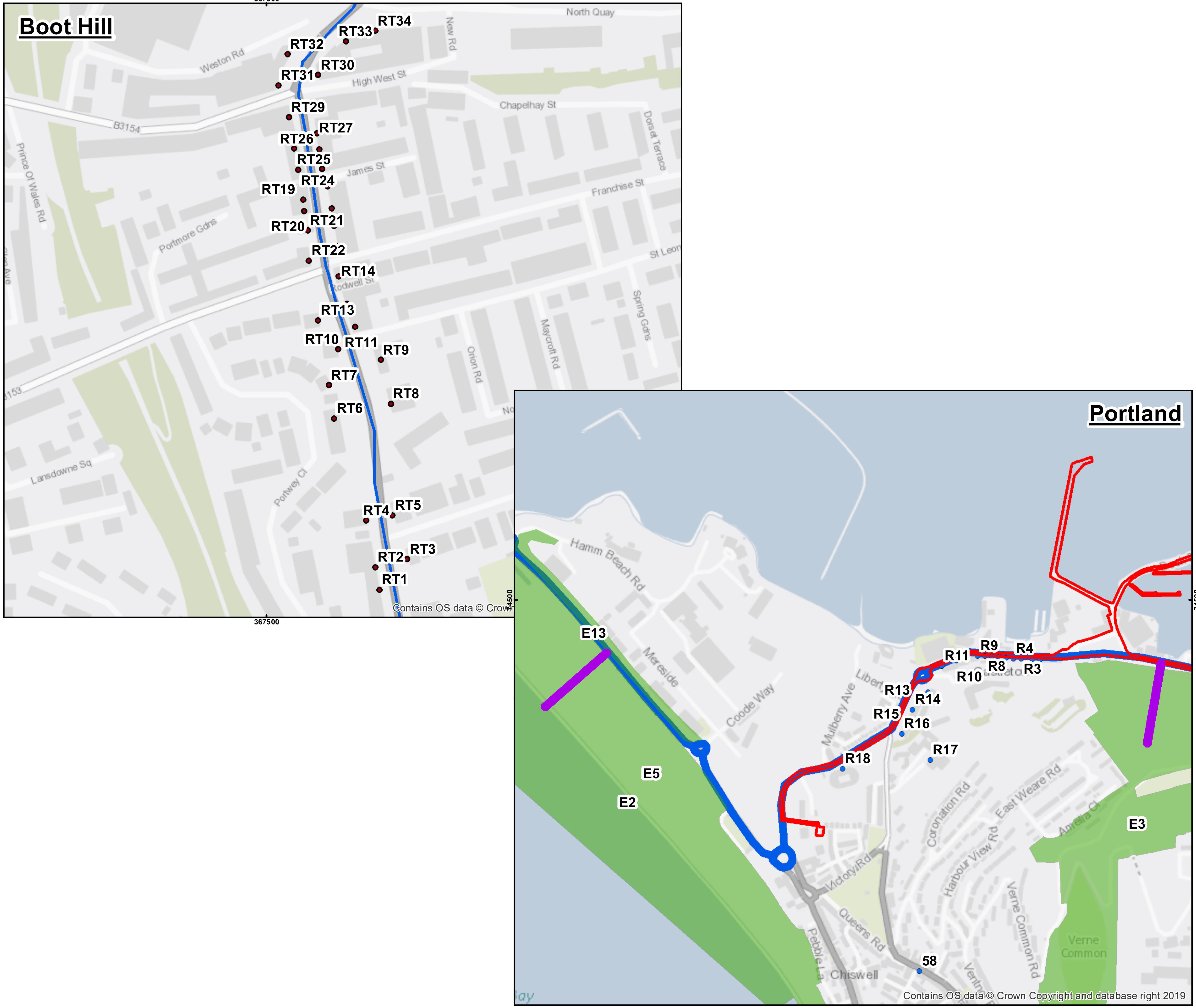
Graph 19: Annual mean nitrogen deposition impact – Chesil and The Fleet



As shown, when combining the impacts from process and traffic emissions the impacts are less than 1% of the Critical Level for oxides of nitrogen and ammonia within a few meters of the edge of the SAC. However, impacts of nitrogen deposition only fall below 1% of the Critical Load at approximately 50m of the edge of the SAC which is adjacent to the road. These results are worst-case as they assume that all deliveries are by road. Further discussion of these impacts is provided in ES chapter 10 and the Habitats Regulations Assessment.

