Portland energy recovery facility

Environmental statement
Addendum
Technical appendices

SECOND ERRATUM VERSION

3.1

THIS SECOND ERRATUM VERSION SHOULD BE READ TOGETHER WITH THE FIRST ERRATUM

FICHTNER

Consulting Engineers Limited

Portland ERF

Powerfuel Ltd

Additional Dispersion Modelling

ENGINEERING + CONSULTING

Document approval

	Name	Signature	Position	Date
Prepared by:	Rosalind Flavell		Senior Environmental Consultant	28/06/2021
Checked by:	Stephen Othen		Technical Director	28/06/2021

Document revision record

Revision no	Date	Details of revisions	Prepared by	Checked by
Final	28/06/2021	Final for issue	RSF	SMO
1	20/10/2021	First addendum to page 7	RSF	SMO
2	13/12/2021	Second addendum to page 7	RSF	SMO

Contents

1 Introduction

1.1 Background

Fichtner Consulting Engineers Ltd (Fichtner) has been engaged to provide supporting evidence to confirm and clarify the statements set out in the Environmental Statement (ES) regarding the following:

- The net change in impacts on air quality due to the provision of shore power for ships whilst in berth at Portland Harbour; and
- The cumulative impact of road and process emissions associated with the proposed development and other consented projects on sites of European ecological importance.

The original assessment of emissions associated with the proposed development (as set out in Chapter 4 [Air Quality] of the ES) quantified the impacts on air quality associated with deliveries by road and noted that the use of ships for the delivery material would reduce the HGV movements on the local roads network and as such would reduce air quality impacts away from the immediate port area. Within the ES, it was explained that there would also be a reduction in emissions from berthed ships which would use shore power provided by the ERF, but that this benefit had not been quantified. These ships would otherwise be using on-vessel generators, with associated emissions. The net change associated with the proposed development has now been quantified as set out in this report.

The original assessment considered the impact of road and process emissions and screened out the need for further consideration of the cumulative impact with other plans and projects at National Site Network (NSN) sites of European ecological importance as the total impact was predicted to be less than 1% of the relevant assessment levels. The cumulative impact with other plans and projects has now been quantified as set out in this report.

1.2 Objectives

The aims of this report are to:

- set out the net change in impacts on air quality due to the provision of shore power for ships whilst in berth at Portland Harbour; and
- set out the cumulative impact of road and process emissions associated with the proposed development and other consented plans and projects on NSN sites of European ecological importance.

2 Discussion

2.1 Shipping emissions

The ES qualitatively explained that the results presented were worst-case as they did not account for the offset of emissions from shipping which would be connected to shore power. These ships would otherwise be using on-vessel generators, with associated emissions. To support this statement, additional modelling has been undertaken which quantifies the impact of emissions from those ships which would be connected to shore power provided by the ERF – i.e. those ships whose on-vessel generator emissions would be displaced as a result of the proposed development.

Detailed modelling of emissions from the ships has been carried out using ADMS 5.2 as per the modelling of process emissions from the ERF. All inputs relating to meteorological data and dispersion site parameters are the same as those used when modelling the ERF in isolation as set out in the ES. The modelling has considered the impact of emissions from cruise ships, which are berthed for less than a day each, and two Royal Fleet Auxiliary (RFA) ships, which are berthed on a longer term basis. The assumptions for each are set out in Appendix A.

The emissions associated with the on-vessel generators are those from the combustion of fuel oil – namely oxides of nitrogen, sulphur dioxide and particulate matter. The impact of all other emissions would be as set out in the ES.

2.1.1 Results

Plot files are provided in Appendix B for each pollutant which show:

- The impact of emissions from the shipping which would be connected to shore power provided by the ERF;
- The impact of emissions from the ERF; and
- The net change in impact.

As shown, for particulate matter there is a net benefit associated with the proposed development at all points across the modelling domain. This is because the impact of emissions from the on-vessel generators, which would no longer be needed, is higher than the impact of emissions from the ERF. For nitrogen dioxide, there is a net benefit for the majority of the area. Where there is a net increase, the increase is extremely small (0.05 µg/m^3 at the point of greatest increase on land and 0.15 µg/m^3 at the point of greatest impact at sea), which can be compared with current background concentrations of around 22 µg/m^3. For sulphur dioxide, there is a net benefit for the majority of the area. Where there is a net increase the increase is extremely small (0.05 µg/m^3 at the point of greatest increase on land and 0.15 µg/m^3 at the point of greatest impact at sea), which can be compared with current background concentrations of around 2 µg/m^3.

As set out in Appendix A, the modelling has made very conservative assumptions over the emissions from the on-vessel generators. The assumptions have assumed that the majority of the generators are modern and as such the emissions would be lower than older generators. If less conservative assumptions were used, and the emissions from the on-vessel generators assumed to be higher, the net change would show a greater benefit of the proposed development.

2.2 Ecological impacts

The original assessment considered the impact of road and process emissions and screened out the need for further consideration of the cumulative impact with other plans and projects at NSN sites of European ecological importance as the total impact of process and road traffic emissions associated with the proposed development was predicted to be less than 1% of the relevant assessment levels. The NSN sites of European ecological importance identified which would be impacted by cumulative emissions from road traffic and process emissions were:

- Chesil and The Fleet SAC; and
- Isle of Portland to Studland Cliffs SAC.

The original dispersion modelling included all the committed developments as the trips associated with the committed developments were included in the predicted 2023 flows for both the do-minimum and do-something scenarios. The change in impact between the do-minimum and do-something flows was predicted. However, results were not presented to show the cumulative change in impact from the do-nothing scenario, which did not include the trips associated with the committed developments.

The detailed modelling has been updated and the do-nothing scenario run using ADMS Roads 5.0 as per the modelling of traffic emissions as set out in the ES. All inputs relating to meteorological data and dispersion site parameters are the same as those set out in the ES. The only difference is the traffic data which is set out in Appendix B. Full details of the committed developments included are as set out in the Transport Assessment. The difference between the do-something and do-nothing has been calculated to determine the cumulative impact of emissions from the proposed development (the ERF and traffic) and other consented projects. This has focussed on impacts of traffic related emissions which there is an assessment level set for the protection of ecosystems – i.e. oxides of nitrogen, ammonia and nitrogen deposition.

Results have been provided for a transect from the road across the SAC as set out in the ES.

For the purpose of this analysis the background concentration of oxides of nitrogen has been taken from the DEFRA mapped background dataset as set out in the ES minus the "primary road in" sector. This is because the contribution of oxides of nitrogen from the road traffic from major roads within the modelling domain has been explicitly modelled and using the total oxides of nitrogen concentration would lead to an overestimation of the PEC. The ammonia and nitrogen deposition background rates have been taken from the APIS background dataset. For ammonia and nitrogen deposition these are on a 5 km x 5 km spatial resolution which is calculated as a rolling average 3-year concentration. This is updated on a periodic basis. The latest update was published in March 2021 and has been updated to the 3-year average for 2017 to 2019. The previous shadow appropriate assessment used the data available at the time of submission which was the 3-year average from 2016 to 2018. An analysis of the differences has shown that the latest 3-year average data is slightly greater than that used in the original shadow appropriate assessment. Therefore, this data produced to support the updated shadow appropriate assessment uses the most recent available data. Unlike the DEFRA dataset the APIS dataset does not source apportion the concentration. Therefore, it is not possible to remove the road contribution modelled. As such the PEC is likely to be an overestimation for the PEC as the baseline contribution from road sources will be double counted.

2.2.1 Results

Graphs are provided in Appendix D for Chesil and the Fleet SAC, and Appendix E for the transect across the Isle of Portland to Studland Cliffs SAC for each pollutant which show the cumulative impact of emissions from the ERF, road vehicles associated with the operation of the proposed development, and the other additional cumulative developments.

As shown, the transect is very similar for the total concentration with and without the proposed development (the do-something and do-minimum scenarios). The do-nothing scenario is much lower. This shows that the impact from the proposed development is minimal and impacts are dominated by the other consented schemes.

