Dover District Council

Local Plan Air Quality Inputs

Dispersion Modelling Assessment – Ammonia

January 2024

THIS PAGE IS LEFT BLANK INTENTIONALLY

Document Control Sheet

Identification	
Client	Dover District Council
Document Title	Local Plan Air Quality Inputs for Dover District Council – Ammonia
Bureau Veritas Ref No.	AIR19588929

Contact Details		
Company Name	Bureau Veritas UK Limited	Dover District Council
Contact Name	Hannah Broomfield-Payne	Jillian Barr
Position	Principal Air Quality Consultant	Senior Policy Planner
Address	5th Floor 66 Prescot Street London E1 8HG	Dover District Council Council Offices White Cliffs Business Park Whitfield Dover CT16 3PJ
Telephone	020 7661 0774	01304 872156
e-mail	hannah.broomfield-payne@bureauveritas.com	jillian.bar@dover.gov.uk
Websites	www.bureauveritas.co.uk	www.dover.gov.uk

Configuration				
Version	**Date**	**Author**	**Reason for Issue/Summary of Changes**	**Status**
1	09/08/2023	J Cai	Draft for comment	Draft
2	22/09/2023	J Cai	Updated	Draft
3	18/12/2023	J Cai	Updated	Draft
4	16/01/2024	J Cai	Updated following NE comments	Final

	Name	Job Title	Signature
Prepared By	J Cai	Graduate Air Quality Consultant	
Approved By	H Broomfield-Payne	Principal Air Quality Consultant	

THIS PAGE IS LEFT BLANK INTENTIONALLY

Table of Contents

List of Figures

List of Tables

Executive Summary

Bureau Veritas UK Ltd has been commissioned by Dover District Council to complete an Air Quality Assessment to supplement the Council's New Local Plan for future development across the district over the next 20 years.

The additional assessment requested by Natural England considered exposure of existing ecological receptors to concentrations of ammonia (NH_3), using the Cambridge Environmental Research Consultants ADMS-Roads™ dispersion model (version 5.2). The methodology applied to assess ammonia was agreed with Natural England prior to commencing the work.

Implementation of the Local Development Plan has a negligible effect upon annual mean concentrations of NH_3 at all receptor locations. It should be noted that the background concentration applied in the assessment is derived from 2019-2021 3-year average modelled background ammonia concentration. The application of the 2019-2021 3-year average background concentration was to allow for a conservative approach to the assessment due to the uncertainties surrounding forecasting future ammonia concentrations.

The predicted increase in NH_3 associated with the implementation of the Local Plan was below 1% of the minimum critical level at all the ecological receptors. Therefore, the impact on local ambient ammonia conditions arising from increased traffic flows as a result of the implementation of the Local Development Plan can be considered **not significant** at all ecological receptors.

The predicted increase in NH_3 associated with the implementation of the Local Plan in combination with other developments in the region was below 1% of the minimum critical levels at all but one receptor ER46. However, the predicted environmental concentration at ER46 was below 70% of the minimum critical levels. Therefore, the impact on local ambient ammonia conditions arising from increased traffic flows as a result of the implementation of the Local Development Plan in combination with other developments can be considered **not significant** at all ecological receptors.

The assessment has also considered the ammonia component of nitrogen deposition and nitric acid deposition.

For nitrogen deposition, the Project Alone predicted Process Contribution (PC) attributed by the Local Plan was below 1% of the minimum critical loads at all of the receptors within the Dover to Kingsdown Cliffs SAC and Lydden & Temple Ewell Downs SAC. Therefore, the impact on nitrogen deposition can be considered **not significant** within these designation areas.

One receptor, ER46, with the Project Alone predicted PC greater than 1%, also has a Project Alone Predicted Environmental Deposition Rate (PEDR) greater than 70%. This indicates that there is a potential adverse impact on this receptor within the Thanet Coast & Sandwich Bay RAMSAR / SPA and Sandwich Bay SAC. For all other ecological receptors within the Thanet Coast & Sandwich Bay RAMSAR / SPA and Sandwich Bay SAC, the Project Alone predicted PC attributed by the Local Plan was below 1% of the minimum critical loads.

A transect study was conducted at receptor ER46. It was found that, for the Thanet Coast & Sandwich Bay SPA / RAMSAR and Sandwich Bay SAC, there is no likely significant impact on nitrogen deposition from road contribution where the distance from the road is greater than **10m**.

For nitrogen deposition, the In Combination predicted PC was below 1% of the minimum critical loads at all of the receptors within the Dover to Kingsdown Cliffs SAC and Lydden & Temple Ewell Downs SAC. Therefore, the impact on nitrogen deposition can be considered **not significant** within these designation areas.

There are the eight receptors predicting an In Combination PC of greater than 1%, which also have an In Combination PEDR of greater than 70%. This indicates that there is potential adverse impact on these receptors within the Thanet Coast & Sandwich Bay RAMSAR / SPA and Sandwich Bay

SAC. A transect study was conducted at the eight receptors ER29, ER30, ER31, ER33, ER 43, ER45, ER46 and ER48. It was found that, for the Thanet Coast & Sandwich Bay SPA / RAMSAR and Sandwich Bay SAC, there is no likely significant impact on nitrogen deposition from road contribution where the distance from the road is greater than **125m**.

For nitric acid deposition, the Project Alone predicted PC was below 1% of the minimum critical loads at all 11 receptors which have habitats sensitive to acid deposition. Therefore, the impact on nitric acid deposition from the Local Plan alone can be considered **not significant** at all ecological receptors.

For nitric acid deposition, the In Combination predicted PC was below 1% of the minimum critical loads at all of the 11 receptors which have habitats sensitive to acid deposition. Therefore, the impact on nitric acid deposition from the Local Plan in combination with other developments can be considered **not significant** at all ecological receptors.

1. Introduction

Bureau Veritas UK Ltd has been commissioned by Dover District Council ('the Council' / DDC) to complete a detailed dispersion modelling assessment to inform the Council's New Local Plan for development across the district that covers the period of 2020 to 2040. A previous assessment (report ref. AIR7493485) was completed in 2020 which assessed both NO_2 and PM_{10} annual mean concentrations, in order to ascertain the likely air quality impacts associated with the allocation of land for housing as specified in the Local Plan. This report is an additional assessment requested by Natural England to consider exposure of existing ecological receptors to concentrations of ammonia (NH_3), using the Cambridge Environmental Research Consultants (CERC) ADMS-Roads™ dispersion model (version 5.2). The methodology applied to assess ammonia was agreed with Natural England prior to commencing the work.

The Housing and Economic Land Availability Assessment (HELAA) has identified multiple sites across the District that are suitable, available and achievable for housing and economic development uses over the Plan period to 2040. Additionally, an Employment Site Assessment has identified additional sites for development for employment purposes. The dispersion modelling assessment has been undertaken to assess the impact of the proposed development sites on the air quality that current and future ecological sites will be subject to.

The HELAA and Employment Site locations are illustrated in Figure 4.1.

1.1 Scope of Assessment

Extensive analysis of the transport impacts of the proposed developments has already been undertaken. Based upon the requirements provided by the Council and Natural England the main objectives of this assessment are as follows:

- To model future NH_3 annual mean concentrations in order to ascertain the likely air quality impacts on ecological receptors associated with the allocation of land for housing;
- Consider internationally designated sites and sensitive ecological receptor locations to determine whether they will be negatively impacted by proposed development in the region;
- To assess the ammonia contribution to nitrogen and acid deposition against relevant critical loads.