Annex

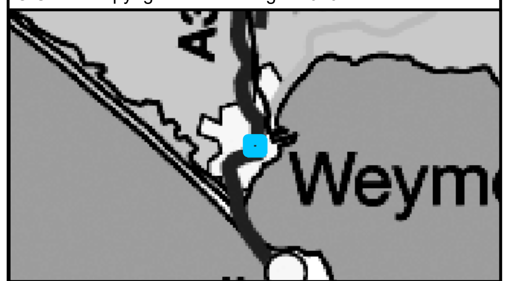
A Figures



Legend

- Site Boundary
- Ecological Sites
- Modelled Roads
- Roads Receptors
- Ecological Transects

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	Figure 1 - Sensitive Receptors
Drawn by: Hannah Lederer	Date: 07/08/2020



0 0.0275 0.055 0.11 km

Scale: 1:2,721

N

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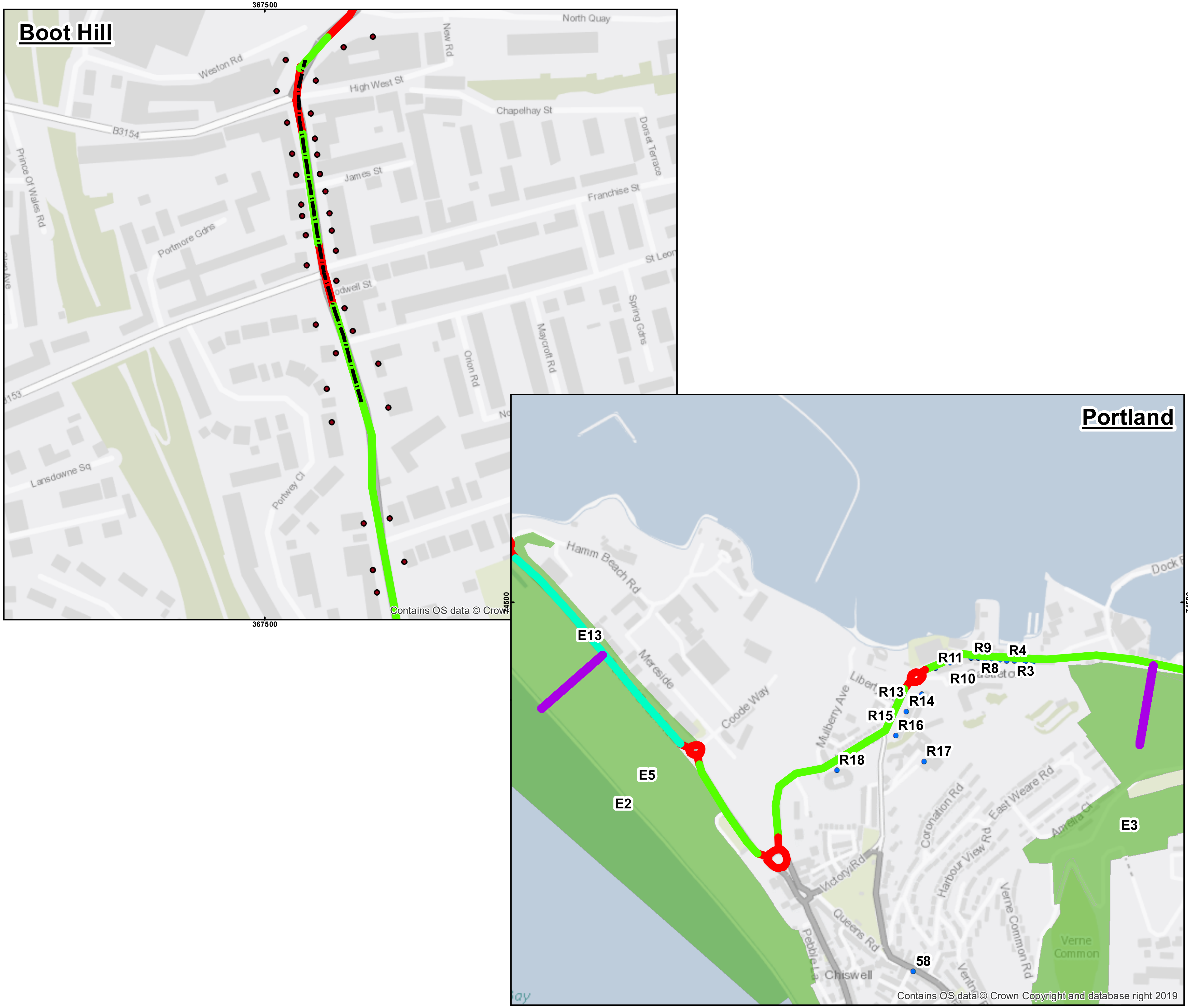