In terms of annual mean oxides of nitrogen impacts at Chesil and the Fleet SAC:

- Figure 8 shows that the impact of the proposed development is predicted to be less than 1% of the critical level within 2m of the road.
- Figure 7 shows that the cumulative impact (with other plans and projects) is predicted to be significantly greater with cumulative impacts within 50m of the road greater than 5% of the critical level.
- Figure 9 shows that the total concentration is predicted to exceed the critical level very close to the road (within 3m of the road). This exceedence is predicted to occur as a result of other cumulative schemes and the additional contribution from the proposed development will not change the distance at which exceedances of the critical level are predicted significantly (i.e. less than a metre). In any case impacts are predicted to be less than 70% of the critical level by 11m from the road for both the do-minimum and do-something scenario.

In terms of annual mean ammonia impacts at Chesil and the Fleet SAC:

- Figure 12 shows that the impact of the proposed development is predicted to be less than 1% of the critical level within 1m of the road.
- Figure 11 shows that the cumulative impact (with other plans and project) is predicted to be significantly greater with cumulative impacts within 50m of the road greater than 8% of the critical level.
- Figure 14 shows that the total concentration is predicted to exceed the critical level close to the road (within 3m of the road). This exceedence is predicted to occur as a result of other cumulative schemes and the additional contribution from the proposed development will not change the distance at which exceedances of the critical level are predicted significantly (i.e. less than a metre). In any case impacts are predicted to be less than 70% of the critical level by 9m from the road for both the do-minimum and do-something scenario.

In terms of nitrogen deposition impacts at Chesil and the Fleet SAC:

- Figure 16 shows that the impact of the proposed development is predicted to be less than 2% of the critical ~~level~~ load within 4m of the road. The greatest source of emissions to nitrogen deposition is ammonia from road traffic emissions.
- Figure 15 shows that the cumulative impact (with other plans and project) is predicted to be significantly greater.
- Figure 18 shows that the total concentration is predicted to be similar for the do-minimum and do-something scenario.

The greatest source of emissions to nitrogen deposition is ammonia from road traffic emissions.

In terms of annual mean oxides of nitrogen impacts at Isle of Portland to Studland Cliffs SAC:

- Figure 23 shows that the impact of the proposed development is predicted to be less than 1% of the critical level within 13m of the road.
- Figure 22 shows that the cumulative impact (with other plans and project) is predicted to be significantly greater with cumulative impacts within 50m of the road greater than 3% of the critical level.
- Figure 24 shows that the total concentration is predicted to be well below the critical level.

In terms of annual mean ammonia impacts at Portland to Studland Cliffs SAC:

- Figure 28 shows that the impact of the proposed development is predicted to be greater than 1% of the critical level for lichen sensitive communities along the transect, but Figure 26 shows that at a distance greater than 4m of the road the impact of the proposed development is predicted to be less than 1% of the critical level for non-lichen sensitive communities.
- Figure 25 and Figure 27 show that the cumulative impact (with other plans and project) is predicted to be significantly greater with cumulative impacts within 50m of the road greater than 6% of the critical level for lichen sensitive communities and 2% for non-lichen sensitive communities.
- Figure 30 shows that the total concentration is predicted to be below the critical level for lichen sensitive communities within a few metres of the road.

In terms of nitrogen deposition impacts at Portland to Studland Cliffs SAC:

- Figure 32 shows that the proposed development is predicted to be less than 1 kgN/ha/yr within 4m of the road. The greatest source of emissions to nitrogen deposition is ammonia from road traffic emissions.
- Figure 31 shows that the cumulative impact (with other plans and project) is predicted to be significantly greater.
- Figure 33 shows that the total concentration is predicted to be similar for the do-minimum and do-something scenario. The do-nothing scenario is very similar to the background as there are very few vehicles along the dock road in the do-nothing scenario.

These results have been fed into the updated shadow appropriate assessment.

Appendices

A Shipping modelling assumptions

This section details the assumptions made when calculating the inputs for the dispersion modelling relating to the shipping emissions. Note only the emissions which would be displaced as a result of the proposed development have been modelled.

A.1 Cruise ships

The following table sets out the assumptions relating to the cruise ships:

Table 1: Cruise Ships - Assumptions

Assumption	Units	Value	Justification / source
Time connected to shore power			
Cruise visits per year	Visits	60	Visits in 2024 from Powerfuel
Connected to shore power	%	62%	% connected in 2024 from Powerfuel
Connected to shore power	Visits	36	Calculated
Average length of stay	Hours	11	From Powerfuel
Start of cruise season	-	Beginning of April	Portland Harbour cruise timetable
End of cruise season	-	End of October	Portland Harbour cruise timetable
Consumption per year	MWh	3,168	Calculated from demand and duration of connection
Energy content of fuel	kg/MWh	180	Energy content of diesel
Fuel usage when docked	tpa	570	Calculated from consumption and energy content of fuel
Emissions			
Stack height	m	60	Agreed assumption – reasonable assumption as an average
Velocity	m/s	25	Agreed assumption
Temperature	°C	300	Agreed assumption
Volume flow	Am^3/s	16.74	Calculated from fuel usage using combustion calculator
Diameter	m	1.46	Calculated to achieve the stated velocity
Sulphur dioxide			
Sulphur content of fuel	%	0.1%	MARPOL Annex VI limit
Release rate	g/s	0.80	Calculated from sulphur content of fuel
Oxides of nitrogen			
Tier emission standard	-	III	

Assumption	Units	Value	Justification / source
Limit	g/kWh	2.0	Assumed to be new ships. If an older ship the emissions would be higher and thus the offset greater
Release rate	g/s	4.44	Calculated from limit and power needed
Particulate matter			
Emission standard	-		US Marine Diesel Engines
Limit	g/kWh	0.5	
Release rate	g/s	1.11	Calculated from limit and power needed

The results are considered to be conservative for the following reasons:

- The number of cruise ship visits and the fraction of cruise ships which are connected to shore power are both expected to increase year on year. Therefore, for future years the emissions offset as a result of providing shore power would be greater.
- The emissions of oxides of nitrogen have been calculated assuming the cruise ships are new (post 2016). Many operational cruise ships were constructed before 2016 andthe limit for NOx for older ships is higher. Therefore, the emissions offset as a result of providing shore power would be greater initially, depending on how quickly older cruise ships are replaced.

For the purpose of the dispersion modelling a time varying fac file has been used. This has been set up to only have emissions from the cruise ships from the hours of 8am to 7pm each day from the beginning of April to the end of October.

The model output has then been factored by the number of hours cruise ships are likely to be berthed and connected to shore power in that period.

$$\frac{Number\ of\ hours\ berthed\ (11)\ x\ Number\ of\ visits\ (36)}{Modelled\ hours\ (11\ x\ 214)}$$

A.2 RFA shipping

The following table sets out the assumptions relating to the RFA ships:

Table 2: RFA Ships - Assumptions

Assumption	Units	Value	Justification / source
Time connected to shore power			
Days in port per year (berth days)	Days	260	From Powerfuel
Connected to shore power	%	100%	From Powerfuel
Average demand	MW	2.75	From Powerfuel
Energy consumption per year	MWh	17,160	Calculated from demand and duration of connection

Assumption	Units	Value	Justification / source
Energy content of fuel	kg/MWh	180	Energy content of diesel
Fuel usage when docked	tpa	3,089	Calculated from power needed and energy content of fuel
Emissions			
Stack height	m	25	Agreed assumption – reasonable assumption as an average
Velocity	m/s	25	Agreed assumption
Temperature	°C	300	Agreed assumption
Volume flow	Am3/s	5.81	Calculated from fuel usage using combustion calculator – includes for % of year connected
Diameter	m	0.86	Calculated to achieve the stated velocity
Sulphur dioxide			
Sulphur content of fuel	%	0.1%	MARPOL Annex VI limit
Release rate	g/s	0.28	Calculated from sulphur content of fuel
Oxides of nitrogen			
Tier emission standard	-	II	Assumed to be oldish ships, there is a mix of ages and the older ship emissions would be higher and thus the offset greater
Limit	g/kWh	7.7	
Release rate	g/s	5.88	Calculated from limit and power needed
Particulate matter			
Emission standard	-	-	US Marine Diesel Engines
Limit	g/kWh	0.5	
Release rate	g/s	0.38	Calculated from limit and power needed

The results are considered to be conservative for the following reason:

- The emissions of oxides of nitrogen have been calculated assuming the RFA ships were constructed between 1 January 2011 and 31 December 2015 and have an engine with a rated speed of > 2000 rpm. A number of the RFA ships were constructed before this period and have a lower rated speed. Therefore, the emissions offset as a result of providing shore power would be greater.