The approach adopted in this assessment to evaluate the impact of road traffic emissions on air quality has utilised CERC ADMS-Roads™ dispersion model (version 5.2).

The approach estimates ammonia emission rates for modelling based on the National Atmospheric Emissions Inventory (NAEI) emission factors database[1]. Estimation is accomplished based on the ratio between the emissions of NH_3 and NO_x, and using the UK fleet composition.

For the modelled results, the same verification factor calculated for NO_x in the previous assessment (report ref. AIR7493485) is applied to the road contribution associated ammonia concentrations. Background ammonia concentrations are derived from APIS background map data.

[1] National Atmospheric Emission Inventory, 2023. Fleet Weighted Road Transport Emission Factor. Available at: https://naei.beis.gov.uk/data/ef-transport

2. Relevant Guidance

2.1 Air Quality and Planning

The Kent and Medway Air Quality Partnership published Air Quality Planning Guidance (Mitigation Options A and B) in December 2015[2]. This guidance is available as technical guidance or for use as a Supplementary Planning document. The aim of the document is to provide advice for developers and their consultants on addressing local air quality when making a planning application.

The guidance initially provides detail on when an air quality assessment is required to accompany a planning application, and following this provides a comprehensive overview of the approach(es) to be taken within any air quality assessment to be completed.

The key concern with regard to the air quality impacts of a development is the likely effect on human health. It is important that an air quality assessment evaluates modelled air quality in terms of changes in pollution concentrations where there is relevant public exposure. The local authority may also need to consider the impact of the development on air quality in neighbouring authorities.

In addition to the Kent and Medway Air Quality Planning Guidance, Natural England provides guidance[3] which evaluates impact significance at ecological receptors, using the criteria in Table 2.1.

Table 2.1 – Impact Descriptors for Changes in Pollutant Concentrations at a Receptor

First Criteria	1% of Critical Minimum Load or Environmental Assessment Level	
	≤1%	>1%
Process Contribution (PC)	No likely significant effect.	To be assessed by the second criteria.
Second Criteria	70% of minimum critical load or level	
	≤70%	>70%
Predicted Environmental Concentration / Predicted Environmental Deposition Rate (PEC / PEDR)	No likely significant effect.	Potential adverse impact, more detailed consideration / assessment needed.
PEC / PEDR = PC + Background		

[2] Kent and Medway Air Quality Planning Guidance http://kentair.org.uk/home/text/66

[3] Natural England. Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations: https://publications.naturalengland.org.uk/publication/4720542048845824

2.2 Environmental Assessment Levels and Critical Loads Relevant to the Assessment of Ecological Receptors

A summary of the relevant Environmental Assessment Levels (EAL) that apply to the emissions from the traffic on roads and their impact on ecological receptors are given in Table 2.2.

Table 2.2 – Summary of Relevant Environmental Assessment Levels (EAL) for Ecological Receptors

Pollutant	Averaging Period	Value
Ammonia (NH_3)	Annual mean	1 µg/m^3 Sensitive lichen communities & bryophytes and ecosystems where lichens & bryophytes are an important part of the ecosystem's integrity)
		3 µg/m^3 Where lichens or bryophytes are not presented

The APIS website provides specific information on the potential effects of nitrogen and acid deposition on various habitats and species which have been utilised in this report.

3. Background Pollutant Concentrations

Modelled background ammonia concentrations are available via the Air Pollution Information Service (APIS) website (http://www.apis.ac.uk). Table 3.1 provides the 2019-2021 3-year average modelled ammonia concentration for the ecological receptors considered in this study, as obtained from the APIS website. It should be noted that the level of uncertainty associated with these modelled estimates is relatively high and the results are presented from the model across the UK on a coarse 1km grid square resolution.

Table 3.1 – APIS 2019-2021 3-year Average Background Ammonia Concentrations

Site Name	Estimated Background Ammonia Concentrations (µg m^{-3})
ER1	1.1
ER5	1.1
ER8	1.2
ER9	1.2
ER10	1.2
ER13	1.2
ER14	1.2
ER15	1.2
ER18	1.2
ER22	1.2
ER24	1.2
ER29	1.2
ER30	1.2
ER31	1.2
ER33	1.2
ER37	1.2
ER38	1.2
ER40	1.1
ER41	1.1
ER43	1.2
ER45	1.2
ER46	1.1
ER48	1.1
Source: Air Pollution Information Service (APIS) website (http://www.apis.ac.uk)	

4. Assessment Methodology

The approach applied to this assessment has been based on the following:

- Quantitative prediction of ambient NH_3 concentrations at ecological receptors as a result of the local plan developments in 2040; and
- Calculation of impacts from nutrient deposition and acid deposition, inclusive of the ammonia contribution, at relevant ecological receptors.

4.1 Operational Effects – Road Traffic Emissions

Concentrations of ammonia from road traffic emissions have been predicted at receptor locations using ADMS-Roads, an advanced atmospheric dispersion model that has been developed and validated by CERC. The ADMS-Roads software is used extensively throughout the UK for regulatory compliance purposes and is accepted as an appropriate air quality modelling tool by the Environment Agency, Natural England and local authorities.

The following scenarios have been assessed:

- Project Alone – The emission contribution attributed solely by the Dover Local Plan. This is the difference between the 2040 Do Something and 2040 Do Minimum modelled results.
- In Combination – The emission contribution attributed by all developments in the region from the baseline year (2019) to the proposed year of completion (2040). This is the difference between the 2040 Do Something and 2040 Baseline modelled results.

The above scenarios are derived from modelling the following:

- 2040 Baseline (2040 BS) – A hypothetical scenario without any assumed traffic growth, 2019 traffic flows have been applied to the proposed year of completion (2040);
- 2040 Do Minimum (2040 DM) – Without development flows, but including other committed schemes, for the proposed year of completion (2040); and
- 2040 Do Something (2040 DS) – With development flows, including other committed schemes, for the proposed year of completion (2040).

Please note that all future predicted traffic flow data used in the modelling assessment are based on pre-COVID data, with more recent post-COVID traffic surveys showing a reduction in baseline traffic levels. TEMPro data was also reviewed recently and vehicle movements are expected to reduce. Therefore, the assessment is assumed to be precautionary. In addition, the Canterbury Local Plan proposals, which is at a very early stage, is not specifically included in the modelling. However, Tempro growth has been applied to include other committed schemes in the area.

Traffic growth from Maston Airport development is not specifically included in the predicted traffic flow data for modelling. However, the modelled NO_x PC results attributed from Manston Airport is derived from Manston Airport Examination Document (Ref: TR020002-003970-ES Addendum - Chapter 6[4]) and added to the relevant receptors, ER43, ER45, ER46 and ER48, in the nitrogen deposition and acid deposition assessment in this report. Other ecological receptors in this assessment are out of the scope of Manston Airport development assessment. Therefore, it is considered that impact from Manston Airport on other ecological receptors in this report is likely to be negligible.

[4] Addendum to the Environmental Statement [APP-033] Chapter 6 Air Quality, TR020002/D6/5.2.6. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR020002/TR020002-003970-ES%20Addendum%20-%20Chapter%206.pdf

4.1.1 Traffic Data and NH_3 Emission Rate Estimation

The ADMS-Roads assessment incorporates the number of road traffic vehicles, the proportion of different vehicle classes and vehicle speeds on the local roads. This data was provided by the appointed transport consultant, WSP. The reduction of vehicle speeds at junctions is accounted for in the transport model. A desktop study identified multiple street canyons within the central high street area within Dover, thus requiring additional model adjustments. The modelled road links are presented in Figure 4.1.

