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EIA Report for Proposed Increase to Waste Tonnage Throughput of the Lostock Sustainable Energy Plant

Appendix 5.3 – Vehicle Emissions Modelling

ENGINEERING CONSULTING

Document approval

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Contents

1 Introduction

This appendix contains the detailed methodology and results of the road vehicle modelling carried out to support Chapter 5 - Air Quality and Human Health for the Environmental Impact Assessment (EIA) Report (Main Report), which supports the Proposal to increase the total waste tonnage of the LSEP.

The IAQM document "Land-Use Planning & Development Control: Planning for Air Quality V1.2" (2017), referred to as the IAQM 2017 Planning Guidance, states that an air quality assessment is required where a development would cause a "significant change" in light duty vehicles (LDVs) or heavy duty vehicles (HDV). The indicative criteria to process to an assessment are:

- A change in LDV flows of:
  - more than 100 Annual Average Daily Traffic (AADT) within or adjacent to an AQMA; or
  - more than 500 AADT elsewhere.
- A change in HDV flows of:
  - more than 25 AADT within or adjacent to an AQMA; or
  - more than 100 AADT elsewhere.

The IAQM guidance does not clearly state the level of assessment which is required. However, if the change in LDV and HDV flows does not exceed the above criteria and there is negligible risk of overlap of emissions with process emissions, the development is not expected to cause a significant change and the significance of effect is deemed to be 'negligible' and further detailed analysis of the impact is not deemed necessary.

As stated in Chapter 4 of the EIA Report (Main Report), the vehicles associated with the operation of the LSEP are expected to result in 514 one-way movements (257 inward journeys and 257 outward journey) on an AADT basis. 434 of these (217 inward journeys and 217 outward journeys) would be HGVs. This is an increase from the number of vehicles within the currents36 consent development of 170 HGV journeys per day and exceeds the criteria above, although there are no AQMAs in the area.

The following table sets out the anticipated vehicle trip generation rate for the operation of the LSEP as set out in Chapter 4 of the EIA Report (Main Report).

Table 1: Traffic Data 24-hour AADT

Scenario	All vehicles	LDVs	HGVs
S36 consent	324	80	264
the Proposal (i.e. the increase)	170	0	170
Total LSEP vehicles with the Proposal	514	80	434

In line with the IAQM 2017 Planning Guidance, it is appropriate to assess the impact of the LSEP with the Proposal against the current baseline for the site, disregarding the extant permissions to reflect the real world increase experienced by receptors.

In addition, the routing of vehicles north east along the A556 has the potential for vehicle emissions to combine with process emissions. Therefore, it has been considered appropriate to undertake a detailed assessment of the transport emissions both as they exceed the IAQM screening threshold and in order to calculate the in combination impact with the process emissions.

2 Methodology

2.1 Model used

All traffic modelling was undertaken using the ADMS-Roads (version 5.1) dispersion modelling package. The ADMS-Roads model is a version of ADMS, which was developed by CERC and is commonly used throughout the UK for environmental assessment purposes. ADMS-Roads is routinely used for modelling of emissions for planning purposes to the satisfaction of local authorities.

2.2 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.

2.3 Traffic flow data

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

- Scenario 1: 2016 Baseline,
- Scenario 2: 2023 do-minimum: including Northwich Traffic Model growth to represent general traffic growth and committed developments in the area; and
- Scenario 3: 2023 do-something: as scenario 2, plus LSEP traffic flows.

The impact is defined as the difference between the 'do-something' and 'do-minimum' scenarios, i.e. scenario 3 minus scenario 2. The do-minimum excludes the vehicles already approved under the s36 consent as such the impact is the total impact of the vehicles associated with the operation of the LSEP.

The 2016 baseline data provided by Axis has been factored to generate a 2018 baseline data using the Department for Transport (DfT) road traffic statistics from count points along the traffic routeways. This is to allow for the use of the most recent Emissions Factors Toolkit (EFT), version 10.1, which does not support years prior to Version 10.1 of the EFT is more accurate than earlier versions and allows the inclusion of gradient.

The Northwich transport model which has been used to calculate the traffic flows, has been developed by Mott Macdonald on behalf of Cheshire West and Chester County Council (CWaCC). It covers a very wide network, which includes over 80 allocated and committed development sites, the traffic from which was distributed across the whole modelled network. This means that it is not possible to isolate the volume of traffic associated with specific committed developments close to the LSEP, but they have been considered within the model.

The roads included in the model are shown in Figure 1 of Appendix C and the traffic data used in the assessment is presented in Appendix A.

2.3.1 Vehicle speeds

Vehicles have been modelled at speeds in accordance with national speed limits and professional judgments of the roads and vehicles. Speeds have been modelled at 32 kph (20 mph) for LDVs and 27 kph (~17 mph) for HDVs along the site access road; 64 kph (40 mph) for LDVs and 59 kph (~37 mph) for HDVs along Griffiths Road; 113 kph (70 mph) for LDVs and 96 kph (~60 mph) for HDVs along the A556 and A350 to the south of the roundabout; and 48 kph (30 mph) for LDVs and 43 kph (~27 mph) for HDVs along the remainder of the roads.

Slower speeds have been used where appropriate; at all junctions and roundabouts. For smaller roads, a slow down section preceding and after a junction of 25 m has been used, as recommended in Local Air Quality Management Technical Guidance (TG16), DEFRA, 2021). At the larger junctions and roundabouts, a longer slow down distance of 50 m has been used. At the junction of the A556 with Gadbrook Road, these distances have been further increased to ~300 m, to reflect the typical speed of traffic here due to traffic lights. Slow down sections use speeds of 20 kph (~12 mph) have been used for LDVs and HDVs. These sections are shown on Figure 2.

2.3.1.1 Queue zones

A review of typical traffic conditions has been undertaken using Google Maps. This has indicated that queuing occurs and along certain stretches during peak periods, and more generally close to major junctions. Representative queue zones 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.

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. The severity of the queuing has also been identified and factored into the model as 25% or 50% as in accordance with the Google Map traffic review. Separate queue profiles have been generated for difference stretches of each of the modelled road links towards and away from the LSEP site.

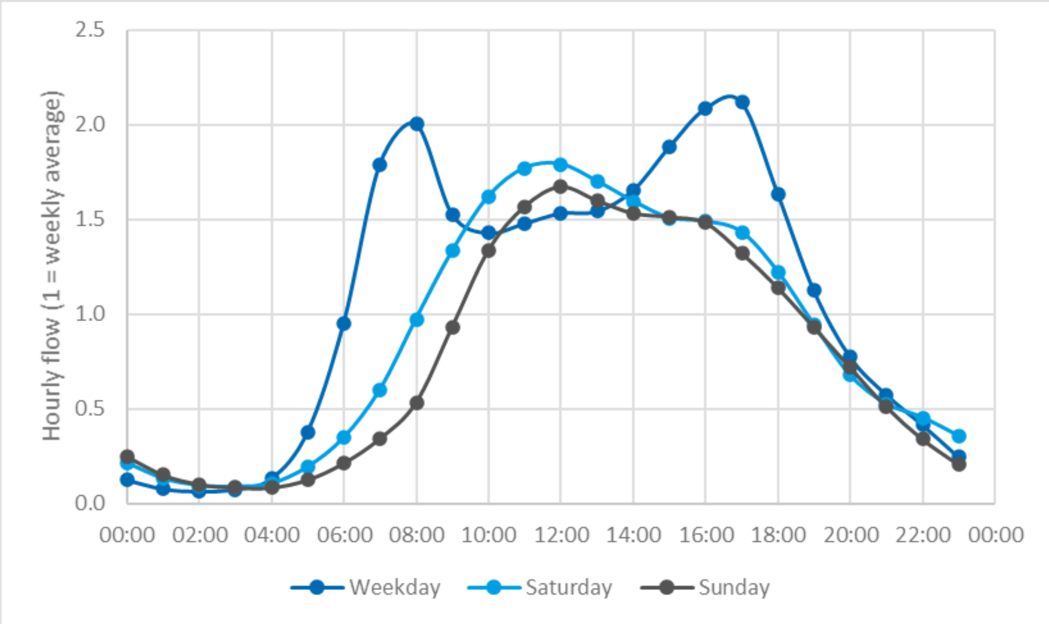
The emissions from the roads that overlap the queue zone are always on. Whilst this has the potential to over-predict emissions during hours of queuing, it is important to retain these emissions as they will capture the increase in emissions due to development-generated traffic. Queue zones always have 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. The sections identified as queue zones are highlighted on Figure 2.

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

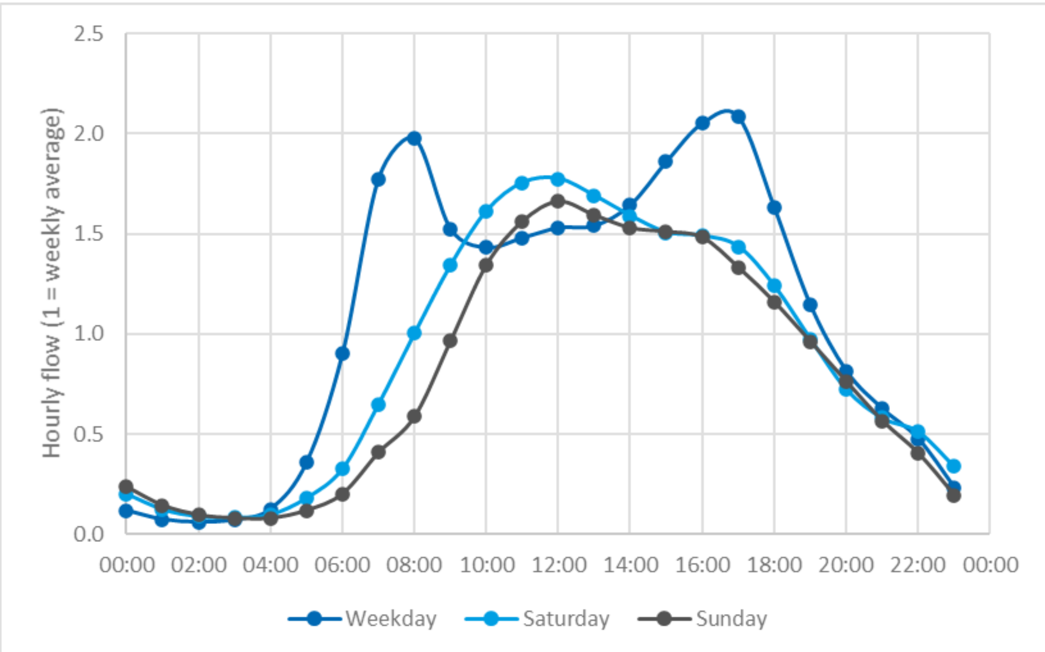
2.4 Daily profile of traffic volume

It is important that the model reflects the variability of the traffic flow during the day. To account for this, a time varying emission profile has been included in the model. This has used the annual daily traffic flow and distribution for 2018 from the road traffic statistics (TRA), provided by the DfT. The time varying profile for the Do Something scenario has also considered additional traffic associated with the operation of the LSEP, and the timings of deliveries between 7 am and 11 pm.

Graph 1: Baseline Traffic Diurnal Profile



Graph 2: DS Traffic Diurnal Profile with LSEPl Delivery times accounted for – Link C



2.5 Vehicle emissions factor

Emission factors for NOx, PM_{10} and $PM_{2.5}$ have been determined for each scenario using the traffic data and the EFT v 10.1 (2VC) database of road traffic emission factors within ADMS Roads. All roads were classified as "England (urban)". Emissions for each link have been calculated using the EFT within the ADMS model.

It is possible to account for the effect of road gradients on vehicle emissions using the EFT, although this only affects emissions from HDVs, and the effects are capped at a gradient of 6%. This option has been used where the gradient is expected to significantly influence emissions from HDVs. There are three sections along the A556 (Link Ia and Ib) which have included gradients of 1.7% and 2%.

The EFT predicts that emissions from road vehicles will reduce in future years as newer cleaner vehicles enter the fleet[2]. However, evidence has shown that the rate of this reduction may not be occurring in the real world as the vehicle fleet turnover rate has reduced. Within this assessment, we have conservatively adopted a worse-case scenario, which assumes no change to the fleet composition on local networks between 2018 and the opening year of 2023. The assessment also conservatively applies 2018 background concentrations to the future scenarios – i.e. assumes no reduction in background concentration.

The EFT does not include emissions of ammonia from vehicles. However, petrol vehicles emit ammonia due to the degradation of catalytic converters, and diesel vehicles emit ammonia due to measures to reduce NOx emissions. This has been shown to be a significant source of nitrogen deposition at roadside locations[3]. Air Quality Consultants (AQC) has published the Calculator for Realistic Emissions of Ammonia (CREAM V1A[4]) for the calculation of emissions of ammonia from vehicles, which has been used to calculate ammonia emissions for each road link and scenario for the assessment of the effect of ammonia on ecological receptors. Ammonia emissions from vehicles are not a concern with regard to human health due to the very high AQAL for the protection of human health and relatively low contributions from vehicles.

2.6 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.

2.7 Discrete receptor points

2.7.1 Human 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. The AQALs only apply at locations where the public may be exposed to pollution for a sufficient period for there to be any measurable health effect. Representative receptors have been chosen at the façade of residential properties along the

[2] In this context 'fleet' refers to the fleet mix, which describes all vehicles on the road, and accounts for a range of vehicle emission standards of LDVs and HGVs

[3] Air Quality Consultants, Ammonia Emissions from Roads for Assessing Impacts on Nitrogen-sensitive Habitats, February 2020

[4] Available from https://www.aqconsultants.co.uk/resources

modelled roads and are shown in Table 2. Reference should be made to Figure 1 which shows the location of each of the discrete receptor locations assessed.

Table 2: Human Sensitive Receptors

ID	Description	X (m)	Y (m)	Height (m)
RR1	A556 – Lostock Gralam	369835	375138	1.5
RR2	A556 – Lostock Gralam	369749	374973	1.5
RR3	A556 – Lostock Gralam	369721	374900	1.5
RR4	A556 – Lostock Gralam	369701	374848	1.5
RR5	A556 – Lostock Gralam	369672	374703	1.5
RR6	Fieldhouse Farm	369784	374318	1.5
RR7	A556 – Lostock Green	369375	373847	1.5
RR8	A556 – Lostock Green	369411	373810	1.5
RR9	A556 – Lostock Green	369392	373750	1.5
RR10	A556 – Lostock Green	369338	373630	1.5
RR11	A556 – Lostock Green	369319	373590	1.5
RR12	Cookes Road	369064	373286	1.5
RR13	Cookes Road	369033	373228	1.5
RR14	High House	368736	372470	1.5
RR15	Shurlach Road	367554	372479	1.5
RR16	Shurlach Road	367634	372552	1.5
RR17	Shurlach Road	367711	372613	1.5
RR18	Shurlach Road	367789	372659	1.5
RR19	Elizabethan Way	368351	372712	1.5
RR20	Tudor Close	368415	372719	1.5
RR21	Mulberry Close	368702	372807	1.5
RR22	Foxglove Way	368648	372785	1.5
RR23	Foxglove Way	368612	372766	1.5
RR24	Foxglove Way	368548	372751	1.5
RR25	Tudor Close	368468	372713	1.5
RR26	Foxglove Way	368525	372764	1.5
RR27	Tudor Close	368469	372781	1.5
RR28	Broken Cross King Street	368462	372883	1.5
RR29	Broken Cross King Street	368451	372867	1.5
RR30	Broken Cross King Street	368451	372920	1.5
RR31	Broken Cross King Street	368419	372961	1.5
RR32	Broken Cross King Street	368430	373010	1.5
RR33	Broken Cross King Street	368402	373034	1.5
RR34	Broken Cross King Street	368416	373051	1.5
RR35	Broken Cross King Street	368409	373108	1.5

ID	Description	X (m)	Y (m)	Height (m)
RR36	Broken Cross King Street	368392	373142	1.5
RR37	Middlewich Road	368319	373210	1.5
RR38	Middlewich Road	368334	373215	1.5
RR39	Middlewich Road	368317	373256	1.5
RR40	Cottage Close	368295	373444	1.5
RR41	Cottage Close	368296	373463	1.5
RR42	Cottage Close	368294	373487	1.5
RR43	Cottage Close	368303	373515	1.5
RR44	Cottage Close	368295	373541	1.5
RR45	Cottage Close	368301	373557	1.5
RR46	Griffiths Road Junction with Manchester Road	368620	374687	1.5
RR47	Griffiths Road Junction with Manchester Road	368630	374705	1.5
RR48	Griffiths Road Junction with Manchester Road	368640	374725	1.5

This is not an exhaustive list but is a selection of receptors along each of the road links where vehicles associated with the operation of the LSEP are expected to travel. The human receptors used for the assessment of process emissions have also been assessed within this vehicle emissions assessment – see Table 5 of Appendix 5.2. Only the results of those receptors within 200 m of the roads used by LSEP vehicles (shown in orange stars on Figure 1) have been presented.

2.7.2 Ecological receptors

Four of the ecological receptors identified within the process emissions assessment are located within 200 m of the vehicle routes;

- Wade Brook LWS;
- Long Wood LWS;
- Rudheath Lime Beds pLWS; and
- Winnington Wood LWS and ancient woodland.

To assess the impact at these receptors, a series of transects at right angles to the road, with points every 1 m have been modelled. Due to the extent of Rudheath Lime Beds, three transects have been modelled at this site, and two at Winnington Woods, on either side of the road. Reference should be made to Figure 1 which shows the location of each of the transects assessed.

2.8 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 to be used in this assessment were taken from Manchester Airport meteorological station for 2018. As stated within Appendix 5.2 of the EIA Report, Manchester is considered to be the most representative meteorological station available.

Typically, road assessments use one-year of meteorological data. The traffic baseline data and meteorological data are all for the year 2018. A wind rose of the 2018 meteorological data is provided in Figure 3 of Appendix 5.2 to the EIA Report.

The surface roughness and Monin-Obukov lengths used within the roads modelling for the site location and meteorological site location are the same as those used for the process emissions modelling as justified in Appendix 5.2 of the EIA Report. A constant surface roughness value has been used as it is not possible to use a variable surface roughness file within ADMS Roads.

Table 3: Meteorological Parameters Summary

Parameter	Dispersion site	Meteorological site
Minimum Monin-Obukhov length	10 m	10 m
Surface roughness	0.5 m	0.3 m

2.9 Background data

For the purpose of this analysis the mapped background concentrations for each receptor point have been extracted from the DEFRA UK AIR background mapping database, for nitrogen dioxide and PM_{10} and $PM_{2.5}$. This data is presented in Table 4. There is uncertainty as to how background pollutant concentrations will change in the future, so as a conservative measure the 2018 background pollutant concentrations have been applied to the future year (2023) scenarios – i.e. assuming no reduction in background pollutant concentrations.

Table 4: Mapped Background Data

Grid square	Annual mean concentration (µg/m³)		
	Nitrogen dioxide	PM_{10}	$PM_{2.5}$
Annual mean AQAL	**40**	**18**	**10**
368500, 374500	11.45	10.64	7.04
368500, 372500	11.76	11.04	7.19
366500,373500	11.22	11.17	7.53
367500,372500	13.34	11.50	7.53
369500,375500	10.33	11.13	7.13
369500,374500	11.42	11.38	7.29
369500,373500	10.50	11.27	7.14
368500,373500	10.70	10.83	7.16
370500,375500	10.90	11.36	7.16

Source: DEFRA 2018 mapped background datasets

As shown the mapped background concentrations are well below the AQAL for nitrogen dioxide, PM_{10} and $PM_{2.5}$.

2.10 Post modelling conversion from NOx to nitrogen dioxide (NO_2)

The modelled road-NOx and the mapped background concentrations have been used as inputs in DEFRA's NOx to NO2 calculator (V8.1) to convert modelled NOx to NO2 in accordance with the methodology outlined in LAQM.TG(16).

When converting from NOx to NO_2 the following inputs have been used:

- The year has been taken as the same as the emissions data, i.e. 2018 for the wort case scenario;
- The local authority has been selected as "Cheshire West and Chester"; and
- The traffic mix has been selected as "All other urban UK traffic".

2.11 Verification

The ADMS Roads model has been validated against real world monitoring. However 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.