For the purpose of the dispersion modelling the model outputs were factored to account for the number of days the RFA ships would be connected to shore power.

B Do Nothing Traffic Data

The following table sets out the traffic data used for the do-nothing scenario. This only focussed on links A and B in the main modelling as all other links are far enough from the area of concern that any contribution from these would be minuscule. For full details of the traffic data for the do-minimum and do-something scenarios, reference should be made to Technical Appendix D2 of the ES.

Table 3: Traffic Data – 24-hour AADT – Do-Minimum

Road Link		Do-nothing 2023	
		Cars	HGVs
A	Port – Lichen Beds	1,111	1,111
B	Portland Beach Road	16,710	7,306

Source: AWP

C Figures - Shipping

Figure 1: Annual mean nitrogen dioxide – including shipping

<Click here to insert figure>

Source: <Insert Source text here>

Figure 2: Annual mean nitrogen dioxide – net change

<Click here to insert figure>

Source: <Insert Source text here>

Figure 3: Annual mean sulphur dioxide – including shipping

<Click here to insert figure>

Source: <Insert Source text here>

Figure 4: Annual mean sulphur dioxide – net change

<Click here to insert figure>

Source: <Insert Source text here>

Figure 5: Annual mean particulate matter – including shipping

<Click here to insert figure>

Source: <Insert Source text here>

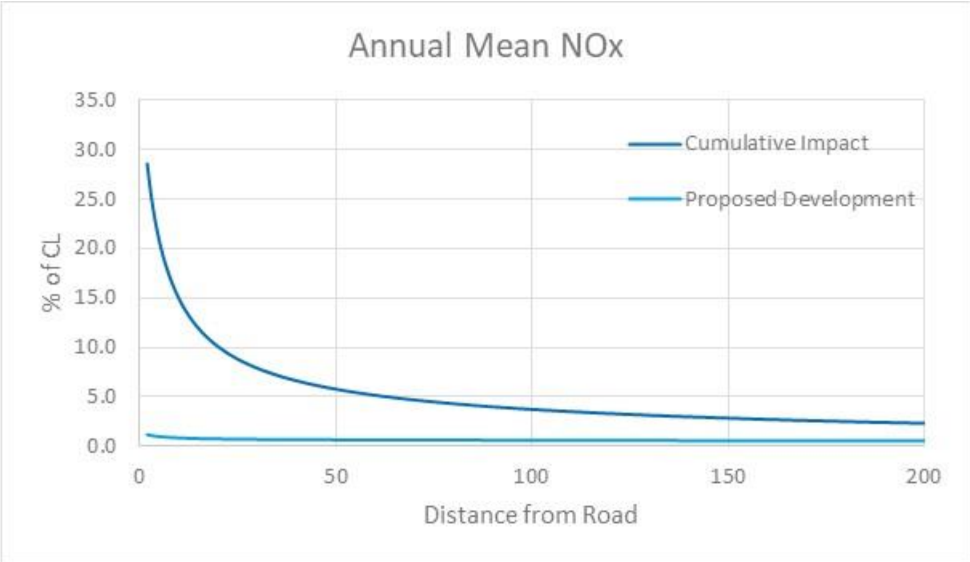
Figure 6: Annual mean particulate matter – net change

<Click here to insert figure>

Source: <Insert Source text here>

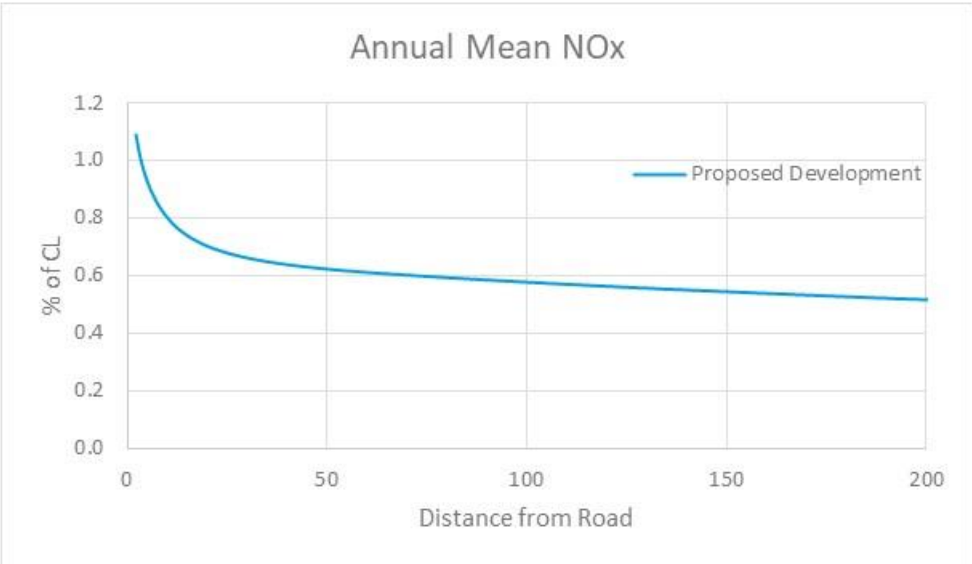
D Figures – Eco Impacts at Chesil

Figure 7: Annual Mean NOx – Chesil Beach



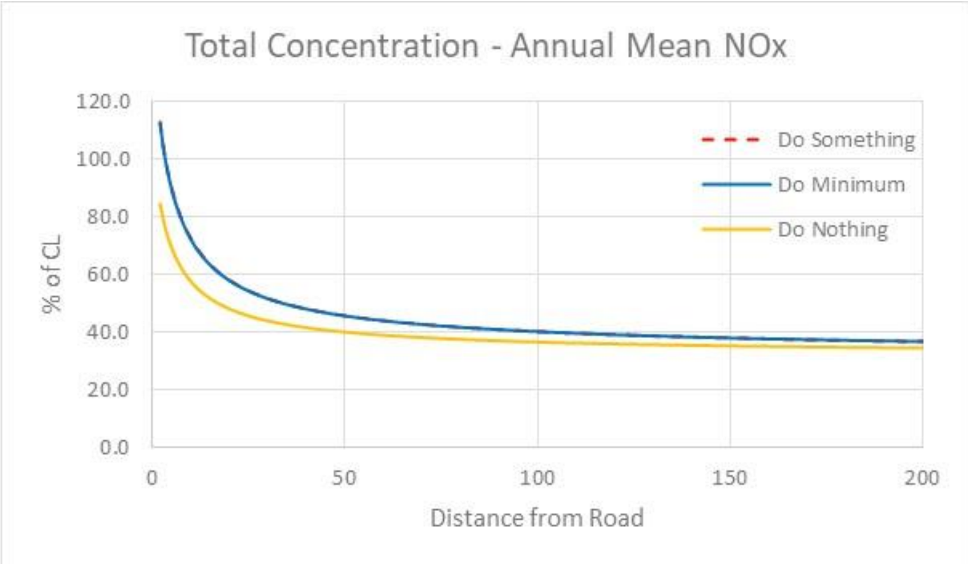
Note: Impacts presented as % of critical level of 30 µg/m³

Figure 8: Annual Mean NOx Proposed Development Only – Chesil Beach



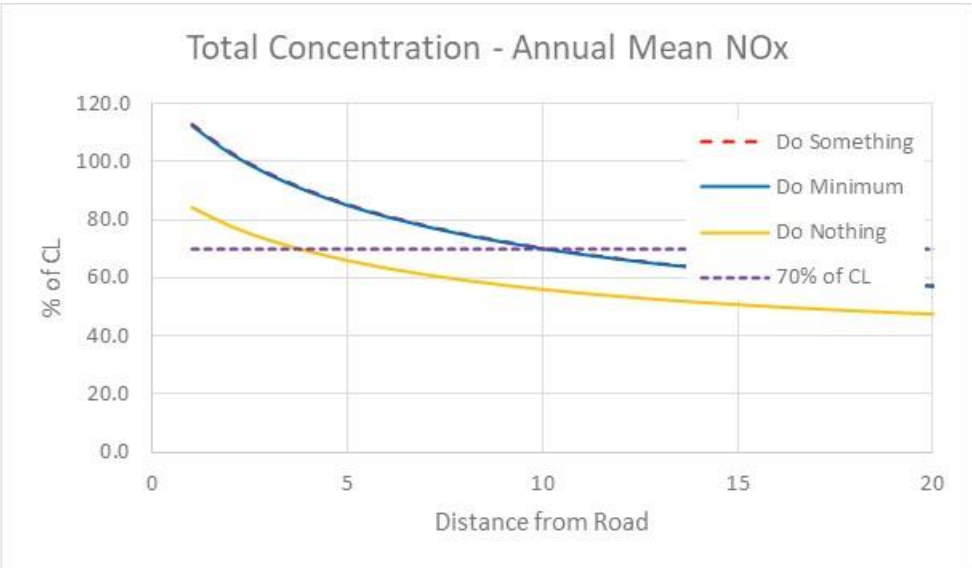
Note: Impacts presented as % of critical level of 30 µg/m³