The approach estimates the ammonia emission rates for modelling based on the National Atmospheric Emissions Inventory (NAEI) emission factors database[1]. The NAEI database provides for an estimate of both NO_x and NH_3 emission factors that align with the format of NO_x emissions calculated and the NO_x emission rates are output by the Emissions Factors Toolkit (EFT)[5] version 12.0.

Fleet projection data are used to calculate accurate NO_x:NH_3 ratios based on the fleet composition in future years and the hot exhaust emission factors by vehicle and road type for NO_x and NH_3 from the NAEI database for the baseline year of 2019. As 2035 is the latest available year for fleet projection data, this year was used for calculating the ammonia emission rates for the 2040 future year scenarios.

The NAEI emission database provides road transport emission factors by vehicle type and road type. The transport emission factors for the 2040 future year scenarios are estimated by adjusting the traffic fleet composition by vehicle type. The urban NO_x:NH_3 ratio is applied to the road links within the model area to align with the road type used in the EFT. Further details of the data and calculation undertaken is provided in the Appendix A.

4.1.2 Modelled Receptors

All ecological receptors considered in the assessment of emissions from road traffic are presented in **Figure 4.1**. The ecological receptor points are those within the designated sites that are closest to the road and so are expected to experience the maximum impacts (**Table 4.1**). It is likely that pollutant concentrations will be at a lower level across the rest of the site. Ecological receptors have been modelled at ground level i.e. 0m.

Table 4.1 – Ecological Receptor Locations

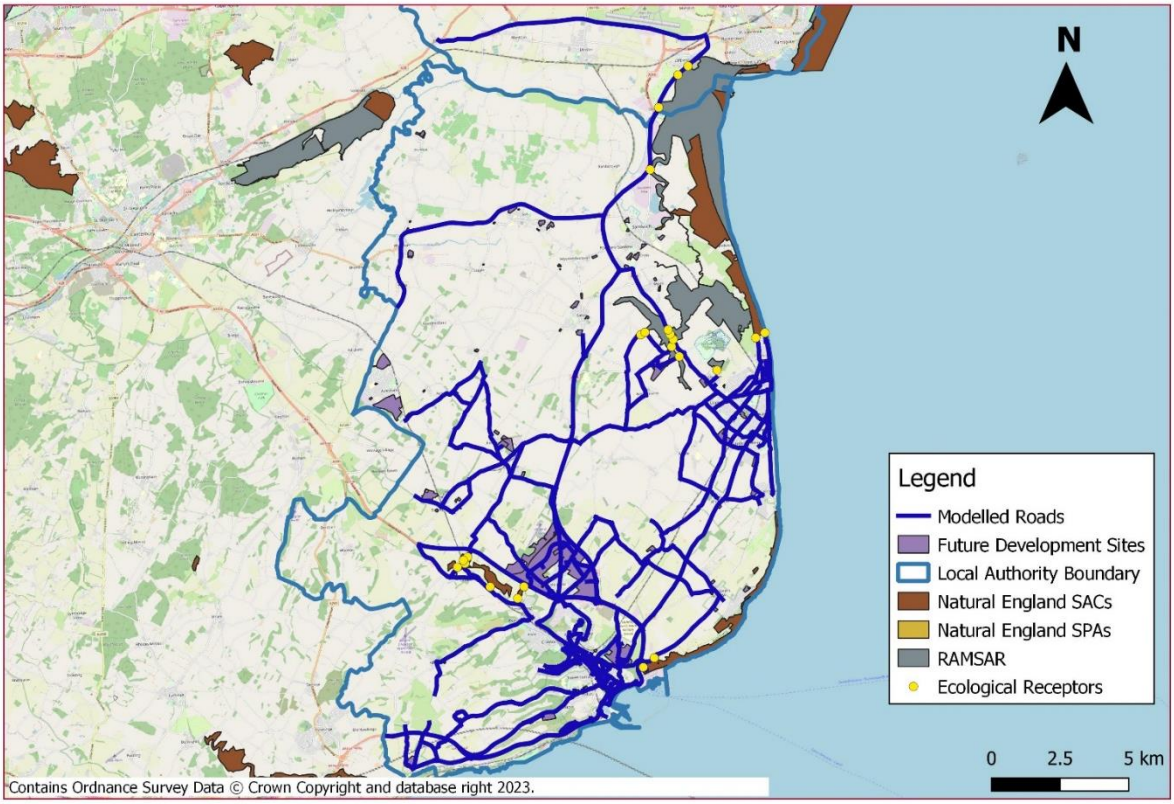
ID	ECO Site	Coordinates		Ecological Designation
		X	Y	
ER1	Dover to Kingsdown Cliffs	633168	142143	SAC
ER5	Dover to Kingsdown Cliffs	633568	142482	SAC
ER8	Lydden & Temple Ewell Downs	628587	144649	SAC
ER9	Lydden & Temple Ewell Downs	628819	145078	SAC
ER10	Lydden & Temple Ewell Downs	627585	145073	SAC
ER13	Lydden & Temple Ewell Downs	626666	145920	SAC
ER14	Lydden & Temple Ewell Downs	626764	146160	SAC
ER15	Lydden & Temple Ewell Downs	626609	146037	SAC
ER18	Lydden & Temple Ewell Downs	626393	145787	SAC
ER22	Thanet Coast & Sandwich Bay	635858	152967	RAMSAR
ER24	Thanet Coast & Sandwich Bay	634483	153468	RAMSAR
ER29	Thanet Coast & Sandwich Bay	634201	153826	RAMSAR
ER29-1	Thanet Coast & Sandwich Bay	634197	153830	RAMSAR
ER30	Thanet Coast & Sandwich Bay	634264	154090	RAMSAR
ER30-1	Thanet Coast & Sandwich Bay	634271	154095	RAMSAR

[5] Department for Environment, Food & Rural AffairsEmissions, 2023. Factors Toolkit v12.0. https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/