Legend

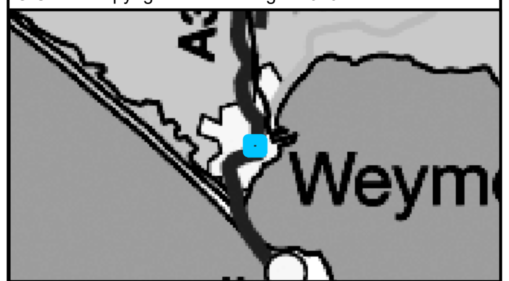
Queue Zone

Speed

- LDV and HGV 20 kph
- LDV 48 kph, HGV 43 kph
- LDV 80 kph, HGV 75 kph
- LDV 96 kph, HGV 91 kph
- Site Boundary
- Ecological Sites
- Modelled Roads
- Roads Receptors
- Ecological Transects

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	Figure 2 - Road Links Modelled

Drawn by: Hannah Lederer | Date: 17/08/2020



0 0.0275 0.055 0.11 km

N

Scale: 1:2,721

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B Detailed Results Tables

Table 5: Annual mean nitrogen dioxide - worst-case

Receptor	Do minimum (µg/m^3)	Do something (µg/m^3)	Impact (µg/m^3)	Impact (as % of AQAL)
RT1	27.26	27.34	0.08	0.20%
RT2	27.48	27.56	0.08	0.20%
RT3	28.88	28.97	0.09	0.23%
RT4	27.10	27.18	0.08	0.20%
RT5	33.75	33.86	0.11	0.27%
RT6	22.68	22.72	0.04	0.10%
RT7	25.81	25.84	0.03	0.08%
RT8	29.71	29.77	0.06	0.15%
RT9	33.08	33.12	0.04	0.10%
RT10	40.93	40.95	0.02	0.05%
RT11	49.93	49.95	0.02	0.05%
RT12	55.83	55.88	0.05	0.13%
RT13	32.48	32.51	0.03	0.08%
RT14	60.71	60.84	0.13	0.33%
RT15	49.23	49.35	0.12	0.30%
RT16	47.14	47.23	0.09	0.22%
RT17	45.48	45.55	0.07	0.18%
RT18	46.51	46.57	0.06	0.15%
RT19	42.89	42.95	0.06	0.15%
RT20	42.25	42.31	0.06	0.15%
RT21	44.03	44.10	0.07	0.18%
RT22	40.93	41.02	0.09	0.23%
RT23	50.64	50.72	0.08	0.20%
RT24	42.30	42.36	0.06	0.15%
RT25	41.81	41.87	0.06	0.15%
RT26	50.77	50.85	0.08	0.20%
RT27	53.14	53.22	0.08	0.20%
RT28	59.52	59.70	0.18	0.45%
RT29	45.72	45.78	0.06	0.15%
RT30	50.32	50.51	0.19	0.47%
RT31	35.36	35.38	0.02	0.05%
RT32	34.28	34.38	0.10	0.25%
RT33	37.61	37.78	0.17	0.43%
RT34	28.79	28.86	0.07	0.18%