Figure 9: Annual Mean NOx PEC – Chesil Beach



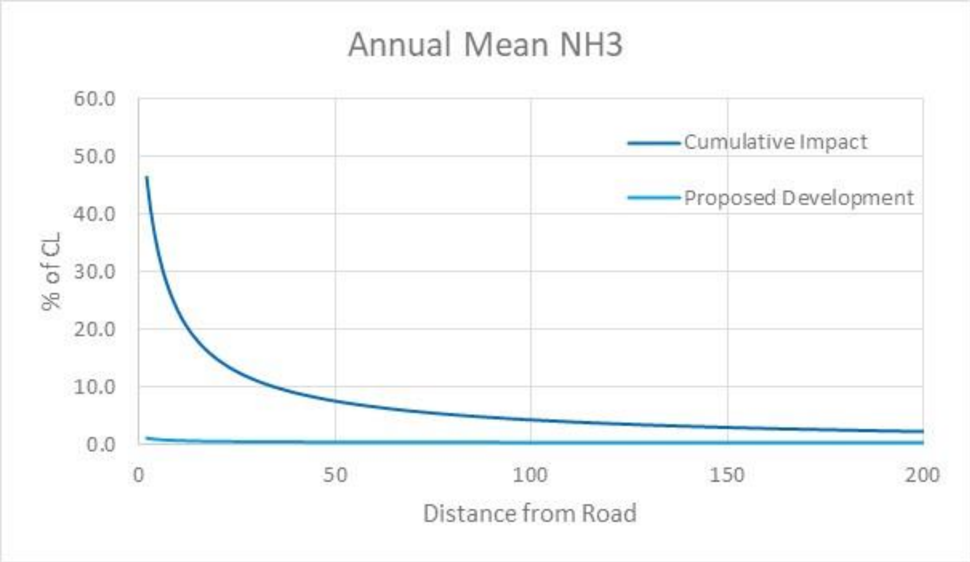
Note: Impacts presented as % of critical level of 30 µg/m³

Figure 10: Annual Mean NOx PEC – Chesil Beach - Analysis



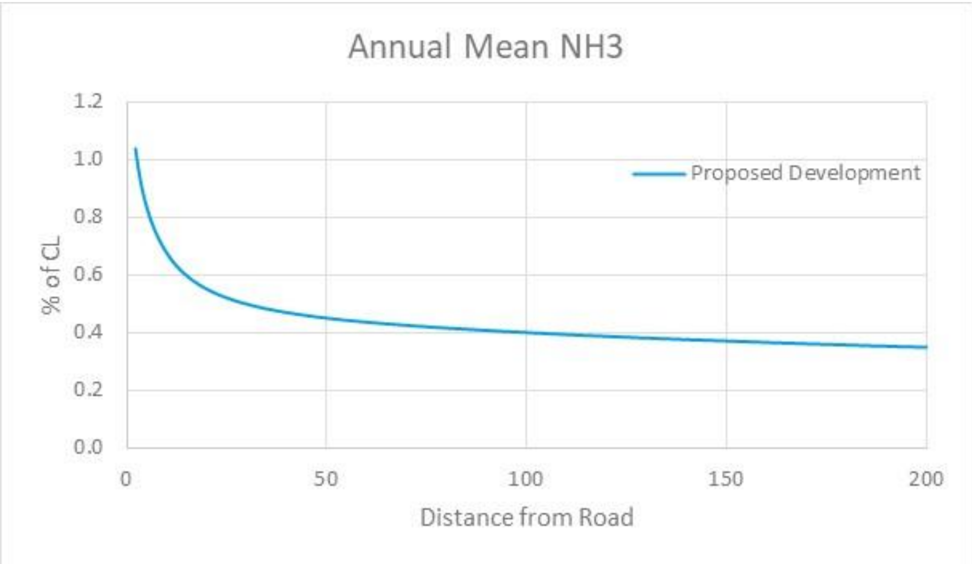
Note: Impacts presented as % of critical level of 30 µg/m³

Figure 11: Annual Mean Ammonia – Chesil Beach



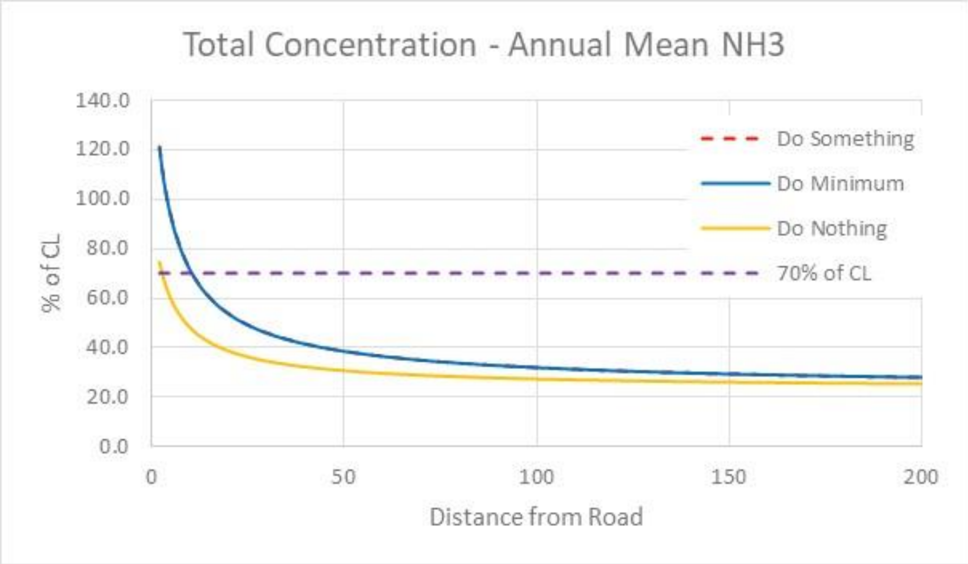
Note: Impacts presented as % of critical level of 3 µg/m³

Figure 12: Annual Mean Ammonia Proposed Development Only – Chesil Beach



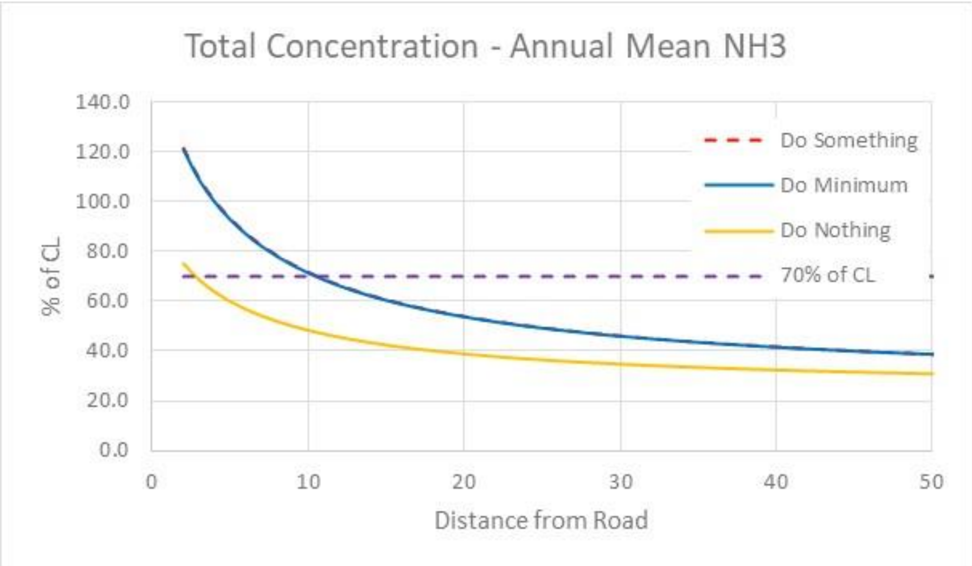
Note: Impacts presented as % of critical level of 3 µg/m³