ID	ECO Site	Coordinates		Ecological Designation
		X	Y	
ER30-2	Thanet Coast & Sandwich Bay	634276	154098	RAMSAR
ER30-3	Thanet Coast & Sandwich Bay	634279	154100	RAMSAR
ER31	Thanet Coast & Sandwich Bay	634148	154278	RAMSAR
ER31-1	Thanet Coast & Sandwich Bay	634144	154276	RAMSAR
ER33	Thanet Coast & Sandwich Bay	634074	154441	RAMSAR
ER33-1	Thanet Coast & Sandwich Bay	634084	154441	RAMSAR
ER33-2	Thanet Coast & Sandwich Bay	634089	154441	RAMSAR
ER33-3	Thanet Coast & Sandwich Bay	634095	154441	RAMSAR
ER37	Thanet Coast & Sandwich Bay	633076	154258	RAMSAR
ER38	Thanet Coast & Sandwich Bay	633235	154349	RAMSAR
ER40	Thanet Coast & Sandwich Bay	637605	154332	SPA / RAMSAR
ER41	Sandwich Bay	637271	154149	SAC
ER43	Thanet Coast & Sandwich Bay	633423	160280	SPA / RAMSAR / SAC
ER43-1	Thanet Coast & Sandwich Bay	633428	160278	SPA / RAMSAR / SAC
ER43-2	Thanet Coast & Sandwich Bay	633433	160276	SPA / RAMSAR / SAC
ER43-3	Thanet Coast & Sandwich Bay	633438	160275	SPA / RAMSAR / SAC
ER43-4	Thanet Coast & Sandwich Bay	633443	160273	SPA / RAMSAR / SAC
ER43-5	Thanet Coast & Sandwich Bay	633448	160271	SPA / RAMSAR / SAC
ER43-6	Thanet Coast & Sandwich Bay	633452	160270	SPA / RAMSAR / SAC
ER43-7	Thanet Coast & Sandwich Bay	633457	160269	SPA / RAMSAR / SAC
ER43-8	Thanet Coast & Sandwich Bay	633462	160267	SPA / RAMSAR / SAC
ER43-9	Thanet Coast & Sandwich Bay	633467	160266	SPA / RAMSAR / SAC
ER43-10	Thanet Coast & Sandwich Bay	633472	160264	SPA / RAMSAR / SAC
ER43-11	Thanet Coast & Sandwich Bay	633476	160263	SPA / RAMSAR / SAC
ER43-12	Thanet Coast & Sandwich Bay	633481	160261	SPA / RAMSAR / SAC
ER43-13	Thanet Coast & Sandwich Bay	633486	160260	SPA / RAMSAR / SAC
ER43-14	Thanet Coast & Sandwich Bay	633491	160258	SPA / RAMSAR / SAC
ER45	Thanet Coast & Sandwich Bay	633736	162544	SPA / RAMSAR
ER45-1	Thanet Coast & Sandwich Bay	633740	162543	SPA / RAMSAR
ER45-2	Thanet Coast & Sandwich Bay	633744	162542	SPA / RAMSAR
ER45-3	Thanet Coast & Sandwich Bay	633749	162541	SPA / RAMSAR
ER45-4	Thanet Coast & Sandwich Bay	633754	162539	SPA / RAMSAR
ER45-5	Thanet Coast & Sandwich Bay	633759	162538	SPA / RAMSAR
ER45-6	Thanet Coast & Sandwich Bay	633764	162537	SPA / RAMSAR
ER45-7	Thanet Coast & Sandwich Bay	633768	162536	SPA / RAMSAR
ER45-8	Thanet Coast & Sandwich Bay	633773	162535	SPA / RAMSAR
ER45-9	Thanet Coast & Sandwich Bay	633779	162534	SPA / RAMSAR / SAC
ER45-10	Thanet Coast & Sandwich Bay	633783	162533	SPA / RAMSAR / SAC
ER45-11	Thanet Coast & Sandwich Bay	633788	162532	SPA / RAMSAR / SAC
ER45-12	Thanet Coast & Sandwich Bay	633793	162531	SPA / RAMSAR / SAC
ER46	Thanet Coast & Sandwich Bay	634439	163729	SPA / RAMSAR / SAC
ER46-1	Thanet Coast & Sandwich Bay	634443	163726	SPA / RAMSAR / SAC
ER46-2	Thanet Coast & Sandwich Bay	634446	163722	SPA / RAMSAR / SAC
ER46-3	Thanet Coast & Sandwich Bay	634450	163718	SPA / RAMSAR / SAC
ER46-4	Thanet Coast & Sandwich Bay	634454	163714	SPA / RAMSAR / SAC
ER46-5	Thanet Coast & Sandwich Bay	634457	163711	SPA / RAMSAR / SAC
ER46-6	Thanet Coast & Sandwich Bay	634461	163708	SPA / RAMSAR / SAC
ER46-7	Thanet Coast & Sandwich Bay	634464	163704	SPA / RAMSAR / SAC
ER46-8	Thanet Coast & Sandwich Bay	634468	163701	SPA / RAMSAR / SAC
ER46-9	Thanet Coast & Sandwich Bay	634471	163698	SPA / RAMSAR / SAC
ER46-10	Thanet Coast & Sandwich Bay	634475	163695	SPA / RAMSAR / SAC

ID	ECO Site	Coordinates		Ecological Designation
		X	Y	
ER46-11	Thanet Coast & Sandwich Bay	634479	163691	SPA / RAMSAR / SAC
ER48	Thanet Coast & Sandwich Bay	634804	164053	SAC
ER48-1	Thanet Coast & Sandwich Bay	634804	164047	SPA / RAMSAR / SAC
ER48-2	Thanet Coast & Sandwich Bay	634804	164041	SPA / RAMSAR / SAC
ER48-3	Thanet Coast & Sandwich Bay	634804	164033	SPA / RAMSAR / SAC
ER48-4	Thanet Coast & Sandwich Bay	634804	164027	SPA / RAMSAR / SAC
ER48-5	Thanet Coast & Sandwich Bay	634804	164020	SPA / RAMSAR / SAC
ER48-6	Thanet Coast & Sandwich Bay	634804	164013	SPA / RAMSAR / SAC
ER48-7	Thanet Coast & Sandwich Bay	634804	164007	SPA / RAMSAR / SAC
ER48-8	Thanet Coast & Sandwich Bay	634805	164000	SPA / RAMSAR / SAC
ER48-9	Thanet Coast & Sandwich Bay	634808	163996	SPA / RAMSAR / SAC
ER48-10	Thanet Coast & Sandwich Bay	634812	163993	SPA / RAMSAR / SAC
ER48-11	Thanet Coast & Sandwich Bay	634815	163989	SPA / RAMSAR / SAC
ER48-12	Thanet Coast & Sandwich Bay	634821	163988	SPA / RAMSAR / SAC

Figure 4.1 – Modelled Road Links and Receptor Locations with respect to Future Development Sites and Ecological Sites



4.1.3 Other Model Inputs

The meteorological data, surface roughness and minimum Monin-Obukhov length are the same as the previous assessment. Details are presented in the report ref. AIR7493485.

4.1.4 Deposition

Ecological receptors can be sensitive to the deposition of pollutants, particularly nitrogen and sulphur compounds, which can affect the character of the habitat through eutrophication and acidification.

Deposition processes in the form of dry and wet deposition remove material from a plume and alter the plume concentration. Dry deposition occurs when particles are brought to the surface by gravitational settling and turbulence. They are then removed from the atmosphere by deposition on the land surface. Wet deposition occurs due to rainout (within cloud) scavenging and washout (below cloud) scavenging of the material in the plume. These processes lead to a variation with downwind distance of the plume strength and may alter the shape of the vertical concentration profile as dry deposition only occurs at the surface.

Near to sources of pollutants (< 2 km), dry deposition is the predominant removal mechanism (Fangmeier et al. 1994). Dry deposition may be quantified from the near-surface plume concentration and the deposition velocity (Chamberlin and Chadwick, 1953);

$$F_d = v_d C(x, y, 0)$$

where:

F_d = dry deposition flux (µg m^{-2} s^{-1})

v_d = deposition velocity (m s^{-1})

$C(x, y, 0)$ = ground level concentration (µg m^{-3})

Assuming irreversible uptake, the total wet deposition rate is found by integrating through a vertical column of air;

$$F_w = \int_0^z \Lambda C \, dz$$

where;

F_w = wet deposition flux (µg m^{-2} s^{-1})

Λ = washout co-efficient (s^{-1})

C = local airborne concentration (µg m^{-3})

z = height (m)

The washout co-efficient is an intrinsic function of the rate of rainfall.