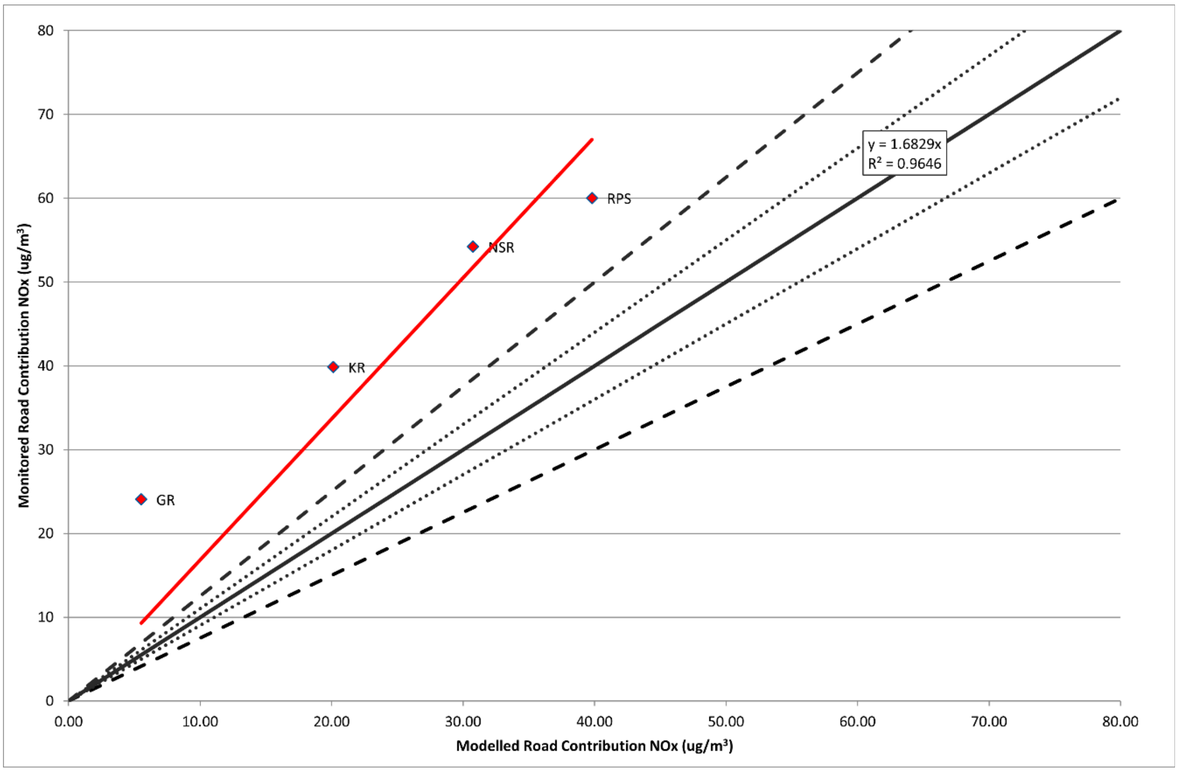
LAQM.TG(16) recommends that a number of points are used and the results plotted. The regression factor should then be used as the verification factor. Analysis of a number of data points can be used to see if the model is not performing well in a given area and highlight issues within the modelling such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

There are four monitoring sites with data for 2018 which are situated along the link routes used in the model; Griffiths Road (GR), King St Rudheath (KR), Station Road (NSR) and Rudheath Primary School (RPS). These are all roadside sites.

An initial screening of the sites has identified that both GR and RPS may be difficult to use for verification. This is because both monitoring sites are at junctions with another road which traffic data is not included within the model. GR is at the junction of Griffiths Road and Manchester Road, but only the former of which is included within the model. Therefore, it is likely that the model will underpredict at this point because it does not include the contribution from Manchester Road. This is a similar situation at RPS, for which the model does not include the influence from Gadbrook Road. In addition RPS is situated close to a school carpark which may not be represented in the model.

Graph 3 below shows the unadjusted results at all four of the monitoring sites. It shows that the model is underpredicting at all locations. As expected, the results at GR are very much underpredicting because the model does not include influence from Manchester Road. At RPS, the model is underpredicted but not to the extent expected. This is likely to be because the major junction and queues modelled on the A556 are the greatest contribution to the monitoring site. It is therefore considered appropriate to use RPS within the verification. Graph 4 shows the verification results excluding monitoring point GR. This gives a regression correction factor of 1.6551, confirming that the model is under-predicting road- NOx. The R_2 value (a measure of the fit of the data points to the trendline, with a maximum value of 1.00) is 0.9892.

Graph 3: Comparison of Monitored against Modelled Road NOx



Graph 4 Comparison of Monitored against Modelled Road NOx

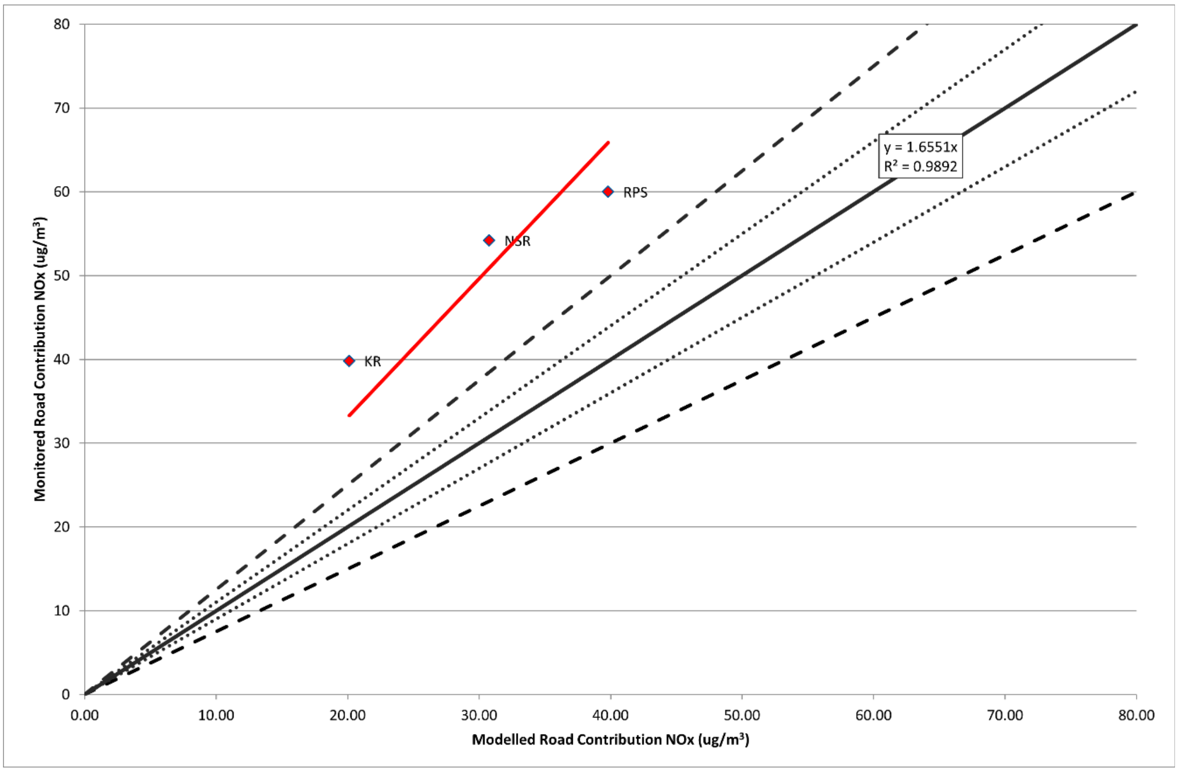


Table 5 details the monitoring locations suitable for verification. In the first instance the monitored road-NOx contribution at each monitoring location has been calculated.

Table 5: Verification Procedure: Monitored Road NOx

Location	2018 monitored NO_2 (µg/m³)	Background NO_2 (µg/m³)	2018 calculated road NOx (µg/m³)
KR	32	11.76	39.84
NSR	38	11.22	54.21
RPS	42.4	13.34	60.02

Note:

All NOx to NO_2 conversions undertaken using DEFRA's NOx to NO_2 calculator V8.1, for 2018 emissions and using the 'All other urban UK traffic' traffic mix setting.

The modelled road-NOx output has then been compared to the calculated road-NOx concentration, and the modelled total NO_2 compared to the monitored NO_2 concentration.

Table 6: Verification Procedure: Raw Model Results Comparison

Location	2018 modelled road NOx (µg/m³)	Ratio of monitored to modelled road NOx	2018 modelled total NO_2 (µg/m³)	Ratio of monitored to modelled total NO_2
KR	20.12	2.0	22.42	0.7
NSR	30.76	1.8	27.18	0.7
RPS	39.80	1.5	33.44	0.8

Note:

All NOx to NO_2 conversions undertaken using DEFRA's NOx to NO_2 calculator V8.1, for 2018 emissions and using the 'All other urban UK traffic' traffic mix setting.

Using the regression correction factor of 1.6551, as identified in Graph 4, it is necessary to adjust the modelled road-NOx. This adjustment factor has been applied to the modelled road-NOx, and the monitored road-NOx has been plotted against adjusted modelled road-NOx (Graph 5). This has then been converted to NO_2, as shown in Table 7 and Graph 6.

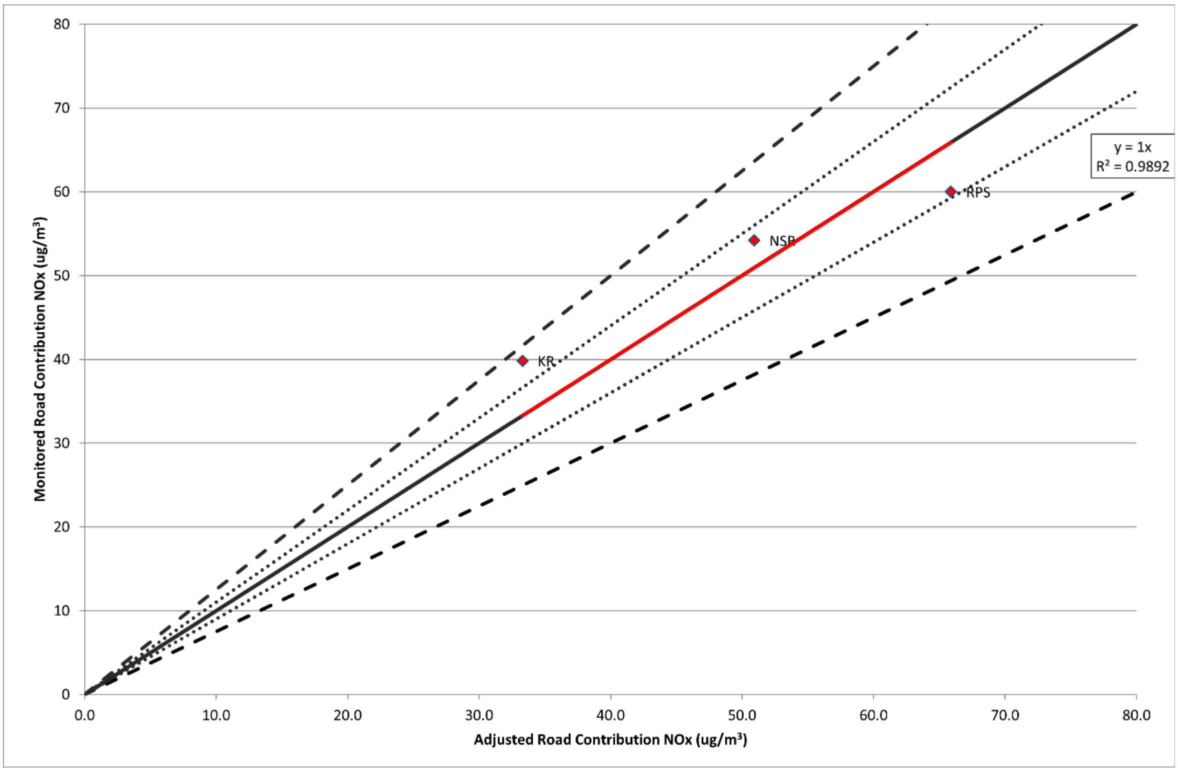
Table 7: Verification Procedure: Adjusted Model Results Comparison

Location	Adjustment applied	2018 monitored total NO_2 (µg/m³)	2018 modelled total NO_2 (µg/m³)	% Difference (modelled - monitored / monitored)
KR	1.6551	32	28.92	-9.62%
NSR	1.6551	38	36.54	-3.84%
RPS	1.6551	42.4	44.86	5.80%

Note:

All NOx to NO_2 conversions undertaken using DEFRA's NOx to NO_2 calculator V8.1, for 2018 emissions and using the 'All other urban UK traffic' traffic mix setting.

Graph 5: Monitored against Adjusted Modelled Road–NOx



Finally, the total monitored NO_2 has been plotted against the adjusted modelled total NO_2, as presented in Graph 6.

Graph 6: Monitored against Adjusted Modelled Total NO_2

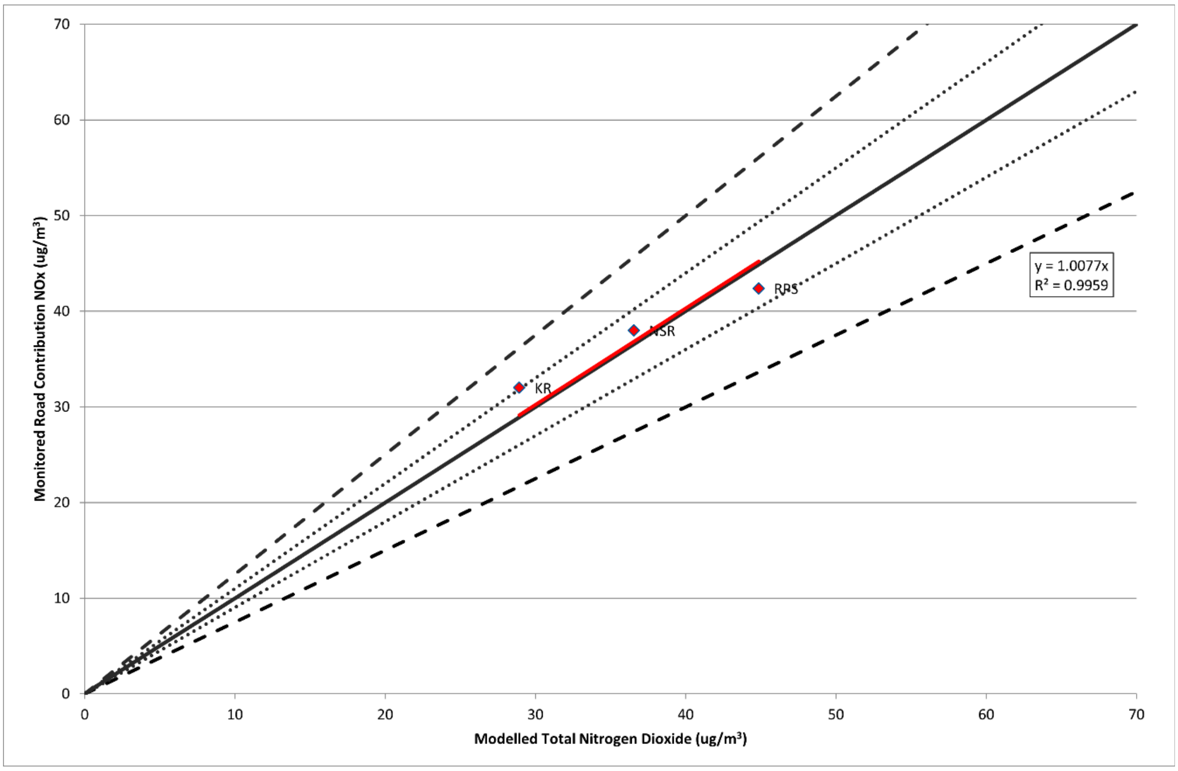


Table 7 and Graph 6 show that the adjusted NO_2 results are within 10% of the monitored NO_2 at all three monitoring sites. Therefore, following adjustment, the model is performing well.

No representative monitoring of PM_{10} or $PM_{2.5}$ is available. To ensure a robust assessment, the adjustment factors calculated for annual mean nitrogen dioxide have also been applied to the modelled concentrations of road PM_{10} and $PM_{2.5}$ at the appropriate receptors in line with guidance set out in LAQM.TG(16).

The supporting documentation for AQC's CREAM V1A explains that the ammonia emissions factors obtained from CREAM V1A will often be used as inputs to ADMS-Roads, but model users will often not be able to verify calculation of ammonia emissions from vehicles due to a lack of roadside ammonia monitoring.

As AQC acknowledge that users will typically not be able to undertake model verification, the documentation includes details of calibration against measurements taken from summer 2014 to summer 2016 at 29 sites in the Ashdown Forest. This shows that the emissions factors obtained using CREAM V1A align well with measurements. This is in contrast to emissions of NOx, which have historically been shown to be under-predicted by DEFRA's EFT. Therefore, it is not considered appropriate to apply the adjustment factor for NOx to emissions of ammonia, as this would likely result in significant over-prediction of ammonia emissions from vehicles.

3 Results

3.1 Human health

Detailed results tables showing the impact at human receptors are provided in Appendix B. This includes the contribution from process emissions associated with the operation of LSEP.

3.1.1 Nitrogen dioxide

As shown in Table 9, for the worst-case scenario, which assumes that the vehicle fleet does not change from the existing mix, the maximum predicted annual mean nitrogen dioxide concentration associated with the traffic from the operation of the LSEP at modelled receptors is 1.81 µg/m^3 (or 4.53% of the AQAL) at RR28, along the A530 through Broken Cross, where the majority of LSEP vehicles will pass. When the contribution from process emissions is added to the road contribution the maximum annual mean nitrogen dioxide impact is 1.91 µg/m^3 (or 4.53% of the AQAL). RR30, also along this section of the A530, shows similar values.

The predicted environmental concentration (PEC) of nitrogen dioxide emissions at RR28, under the Do Minimum scenario, which incorporates natural growth and other local developments, is 78.6% of the AQAL. The PEC under the Do Something scenario, which includes the LSEP, is 83.3% of the AQAL.

Excluding RR28 and RR30, the PCs at all other receptors are less than 5.5% of the AQAL and PECs are below 75% of the AQAL.

Additional analysis has been carried out for short term impacts. DEFRA's Local Air Quality Management Technical Guidance Note 16 (LAQM.(TG16)) states that if annual mean nitrogen dioxide concentrations are above 60 µg/m^3 (i.e. 150% of the AQAL), there is the potential for exceedences of the 1-hour AQAL. Even in the worst-case scenario that the fleet mix does not change from current levels the maximum predicted concentration is well below 60 µg/m^3. Therefore, there is no potential for exceedences of the 1-hour nitrogen dioxide AQAL.

Although the model has been verified to the best of ability providing the local monitoring data and locations, a degree of uncertainty should be given when interpreting the results. However, the magnitude of change results provide some flexibility – there is room for increases in the road concentrations and baseline before impacts would be considered as moderate adverse at the receptors of maximum impact.

During the verification process, it has been noted that the background concentrations from the DEFRA mapped background data are lower than the monitored concentrations. If the actual background concentrations are in fact more in line with the monitored concentrations, this would mean a smaller difference between the roads impacts with LSEP contributions when compared to the baseline. If this were the case, although the background and PECs would be higher, the results of the LSEP impacts would be lower than presented in these results.

Furthermore, the results presented are for the worst-case emissions scenario, in which there is no change to the fleet composition on local networks between 2018 and 2023 and using the 2018 background concentrations. This is a conservative approach as there will be some changeover of the fleet with newer cleaner vehicles and background concentrations are predicted to decrease in future.

3.1.2 Particulate matter

As shown in Table 10, for the worst-case scenario which assumes that the vehicle fleet does not change from the existing mix, the maximum predicted annual mean particulate matter concentration (as PM_{10} or $PM_{2.5}$) associated with the vehicles from LSEP is 0.28 µg/m^3 (0.69% of the AQAL), and 0.17 µg/m^3 (0.83% of the AQAL) respectively. When the contribution from process emissions is added to the road contribution the maximum annual mean particulate matter concentration (as PM_{10} or $PM_{2.5}$) impact increases so minutely and the impact to two decimal places remains at 0.28 µg/m^3 (or 0. 0.70% of the AQAL) and 0.17 µg/m^3 (or 0.84% of the AQAL). The maximum PEC for the Do Something scenario at all roads receptors is 36.77% of the AQAL for PM_{10} and 46.81% of the AQAL for $PM_{2.5.}$

As detailed in Appendix 5.2 of the EIA Report, the World Health Organisation (WHO) recommends guidelines for particulate matter which are more stringent than those currently set in UK legislation.

The WHO annual mean PM guidelines values for annual means are as follows:

- Fine particulate matter ($PM_{2.5}$) – 10 µg/m3 as an annual mean.
- Course particulate matter (PM_{10}) – 20 µg/m3 as an annual mean.

The Environment Bill introduces a duty to set a legally binding target for $PM_{2.5}$ although to date this has not been set. For completeness, the results of the maximum of all roads receptors has been compared to the WHO limits guidelines.

Using the WHO limits, the maximum predicted annual mean particulate matter concentration (as PM_{10} or $PM_{2.5}$) associated with the vehicles from LSEP is 1.38% of the AQAL, and 1.67% of the AQAL respectively. When the contribution from process emissions is added to the road contribution the maximum annual mean particulate matter concentration (as PM_{10} or $PM_{2.5}$) impact increases slightly to 1.40% of the AQAL and 1.69% of the AQAL. The maximum PEC for the Do Something scenario at all roads receptors is 68.57% of the AQAL for PM_{10} and 93.61% of the AQAL for $PM_{2.5.}$ This conservatively assumes that the entire dust emissions consist of only PM10 or PM2.5s.

3.2 Ecological receptors

There are four ecological sites within 200 m of the roads used by vehicles associated with the LSEP. These are

- Wade Brook LWS;
- Long Wood LWS;
- Rudheath Lime Beds pLWS; and
- Winnington Wood LWS and ancient woodland.