Figure 13: Annual Mean Ammonia PEC – Chesil Beach



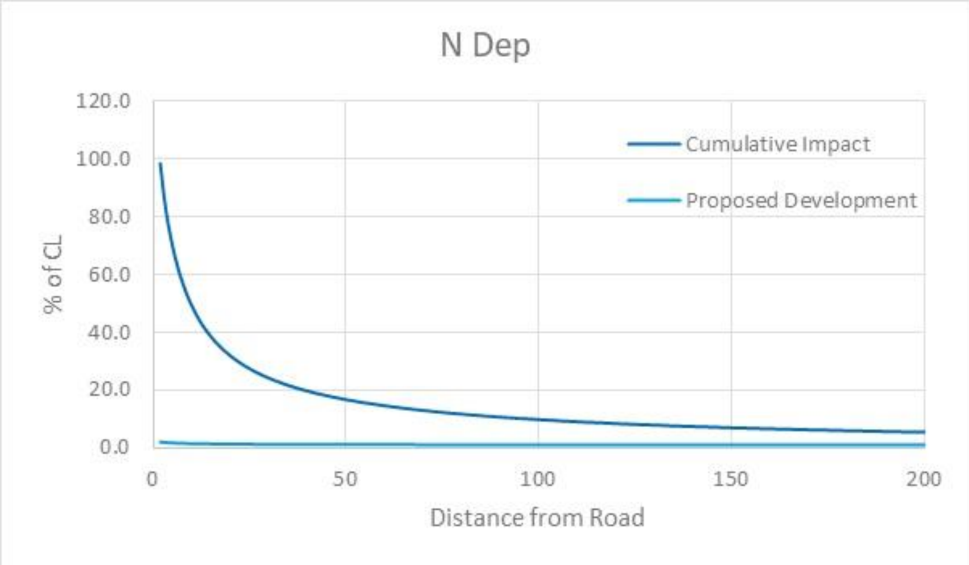
Note: Impacts presented as % of critical level of 3 µg/m³

Figure 14: Annual Mean Ammonia PEC – Chesil Beach - Analysis



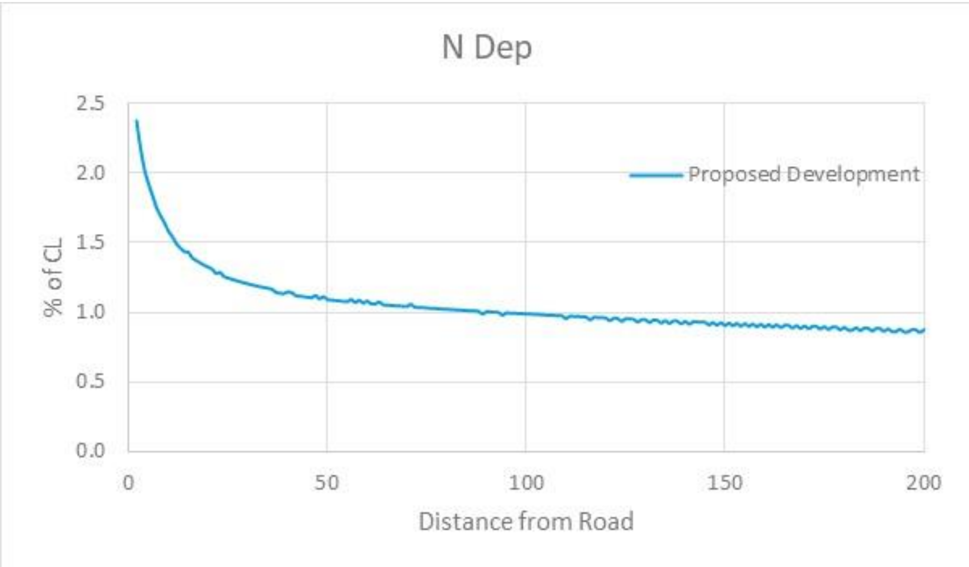
Note: Impacts presented as % of critical level of 3 µg/m³

Figure 15: Annual Mean N Dep – Chesil Beach



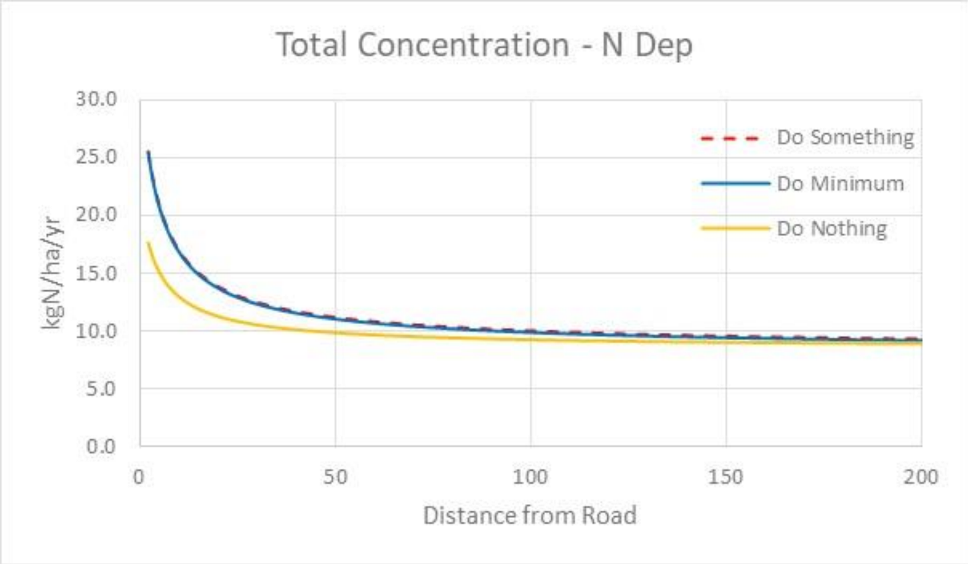
Note: Impacts presented as % of CL 8 and include the contribution from nitrogen dioxide and ammonia emissions from traffic and the ERF

Figure 16: Annual mean N Dep Proposed Development Only – Chesil Beach



Note: Impacts presented as % of CL 8 and include the contribution from nitrogen dioxide and ammonia emissions from traffic and the ERF

Figure 17: Annual mean N Dep PEC – Chesil Beach



Note: Impacts presented as kgN/ha/yr and include the contribution from nitrogen dioxide and ammonia emissions from traffic, the ERF and mapped background

Figure 18: Annual mean N Dep PEC – Chesil Beach - Zoomed

Note: Impacts presented as kgN/ha/yr and include the contribution from nitrogen dioxide and ammonia emissions from traffic, the ERF and mapped background

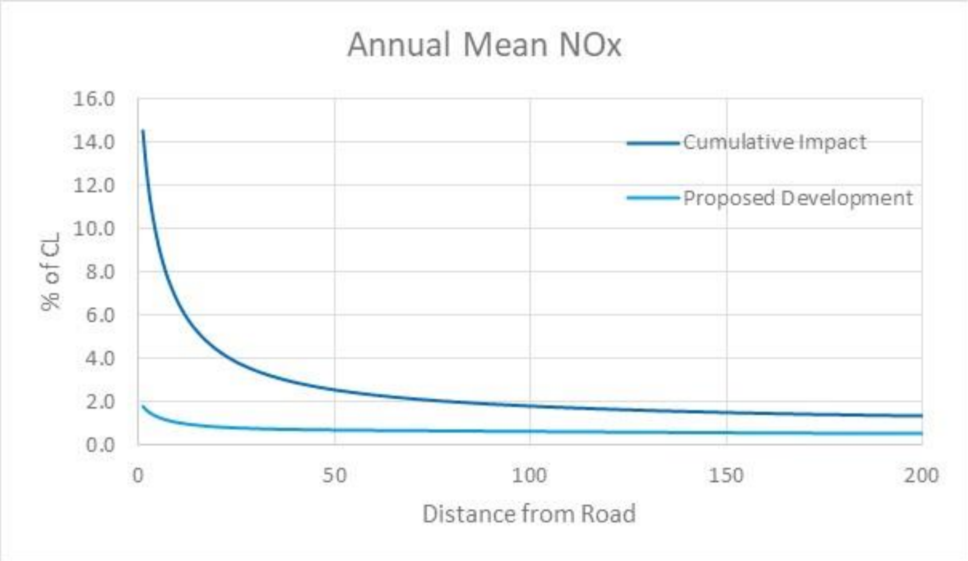
Figure 19: Annual Mean NOx – Contour Plot – Proposed Development Only