Environment Agency guidance AQTAG06 (Environment Agency, 2014) and IAQM guidance[6] recommends deposition velocities for various pollutants, according to land use classification (Table 4.2).

Table 4.2 – Recommended Deposition Velocities

Pollutant	Deposition Velocity (m s^{-1})	
	Short Vegetation	Long Vegetation/Forest
NH_3	0.020	0.030

Source: Environment Agency (2014) 'Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air', AQTAG06 Updated Version (March 2014)'

In order to assess the impacts of deposition, habitat-specific critical loads and critical levels have been created. These are generally defined as (e.g., Nilsson and Grennfelt, 1988):

> *"a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge"*

It is important to distinguish between a critical load and a critical level. The critical load relates to the quantity of a material deposited from air to the ground, whilst critical levels refer to the concentration of a material in air. The UK Air Pollution Information System (APIS) provides critical load data for ecological sites in the UK.

The critical loads used to assess the impact of compounds deposited to land which can result in eutrophication and acidification are expressed in terms of kilograms of nitrogen deposited per hectare per year (kg N ha^{-1} y^{-1}) and kilo equivalents deposited per hectare per year (keq ha^{-1} y^{-1}). To enable a direct comparison against the critical loads, the modelled total wet and dry deposition flux (µg m^{-2} s^{-1}) must be converted into an equivalent value.

For a continuous release, the annual deposition flux of nitrogen can be expressed as:

$$F_{NTot} = \left(\frac{K_2}{K_3}\right) \cdot t \cdot \sum_{i=1}^{T} F_i \left(\frac{M_N}{M_i}\right)$$

where:

F_{NYot} = Annual deposition flux of nitrogen (kg N ha^{-1} y^{-1})

K_2 = Conversion factor for m^2 to ha (= 1x104 m^2 ha^{-1})

K_3 = Conversion factor for µg to kg (= 1x109 µg kg^{-1})

t = Number of seconds in a year (= 3.1536x107 s y^{-1})

i = 1,2,3…….T

T = Total number of nitrogen containing compounds

[6] IAQM, 2019. A guide to the assessment of air quality impacts on designated nature conservation sites: https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2019.pdf

F = Modelled deposition flux of nitrogen containing compound (µg m^{-2} s^{-1})

M_N = Molecular mass of nitrogen (kg)

M = Molecular mass of nitrogen containing compound (kg)

The unit eq (1 keq ≡ 1,000 eq) refers to molar equivalent of potential acidity resulting from e.g. sulphur, oxidised and reduced nitrogen, as well as base cations. Conversion units are provided in AQTAG(06) for nitrogen:

- 1 keq ha^{-1} y^{-1} = 14 kg N ha^{-1} y^{-1}

For the purposes of this assessment, dry deposition rates of nitrogen and acidic equivalents at the identified ecological receptors have been calculated by applying the 'short vegetation' deposition velocities (as detailed in Table 4.2) to the modelled annual mean concentrations of NH_3. Wet deposition has not been assessed since this is not a significant contributor to total deposition over shorter ranges (Fangmeier et al. 1994; Environment Agency, 2006).

Estimated background deposition rates of nutrient nitrogen and total acid deposition for the UK are available via the Air Pollution Information Service (APIS) website (http://www.apis.ac.uk). Table 4.3 provides the estimated 2019-2021 3-year average deposition rates for the ecological receptors considered in this study, as obtained from the APIS website. It should be noted that the level of uncertainty associated with these modelled estimates is relatively high and the results are presented from the model across the UK on a coarse 1km grid square resolution. Considering NH_3 and NO_x emissions are expected to decrease in the future, the background deposition is also likely to be lower in the future 2040 Scenario. Therefore, the use of 2019-2021 3-year average deposition rates as background is a conservative approach to present a precautionary scenario.

Table 4.3 - APIS Background Deposition Rates

ID	Background Nitrogen Deposition (kg N ha-1 y-1)	Background Nitric Acid Deposition (keq ha-1 y-1)
ER1	13.2	1.0
ER5	13.2	1.0
ER8	15.6	1.1
ER9	15.8	1.1
ER10	15.9	1.1
ER13	15.8	1.1
ER14	16.0	1.1
ER15	16.0	1.1
ER18	15.8	1.1
ER22	13.5	1.0
ER24	13.4	1.0
ER29	13.4	1.0
ER30	13.2	0.9
ER31	13.2	0.9
ER33	13.2	0.9
ER37	13.4	1.0
ER38	13.4	1.0
ER40	12.5	0.9
ER41	12.5	0.9
ER43	12.4	0.9
ER45	12.4	0.9
ER46	12.4	0.9
ER48	12.2	0.9
Source: Air Pollution Information Service (APIS) website (http://www.apis.ac.uk)		

4.1.5 Uncertainty and Model Outputs Verification

Due to the number of inputs that are associated with the modelling of the study area there is a level of uncertainty that has to be taken into account when drawing conclusions from the predicted concentrations of NH_3. The predicted concentrations are based upon a number of inputs from a number of different sources; traffic data, background concentrations, emission factors, meteorological data and availability of monitoring data from the assessment areas.

A degree of quality assurance/quality control (QA/QC) is completed throughout the modelling process, though the inputs, modelled outputs, and processing of results, to ensure that the accuracy of the modelled predictions is of a high standard to allow conclusions to be made upon them.

In the absence of a nearby ammonia monitoring station within the model area, the direct verification of the modelled ammonia concentrations is not possible. Therefore, the same verification factor of 2.920 calculated for NO_x in the previous assessment (report ref. AIR7493485) is applied to the road contribution associated ammonia concentrations as a conservative approach.

5. Assessment of Ecological Receptors

The following section considers emissions of ammonia from road traffic at existing ecological receptor locations. The results of the dispersion modelling are provided below, for those ecological receptor locations detailed and illustrated previously (Figure 4.1 and Table 4.1). It should be noted that the ecological receptor points are those within the designated sites that are closest to the road and so are likely to demonstrate the maximum impacts. It is likely that concentrations and deposition rates will be at a lower level across the rest of the site area. All EALs (critical loads and levels) used in the assessment have been agreed with the project ecologist.

5.1 NH_3 Impacts at Ecological Receptors – Project Alone and In Combination

Table 5.1 details the results of the impact assessment for NH_3 for Project Alone and In Combination scenarios.

Table 5.1 – NH_3 Impacts at Ecological Receptors for the Project Alone and In Combination Scenarios

Receptor ID	Annual Mean				
	EAL µg m^{-3}	Project Alone		In Combination	
		PC µg m^{-3}	% PC OF EAL	PC µg m^{-3}	% PC OF EAL
ER1	1	<0.01	0.31	0.01	0.82
ER5	1	<0.01	0.43	0.01	0.78
ER8	1	<0.01	0.13	<0.01	0.20
ER9	1	<0.01	0.15	<0.01	0.28
ER10	1	<0.01	0.23	<0.01	0.29
ER13	1	-0.01	-0.78	<0.01	0.46
ER14	1	-0.01	-0.97	0.01	0.53
ER15	1	<0.01	0.01	<0.01	0.16
ER18	1	<0.01	0.03	<0.01	0.15
ER22	3	<0.01	0.01	<0.01	0.05
ER24	3	<0.01	-0.02	0.01	0.21
ER29	3	0.01	0.31	0.01	0.48
ER30	3	0.01	0.21	0.02	0.69
ER31	3	<0.01	0.12	0.01	0.41
ER33	3	0.01	0.19	0.02	0.69
ER37	3	<0.01	0.01	<0.01	0.03
ER38	3	<0.01	0.01	<0.01	0.03
ER40	3	<0.01	0.01	<0.01	0.02
ER41	3	<0.01	0.01	<0.01	0.04
ER43	3	<0.01	0.15	0.01	0.32
ER45	3	0.01	0.40	0.02	0.80
ER46	3	0.02	0.69	0.04	**1.39**
ER48	3	0.01	0.36	0.02	0.73

EAL = Environmental Assessment Level;
PC = Process Contribution.
% PC greater than 1% are bold.