To assess the impacts at these sites, 200 m transects from the edge of the ecological site closest to the road have been modelled, at right angles with the road. The results at each meter along the transect have then been assessed. The transect points have also been entered as receptors into the process emissions from the stack model, to give an overall impact of the LSEP. Due to their size and locations, 3 transects have been produced for Rudheath Lime Beds pLWS and 2 transects for Winnington Woods LWS.

For each transect, the results of the PC and PEC has been presented for annual mean oxides of nitrogen, annual mean ammonia, nitrogen deposition and acid deposition, which are the pollutants from vehicle emissions which have the potential to impact ecological sites. The Do Minimum scenario is based on the predicted 2023 traffic data, incorporating natural growth and new developments and including background levels, and the Do Something scenario is the Do Minimum plus the impact of the LSEP. This is the total number of vehicles associated with the operation of the LSEP not just the change in vehicles associated with the increase in throughput (i.e. the Proposal).

The verification factor determined for oxides of nitrogen emissions from vehicles (as set out in Section 2.11) has been applied. No additional adjustment has been carried out of the ammonia emissions. The results are based on the worst case scenario that there are no changes to the fleet mix since 2018 – i.e. there is no reduction in emissions in line with projections. As with emissions of NOx, PM_{10} and $PM_{2.5}$ emissions of ammonia are predicted to change in future years. However, the emissions are not necessarily predicted to decrease in the future and when calculating nitrogen deposition, reductions in NOx may be counteracted by increases in ammonia. As such, a sensitivity analysis has been carried out to determine the difference between using the 2018 and 2023 emission factors for all pollutants. This has shown that the projected reduction in road NOx is offset by an increase in ammonia from vehicles and the nitrogen and acid deposition is similar between the 2018 and 2023 emissions scenarios. The impacts of ammonia are slightly higher using the 2023 rather than the 2018 emission factors. As such all results for NOx, nitrogen and acid deposition are presented using the 2018 emission factors, and ammonia using the 2023 emission factors. Projected ammonia impacts from traffic are not significantly different year on year from 2023. Therefore, it is considered that the use of 2023 emission factors as the maximum impact over the lifetime of the LSEP is appropriate.

When considering the impact of nitrogen and acid deposition the DEFRA NOx to NO2 converter has been used to convert roadside NOx into NO2. This only provides results to 2 decimal places. As such there are small differences between points causing a spiky effect in the graph.

3.2.1 Wade Brook LWS

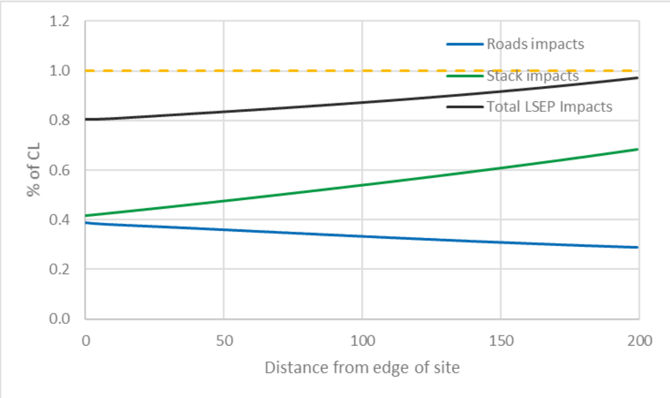
The following section sets out the combined impact of stack emissions and road vehicles along the transect marked in Figure 1 at Wade Brook LWS. Impacts have been presented for the contribution from the roads and process individually and combined, and the PEC which includes the local background concentration. Where appropriate, reference has been made to the 1% and 70% screening criteria.

The impacts have been modelled from the edge of the site, which is 2.9 m from the edge of the road.

Graph 7 to Graph 12 show that the impact of road pollutants decreases with distance away from the road. However, due to the location of Wade Brook LWS in relation to the stack and stack dispersion, the impact of emissions from the LSEP stack, and also overall LSEP impact, increases with distance from the road. This shows that the main contribution to Wade Brook LWS is from the stack rather than the roads. The maximum impacts at Wade Brook LWS are therefore as set out in Appendix 5.2 of the EIA Report (1.5% of the Critical Level for oxides of nitrogen).

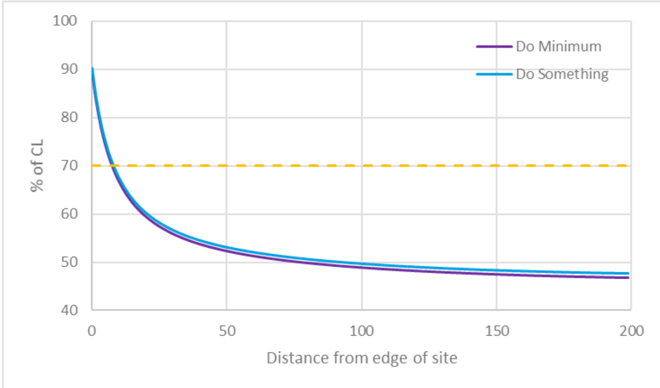
The PECs for ammonia impacts are above the Critical Level for both lichen sensitive communities and non-lichen sensitive communities. However, this is due to high background levels, and the graphs show the minimal difference between Do Minimum impacts, which include general predicted traffic growth and contribution from other developments by 2023, and the Do Something impacts, which includes the contributions from the LSEP (stack and vehicles).

Graph 7: Annual mean NOx impact - PC



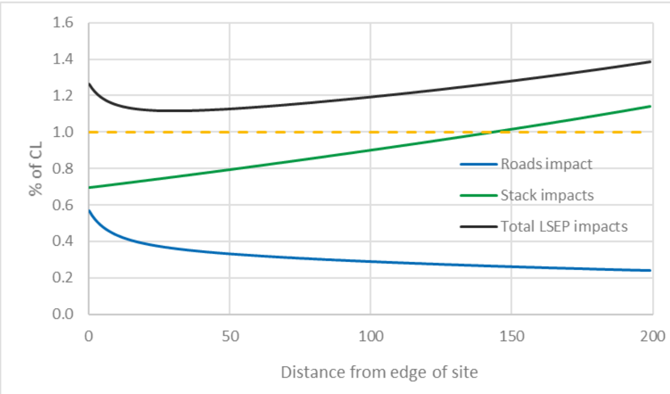
Note: CL = 30 µg/m³

Graph 8: Annual mean NOx impact - PEC



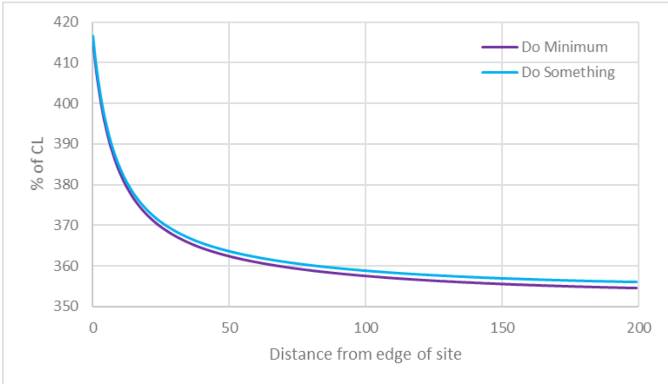
Note: CL = 30 µg/m³. Bg =11.42 µg/m³

Graph 9: Annual mean ammonia impact – PC



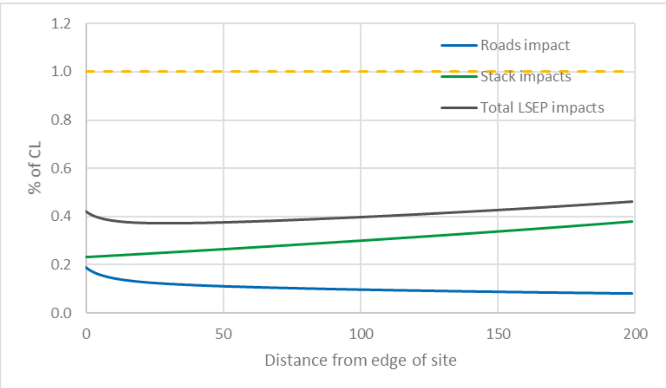
Note: CL = 1 µg/m³ for lichen sensitive habitats

Graph 10: Annual mean ammonia impact – PEC



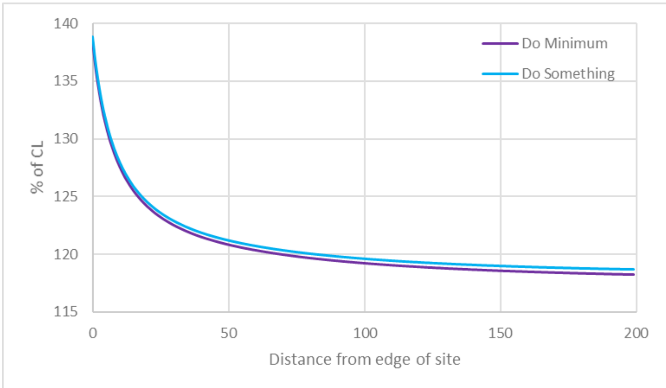
Note: CL = 1 µg/m³. Bg = 3.45 µg/m³

Graph 11: Annual mean ammonia impact – PC



Note: CL = 3µg/m³ for non lichen sensitive habitats

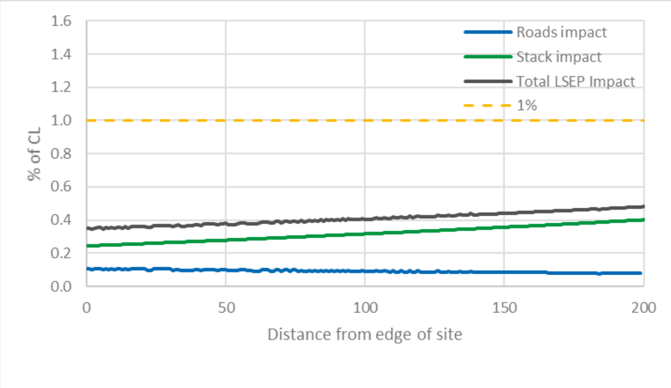
Graph 12: Annual mean ammonia impact – PEC



Note: CL = 3 µg/m³. Bg = 3.45 µg/m³

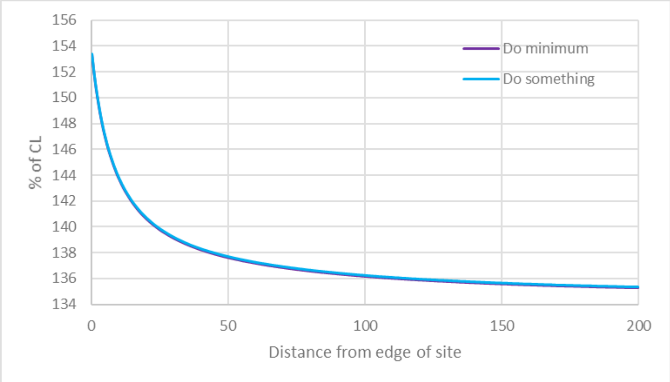
Graph 13 to Graph 16 show the deposition impacts. Results for nitrogen deposition have been calculated as a percentage of the lower Critical Load for low and medium altitude hay meadows (10 kgN/ha/yr), noting that the upper Critical Load is 20 kgN/ha/yr. Results for acid deposition have been calculated as a percentage of the lower Critical Load for calcareous grassland (3.017 KeqN/ha/yr).

Graph 13: Annual mean N dep - Grasslands- PC



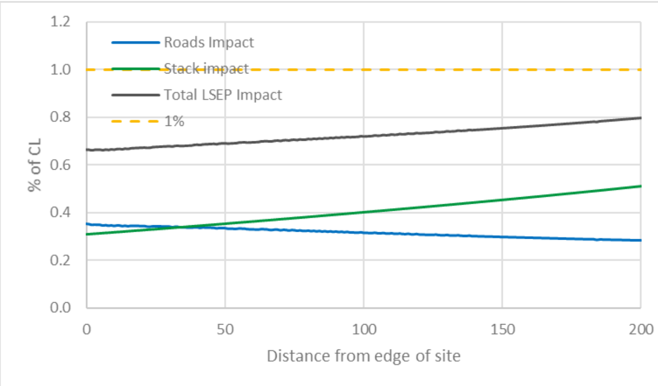
Note:. Lower CL = 20 kgN/ha/yr. Bg = 26.46 kgN/ha/yr

Graph 14: Annual mean N dep –Grasslands PEC



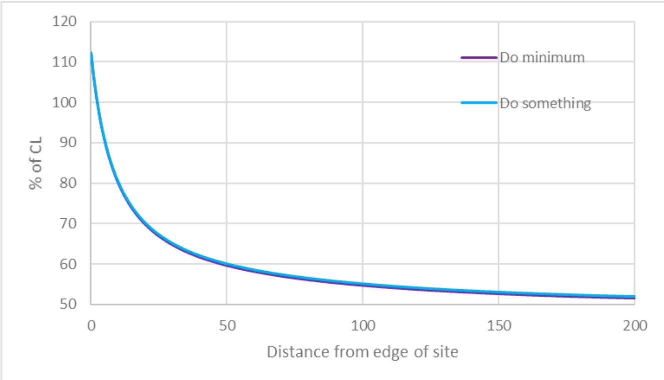
Note: Lower CL = 20 kgN/ha/yr. Bg = 26.46 kgN/ha/yr

Graph 15: Annual mean acid dep - Grasslands - PC



Note:. CLmaxN = 5.017 KeqN/ha/yr. Bg: = N 1.89, S 0.21 keq/ha/yr

Graph 16: Annual mean acid dep - Grasslands -PEC



Note:. CLmaxN = 5.017 KeqN/ha/yr. Bg: = N 1.89, S 0.21 keq/ha/yr

For deposition impacts the results show that the impact of road pollutants decreases with distance away from the road, but the stack impact, and also overall LSEP impact, increases with distance from the road. This shows that the main contribution to Wade Brook LWS is from the stack rather than the roads.

Results for deposition show that the impact of the LSEP (roads and stack) is below the 1% screening criteria. The results for the stack emissions show that the maximum impact of stack emissions is 0.9% of the lower Critical Level for nitrogen deposition, and 0.6% of the lower Critical Load for acid deposition. This analysis demonstrates that the inclusion of emissions from traffic associated with the LSEP does not change the conclusions that the impact of nitrogen and acid deposition across the site is less than 1% of the Critical Load

3.2.2 Rudheath Lime Beds pLWS – Transect 1

The following section sets out the combined impact of stack emissions and road vehicles along the transect 1 marked in Figure 1 at Rudheath Lime Beds LWS. Impacts have been presented for the contribution from the roads and process individually and combined, and the PEC which includes the local background concentration. Where appropriate, reference has been made to the 1% and 70% screening criteria.

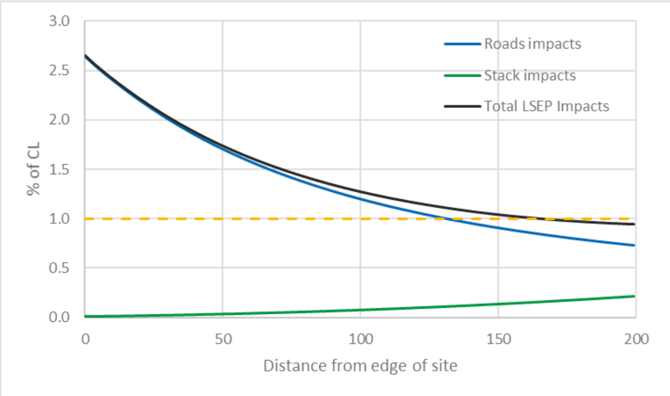
The impacts have been modelled from the edge of the ecological site, which is 2.0 m from the edge of the road.

Graph 17 to Graph 22 show that the impact of road and stack emissions decreases with distance away from the road. The LSEP impact at this location is more influenced by road emissions than stack emissions. The maximum stack contributions at Rudheath Lime Beds are as set out in Appendix 5.2 of the EIA Report (1.3% of the Critical Level for oxides of nitrogen and 2.2% of the Critical Level for annual mean ammonia using the lower Critical Level of 1 $\mu g/m^3$). However, this point of maximum impact occurs to the north east edge of the ecological site and is lower at the location of the transect.

For oxides of nitrogen impacts, although the roads impact does not fall to under 1% of the Critical Level until 133 m from the edge of the ecological site, the PEC of the Do Something scenario falls below 70% of the Critical Level at 11 m from edge of the site. Furthermore, this is only 2 m greater than the distance at which the PEC would fall below 70% of the Critical Level under the Do Minimum scenario.

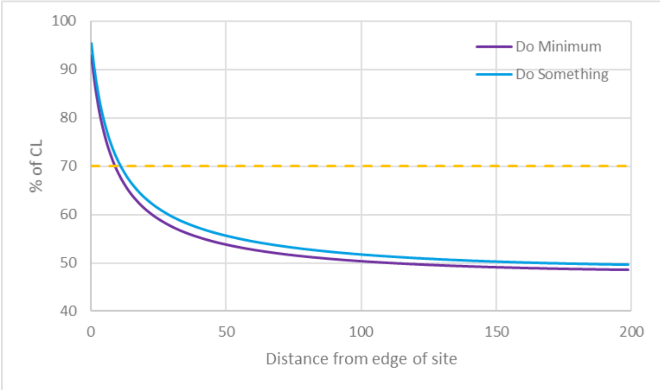
For ammonia impacts, using the higher Critical Level of 3 $\mu g/m^3$, all impacts are below the 1% screening criteria. When using the lower Critical Level of 1 $\mu g/m^3$ for lichen sensitive communities, the roads impact falls below the 1% of the Critical Level at 91 m from edge of the ecological site and total impact of the LSEP (roads and stack emissions) fall below 1% of the Critical Level at 129 m from edge of the ecological site. The PEC for ammonia, at either Critical Level, is above the 70% screening criteria due to high background levels. However, Graph 20 and Graph 22 show that impact decreases rapidly with distance from edge of the ecological site and that the difference between the Do Minimum and Do Something scenarios is small.

Graph 17: Annual mean NOx impact - PC



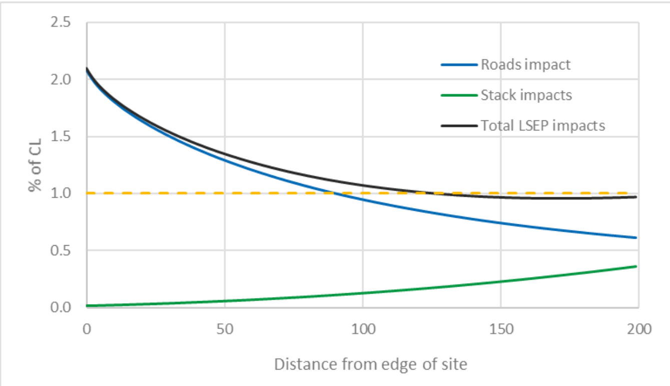
Note: CL = 30 µg/m³

Graph 18: Annual mean NOx impact - PEC



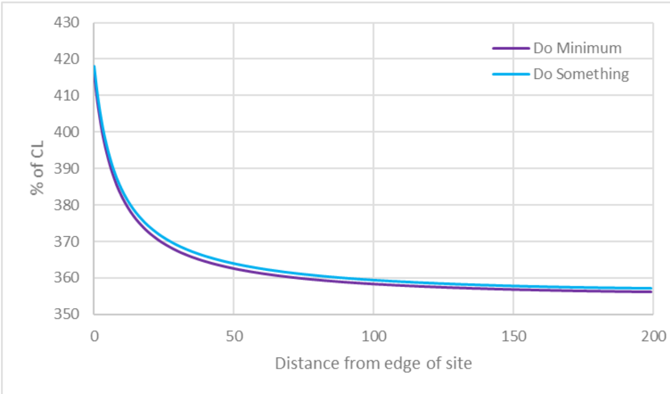
Note: CL = 30 µg/m³. Bg =11.42 µg/m³

Graph 19: Annual mean ammonia impact – PC



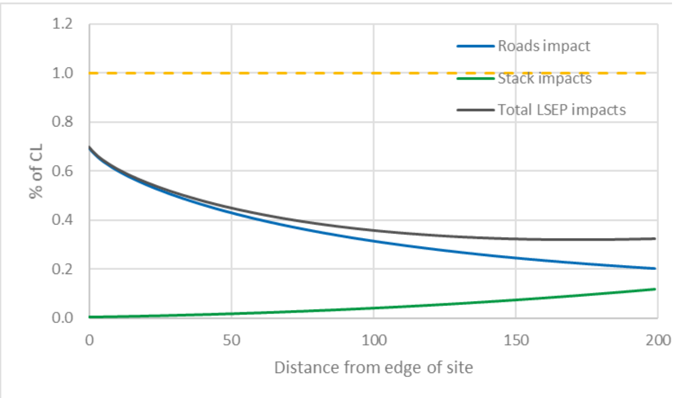
Note: CL = 1 µg/m³ for lichen sensitive habitats

Graph 20: Annual mean ammonia impact – PEC



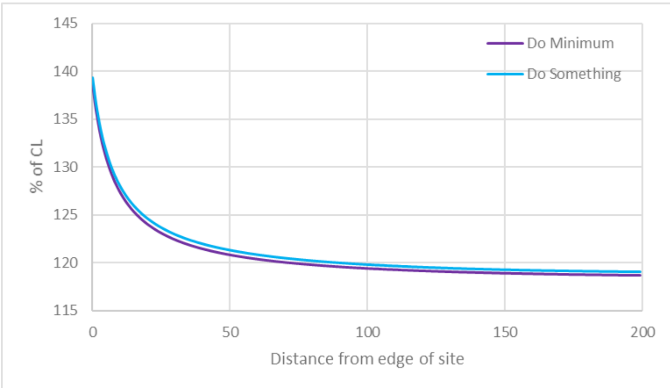
Note: CL = 1 µg/m³. Bg = 3.45 µg/m³

Graph 21: Annual mean ammonia impact – PC



Note: CL = 3µg/m³ for non lichen sensitive habitats

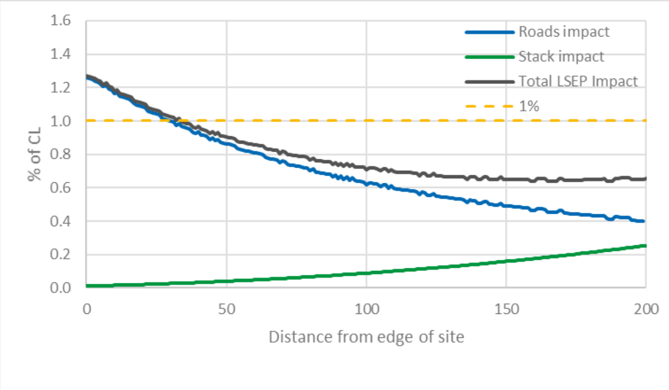
Graph 22: Annual mean ammonia impact – PEC



Note: CL = 3 µg/m³. Bg = 3.45 µg/m³

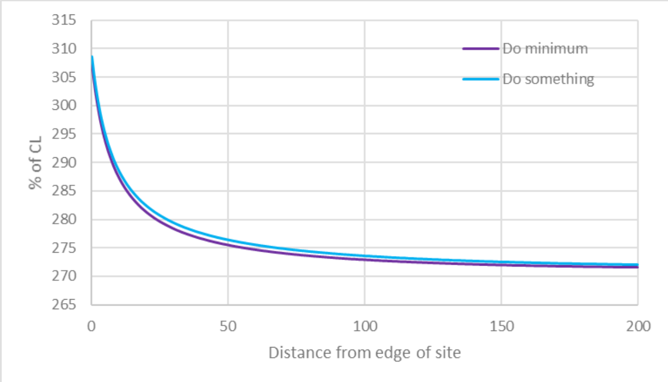
Graph 23 to Graph 26 below show the deposition impacts. Results for nitrogen deposition have been calculated as a percentage of the lower Critical Load for valley mires, poor fens and transition mires (10 kgN/ha/yr), noting that the upper Critical Load is 15 kgN/ha/yr. Results for acid deposition have been calculated as a percentage of the lower Critical Load for calcareous grassland (5.017 KeqN/ha/yr).