Figure 20: Annual Mean NOx – Contour Plot – Cumulative

Figure 21: Annual Mean NOx – Contour Plot – PEC – do-something

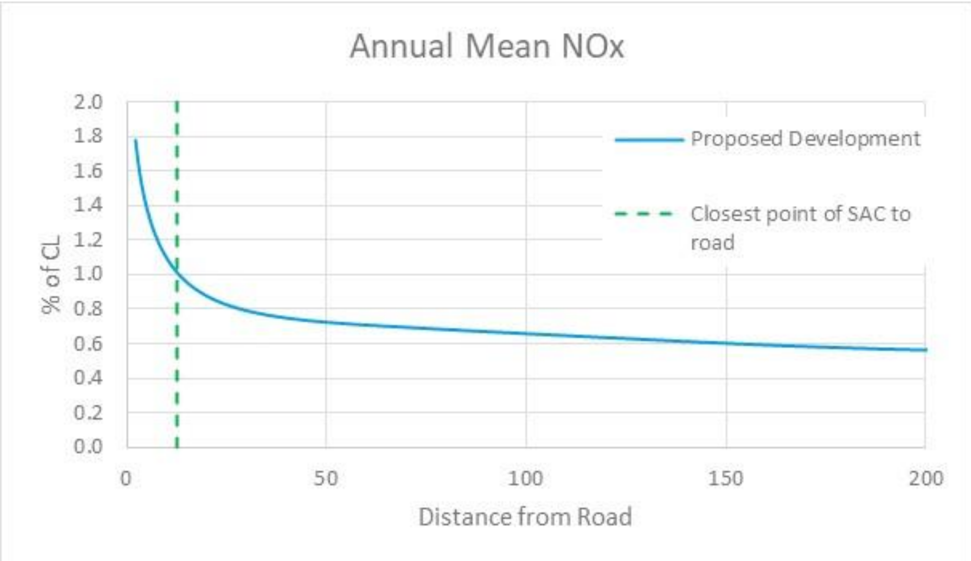
E Figures – Eco Impacts at Portland

Figure 22: Annual Mean NOx – Isle of Portland to Studland Cliffs



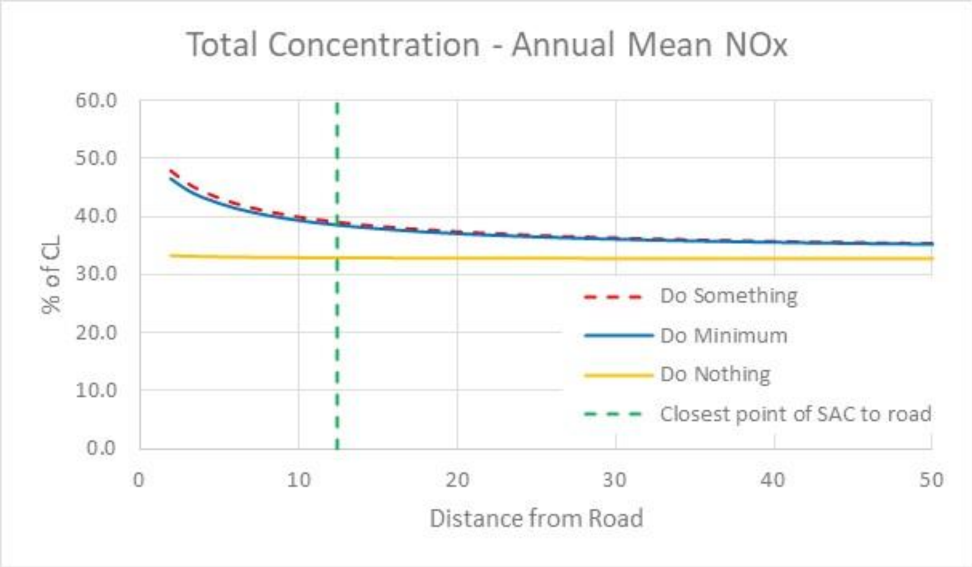
Note: Impacts presented as % of critical level of 30 µg/m^3

Figure 23: Annual Mean NOx Proposed Development Only – Isle of Portland to Studland Cliffs



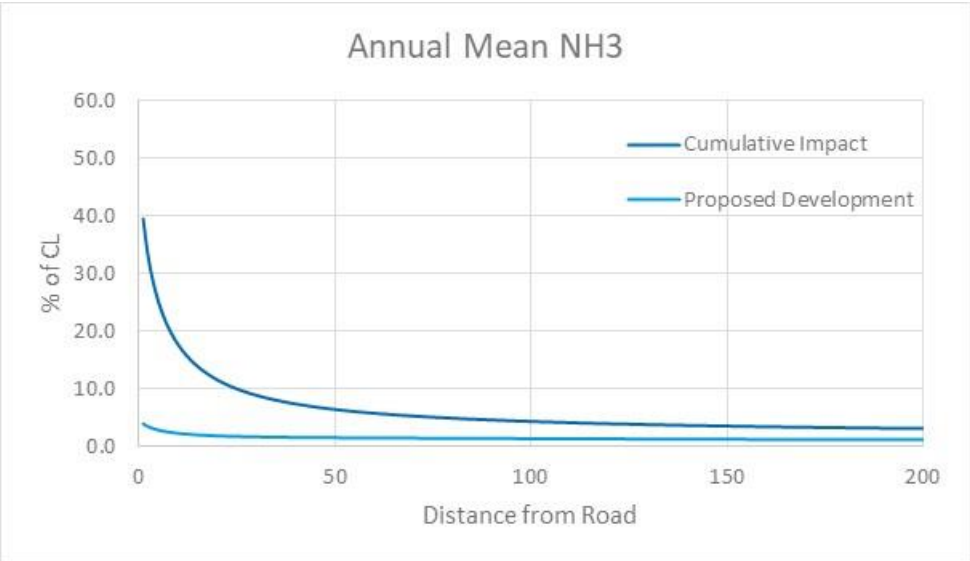
Note: Impacts presented as % of critical level of 30 µg/m^3

Figure 24: Annual Mean NOx PEC – Isle of Portland to Studland Cliffs



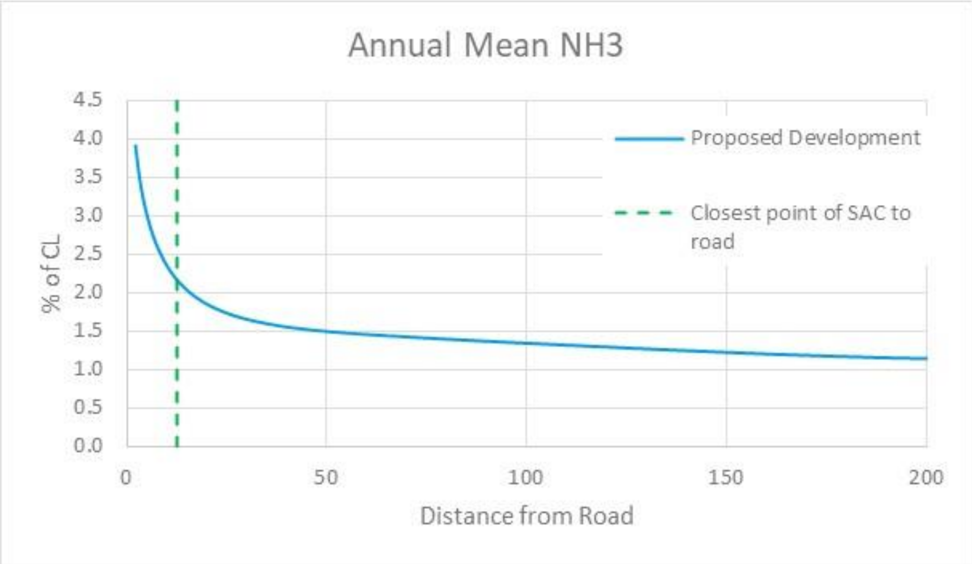
Note: Impacts presented as % of critical level of 30 µg/m³