Table 5.2 – NH_3 Impacts at ER46 for In Combination Scenario – Further Assessment

Receptor ID	Annual Mean				
	EAL µg m^{-3}	PC µg m^{-3}	Background	PEC µg m^{-3}	% PEC OF EAL
ER46	3	0.04	1.1	1.18	39
EAL = Environmental Assessment Level; PC = Process Contribution; PEC = Predicted Environmental Concentration (PC + Background)					

ER13 and ER14 in Lydden & Temple Ewell Downs SAC and ER24 in Thanet Coast & Sandwich Bay RAMSAR see a reduction in the process contribution from the modelled roads for the Project Alone scenario. These negative PC values represent a reduction in traffic flows, likely due to changes in road layouts associated with the new Local Plan developments.

Table 5.1 indicates that, regarding Project Alone impact, all the receptors have a process contribution attributed to the Local Development Plan of less than 1% of the EAL indicating that the first criteria of Natural England assessment guidance is met. Therefore, the Local Development Plan is unlikely to cause a significant impact on all the receptors.

Considering the In Combination impact, Table 5.1 shows that, all of the receptors apart from ER46 have an In Combination PC less than 1%, indicating that the PC at most receptors have met the first criteria of Natural England assessment guidance. Therefore, the Local Development Plan in combination with all other developments in the region is unlikely to cause a significant impact on all the receptors but ER46.

Table 5.2 presents a further assessment against In Combination PEC percentage of EAL for ER46. The PEC at ER46 is below 70% of the Environmental Assessment Level. Therefore, the Local Development Plan in combination with all other developments in the region is unlikely to cause a significant impact at ER46 with regards to ammonia.

5.2 Nitrogen Deposition Rates at Ecological Receptors – Project Alone

Table 5.3 details the results of changes in nitrogen deposition at ecological receptors for the Project Alone scenario, considering both NH_3 and NO_x emissions.

Table 5.3 – Nitrogen Deposition Rates at Ecological Receptors - Project Alone Scenario

Receptor ID	CL (kg N ha^{-1} yr^{-1})	NH_3 PC (kg N ha^{-1} yr^{-1})	NO_x PC (kg N ha^{-1} yr^{-1})	Total PC (kg N ha^{-1} yr^{-1})	% NH_3 PC of CL_{min} (%)	%Total PC of CL_{min} (%)
ER1	10-20	0.02	0.01	0.03	0.16	0.31
ER5	10-20	0.02	0.02	0.04	0.22	0.39
ER8	10-20	0.01	<0.01	0.01	0.07	0.11
ER9	10-20	0.01	0.01	0.01	0.08	0.14
ER10	10-20	0.01	0.01	0.02	0.12	0.20
ER13	10-20	-0.04	-0.04	-0.08	-0.41	-0.78
ER14	10-20	-0.05	-0.05	-0.10	-0.50	-0.96
ER15	10-20	<0.01	<0.01	<0.01	0.01	0.01
ER18	10-20	<0.01	<0.01	<0.01	0.02	0.03
ER22	10-20	<0.01	<0.01	<0.01	0.02	0.04
ER24	10-20	<0.01	<0.01	-0.01	-0.04	-0.08

Receptor ID	CL (kg N ha^{-1} yr^{-1})	NH_3 PC (kg N ha^{-1} yr^{-1})	NO_x PC (kg N ha^{-1} yr^{-1})	Total PC (kg N ha^{-1} yr^{-1})	% NH_3 PC of CL_{min} (%)	%Total PC of CL_{min} (%)
ER29	10-20	0.05	0.03	0.08	0.49	0.80
ER30	10-20	0.03	0.02	0.05	0.33	0.51
ER31	10-20	0.02	0.01	0.03	0.19	0.29
ER33	10-20	0.03	0.02	0.05	0.29	0.49
ER37	10-20	<0.01	<0.01	<0.01	0.02	0.03
ER38	10-20	<0.01	<0.01	<0.01	0.02	0.03
ER40	10-15	<0.01	<0.01	<0.01	0.02	0.02
ER41	10-15	<0.01	<0.01	<0.01	0.02	0.03
ER43	10-20	0.02	<0.01	0.02	0.24	0.24
ER45	10-20	0.06	<0.01	0.06	0.62	0.64
ER46	10-20	0.11	<0.01	0.11	**1.08**	**1.09**
ER48	10-20	0.06	<0.01	0.06	0.56	0.56

CL = Critical load – *the CL selected for each designated site relates to its most N-sensitive habitat (or a similar surrogate) listed on the site citation for which data on Critical Loads are available and is also based on a precautionary approach using professional judgement.*
PC = Process contribution
% PC greater than 1% are bold.

ER13 and ER14 in Lydden & Temple Ewell Downs SAC and ER24 in Thanet Coast & Sandwich Bay RAMSAR see a reduction in the process contribution from the modelled roads. These negative PC values represent a reduction in traffic flows, likely due to changes in road layouts associated with the new Local Plan developments.

Table 5.3 indicates that the total nitrogen deposition PC that is attributed to the Local Development Plan is less than 1% of the minimum critical load at most sites except for ER46, within the Thanet Coast & Sandwich Bay SPA. If only considering the ammonia contribution, the ammonia PC towards nutrient nitrogen deposition is less than 1% of the minimum critical load at all the sites except for ER46 within the Thanet Coast & Sandwich Bay SPA. Therefore, nitrogen deposition from the road contribution attributed by the Local Development Plan can be regarded as not significant within Dover to Kingsdown Cliffs SAC, Lydden & Temple Ewell Downs SAC and Sandwich Bay SAC.

A further assessment at ER46, where the PC is more than 1% of the minimum critical load, is presented in the Table 5.4 below.

Table 5.4 – Nitrogen Deposition Rates at Ecological Receptors (ER46) for Project Alone Scenario – Further Assessment

Receptor ID	CL (kg N ha^{-1} yr^{-1})	NH_3 PC (kg N ha^{-1} yr^{-1})	NO_x PC (kg N ha^{-1} yr^{-1})	Total PC (kg N ha^{-1} yr^{-1})	Background Deposition rate (kg N ha^{-1} yr^{-1})	PEDR (kg N ha^{-1} yr^{-1})	%Total PEDR of CL_{min} (%)
ER46	10-20	0.11	<0.01	0.11	12.4	12.5	125

CL = Critical load – *the CL selected for each designated site relates to its most N-sensitive habitat (or a similar surrogate) listed on the site citation for which data on Critical Loads are available and is also based on a precautionary approach using professional judgement.*
PC = Process contribution
PEDR = Predicted environmental deposition rate (= PC + background)

Table 5.4 provides the predicted deposition rates for receptor ER46 with the PC attributed by the Local Development greater than 1% of the minimum critical loads. ER46 has a total PEDR greater

than 70% of the minimum critical load. This indicates that there may be potential adverse impacts at ER46 within the Thanet Coast & Sandwich Bay RAMSAR and the Thanet Coast & Sandwich Bay SPA, more detailed consideration should be given to these sites.