Graph 23: Annual mean N dep – Grasslands – PC



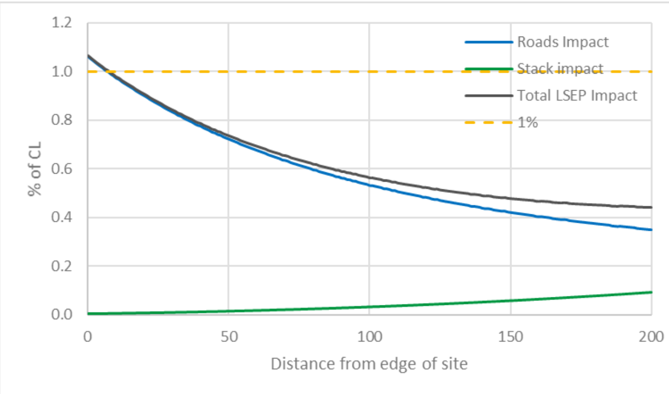
Note:. Lower CL = 10 kgN/ha/yr Bg = 26.46 kgN/ha/yr

Graph 24: Annual mean N dep – Grasslands – PEC



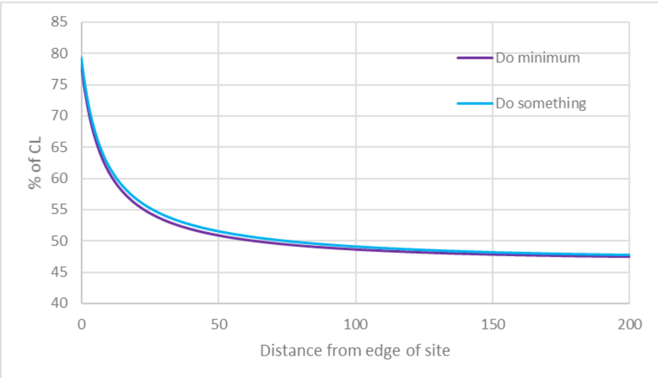
Note:. Lower CL = 10 kgN/ha/yr Bg = 26.46 kgN/ha/yr

Graph 25: Annual mean acid dep -Grassland- PC



Note: CLmaxN = 5.071 KeqN/ha/yr. Bg = N 1.89, S 0.21 keq/ha/yr

Graph 26: Annual mean acid dep -Grassland- PEC



Note: CLmaxN = 5.071 KeqN/ha/yr. Bg = N 1.89, S 0.21 keq/ha/yr

For deposition impacts the results show that the impact of road pollutants decreases with distance away from the road and the stack impact increases with distance away from the road. The total LSEP impact is more greatly influenced by the road emissions than the stack emissions for this transect.

For nitrogen deposition, the road impact falls below 1% of the Critical Load at 31 m from the edge of the ecological site, and the total LSEP impact falls below 1% at 34 m from the edge of the ecological site. Nitrogen deposition PEC is well above the 70% screening criteria due to high background levels, however Graph 24 shows that the difference between the Do Minimum and Do Something scenarios is small. For acid deposition, the road impact falls below 1% of the Critical Load at 8 m from the edge of the ecological site and total LSEP impacts fall below 1% of the Critical Load at 9 m from the edge of the ecological site. The PEC for the Do Something scenario falls below the 70% screening criteria at 5 m from the edge of the ecological site.

This analysis demonstrates that the inclusion of emissions from traffic associated with the LSEP means that the impact within 34 m of the edge of the ecological site is greater than 1% of the Critical Load. However, across the rest of the ecological site the impact of nitrogen and acid deposition is less than 1% of the Critical Load.

3.2.3 Rudheath Lime Beds pLWS – Transect 2

The following section sets out the combined impact of process emissions and road vehicles along the transect 2 marked in Figure 1 at Rudheath Lime Beds. The location of this transect is perpendicular to the section of road which the majority of LSEP traffic will be routed. Impacts have been presented for the contribution from the roads and stack emissions individually and combined, and the PEC which includes the local background concentration. Where appropriate, reference has been made to the 1% and 70% screening criteria.

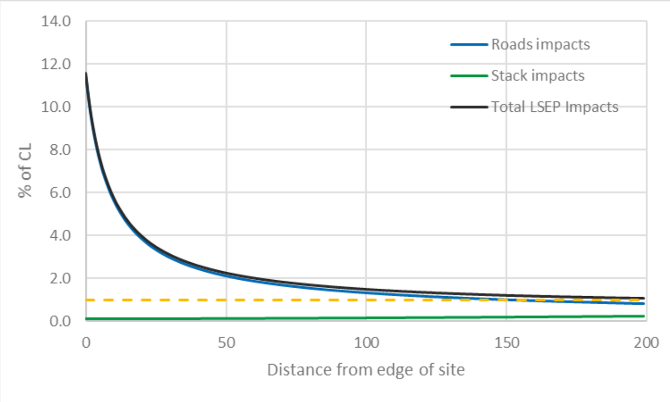
The impacts have been modelled from the edge of the ecological site, which is 2.0 m from the edge of the road.

Graph 27 to Graph 32 show that the impact of road pollutants rapidly decreases with distance away from the road and stack pollutants very slightly increase with distance away from the road. The total LSEP impact at this location is predominantly influenced by road impacts rather than stack impacts. The maximum stack contributions at Rudheath Lime Beds are as set out in Appendix 5.2 of the EIA Report (1.3% of the Critical Level for oxides of nitrogen and 2.2% of the Critical Level for annual mean ammonia using the lower Critical Level of 1 $\mu g/m^3$). However, this point of maximum impact occurs to the north east edge of the ecological site and is lower at the location of the transect.

For oxides of nitrogen impacts, although the roads impact does not fall to under 1% of the Critical Level until 153 m from the edge of the ecological site and total LSEP impacts do not fall to under 1% of the Critical Level within the 200 m transect, the PEC of the Do Something scenario falls below 70% of the Critical Level at 24 m from edge of the site. This is 6 m greater than the distance at which the PEC would fall below 70% of the Critical Level under the Do Minimum scenario.

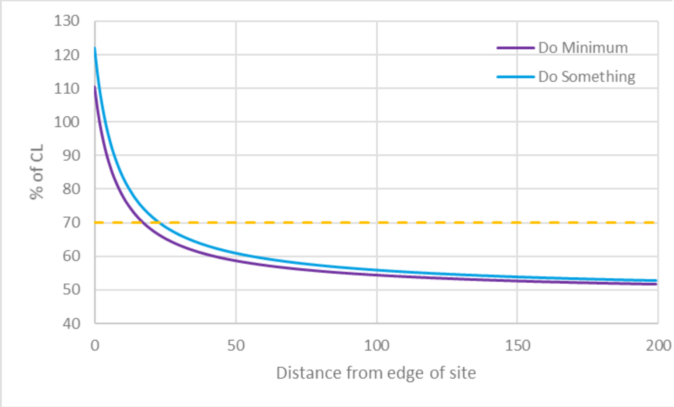
For ammonia impacts, using the higher Critical Level of 3 $\mu g/m^3$, road impacts fall below the 1% screening criteria at 43 m from the edge of the ecological site and total LSEP impacts fall below the 1% at 48 m from the edge of the ecological site. When using the lower Critical Level of 1 $\mu g/m^3$ for lichen sensitive communities, the roads impact does not fall below the 1% of the Critical Level until 178 m from edge of the ecological site and total LSEP impacts do not fall below 1% of the Critical Level within the 200 m transect. The PEC for ammonia, at either Critical Level, is above the 70% screening criteria due to high background levels. However, Graph 30 and Graph 32 show that impact decreases rapidly with distance from edge of the ecological site and that the difference between the Do Minimum and Do Something scenarios is slight.

Graph 27: Annual mean NOx impact - PC



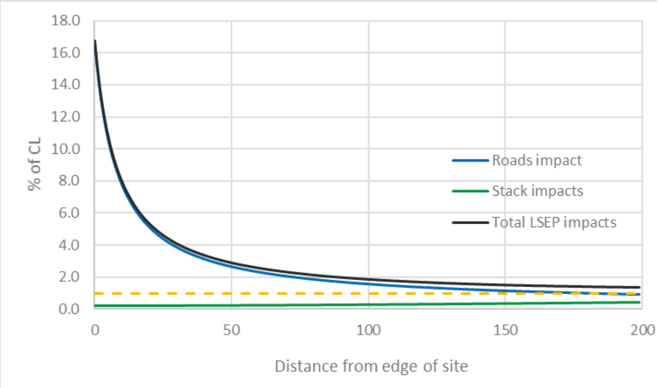
Note: CL = 30 µg/m³

Graph 28: Annual mean NOx impact - PEC



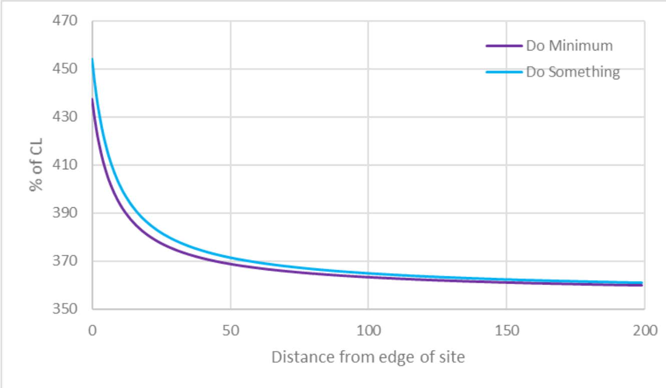
Note: CL = 30 µg/m³. Bg =11.42 µg/m³

Graph 29: Annual mean ammonia impact – PC



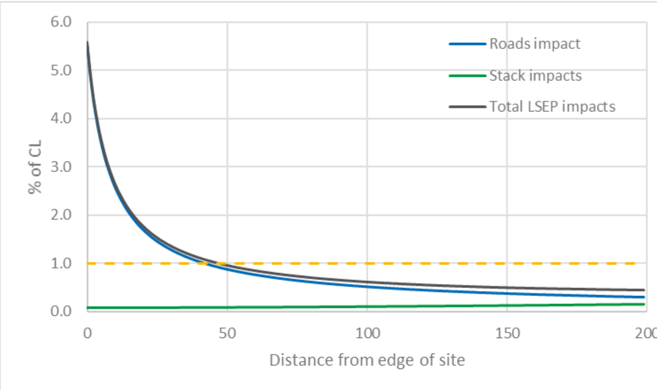
Note: CL = 1 µg/m³ for lichen sensitive habitats

Graph 30: Annual mean ammonia impact – PEC



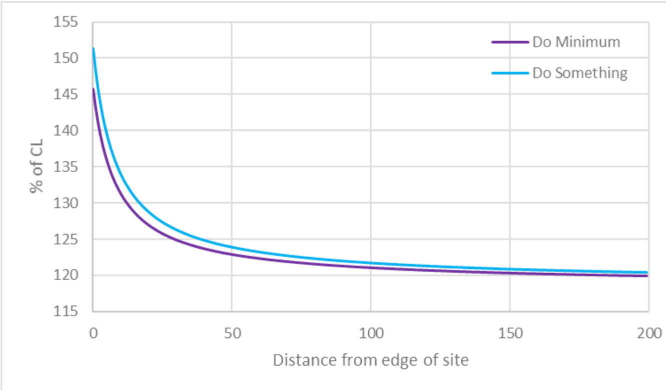
Note: CL = 1 µg/m³. Bg = 3.45 µg/m³

Graph 31: Annual mean ammonia impact – PC



Note: CL = 3µg/m³ for non lichen sensitive habitats

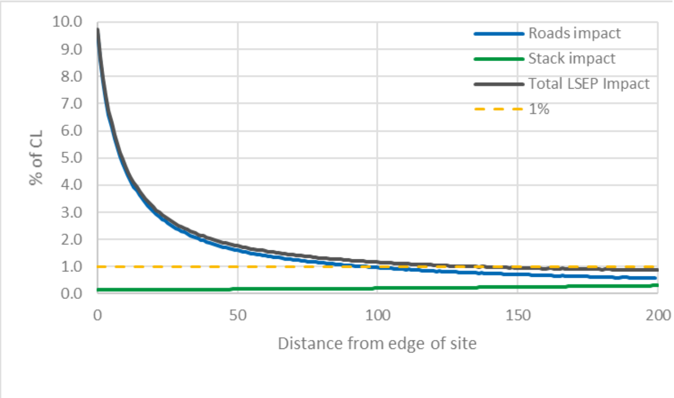
Graph 32: Annual mean ammonia impact – PEC



Note: CL = 3 µg/m³. Bg = 3.45 µg/m³

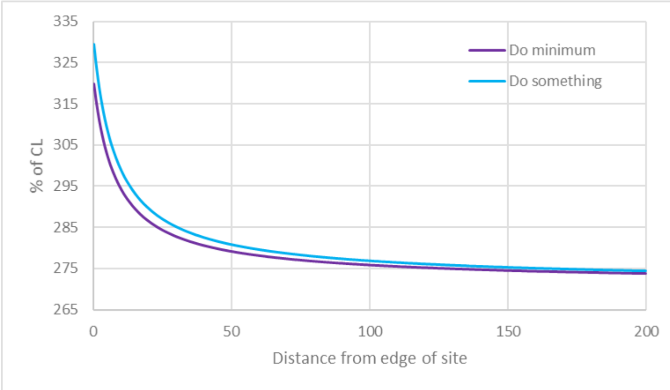
Graph 33 to Graph 36 below show the deposition impacts. Results for nitrogen deposition have been calculated as a percentage of the lower Critical Load for valley mires, poor fens and transition mires (10 kgN/ha/yr), noting that the upper Critical Load is 15 kgN/ha/yr. Results for acid deposition have been calculated as a percentage of the lower Critical Load for calcareous grassland (5.017 KeqN/ha/yr).

Graph 33: Annual mean N Dep Grassland- PC



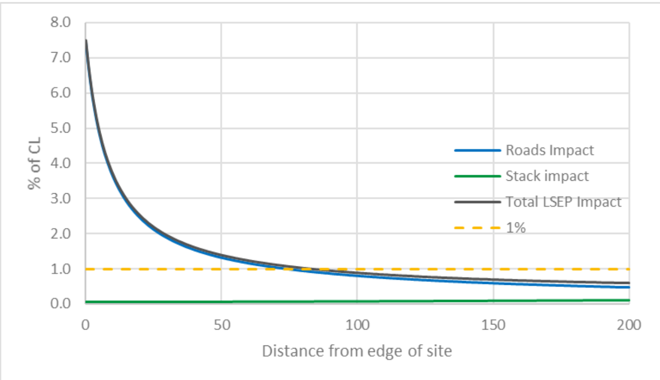
Note:. Lower CL = 10 kgN/ha/yr Bg = 26.46 kgN/ha/yr

Graph 34: Annual mean N Dep Grassland- PEC



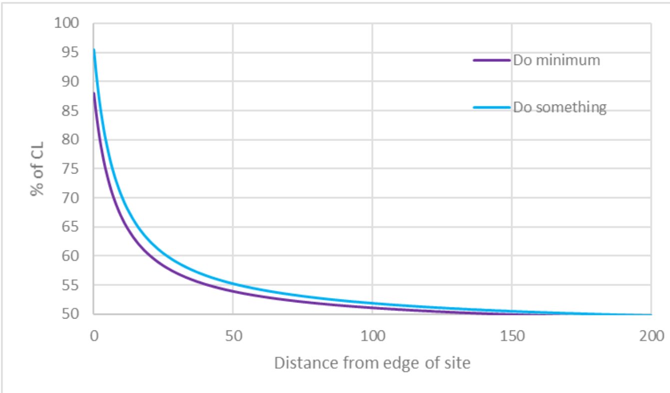
Note:. Lower CL = 10 kgN/ha/yr Bg = 26.46 kgN/ha/yr

Graph 35: Annual mean acid dep - Grassland- PC



Note:. CLmaxN = 5.071 KeqN/ha/yr, Bg = N 1.89, S 0.21 keq/ha/yr

Graph 36: Annual mean acid dep - Grassland- PEC



Note:. CLmaxN = 5.071 KeqN/ha/yr, Bg = N 1.89, S 0.21 keq/ha/yr

For deposition impacts the results show that the impact of road pollutants decreases rapidly with distance away from the road. The stack impact at this location is not very influential on the total LSEP impact.

For nitrogen deposition, the road impact falls below 1% of the Critical Load at 96 m from the edge of the ecological site, and the total LSEP impact falls below 1% at 136 m from the edge of the ecological site. Nitrogen deposition PEC is well above the 70% screening criteria due to high background levels, however Graph 34 shows that the difference between the Do Minimum and Do Something scenarios is small. For acid deposition, the road impact falls below 1% of the Critical Load at 76 m from the edge of the ecological site, and the total LSEP impact falls below 1% at 84 m from the edge of the ecological site. The PEC for the Do Something scenario rapidly decreases with distance from the road and falls below the 70% screening criteria at 11 m from the edge of the ecological site.

This analysis demonstrates that the inclusion of emissions from traffic associated with the LSEP is the main contribution to the impact on Rudheath Lime Beds along this section of the A530. This is not unexpected, as the vast majority of all LSEP traffic and all LSEP HGV traffic will be routed down this section of road. As shown above, the impacts drop of rapidly from the edge of the site, and the difference between the Do Minimum and Do Something scenarios shall be assessed for significance within the ecological interpretation (Appendix 5.5).

3.2.4 Rudheath Lime Beds pLWS – Transect 3

The following section sets out the combined impact of process emissions and road vehicles along the transect 3 marked in Figure 1 at Rudheath Lime Beds. The location of this transect perpendicular to the A556, but is set back from the edge of the road by 81.5 m, beginning at the edge of the ecological site. The transect travels from east to west, away from the A556, but towards the LSEP and Griffiths Road. Impacts have been presented for the contribution from the roads and stack emissions individually and combined, and the PEC which includes the local background concentration. Where appropriate, reference has been made to the 1% and 70% screening criteria.

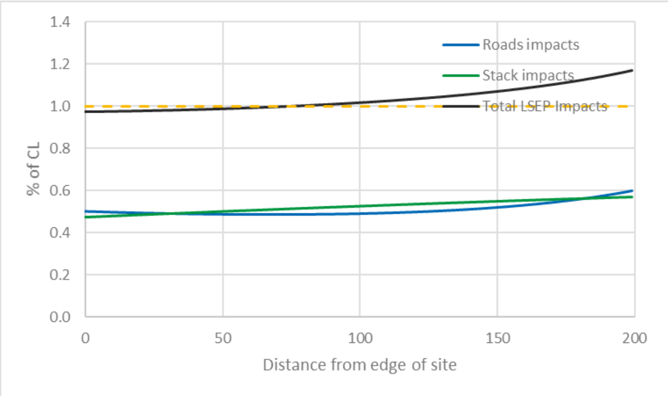
The impacts have been modelled from the edge of the ecological site, which is 81.5 m from the edge of the road.