Figure 25: Annual Mean Ammonia – Isle of Portland to Studland Cliffs



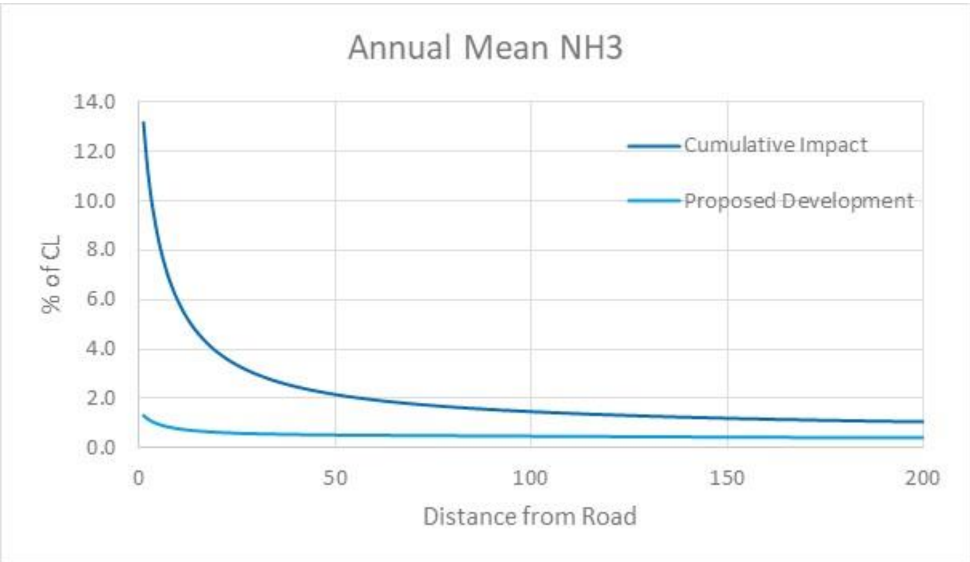
Note: Impacts presented as % of critical level of 1 µg/m³

Figure 26: Annual Mean Ammonia Proposed Development Only – Isle of Portland to Studland Cliffs



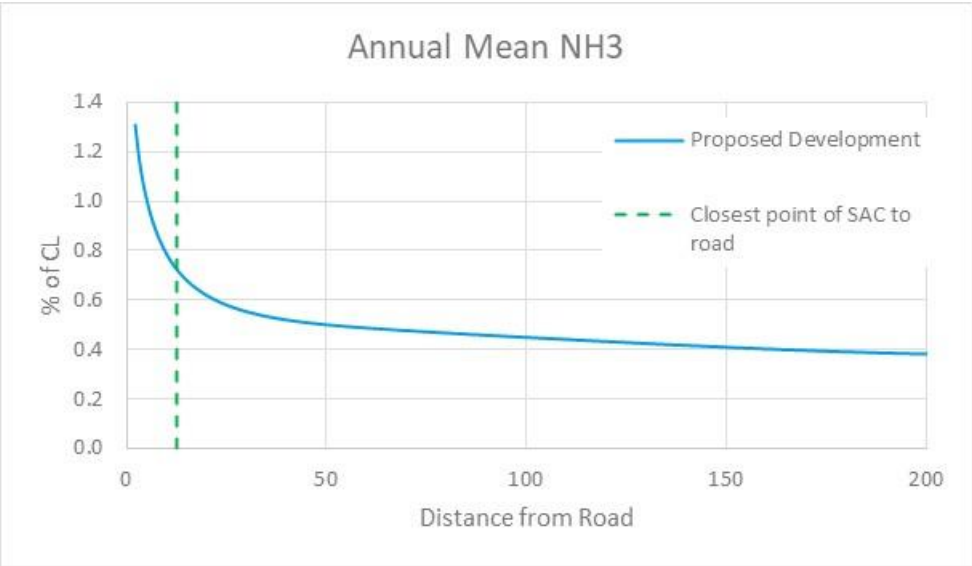
Note: Impacts presented as % of critical level of 1 µg/m³

Figure 27: Annual Mean Ammonia – Isle of Portland to Studland Cliffs



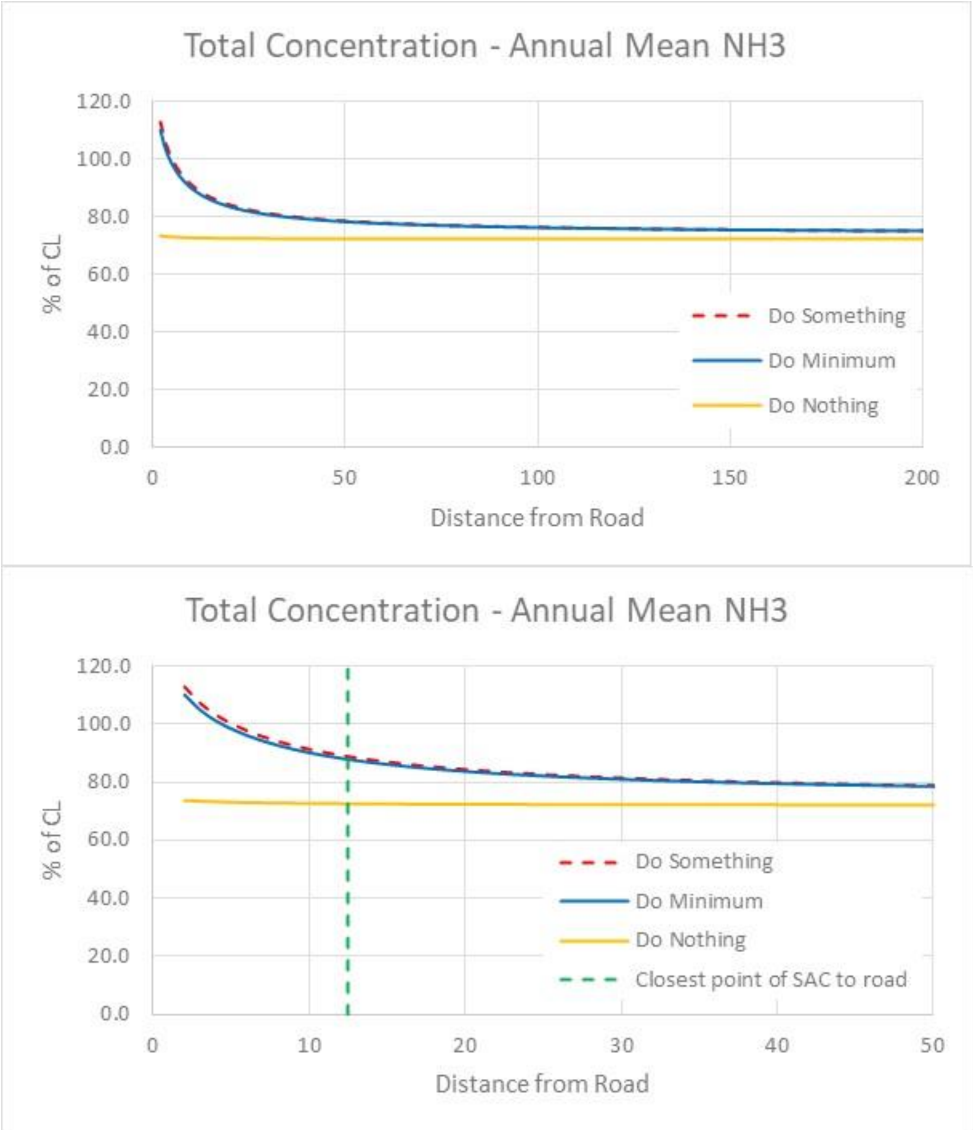
Note: Impacts presented as % of critical level of 3 µg/m³

Figure 28: Annual Mean Ammonia Proposed Development Only – Isle of Portland to Studland Cliffs