It should be noted that the background rate alone exceeds the critical load for all sites. The background deposition rate used in this assessment is derived from the 2019- 2021 3-year average APIS database and the background deposition rate is likely to decrease in the future year 2040. The use of 2019-2021 3-year average background deposition is a conservative approach.

The ecological receptor points assessed are those within the designated sites that are closest to the road. It is expected that the impact on nitrogen deposition will reduce as the distance of receptor to road increases. For the receptor location ER46 of which both the total PC towards nitrogen deposition is greater than 1% of the minimum critical loads and the PEDR is greater than 70% of the minimum of the critical loads, a scaled distance study was undertaken to present the reduction of impact with increasing distance from the road.

Table 5.5 below indicates that as the distance from the road increases, the impact at receptor ER46 reduces. For ER46 within the Thanet Coast & Sandwich Bay SPA / RAMSAR and the Sandwich Bay SAC (overlapping designation areas), there is no likely significant impact on nitrogen deposition from road contribution where the distance from the road is greater than **10m**, that is to say that the modelled PC falls below 1% of the minimum critical load at this distance.

Table 5.5 – Nitrogen Deposition Rates at Ecological Receptors: Transects from Road

Receptor ID	Distance to Road (m)	Change between 2040 DM and DS Scenario	
		PC Change (kg N ha^{-1} yr^{-1})	% PC Change Of CL_{min}
ER46	5	0.11	1.09
ER46-1	10	0.08	0.76

CL = Critical load – *the CL selected for each designated site relates to its most N-sensitive habitat (or a similar surrogate) listed on the site citation for which data on Critical Loads are available and is also based on a precautionary approach using professional judgement.*
PC = Process contribution
% PC less than 1% are highlighted in green.

5.3 Nitrogen Deposition Rates at Ecological Receptors – In Combination

Table 5.6 details the results of the nitrogen deposition at ecological receptors for the In Combination Scenario. Manston Airport nitrogen deposition rates PCs have been calculated and added to the relevant receptors, ER43, ER45, ER46 and ER48.

Table 5.6 – Nitrogen Deposition Rates at Ecological Receptors - In Combination Scenario

Receptor ID	CL (kg N ha^{-1} yr^{-1})	NH_3 PC (kg N ha^{-1} yr^{-1})	NO_x PC (kg N ha^{-1} yr^{-1})	Manston Airport PC (kg N ha^{-1} yr^{-1})	Total PC (kg N ha^{-1} yr^{-1})	% NH_3 PC of CL_{min} (%)	%Total PC of CL_{min} (%)
ER1	10-20	0.04	0.04	-	0.08	0.43	0.79
ER5	10-20	0.04	0.03	-	0.07	0.41	0.74
ER8	10-20	0.01	0.01	-	0.02	0.10	0.19
ER9	10-20	0.01	0.01	-	0.03	0.15	0.26
ER10	10-20	0.01	0.01	-	0.03	0.15	0.26
ER13	10-20	0.02	0.02	-	0.04	0.24	0.42
ER14	10-20	0.03	0.02	-	0.05	0.28	0.49

Receptor ID	CL (kg N ha^{-1} yr^{-1})	NH_3 PC (kg N ha^{-1} yr^{-1})	NO_x PC (kg N ha^{-1} yr^{-1})	Manston Airport PC (kg N ha^{-1} yr^{-1})	Total PC (kg N ha^{-1} yr^{-1})	% NH_3 PC of CL_{min} (%)	%Total PC of CL_{min} (%)
ER15	10-20	0.01	0.01	-	0.02	0.08	0.15
ER18	10-20	0.01	0.01	-	0.01	0.08	0.13
ER22	10-20	0.01	0.01	-	0.01	0.07	0.13
ER24	10-20	0.03	0.03	-	0.06	0.32	0.59
ER29	10-20	0.08	0.06	-	0.14	0.76	**1.37**
ER30	10-20	0.11	0.08	-	0.19	**1.07**	**1.92**
ER31	10-20	0.06	0.05	-	0.11	0.64	**1.14**
ER33	10-20	0.11	0.09	-	0.20	**1.07**	**1.96**
ER37	10-20	0.00	0.00	-	0.01	0.04	0.09
ER38	10-20	0.00	0.00	-	0.01	0.04	0.09
ER40	10-15	0.00	0.00	-	0.01	0.04	0.06
ER41	10-15	0.01	0.00	-	0.01	0.06	0.10
ER43	10-20	0.05	0.04	0.11	0.19	0.49	**1.94**
ER45	10-20	0.13	0.10	0.10	0.22	**1.25**	**2.24**
ER46	10-20	0.22	0.17	0.11	0.49	**2.16**	**4.92**
ER48	10-20	0.11	0.09	0.13	0.33	**1.13**	**3.33**

CL = Critical load – *the CL selected for each designated site relates to its most N-sensitive habitat (or a similar surrogate) listed on the site citation for which data on Critical Loads are available and is also based on a precautionary approach using professional judgement.*
PC = Process contribution
% PC greater than 1% are bold.

Table 5.6 indicates that the total PC towards nitrogen deposition attributed by the Local Development Plan in combination with other developments is less than 1% of the minimum critical load at most sites except for ER29, ER30, ER 31 and ER33 within Thanet Coast & Sandwich Bay RAMSAR, and ER43, ER45, ER46 and ER48 within Thanet Coast & Sandwich Bay RAMSAR / SPA and Sandwich Bay SAC. If only considering the ammonia contribution, the ammonia PC towards nutrient nitrogen deposition is less than 1% of the minimum critical load at most sites but ER30 within Thanet Coast & Sandwich Bay RAMSAR, ER45, ER46 and ER48 Thanet Coast & Sandwich Bay RAMSAR / SPA and Sandwich Bay SAC. Therefore, nitrogen deposition from the road contribution attributed by the Local Development Plan in combination with other developments can be regarded as not significant within Dover to Kingsdown Cliffs SAC and Lydden & Temple Ewell Downs SAC.

A further assessment on these receptors with the PC more than 1% of the minimum critical load is presented in the Table 5.7 below.

Table 5.7 – Nitrogen Deposition Rates at Ecological Receptors (ER29, ER30, ER 31, ER33, ER43, ER45, ER46 and ER48) for In Combination Scenario – Further Assessment

Receptor ID	CL (kg N ha^{-1} yr^{-1})	NH_3 PC (kg N ha^{-1} yr^{-1})	NO_x PC (kg N ha^{-1} yr^{-1})	Manston Airport PC (kg N ha^{-1} yr^{-1})	Total PC (kg N ha^{-1} yr^{-1})	Background Deposition rate (kg N ha^{-1} yr^{-1})	PEDR (kg N ha^{-1} yr^{-1})	%Total PEDR of CL_{min} (%)
ER29	10-20	0.08	0.06	-	0.14	16.2	16.4	164
ER30	10-20	0.11	0.08	-	0.19	16.2	16.4	164
ER31	10-20	0.06	0.05	-	0.11	16.2	16.4	164