Graph 37 to Graph 42 show that the impact of road pollutants slightly increases with distance away from the A556. There is not a rapid decrease due to the distance of the ecological site from the edge of the road, and the increase with distance from the A556 is in keeping with the transect getting closer to Griffiths Road, which has the highest vehicle impact from the LSEP. The impact at this transect is influenced by both traffic and the stack emissions at a similar level. The maximum stack contributions at Rudheath Lime Beds are as set out in Appendix 5.2 of the EIA Report (1.3% of the Critical Level for oxides of nitrogen and 2.2% of the Critical Level for annual mean ammonia using the lower Critical Level of 1 $\mu g/m^3$). However, this point of maximum impact occurs to the north east edge of the ecological site and is lower at the location of the transect.

For oxides of nitrogen impacts, both the roads and stack emissions are well below the 1% screening criteria, but when in combination, they exceed the 1% screening criteria closer to the LSEP site. The PEC is below 70% at the western side of the ecological site, but the transect shows it exceeds 70% moving into the centre of the ecological site towards the LSEP.

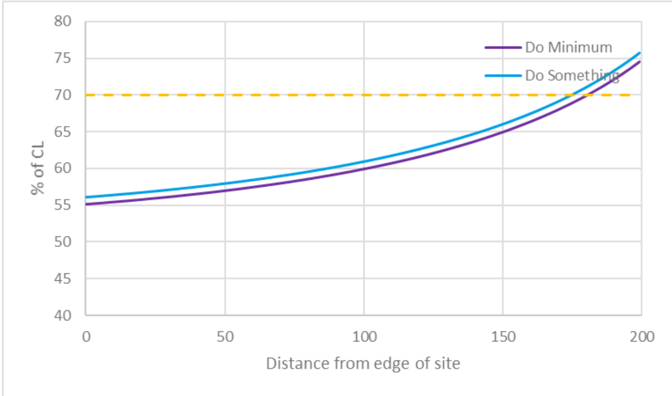
For ammonia impacts, using the lower Critical Level of 1 $\mu g/m^3$ for lichen sensitive communities, roads impacts and stack impacts are below the 1% screening criteria, however, when in combination, exceed the 1% screening criteria. When using the higher Critical Level of 3 $\mu g/m^3$, all impacts are below the 1% screening criteria. Due to high background levels, the ammonia PEC is above 70% for both lichen sensitive communities and non- lichen sensitive communities. Graph 40 and Graph 42 show there is a small increase in the impact with the Do Something scenario compared to the Do Minimum scenario.

Graph 37: Annual mean NOx impact - PC



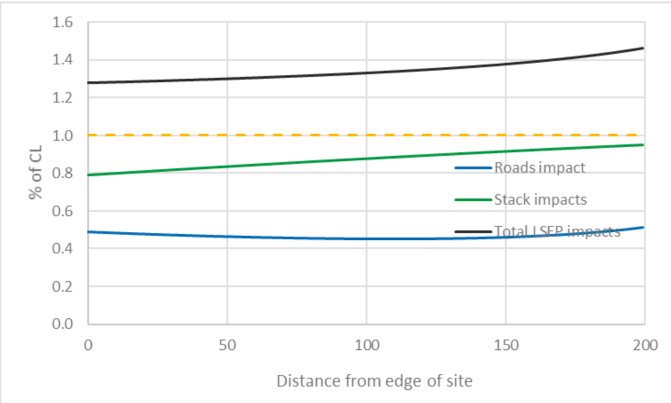
Note: CL = 30 µg/m³

Graph 38: Annual mean NOx impact - PEC



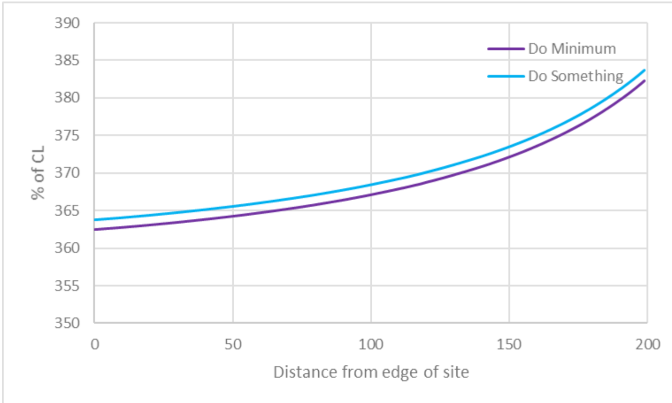
Note: CL = 30 µg/m³. Bg =11.42 µg/m³

Graph 39: Annual mean ammonia impact – PC



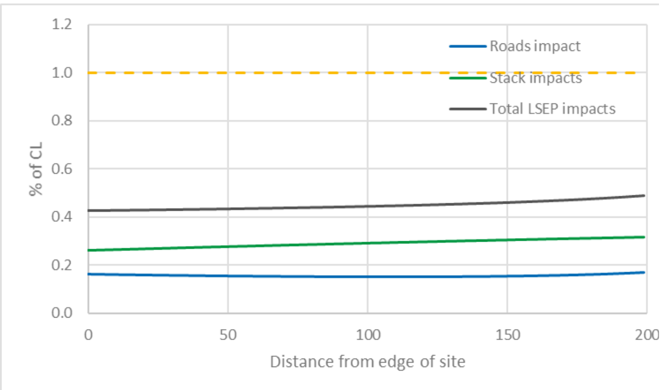
Note: CL = 1 µg/m³ for lichen sensitive habitats

Graph 40: Annual mean ammonia impact – PEC



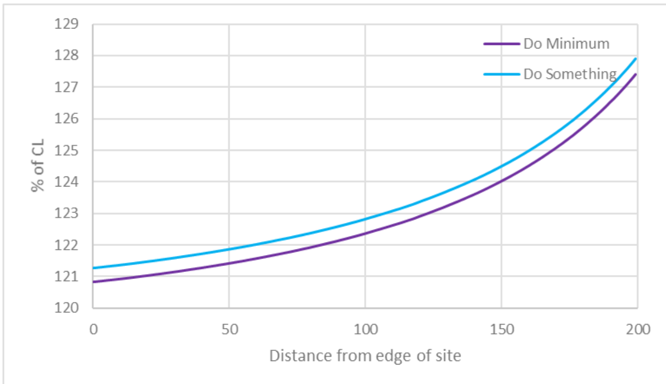
Note: CL = 1 µg/m³. Bg = 3.45 µg/m³

Graph 41: Annual mean ammonia impact – PC



Note: CL = 3µg/m³ for non lichen sensitive habitats

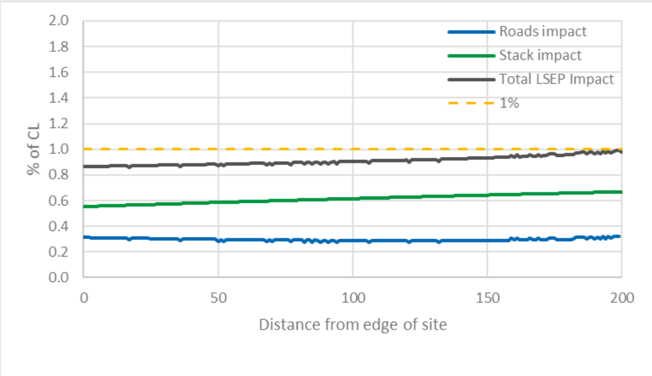
Graph 42: Annual mean ammonia impact – PEC



Note: CL = 3 µg/m³. Bg = 3.45 µg/m³

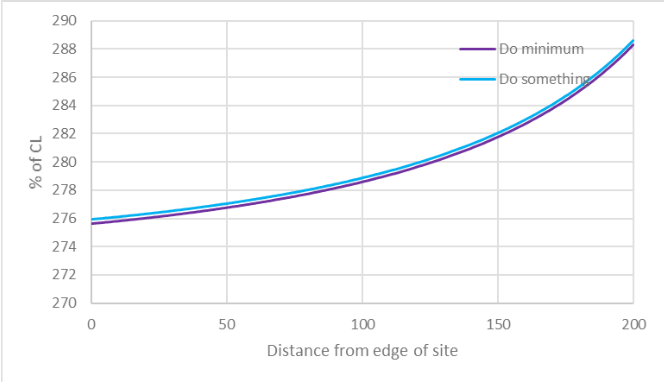
Graph 43 to Graph 46 below show the deposition impacts. Results for nitrogen deposition have been calculated as a percentage of the lower Critical Load for valley mires, poor fens and transition mires (10 kgN/ha/yr), noting that the upper Critical Load is 15 kgN/ha/yr. Results for acid deposition have been calculated as a percentage of the lower Critical Load for calcareous grassland (5.017 KeqN/ha/yr).

Graph 43: Annual mean N dep- Grassland- PC



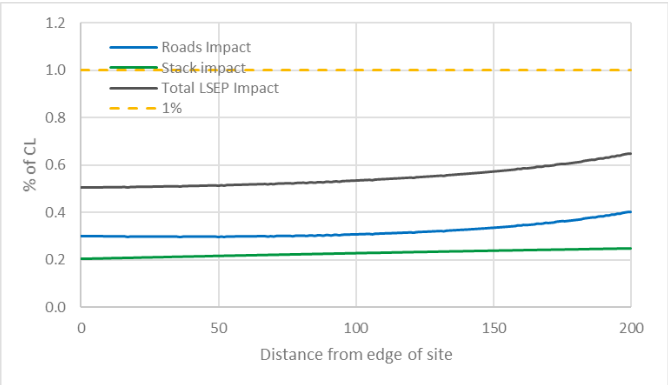
Note:. Lower CL = 10 kgN/ha/yr Bg = 26.46 kgN/ha/yr

Graph 44: Annual mean N dep- Grassland- PEC



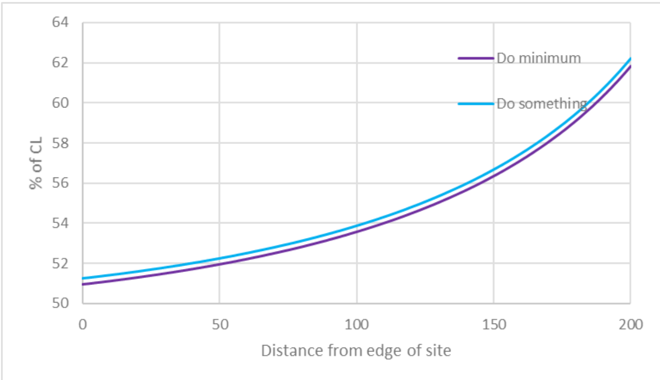
Note:. Lower CL = 10 kgN/ha/yr Bg = 26.46 kgN/ha/yr

Graph 45: Annual mean acid dep - Grassland- PC



Note:. CLmaxN = 5.071 KeqN/ha/yr, Bg = N 1.89, S 0.21 keq/ha/yr

Graph 46: Annual mean acid dep - Grassland- PEC



Note:.CLmaxN = 5.071 KeqN/ha/yr, Bg = N 1.89, S 0.21 keq/ha/yr

For deposition impacts the results show that the impact of both road pollutants and stack pollutants increase very slightly towards the centre of the ecological site. All impacts remain under the 1% screening criteria, although the nitrogen deposition graph is suggestive that the impacts would exceed the 1% if the transect was continued towards the LSEP and Griffiths Road. PEC for nitrogen deposition is over the 70% screening criteria due to high background levels.

This analysis demonstrates that the inclusion of emissions from traffic associated with the LSEP has a contribution to the impact on Rudheath Lime Beds, but suggests that the larger contribution is from the A530 rather than the A556. The vast majority of all LSEP LDV traffic and all LSEP HGV traffic will be routed down this section of the A530.

3.2.5 Long Wood LWS

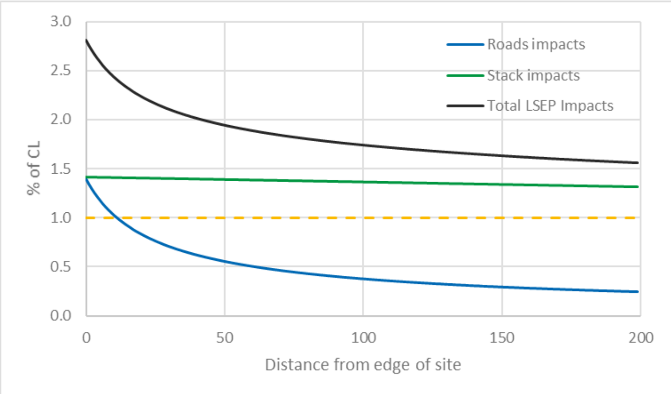
The following section sets out the combined impact of process emissions and road vehicles along the transect marked in Figure 1 at Long Wood. The transect runs from west to east on the eastern side of the A556 near the junction at Lostock Gralam. The transect is not fully perpendicular to the road due to the shape of the ecological site which it fits within. Impacts have been presented for the contribution from the roads and process individually and combined, and the PEC which includes the local background concentration. Where appropriate, reference has been made to the 1% and 70% screening criteria.

The impacts have been modelled from the edge of the ecological site, which is 5.5 m from the edge of the road.

Graph 47 to Graph 52 show that the impact of road pollutants decreases with distance away from the road. Stack pollutant impacts also decrease with distance away from the road, but remain an influence to the in combination impacts. The maximum stack contributions at Long Wood are as set out in Appendix 5.2 of the EIA Report (1.6% of the Critical Level for oxides of nitrogen and 2.6% of the Critical Level for annual mean ammonia using the lower Critical Level of 1 $\mu g/m^3$).

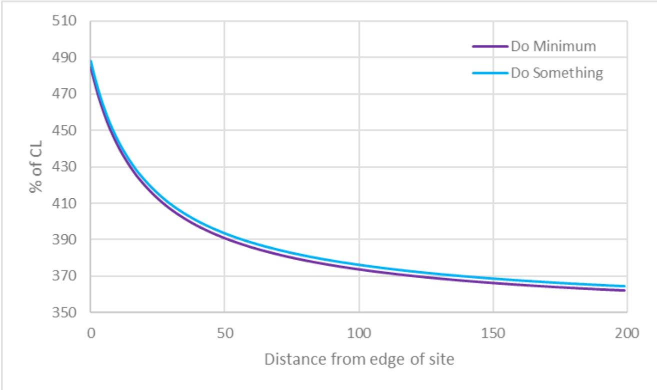
For oxides of nitrogen impacts, at the edge of the site, the roads impact is above the 1% screening criteria, but quickly decreases with distance and falls below the 1% screening criteria at 12 m from the edge of the ecological site. However, due to the impact of stack emissions at this location, the in-combination impact is above the 1% screening criteria along the whole transect. A similar pattern is shown for ammonia impacts when using the lower Critical Level of 1 $\mu g/m^3$. When using the higher Critical Level of 3 $\mu g/m^3$, the total LSEP impact exceeds the 1% screening criteria up to 20 m from the edge of the ecological site. The PEC graphs show that although there are exceedances of the 70% screening criteria, there is minimal difference between the Do Minimum and Do Something scenarios. The drop off from the road is more pronounced within the PEC graphs due to the inclusion of other regular traffic.

Graph 47: Annual mean NOx impact - PC



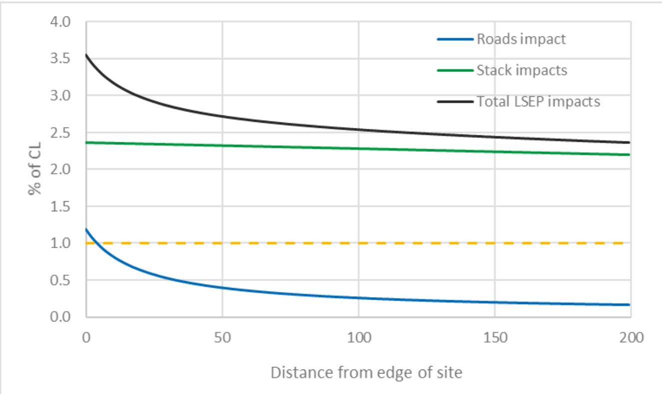
Note: CL = 30 µg/m³

Graph 48: Annual mean NOx impact - PEC



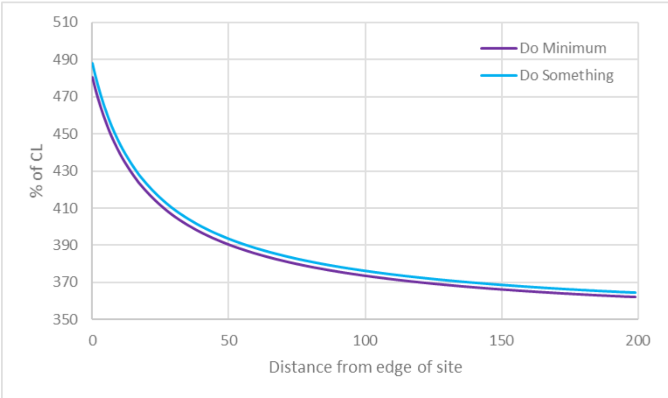
Note: CL = 30 µg/m³. Bg =11.42 µg/m³

Graph 49: Annual mean ammonia impact – PC



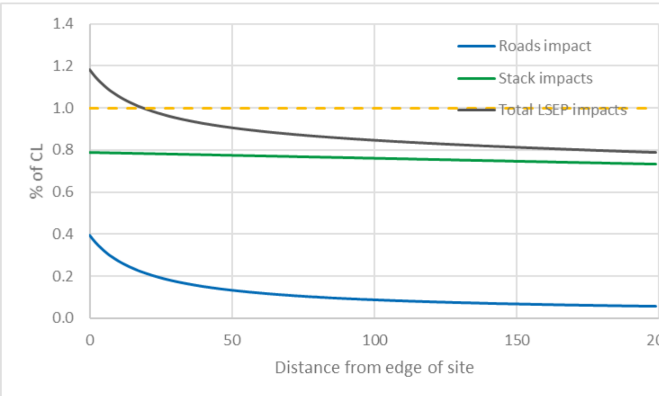
Note: CL = 1 µg/m³ for lichen sensitive habitats

Graph 50: Annual mean ammonia impact – PEC



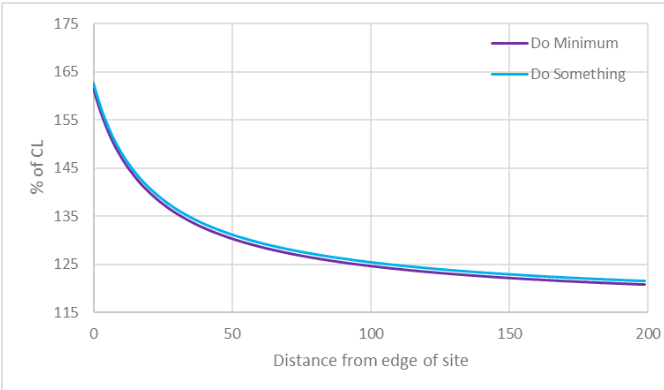
Note: CL = 1 µg/m³. Bg = 3.45 µg/m³

Graph 51: Annual mean ammonia impact – PC



Note: CL = 3µg/m³ for non lichen sensitive habitats

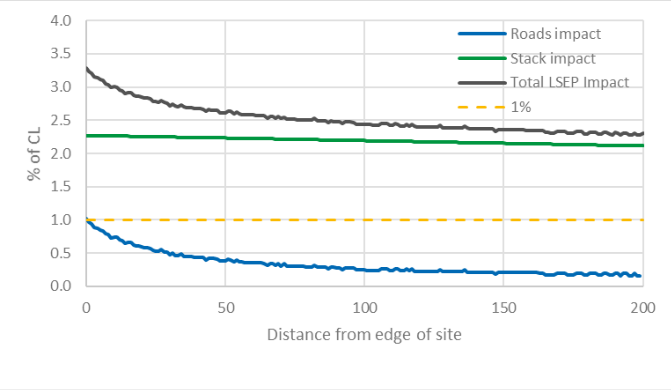
Graph 52: Annual mean ammonia impact – PEC



Note: CL = 3 µg/m³. Bg = 3.45 µg/m³

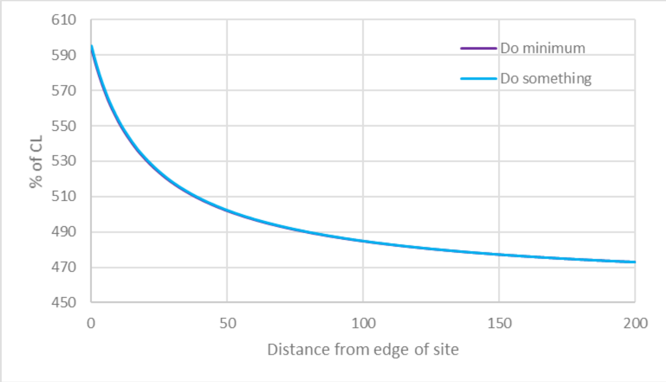
Graph 53 to Graph 56 below show the deposition impacts. Results for nitrogen deposition have been calculated as a percentage of the lower Critical Load for broadleaved deciduous woodland (10 kgN/ha/yr), noting that the upper Critical Load is 20 kgN/ha/yr. Results for acid deposition have been calculated as a percentage of the lower Critical Load for unmanaged broadleaved coniferous woodland (1.897 KeqN/ha/yr).