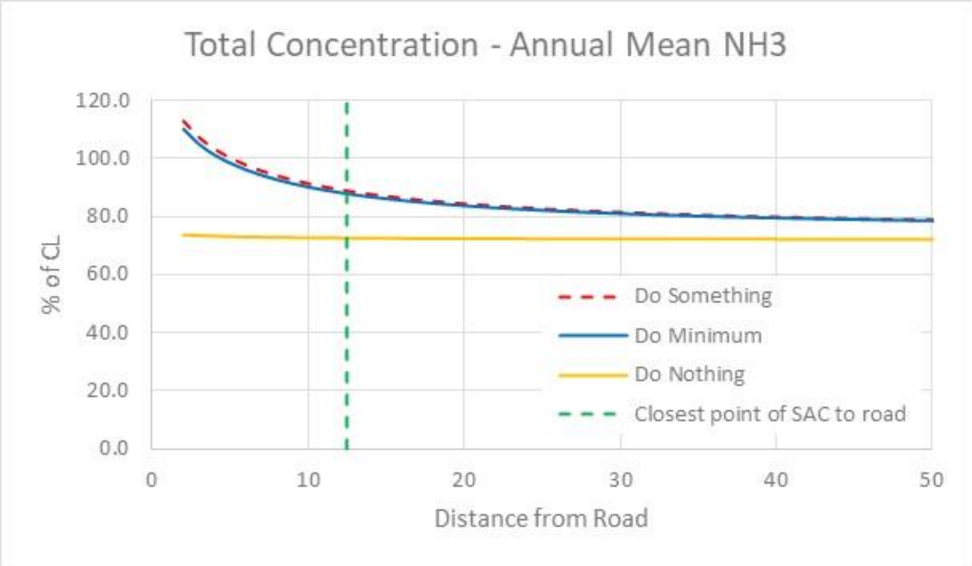
Note: Impacts presented as % of critical level of 3 µg/m³

Figure 29: Annual Mean Ammonia PEC – Isle of Portland to Studland Cliffs



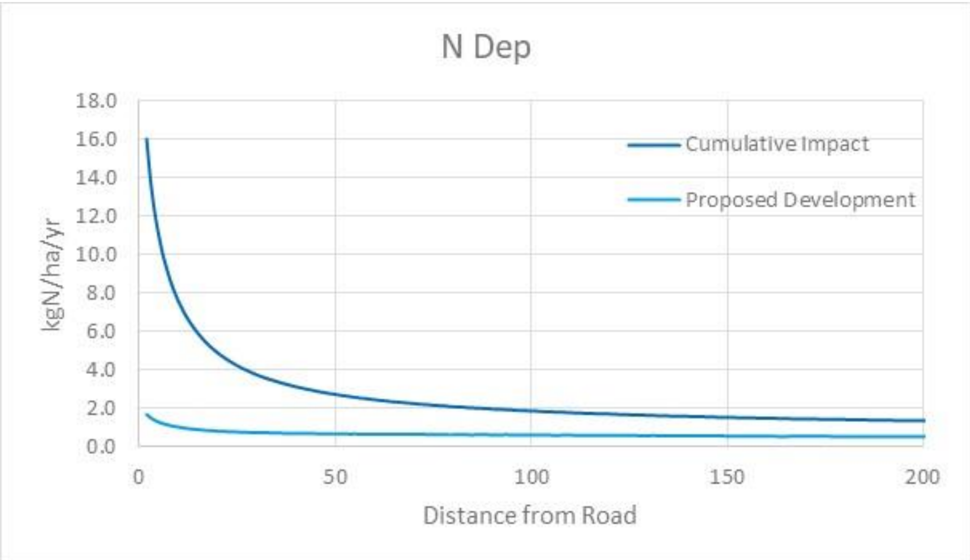
Note: Impacts presented as % of critical level of 1 μg/m³

Figure 30: Annual Mean Ammonia PEC – Isle of Portland to Studland Cliffs - Analysis



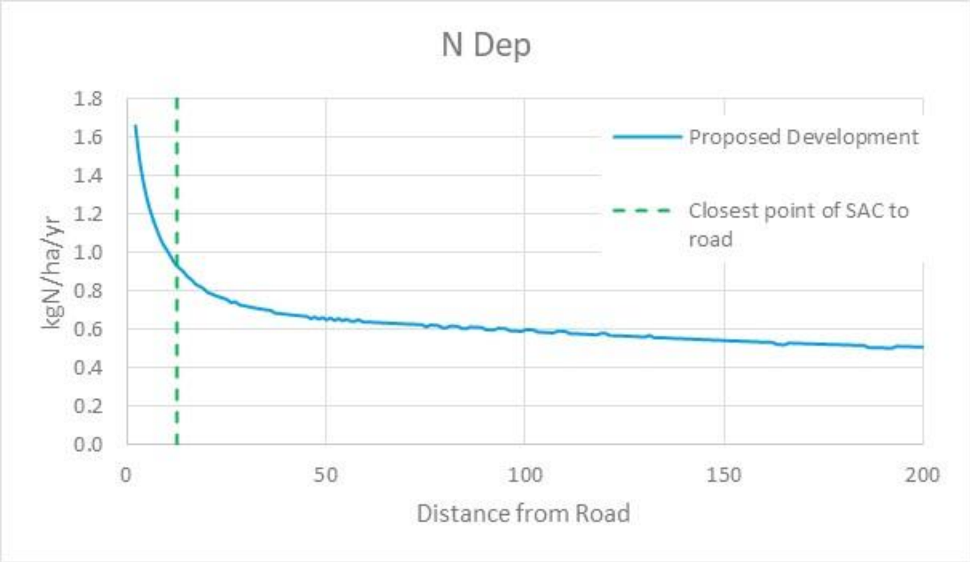
Note: Impacts presented as % of critical level of 1 µg/m³

Figure 31: Annual Mean N Dep – Isle of Portland to Studland Cliffs



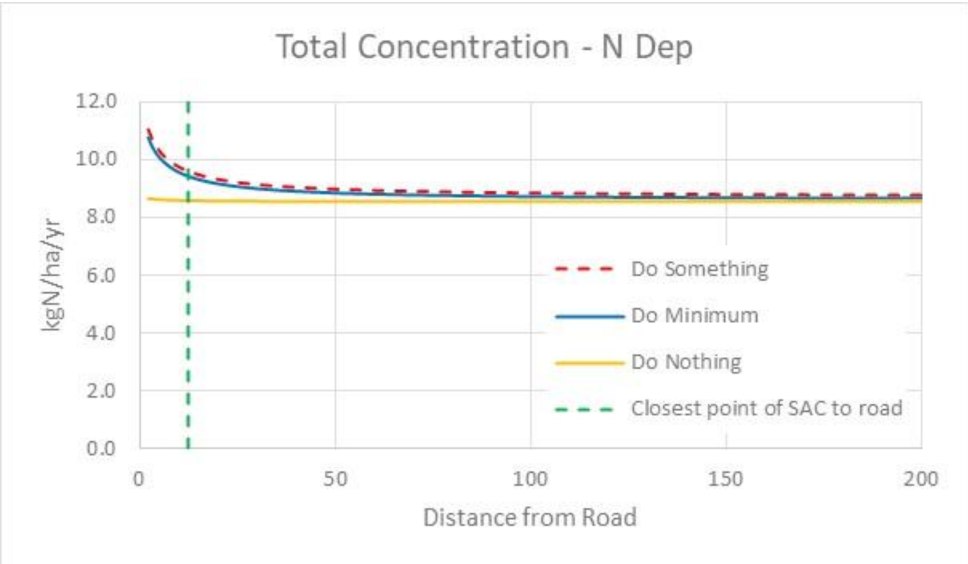
Note: Impacts presented as kgN/ha/yr and include the contribution from nitrogen dioxide and ammonia emissions from traffic and the ERF

Figure 32: Annual mean N Dep Proposed Development Only – Isle of Portland to Studland Cliffs



Note: Impacts presented as kgN/ha/yr and include the contribution from nitrogen dioxide and ammonia emissions from traffic and the ERF

Figure 33: Annual mean N Dep PEC – Isle of Portland to Studland Cliffs



Note: Impacts presented as kgN/ha/yr and include the contribution from nitrogen dioxide and ammonia emissions from traffic, the ERF and mapped background

ENGINEERING CONSULTING

FICHTNER
Consulting Engineers Limited

Kingsgate (Floor 3), Wellington Road North,
Stockport, Cheshire, SK4 1LW,
United Kingdom

t: +44 (0)161 476 0032
f: +44 (0)161 474 0618

www.fichtner.co.uk