Table 6: Annual mean nitrogen dioxide - best-case

Receptor	Do minimum (µg/m³)	Do something (µg/m³)	Impact (µg/m³)	Impact (as % of AQAL)
RT1	18.38	18.41	0.03	0.08%
RT2	18.50	18.53	0.03	0.08%
RT3	19.19	19.22	0.03	0.07%
RT4	18.35	18.38	0.03	0.07%
RT5	21.65	21.69	0.04	0.10%
RT6	16.67	16.68	0.01	0.02%
RT7	18.70	18.71	0.01	0.03%
RT8	20.40	20.41	0.01	0.03%
RT9	23.04	23.05	0.01	0.03%
RT10	27.89	27.91	0.02	0.05%
RT11	33.76	33.78	0.02	0.05%
RT12	37.53	37.58	0.05	0.13%
RT13	22.83	22.86	0.03	0.08%
RT14	40.86	40.92	0.06	0.15%
RT15	33.39	33.44	0.05	0.12%
RT16	31.97	32.00	0.03	0.08%
RT17	30.84	30.86	0.02	0.05%
RT18	31.41	31.43	0.02	0.05%
RT19	29.14	29.16	0.02	0.05%
RT20	28.76	28.77	0.01	0.02%
RT21	29.91	29.94	0.03	0.08%
RT22	28.11	28.15	0.04	0.10%
RT23	33.97	34.00	0.03	0.08%
RT24	28.71	28.73	0.02	0.05%
RT25	28.28	28.30	0.02	0.05%
RT26	33.9	33.92	0.02	0.05%
RT27	35.06	35.08	0.02	0.05%
RT28	38.29	38.36	0.07	0.18%
RT29	29.97	29.98	0.01	0.03%
RT30	32.46	32.54	0.08	0.20%
RT31	23.65	23.65	0.00	0.00%
RT32	22.86	22.90	0.04	0.10%
RT33	23.96	24.02	0.06	0.15%
RT34	19.32	19.34	0.02	0.05%

Table 7: Annual mean particulate matter - worst-case – 2017 Emission Factors

Receptor	Impact (µg/m³)	As % of AQAL for PM_{10}	As % of AQAL for $PM_{2.5}$
RT1	0.01	0.03%	0.05%
RT2	0.01	0.03%	0.05%
RT3	0.01	0.03%	0.05%
RT4	0.01	0.03%	0.04%
RT5	0.02	0.04%	0.07%
RT6	0.00	0.01%	0.02%
RT7	0.00	0.01%	0.01%
RT8	0.01	0.02%	0.03%
RT9	0.00	0.01%	0.01%
RT10	0.00	0.00%	0.00%
RT11	0.00	0.00%	0.00%
RT12	0.00	0.00%	0.00%
RT13	0.00	0.00%	0.01%
RT14	0.02	0.04%	0.06%
RT15	0.01	0.04%	0.06%
RT16	0.01	0.02%	0.04%
RT17	0.01	0.02%	0.03%
RT18	0.01	0.02%	0.03%
RT19	0.01	0.01%	0.02%
RT20	0.01	0.01%	0.02%
RT21	0.01	0.02%	0.03%
RT22	0.01	0.02%	0.04%
RT23	0.01	0.02%	0.03%
RT24	0.01	0.02%	0.02%
RT25	0.01	0.02%	0.03%
RT26	0.01	0.02%	0.03%
RT27	0.01	0.02%	0.03%
RT28	0.02	0.05%	0.08%
RT29	0.00	0.01%	0.02%
RT30	0.02	0.06%	0.09%
RT31	0.00	0.00%	0.00%
RT32	0.01	0.03%	0.04%
RT33	0.02	0.05%	0.08%
RT34	0.01	0.02%	0.03%

Notes: PM10 impacts have been compared to the AQAL for PM10 and PM2.5 in line with the IAQM guidance

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