Graph 53: Annual mean N dep - Woodlands- PC



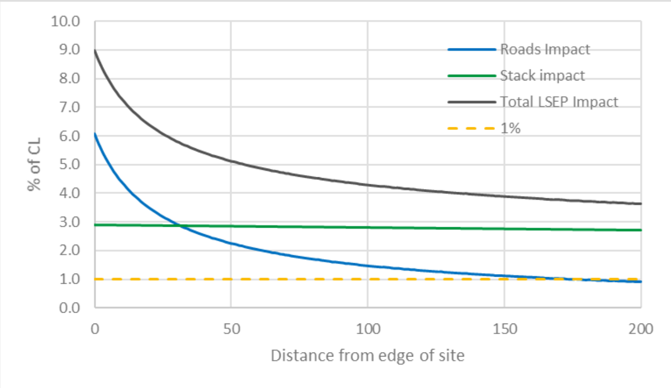
Note:. Lower CL = 10 kgN/ha/yr Bg:= 45.50 kgN/ha/yr

Graph 54: Annual mean N dep - Woodlands- PEC



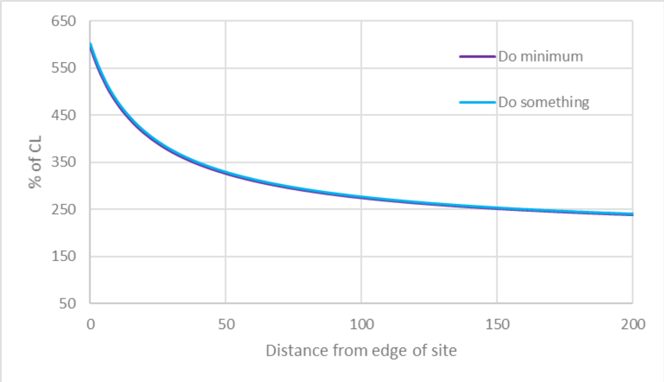
Note:. Lower CL = 10 kgN/ha/yr Bg = 45.50 kgN/ha/yr

Graph 55: Annual mean acid dep Woodland-PC



Note: CLmaxN = 1.897 KeqN/ha/yr, Bg = N 3.25, S 0.25 keq/ha/yr

Graph 56: Annual mean acid dep Woodland-PEC



Note: CLmaxN = 1.897 KeqN/ha/yr, Bg = N 3.25, S 0.25 keq/ha/yr

For deposition impacts the results show that the impact of road pollutants decreases with distance away from the road. Stack pollutant impacts also decrease with distance away from the road, but remain an influence to the in combination impacts. The drop off from the road is more pronounced within the PEC graphs due to the inclusion of other regular traffic.

For nitrogen deposition, although the roads impact is below the 1% screening criteria, the contribution from the stack emissions causes in-combination effects to exceed the criteria.

For acid deposition, the road contribution is above the 1% screening criteria until 179 m from the edge of the ecological site. The PEC for all deposition impacts is well above the 70% screening criteria due to high background levels.

The results for the stack emissions show that the maximum impact of stack emissions is 3.0% of the lower Critical Level for nitrogen deposition, and 3.6% of the lower Critical Load for acid deposition.

This analysis demonstrates that the inclusion of emissions from traffic associated with the LSEP has some contribution to the impact on Long Wood, but suggests that at a distance from the road, the main contribution at this location is from the stack.

3.2.6 Winnington Woods LWS - Transect 1

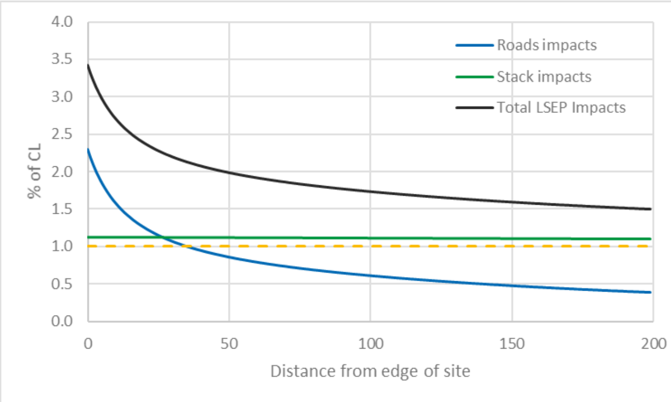
The following section sets out the combined impact of process emissions and road vehicles along the transect 1 marked in Figure 1 at Winnington Woods. The transect runs from south to north perpendicular to the A556. Impacts have been presented for the contribution from the roads and process individually and combined, and the PEC which includes the local background concentration. Where appropriate, reference has been made to the 1% and 70% screening criteria.

The impacts have been modelled from the edge of the ecological site, which is 5.5 m from the edge of the road.

Graph 57 to Graph 62 show that the impact of road pollutants decreases with distance away from the road. At this location and transect orientation in relation to the LSEP, the stack contributions are quite consistent across the transect. The maximum stack contributions at Winnington Wood are as set out in Appendix 5.2 of the EIA Report (1.5% of the Critical Level for oxides of nitrogen and 2.45% of the Critical Level for annual mean ammonia using the lower Critical Level of 1 µg/m^3). These values already exceed the 1% screening criteria, so the in-combination impact is also in exceedance. However, the impact from the road drops off to below the 1% screening criteria at 36 m from the edge of the ecological site for oxides of nitrogen and 20 m from the edge of the ecological site for ammonia (when using the lower Critical Level of 1 µg/m^3). When using the higher Critical Level of 3 µg/m^3, the roads impact is well below the 1% screening criteria and the total LSEP impact falls below the 1% screening criteria at 16 m from the edge of the ecological site. The contributions from the stack at the point of maximum impact at Winnington Wood are as set out in Appendix 5.2 of the EIA Report (1.5% of the Critical Level for oxides of nitrogen and 2.45% for annual mean ammonia using the lower Critical Level of 1 µg/m^3).

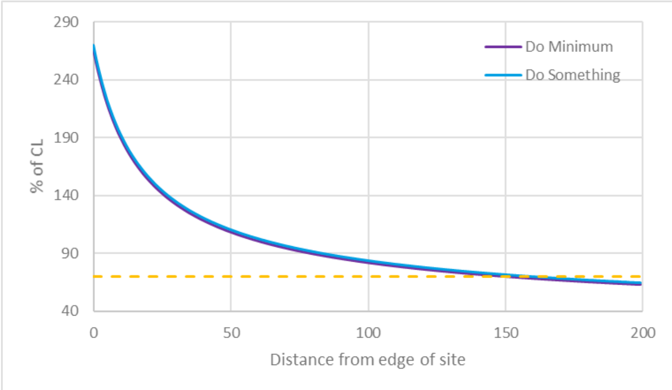
The PEC graphs show an exceedences of the 70% screening criteria due to high background levels, but show the minimal difference between the Do Minimum and Do Something scenarios.

Graph 57: Annual mean NOx impact - PC



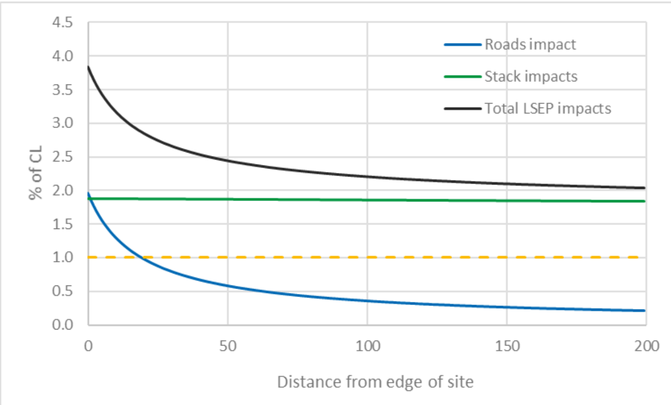
Note: CL = 30 µg/m³

Graph 58: Annual mean NOx impact - PEC



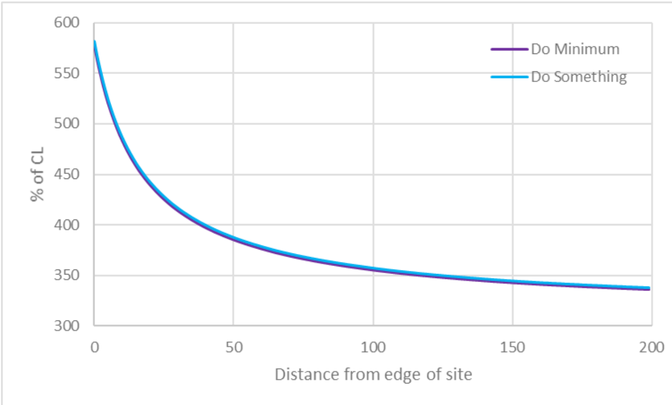
Note: CL = 30 µg/m³. Bg =11.42 µg/m³

Graph 59: Annual mean ammonia impact – PC



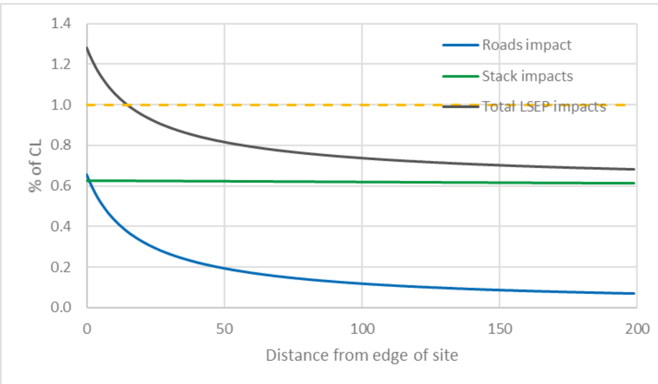
Note: CL = 1 µg/m³ for lichen sensitive habitats

Graph 60: Annual mean ammonia impact – PEC



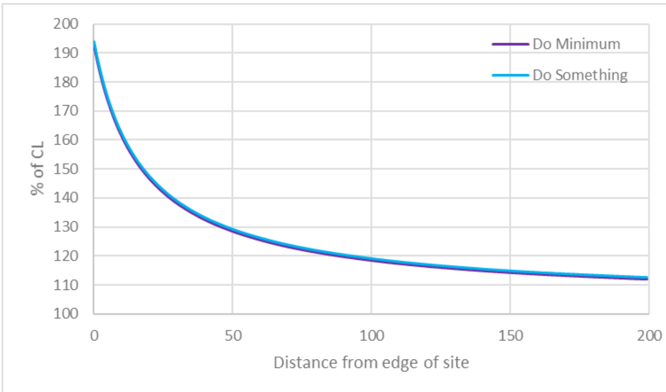
Note: CL = 1 µg/m³. Bg = 3.11 µg/m³

Graph 61: Annual mean ammonia impact – PC



Note: CL = 3µg/m³ for non lichen sensitive habitats

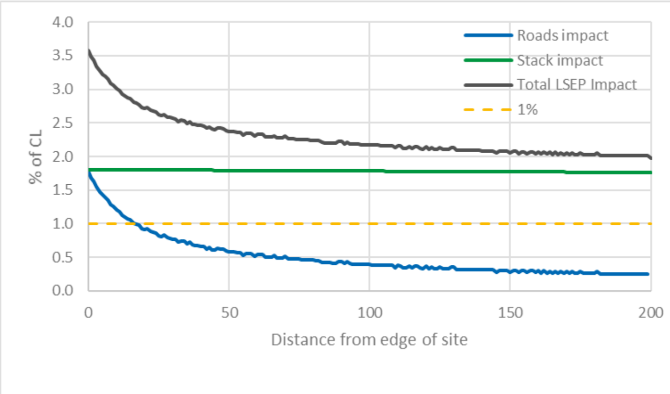
Graph 62: Annual mean ammonia impact – PEC



Note: CL = 3 µg/m³. Bg = 3.11 µg/m³

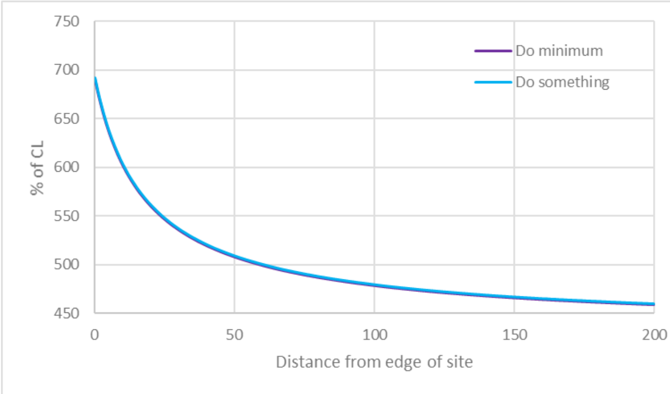
Graph 63 to Graph 66 below show the deposition impacts. Results for nitrogen deposition have been calculated as a percentage of the lower Critical Load for broadleaved deciduous woodland (10 kgN/ha/yr), noting that the upper Critical Load is 20 kgN/ha/yr. Results for acid deposition have been calculated as a percentage of the lower Critical Load for unmanaged broadleaved coniferous woodland (1.871 KeqN/ha/yr).

Graph 63: Annual mean N dep – Woodlands - PC



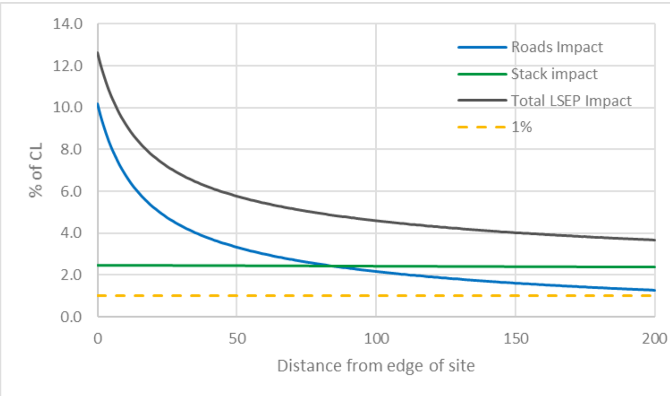
Note: Lower CL = 10 kgN/ha/yr, Bg = 43.40 kgN/ha/yr

Graph 64: Annual mean N dep – Woodlands - PEC



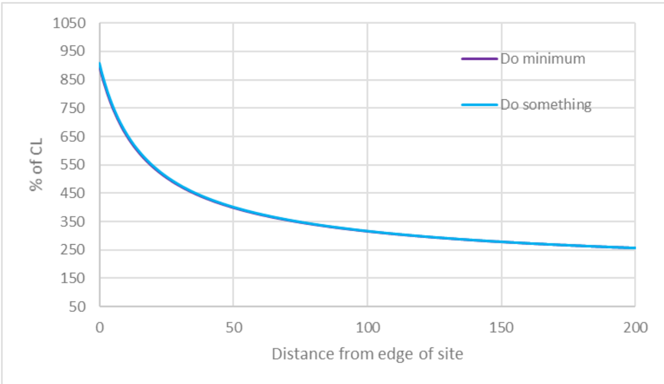
Note: Lower CL = 10 kgN/ha/yr, Bg = 43.40 kgN/ha/yr

Graph 65: Annual mean acid dep Woodland- PC



Note: CLmaxN = 1.871 KeqN/ha/yr, Bg =N 3.10, S 0.26 keq/ha/yr

Graph 66: Annual mean acid dep Woodland-PEC



Note: CLmaxN = 1.871 KeqN/ha/yr, Bg =N 3.10, S 0.26 keq/ha/yr

For deposition impacts the results show that the impact of road pollutants decreases with distance away from the road. At this location and transect orientation in relation to the LSEP, the stack contributions are quite consistent across the transect, but have an influence on the in combination impacts. The drop off from the road is more pronounced within the PEC graphs due to the inclusion of other regular traffic.

For nitrogen deposition, although the roads impact falls below the 1% screening criteria at 17 m from the edge of the ecological site, the contribution from the stack emissions causes in-combination effects to exceed the 1% screening criteria across the transect. The stack contribution at the point of maximum impact across Winnington Wood is 2.8% of the lower Critical Load.

For acid deposition, the road contribution, and also total LSEP contribution, is above the 1% screening criteria for the full length of the transect. The stack contribution at the point of maximum impact across Winnington Wood is 3.8% of the lower Critical Load. The PEC for all deposition impacts is well above the 70% screening criteria due to high background levels.

This analysis demonstrates that the inclusion of emissions from traffic associated with the LSEP has some contribution to the impact on Winnington Long Wood, but suggests that at distance from the road, the main constant contribution at this location is from the stack.

3.2.7 Winnington Wood LWS – Transect 2

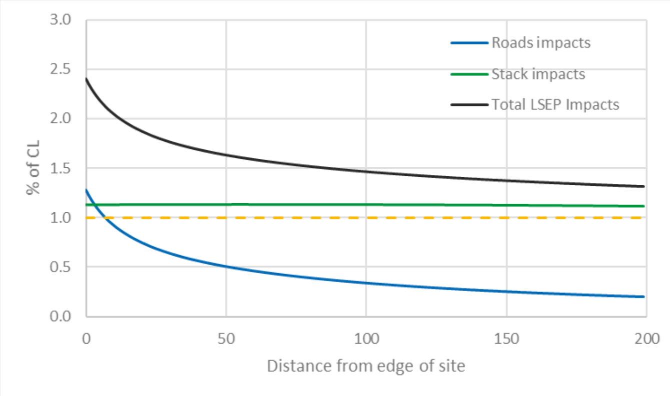
The following section sets out the combined impact of process emissions and road vehicles along the transect 2 marked in Figure 1 at Winnington Woods. The transect runs from north to south, perpendicular to the A556 and opposite Winnington Woods transect 1. Impacts have been presented for the contribution from the roads and process individually and combined, and the PEC which includes the local background concentration. Where appropriate, reference has been made to the 1% and 70% screening criteria.

The impacts have been modelled from the edge of the ecological site, which is 5.5 m from the edge of the road.

Graph 67 to Graph 72 show that the impact of road pollutants decreases with distance away from the road. At this location and transect orientation in relation to the LSEP, the stack contributions are quite consistent across the transect. The maximum stack contributions at Winnington Wood are as set out in Appendix 5.2 of the EIA Report (1.5% of the Critical Level for oxides of nitrogen and 2.45% of the Critical Level for annual mean ammonia using the lower Critical Level of 1 $\mu g/m^3$. These values already exceed the 1% screening criteria, so the in-combination impact is also in exceedance. However, the impact from the road drops off to below the 1% screening criteria at 7 m from the edge of the ecological site for oxides of nitrogen, at 4 m from the edge pf the ecological site for annual mean ammonia (using the lower Critical Level of 1 $\mu g/m^3$) and is below the 1% screening criteria for ammonia when using the higher Critical Level of 3 $\mu g/m^3$.

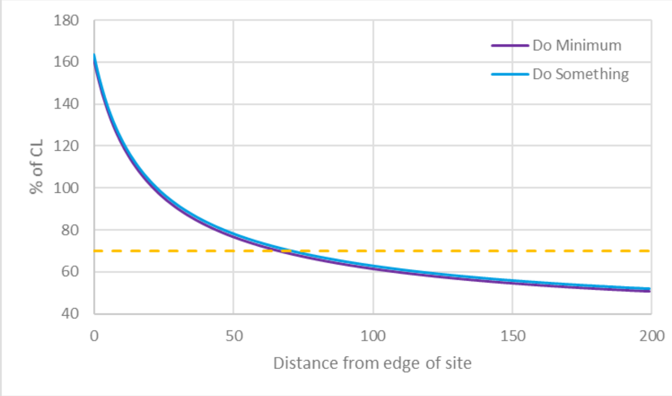
The PEC graphs show an exceedences of the 70% screening criteria due to high background levels, but show the minimal difference between the Do Minimum and Do Something scenarios.

Graph 67: Annual mean NOx impact - PC



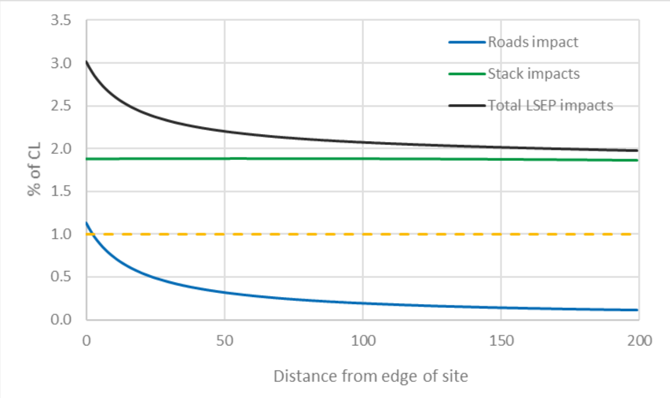
Note: CL = 30 µg/m³

Graph 68: Annual mean NOx impact - PEC



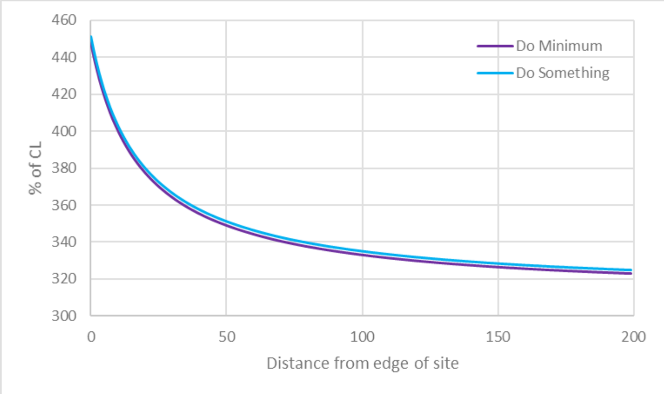
Note: CL = 30 µg/m³. Bg =11.42 µg/m³

Graph 69: Annual mean ammonia impact – PC



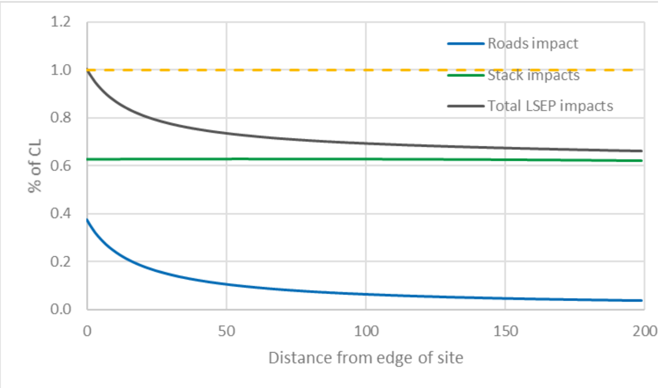
Note: CL = 1 µg/m³ for lichen sensitive habitats

Graph 70: Annual mean ammonia impact – PEC



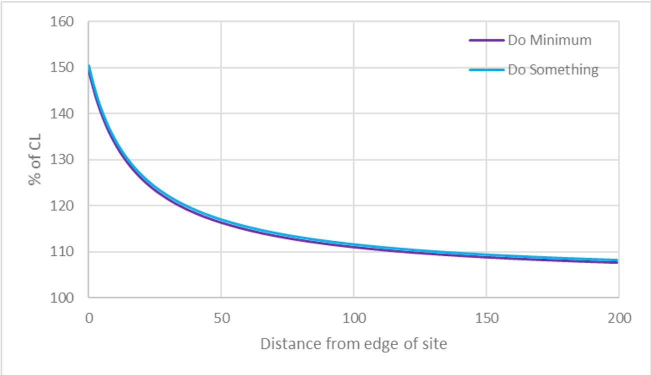
Note: CL = 1 µg/m³. Bg = 3.11 µg/m³

Graph 71: Annual mean ammonia impact – PC



Note: CL = 3µg/m³ for non lichen sensitive habitats

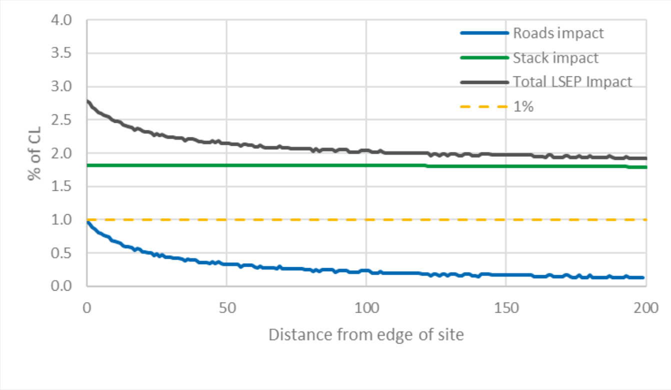
Graph 72: Annual mean ammonia impact – PEC



Note: CL = 3 µg/m³. Bg = 3.11 µg/m³

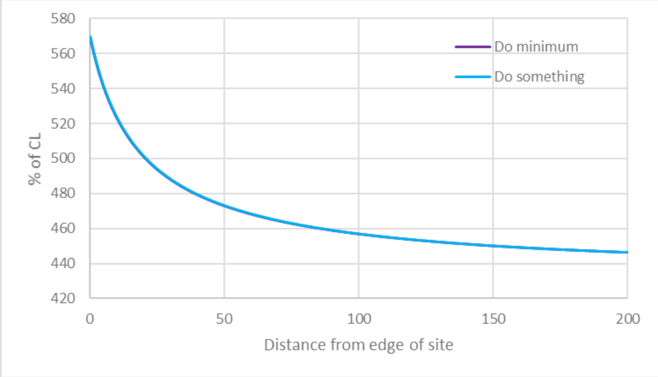
Graph 73 to Graph 76 below show the deposition impacts. Results for nitrogen deposition have been calculated as a percentage of the lower Critical Load for broadleaved deciduous woodland (10 kgN/ha/yr), noting that the upper Critical Load is 20 kgN/ha/yr. Results for acid deposition have been calculated as a percentage of the lower Critical Load for unmanaged broadleaved coniferous woodland (1.871 KeqN/ha/yr).

Graph 73: Annual mean N dep – Woodlands - PC



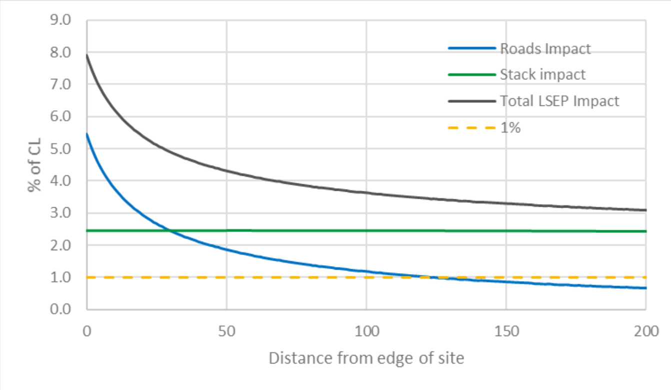
Note: Lower CL = 10 kgN/ha/yr, Bg = 43.40 kgN/ha/yr

Graph 74: Annual mean N dep – Woodlands - PEC



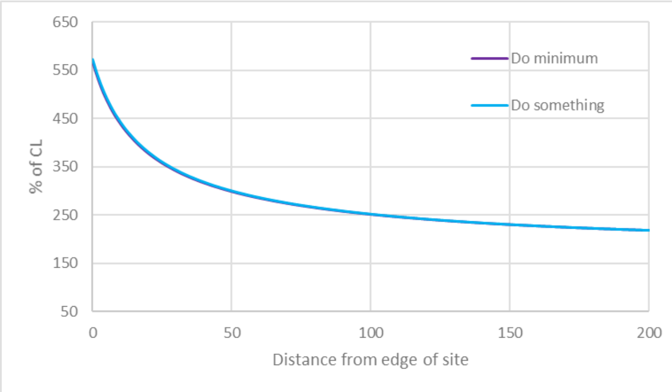
Note: Annual mean acid dep Woodland-PEC

Graph 75: Annual mean acid dep Woodland- PC



Note: CLmaxN = 1.871 KeqN/ha/yr, Bg =N 3.10, S 0.26 keq/ha/yr

Graph 76: Annual mean acid deposition Woodland-PEC



Note: CLmaxN = 1.871 KeqN/ha/yr, Bg =N 3.10, S 0.26 keq/ha/yr

For deposition impacts the results show that the impact of road pollutants decreases with distance away from the road. At this location and transect orientation in relation to the LSEP facility, the stack contributions are quite consistent across the transect, but an influence to the in combination impacts. The drop off from the road is more pronounced within the PEC graphs due to the inclusion of other regular traffic.

For nitrogen deposition, although the roads impact is below the 1% screening criteria the contribution from the stack emissions causes in-combination effects to exceed the 1% screening criteria across the transect. The stack contribution at the point of maximum impact across Winnington Wood is 2.8% of the lower Critical Load.

For acid deposition, the road contribution falls below the 1% screening criteria at 123 m from the edge of the ecological site, but the total LSEP contribution is above the 1% screening criteria for the full length of the transect. The stack contribution at the point of maximum impact across Winnington Wood is 3.8% of the lower Critical Load. The PEC for all deposition impacts is well above the 70% screening criteria due to high background levels.

This analysis demonstrates that the inclusion of emissions from traffic associated with the LSEP has some contribution to the impact on Winnington Wood, but suggests that at distance from the road, the main contribution at this location is from the stack.

Annexes

A Traffic data

Table 8: Traffic Data for Road Links (24-hour AADT)

Road link	Road name/description	Baseline 2018		Do Minimum 2023		Do Something 2023		Development trips	
		LDVs	HDVs	LDVs	HDVs	LDVs	HDVs	LDVs	HDVs
A	Site Access Road	1,289	277	1,593	268	1,674	702	82	434
B	Griffiths Road, north of Site entrance	7,722	0	8,093	0	8,107	0	14	0
C	Griffiths Road, south of Site entrance	8,021	277	8,363	268	8,430	702	67	434
D	Middlewich Road into Northwich	9,692	265	9,650	244	9,650	244	0	0
E	Penny Lane	0	0	0	0	0	0	0	0
F	A350 south of Middlewich Road Junction	15,616	535	15,874	502	15,942	935	67	434
Ga	A556, west of roundabout eastbound	13,341	669	13,454	630	13,455	706	1	76
Gb	A556, west of roundabout westbound	17,214	686	16,328	657	16,329	733	1	76
Ha	A350 south of roundabout, northbound	6,907	315	6,733	297	6,755	362	22	65
Hb	A350 south of roundabout, southbound	6,261	241	6,527	229	6,549	294	22	65
H	A350 south of roundabout, single carriageway	13,168	556	13,260	526	13,305	656	44	130
Ia	A556, east of roundabout eastbound	15,828	881	14,240	744	14,250	820	10	76
Ib	A556, east of roundabout westbound	17,377	1,101	14,925	926	14,935	1002	10	76

Note:

Figures subject to minor rounding errors

Development trips equates to the total throughput of the LSEP rather than just the increase.

The Do-Minimum scenario excludes the contribution associated with the section 36 consent.

B Vehicle emissions detailed results tables- human receptors

Table 9: Annual Mean Nitrogen Dioxide – Worst Case

Receptor	Do-Minimum		LSEP		Do-Something		Impact		
			Stack PC	Road contribution					
	µg/m³	% AQAL	µg/m³	µg/m³	µg/m³	% AQAL	µg/m³	% AQAL	Magnitude of change descriptor
RR1	19.18	48.0%	0.28	0.10	19.56	48.91%	0.38	0.96%	negligible
RR2	18.35	45.9%	0.30	0.08	18.73	46.83%	0.38	0.95%	negligible
RR3	18.32	45.8%	0.31	0.08	18.71	46.77%	0.39	0.97%	negligible
RR4	18.29	45.7%	0.31	0.08	18.68	46.70%	0.39	0.97%	negligible
RR5	21.04	52.6%	0.31	0.12	21.47	53.68%	0.43	1.08%	negligible
RR6	13.61	34.0%	0.32	0.04	13.97	34.93%	0.36	0.91%	negligible
RR7	26.52	66.3%	0.37	0.19	27.08	67.70%	0.56	1.40%	negligible
RR8	26.91	67.3%	0.37	0.22	27.50	68.75%	0.59	1.48%	negligible
RR9	23.26	58.2%	0.36	0.15	23.77	59.44%	0.51	1.29%	negligible
RR10	23.9	59.8%	0.35	0.16	24.41	61.02%	0.51	1.27%	negligible
RR11	24.3	60.8%	0.34	0.17	24.81	62.03%	0.51	1.28%	negligible
RR12	18.12	45.3%	0.19	0.10	18.41	46.02%	0.29	0.72%	negligible
RR13	18.38	46.0%	0.17	0.11	18.66	46.64%	0.28	0.69%	negligible
RR14	14.39	36.0%	0.06	0.06	14.51	36.28%	0.12	0.30%	negligible*
RR15	25.02	62.6%	0.12	0.14	25.28	63.21%	0.26	0.66%	negligible
RR16	27.3	68.3%	0.13	0.31	27.74	69.34%	0.44	1.09%	negligible

Receptor	Do-Minimum		LSEP		Do-Something		Impact		
			Stack PC	Road contribution					
	µg/m³	% AQAL	µg/m³	µg/m³	µg/m³	% AQAL	µg/m³	% AQAL	Magnitude of change descriptor
RR17	28.57	71.4%	0.12	0.37	29.06	72.66%	0.49	1.23%	negligible
RR18	29.35	73.4%	0.12	0.41	29.88	74.70%	0.53	1.32%	negligible
RR19	25.37	63.4%	0.06	0.25	25.68	64.19%	0.31	0.77%	negligible
RR20	24.34	60.9%	0.06	0.28	24.68	61.69%	0.34	0.84%	negligible
RR21	23.81	59.5%	0.07	0.19	24.07	60.18%	0.26	0.65%	negligible
RR22	23.56	58.9%	0.07	0.22	23.85	59.62%	0.29	0.72%	negligible
RR23	25.11	62.8%	0.06	0.28	25.45	63.64%	0.34	0.86%	negligible
RR24	27.58	69.0%	0.06	0.74	28.38	70.95%	0.80	2.00%	negligible
RR25	30.11	75.3%	0.06	0.46	30.63	76.57%	0.52	1.30%	negligible
RR26	26.62	66.6%	0.06	0.85	27.53	68.83%	0.91	2.28%	negligible
RR27	22.92	57.3%	0.06	0.66	23.64	59.10%	0.72	1.80%	negligible
RR28	31.43	78.6%	0.06	1.81	33.30	83.25%	1.87	4.68%	slight, adverse
RR29	24.41	61.0%	0.06	1.09	25.56	63.90%	1.15	2.88%	negligible
RR30	30.38	76.0%	0.06	1.74	32.18	80.45%	1.80	4.50%	slight, adverse
RR31	21.95	54.9%	0.06	0.92	22.93	57.33%	0.98	2.45%	negligible
RR32	25.13	62.8%	0.06	1.39	26.58	66.45%	1.45	3.63%	negligible
RR33	21.81	54.5%	0.06	1.06	22.93	57.33%	1.12	2.80%	negligible
RR34	27.61	69.0%	0.06	1.66	29.33	73.33%	1.72	4.30%	negligible
RR35	22.06	55.2%	0.06	1.09	23.21	58.02%	1.15	2.87%	negligible

Receptor	Do-Minimum		LSEP		Do-Something		Impact		
			Stack PC	Road contribution					
	µg/m³	% AQAL	µg/m³	µg/m³	µg/m³	% AQAL	µg/m³	% AQAL	Magnitude of change descriptor
RR36	25.83	64.6%	0.06	1.45	27.34	68.35%	1.51	3.77%	negligible
RR37	22.1	55.3%	0.06	0.35	22.51	56.27%	0.41	1.02%	negligible
RR38	20.03	50.1%	0.06	0.52	20.61	51.51%	0.58	1.44%	negligible
RR39	17.56	43.9%	0.05	0.49	18.10	45.26%	0.54	1.36%	negligible
RR40	18.9	47.3%	0.03	1.12	20.05	50.13%	1.15	2.88%	negligible
RR41	17.91	44.8%	0.03	0.97	18.91	47.28%	1.00	2.50%	negligible
RR42	16.41	41.0%	0.03	0.74	17.18	42.94%	0.77	1.92%	negligible
RR43	17.02	42.6%	0.02	0.86	17.90	44.76%	0.88	2.21%	negligible
RR44	15.14	37.9%	0.02	0.55	15.71	39.27%	0.57	1.42%	negligible
RR45	15.24	38.1%	0.02	0.58	15.84	39.59%	0.60	1.49%	negligible
RR46	16.35	40.9%	0.20	0.03	16.58	41.44%	0.23	0.57%	negligible
RR47	15.96	39.9%	0.20	0.03	16.19	40.48%	0.23	0.58%	negligible
RR48	16.33	40.8%	0.21	0.03	16.57	41.42%	0.24	0.59%	negligible
R3	15.31	38.28%	0.20	0.03	15.54	38.84%	0.23	0.56%	negligible
R8	20.47	51.18%	0.37	0.13	20.97	52.42%	0.50	1.24%	negligible
R9	30.35	75.88%	0.34	0.22	30.91	77.28%	0.56	1.41%	negligible
R10	17.56	43.90%	0.19	0.10	17.85	44.63%	0.29	0.73%	negligible
R11	14.99	37.48%	0.07	0.25	15.31	38.26%	0.32	0.79%	negligible
R12	14.86	37.15%	0.02	0.51	15.39	38.46%	0.53	1.31%	negligible

Receptor	Do-Minimum		LSEP		Do-Something		Impact		
			Stack PC	Road contribution					
	µg/m³	% AQAL	µg/m³	µg/m³	µg/m³	% AQAL	µg/m³	% AQAL	Magnitude of change descriptor
R13	12.94	32.35%	0.04	0.11	13.09	32.72%	0.15	0.37%	negligible*
R20	18.11	45.28%	0.09	0.15	18.35	45.87%	0.24	0.60%	negligible
R25	12.05	30.13%	0.11	0.02	12.18	30.46%	0.13	0.33%	negligible*
R27	16.60	41.50%	0.29	0.08	16.97	42.42%	0.37	0.92%	negligible

Note:
**Negligible irrespective of the total concentration.*
Assumes 70% conversion of NOx to NO2 for process emissions
Road traffic NOx converted to NO2 using the LAQM calculator

Table 10: Annual Mean Particulate Matter as PM_{10} – Worst Case

Receptor	Do-Minimum		LSEP		Do-Something		Impact		
			Stack PC	Road contribution					
	µg/m³	% AQAL	µg/m³	µg/m³	µg/m³	% AQAL	µg/m³	% AQAL	Magnitude of change descriptor
RR1	12.44	31.1%	0.01	0.02	12.47	31.18%	0.03	0.08%	negligible*
RR2	12.40	31.0%	0.01	0.02	12.43	31.08%	0.03	0.07%	negligible*
RR3	12.40	31.0%	0.01	0.02	12.43	31.07%	0.03	0.07%	negligible*
RR4	12.39	31.0%	0.01	0.02	12.42	31.06%	0.03	0.07%	negligible*
RR5	12.79	32.0%	0.01	0.02	12.83	32.07%	0.04	0.09%	negligible*
RR6	11.70	29.2%	0.01	0.01	11.71	29.29%	0.02	0.05%	negligible*
RR7	13.66	34.2%	0.01	0.04	13.72	34.29%	0.05	0.13%	negligible*
RR8	13.68	34.2%	0.01	0.04	13.74	34.35%	0.05	0.14%	negligible*
RR9	13.17	32.9%	0.01	0.03	13.21	33.03%	0.05	0.12%	negligible*
RR10	13.28	33.2%	0.01	0.03	13.32	33.31%	0.05	0.12%	negligible*
RR11	13.34	33.3%	0.01	0.03	13.39	33.47%	0.05	0.12%	negligible*
RR12	12.39	31.0%	0.01	0.02	12.42	31.06%	0.03	0.07%	negligible*
RR13	12.44	31.1%	0.01	0.02	12.46	31.16%	0.03	0.07%	negligible*
RR14	11.41	28.5%	<0.01	0.01	11.42	28.56%	0.01	0.03%	negligible*
RR15	13.21	33.0%	<0.01	0.03	13.25	33.12%	0.04	0.09%	negligible*
RR16	13.37	33.4%	<0.01	0.04	13.41	33.51%	0.04	0.10%	negligible*
RR17	13.49	33.7%	<0.01	0.04	13.53	33.83%	0.04	0.11%	negligible*
RR18	13.55	33.9%	<0.01	0.04	13.60	33.99%	0.04	0.11%	negligible*

Receptor	Do-Minimum		LSEP		Do-Something		Impact		
			Stack PC	Road contribution					
	µg/m³	% AQAL	µg/m³	µg/m³	µg/m³	% AQAL	µg/m³	% AQAL	Magnitude of change descriptor
RR19	13.34	33.4%	<0.01	0.05	13.39	33.48%	0.05	0.13%	negligible*
RR20	13.12	32.8%	<0.01	0.05	13.18	32.94%	0.05	0.13%	negligible*
RR21	12.86	32.2%	<0.01	0.04	12.91	32.26%	0.04	0.10%	negligible*
RR22	12.83	32.1%	<0.01	0.04	12.87	32.19%	0.04	0.11%	negligible*
RR23	13.08	32.7%	<0.01	0.05	13.14	32.84%	0.05	0.14%	negligible*
RR24	13.53	33.8%	<0.01	0.12	13.65	34.13%	0.12	0.30%	negligible*
RR25	14.00	35.0%	<0.01	0.07	14.08	35.19%	0.08	0.19%	negligible*
RR26	13.40	33.5%	<0.01	0.13	13.53	33.83%	0.13	0.33%	negligible*
RR27	12.82	32.1%	<0.01	0.10	12.92	32.30%	0.10	0.25%	negligible*
RR28	14.43	36.1%	<0.01	0.28	14.71	36.77%	0.28	0.70%	negligible
RR29	13.15	32.9%	<0.01	0.16	13.31	33.27%	0.16	0.40%	negligible*
RR30	14.24	35.6%	<0.01	0.26	14.51	36.26%	0.27	0.67%	negligible
RR31	12.72	31.8%	<0.01	0.13	12.86	32.14%	0.13	0.33%	negligible*
RR32	13.26	33.1%	<0.01	0.20	13.46	33.66%	0.20	0.51%	negligible
RR33	12.68	31.7%	<0.01	0.15	12.84	32.09%	0.15	0.38%	negligible*
RR34	13.72	34.3%	<0.01	0.25	13.96	34.91%	0.25	0.62%	negligible
RR35	12.71	31.8%	<0.01	0.15	12.87	32.18%	0.16	0.39%	negligible*
RR36	13.38	33.5%	<0.01	0.21	13.60	33.99%	0.22	0.54%	negligible
RR37	12.56	31.4%	<0.01	0.06	12.62	31.54%	0.06	0.15%	negligible*

Receptor	Do-Minimum		LSEP		Do-Something		Impact		
			Stack PC	Road contribution					
	µg/m³	% AQAL	µg/m³	µg/m³	µg/m³	% AQAL	µg/m³	% AQAL	Magnitude of change descriptor
RR38	12.28	30.7%	<0.01	0.09	12.37	30.92%	0.09	0.22%	negligible*
RR39	11.91	29.8%	<0.01	0.08	11.99	29.98%	0.08	0.21%	negligible*
RR40	12.24	30.6%	<0.01	0.20	12.44	31.10%	0.20	0.50%	negligible*
RR41	12.06	30.2%	<0.01	0.17	12.23	30.58%	0.17	0.43%	negligible*
RR42	11.79	29.5%	<0.01	0.13	11.92	29.80%	0.13	0.32%	negligible*
RR43	11.91	29.8%	<0.01	0.15	12.06	30.14%	0.15	0.37%	negligible*
RR44	11.57	28.9%	<0.01	0.09	11.67	29.16%	0.09	0.23%	negligible*
RR45	11.59	29.0%	<0.01	0.10	11.69	29.22%	0.10	0.24%	negligible*
RR46	11.51	28.8%	0.01	<0.01	11.52	28.80%	0.01	0.03%	negligible*
RR47	11.40	28.5%	0.01	<0.01	11.42	28.54%	0.01	0.03%	negligible*
RR48	11.39	28.5%	0.01	<0.01	11.40	28.49%	0.01	0.03%	negligible*
R3	11.32	28.29%	0.01	0.00	11.33	28.32%	0.01	0.03%	negligible*
R8	12.72	31.80%	0.01	0.02	12.76	31.89%	0.04	0.10%	negligible*
R9	14.34	35.84%	0.01	0.05	14.40	36.00%	0.06	0.16%	negligible*
R10	12.31	30.77%	0.01	0.02	12.34	30.84%	0.03	0.07%	negligible*
R11	11.49	28.73%	<0.01	0.04	11.53	28.82%	0.04	0.10%	negligible*
R12	11.52	28.81%	<0.01	0.09	11.61	29.02%	0.09	0.21%	negligible*
R13	11.17	27.91%	<0.01	0.02	11.18	27.96%	0.02	0.04%	negligible*
R20	11.94	29.86%	<0.01	0.02	11.97	29.91%	0.02	0.06%	negligible*

Receptor	Do-Minimum		LSEP		Do-Something		Impact		
			Stack PC	Road contribution					
	µg/m³	% AQAL	µg/m³	µg/m³	µg/m³	% AQAL	µg/m³	% AQAL	Magnitude of change descriptor
R25	11.39	28.48%	<0.01	<0.01	11.40	28.50%	0.01	0.02%	negligible*
R27	12.05	30.12%	0.01	0.02	12.07	30.19%	0.03	0.07%	negligible*

Note:
**Negligible irrespective of the total concentration.*
Impacts calculated as a percentage of the AQAL of 40 µg/m³

Table 11: Annual Mean Particulate Matter as $PM_{2.5}$ – Worst Case

Receptor	Do-Minimum		LSEP		Do-Something		Impact		
			Stack PC	Road contribution					
	µg/m³	% AQAL	µg/m³	µg/m³	µg/m³	% AQAL	µg/m³	% AQAL	Magnitude of change descriptor
RR1	7.91	39.56%	0.01	0.01	7.94	39.68%	0.02	0.12%	negligible*
RR2	7.91	39.53%	0.01	0.01	7.93	39.64%	0.02	0.11%	negligible*
RR3	7.90	39.51%	0.01	0.01	7.92	39.62%	0.02	0.11%	negligible*
RR4	7.90	39.49%	0.01	0.01	7.92	39.60%	0.02	0.11%	negligible*
RR5	8.14	40.70%	0.01	0.01	8.17	40.83%	0.03	0.13%	negligible*
RR6	7.48	37.39%	0.01	0.00	7.50	37.48%	0.02	0.08%	negligible*
RR7	8.59	42.93%	0.01	0.02	8.62	43.12%	0.04	0.19%	negligible*
RR8	8.60	43.01%	0.01	0.02	8.64	21.60%	0.04	0.19%	negligible*

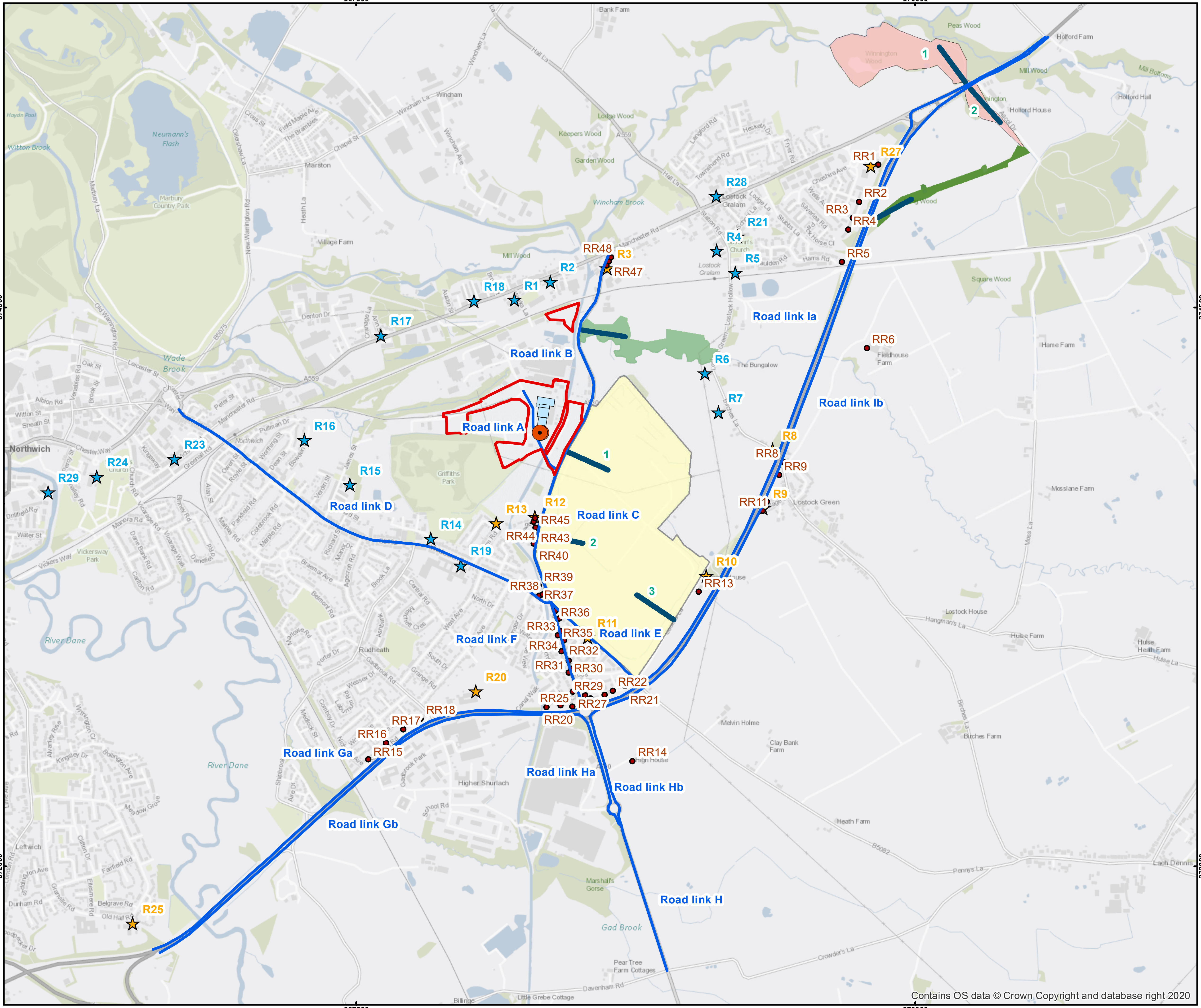
Receptor	Do-Minimum		LSEP		Do-Something		Impact		
			Stack PC	Road contribution					
	µg/m³	% AQAL	µg/m³	µg/m³	µg/m³	% AQAL	µg/m³	% AQAL	Magnitude of change descriptor
RR9	8.29	41.44%	0.01	0.02	8.32	20.80%	0.03	0.17%	negligible*
RR10	8.35	41.76%	0.01	0.02	8.39	20.96%	0.03	0.17%	negligible*
RR11	8.39	41.95%	0.01	0.02	8.42	21.06%	0.03	0.17%	negligible*
RR12	7.82	39.10%	0.01	0.01	7.84	19.60%	0.02	0.10%	negligible*
RR13	7.85	39.23%	0.01	0.01	7.86	19.66%	0.02	0.10%	negligible*
RR14	7.41	37.06%	<0.01	0.01	7.42	18.55%	0.01	0.05%	negligible*
RR15	8.57	42.85%	<0.01	0.02	8.59	21.49%	0.02	0.12%	negligible*
RR16	8.67	43.36%	<0.01	0.02	8.70	21.75%	0.03	0.13%	negligible*
RR17	8.75	43.75%	<0.01	0.02	8.78	21.95%	0.03	0.14%	negligible*
RR18	8.79	43.95%	<0.01	0.02	8.82	22.05%	0.03	0.15%	negligible*
RR19	8.55	42.77%	<0.01	0.03	8.59	21.46%	0.03	0.16%	negligible*
RR20	8.43	42.13%	<0.01	0.03	8.46	21.14%	0.03	0.16%	negligible*
RR21	8.29	41.43%	<0.01	0.02	8.31	20.78%	0.03	0.13%	negligible*
RR22	8.26	41.32%	<0.01	0.02	8.29	20.73%	0.03	0.14%	negligible*
RR23	8.41	42.07%	<0.01	0.03	8.45	21.12%	0.03	0.17%	negligible*
RR24	8.68	43.38%	<0.01	0.07	8.75	21.87%	0.07	0.36%	negligible*
RR25	8.95	44.74%	<0.01	0.04	9.00	22.49%	0.05	0.23%	negligible*
RR26	8.60	42.98%	<0.01	0.08	8.67	21.69%	0.08	0.40%	negligible*
RR27	8.25	41.23%	<0.01	0.06	8.31	20.77%	0.06	0.30%	negligible*

Receptor	Do-Minimum		LSEP		Do-Something		Impact		
			Stack PC	Road contribution					
	µg/m³	% AQAL	µg/m³	µg/m³	µg/m³	% AQAL	µg/m³	% AQAL	Magnitude of change descriptor
RR28	9.19	45.96%	<0.01	0.17	9.36	23.40%	0.17	0.84%	negligible
RR29	8.44	42.18%	<0.01	0.10	8.53	21.33%	0.10	0.49%	negligible*
RR30	9.08	45.39%	<0.01	0.16	9.24	23.10%	0.16	0.81%	negligible
RR31	8.19	40.93%	<0.01	0.08	8.27	20.67%	0.08	0.41%	negligible*
RR32	8.59	42.95%	<0.01	0.12	8.71	21.78%	0.12	0.62%	negligible
RR33	8.25	41.24%	<0.01	0.09	8.34	20.85%	0.09	0.46%	negligible*
RR34	8.86	44.29%	<0.01	0.15	9.01	22.52%	0.15	0.75%	negligible
RR35	8.27	41.34%	<0.01	0.09	8.36	20.91%	0.10	0.48%	negligible*
RR36	8.66	43.31%	<0.01	0.13	8.79	21.98%	0.13	0.66%	negligible
RR37	8.19	40.95%	<0.01	0.03	8.23	20.57%	0.04	0.18%	negligible*
RR38	8.02	40.10%	<0.01	0.05	8.07	20.18%	0.05	0.27%	negligible*
RR39	7.80	38.98%	<0.01	0.05	7.85	19.62%	0.05	0.25%	negligible*
RR40	7.98	39.92%	<0.01	0.12	8.10	20.26%	0.12	0.59%	negligible
RR41	7.88	39.40%	<0.01	0.10	7.98	19.95%	0.10	0.51%	negligible
RR42	7.72	38.61%	<0.01	0.07	7.80	19.49%	0.08	0.38%	negligible*
RR43	7.79	38.94%	<0.01	0.09	7.88	19.69%	0.09	0.44%	negligible*
RR44	7.59	37.96%	<0.01	0.05	7.65	19.12%	0.06	0.28%	negligible*
RR45	7.60	38.01%	<0.01	0.06	7.66	19.15%	0.06	0.29%	negligible*
RR46	7.55	37.76%	0.01	<0.01	7.56	18.91%	0.01	0.05%	negligible*

Receptor	Do-Minimum		LSEP		Do-Something		Impact		
			Stack PC	Road contribution					
	µg/m³	% AQAL	µg/m³	µg/m³	µg/m³	% AQAL	µg/m³	% AQAL	Magnitude of change descriptor
RR47	7.49	37.46%	0.01	<0.01	7.50	18.76%	0.01	0.05%	negligible*
RR48	7.49	37.44%	0.01	<0.01	7.50	18.75%	0.01	0.06%	negligible*
R3	7.44	37.19%	0.01	<0.01	7.45	37.25%	0.01	0.05%	negligible*
R8	8.02	40.09%	0.01	0.01	8.05	40.23%	0.03	0.15%	negligible*
R9	8.99	44.96%	0.01	0.03	9.03	45.17%	0.04	0.21%	negligible*
R10	7.77	38.84%	0.01	0.01	7.79	38.94%	0.02	0.10%	negligible*
R11	7.55	37.74%	<0.01	0.02	7.57	37.85%	0.02	0.12%	negligible*
R12	7.56	37.81%	<0.01	0.05	7.61	19.03%	0.05	0.26%	negligible*
R13	7.35	36.77%	<0.01	0.01	7.37	18.41%	0.01	0.06%	negligible*
R20	7.73	38.65%	<0.01	0.01	7.75	19.37%	0.02	0.08%	negligible*
R25	7.38	36.90%	<0.01	<0.01	7.39	18.47%	0.01	0.03%	negligible*
R27	7.68	38.38%	0.01	0.01	7.70	19.24%	0.02	0.10%	negligible*

Note:
**Negligible irrespective of the total concentration.*
Impacts calculated as a percentage of the AQAL of 20 µg/m³

C Figures



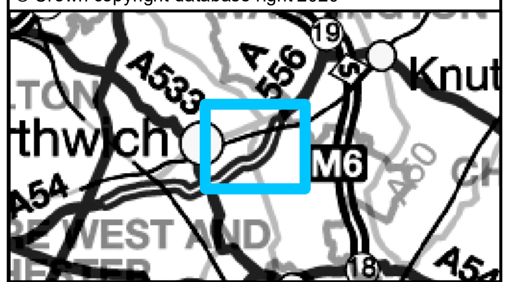
Legend

- Stack locations
- Site boundary
- Buildings
- Road sources
- Eco trasnects
- Roads receptors
- Process emissions modelling human receptors within 200 m of the roads used by LSEP vehicles
- Process emissions modelling human receptors
- Long Wood
- Wade Brook new
- Winnington Wood
- Rudheath Lime Beds pLWS

Client:	Lostock Sustainable Energy Plant Ltd
Site:	LSEP
Project:	3291
Title:	

Figure 1 - Roads modelled and receptors

Drawn by: HKL | Date: 28/07/2021



0 0.15 0.3 0.6 km

Scale: 1:16,000

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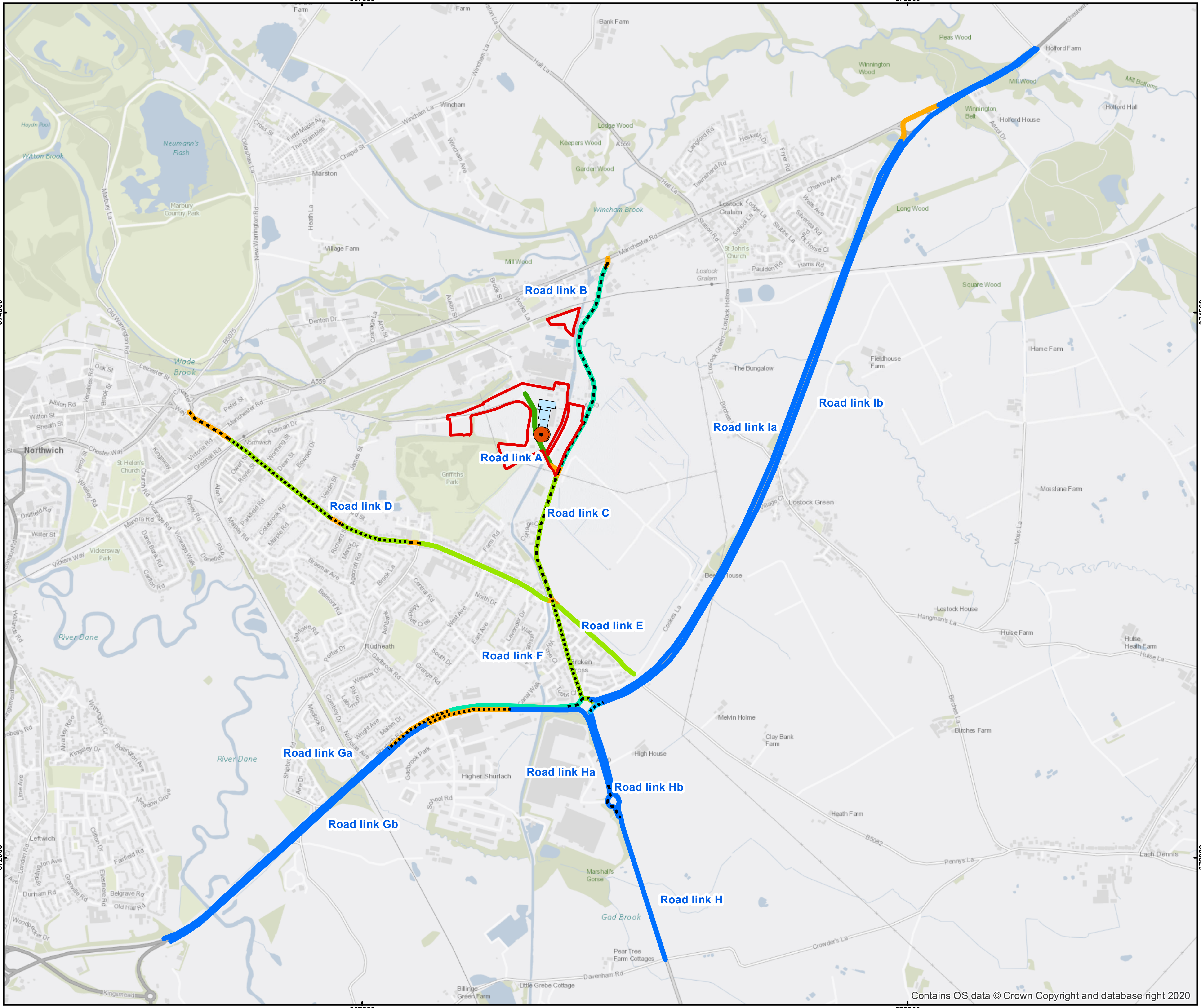


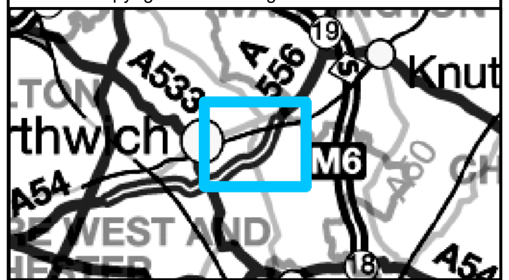
Legend

- Stack locations
- Site boundary
- Buildings
- Queue zones
- Slow down (20 kph)
- 133 kph LDVs, 96 kph HGVs
- 97 kph LDVs, 92 kph HGVs
- 64 kph LDVs, 59 kph HGVs
- 48 kph LDVs, 43 kph HGVs
- 32 kph LDVs, 27 kph HGVs

Client:	Lostock Sustainable Energy Plant Ltd
Site:	LSEP
Project:	3291
Title:	

Figure 2 - Roads Modelled with speeds and queues

Drawn by: HKL | Date: 28/07/2021



0 0.15 0.3 0.6 km

Scale: 1:16,401

N

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