Receptor ID	CL (kg N ha^{-1} yr^{-1})	NH_3 PC (kg N ha^{-1} yr^{-1})	NO_x PC (kg N ha^{-1} yr^{-1})	Manston Airport PC (kg N ha^{-1} yr^{-1})	Total PC (kg N ha^{-1} yr^{-1})	Background Deposition rate (kg N ha^{-1} yr^{-1})	PEDR (kg N ha^{-1} yr^{-1})	%Total PEDR of CL_{min} (%)
ER33	10-20	0.11	0.09	-	0.20	16.2	16.4	164
ER43	10-20	0.05	0.04	0.11	0.19	13.2	13.4	134
ER45	10-20	0.13	0.10	0.10	0.22	13.2	13.5	135
ER46	10-20	0.22	0.17	0.11	0.49	13.2	13.7	137
ER48	10-20	0.11	0.09	0.13	0.33	13.2	13.5	135

CL = Critical load – *the CL selected for each designated site relates to its most N-sensitive habitat (or a similar surrogate) listed on the site citation for which data on Critical Loads are available and is also based on a precautionary approach using professional judgement.*
PC = Process contribution
PEDR = Predicted environmental deposition rate (= PC + background)

Table 5.7 provides the predicted deposition rates for receptors ER29, ER30, ER 31, ER33, ER43, ER45, ER46 and ER48 with the In Combination PC greater than 1% of the minimum critical loads. It can be found that receptors ER29, ER30, ER 31, ER33, ER43, ER45, ER46 and ER48 all have a total PEDR greater than 70% of the minimum critical load. This indicates that there may be potential adverse impacts at ER29, ER30, ER 31, ER33 within the Thanet Coast & Sandwich Bay RAMSAR, and ER43, ER45, ER46 and ER48 within Thanet Coast & Sandwich Bay RAMSAR / SPA and Sandwich Bay SAC, more detailed consideration should be given to these sites.

It should be noted that the background rate alone exceeds the critical load for all sites. The background deposition rate used in this assessment is derived from the 2019-2021 3-year average APIS database and the background deposition rate is likely to decrease in the future year 2040. The use of 2019-2021 3-year average background deposition is a conservative approach to present a precautionary scenario.

The ecological receptor points assessed are those within the designated sites that are closest to the road. It is expected that the impact on nitrogen deposition will reduce as the distance of receptor to road increases. For the receptor locations receptors ER29, ER30, ER 31, ER33, ER43, ER45, ER46 and ER48 of which both the total In Combination PC towards nitrogen deposition is greater than 1% of the minimum critical loads and the In Combination PEDR is greater than 70% of the minimum of the critical loads, a scaled distance study was undertaken to present the reduction of impact with increasing distance from the road.

Table 5.8 below indicates that as the distance from the road increases, the impact at receptors reduces. Figure 5.1 and Figure 5.2 below shows the transect study results on map.

For ER29 within the Thanet Coast & Sandwich Bay RAMSAR, there is no likely significant impact on nitrogen deposition from road contribution where the distance from the road is greater than 5m. For ER30 and ER33 within the Thanet Coast & Sandwich Bay RAMSAR, there is no likely significant impact on nitrogen deposition from road contribution where the distance from the road is greater than 20m. For ER31 within the Thanet Coast & Sandwich Bay RAMSAR, there is no likely significant impact on nitrogen deposition from road contribution where the distance from the road is greater than 10m.

For ER43 within the Thanet Coast & Sandwich Bay SPA / RAMSAR and Sandwich Bay SAC (overlapping designation areas), there is no likely significant impact on nitrogen deposition from road contribution where the distance from the road is greater than 125m. For ER45 within the Thanet Coast & Sandwich Bay SPA / RAMSAR and Sandwich Bay SAC (overlapping designation areas), there is no likely significant impact on nitrogen deposition from road contribution where the distance from the road is greater than 75m. For ER46 within the Thanet Coast & Sandwich Bay SPA / RAMSAR and Sandwich Bay SAC (overlapping designation areas), there is no likely significant impact on nitrogen deposition from road contribution where the distance from the road is greater

than 60m. For ER48 within the Thanet Coast & Sandwich Bay SPA / RAMSAR and Sandwich Bay SAC (overlapping designation areas), there is no likely significant impact on nitrogen deposition from road contribution where the distance from the road is greater than 75m.

Table 5.8 – Nitrogen Deposition Rates at Ecological Receptors: Transects from Road

Receptor ID	Distance to Road (m)	Change between 2040 DM and DS Scenario	
		PC Change (kg N ha^{-1} yr^{-1})	% PC Change of CL_{min}
ER29	0	0.14	1.37
ER29-1	5	0.08	0.79
ER30	5	0.19	1.92
ER30-1	10	0.13	1.35
ER30-2	15	0.11	1.06
ER30-3	20	0.09	0.90
ER31	5	0.11	1.14
ER31-1	10	0.08	0.81
ER33	5	0.20	1.96
ER33-1	10	0.14	1.39
ER33-2	15	0.11	1.08
ER33-3	20	0.09	0.89
ER43	55	0.19	1.94
ER43-1	60	0.18	1.80
ER43-2	65	0.17	1.71
ER43-3	70	0.16	1.58
ER43-4	75	0.15	1.50
ER43-5	80	0.14	1.43
ER43-6	85	0.14	1.36
ER43-7	90	0.12	1.23
ER43-8	95	0.12	1.22
ER43-9	100	0.12	1.15
ER43-10	105	0.11	1.14
ER43-11	110	0.10	1.02
ER43-12	115	0.10	1.01
ER43-13	120	0.10	1.00
ER43-14	125	0.09	0.94
ER45	15	0.32	3.22
ER45-1	20	0.27	2.71
ER45-2	25	0.23	2.33
ER45-3	30	0.20	2.01
ER45-4	35	0.18	1.81
ER45-5	40	0.16	1.63
ER45-6	45	0.15	1.48
ER45-7	50	0.14	1.35
ER45-8	55	0.13	1.26
ER45-9	60	0.12	1.16

Receptor ID	Distance to Road (m)	Change between 2040 DM and DS Scenario	
		PC Change (kg N ha^{-1} yr^{-1})	% PC Change of CL_{min}
ER45-10	65	0.11	1.08
ER45-11	70	0.10	1.02
ER45-12	75	0.10	0.97
ER46	5	0.49	4.92
ER46-1	10	0.35	3.47
ER46-2	15	0.27	2.68
ER46-3	20	0.22	2.17
ER46-4	25	0.18	1.83
ER46-5	30	0.16	1.62
ER46-6	35	0.14	1.42
ER46-7	40	0.13	1.27
ER46-8	45	0.12	1.19
ER46-9	50	0.11	1.08
ER46-10	55	0.10	1.00
ER46-11	60	0.09	0.92
ER48	15	0.33	3.33
ER48-1	20	0.28	2.80
ER48-2	25	0.24	2.42
ER48-3	30	0.21	2.08
ER48-4	35	0.18	1.83
ER48-5	40	0.17	1.66
ER48-6	45	0.15	1.49
ER48-7	50	0.13	1.35
ER48-8	55	0.12	1.24
ER48-9	60	0.11	1.14
ER48-10	65	0.11	1.11
ER48-11	70	0.10	1.02
ER48-12	75	0.10	0.96

CL = Critical load – *the CL selected for each designated site relates to its most N-sensitive habitat (or a similar surrogate) listed on the site citation for which data on Critical Loads are available and is also based on a precautionary approach using professional judgement.*

PC = Process contribution

% PC less than 1% are highlighted in green.

Figure 5.1 – In Combination Nitrogen Deposition PC Transect Study Results – ER29, ER30, ER31 and ER33

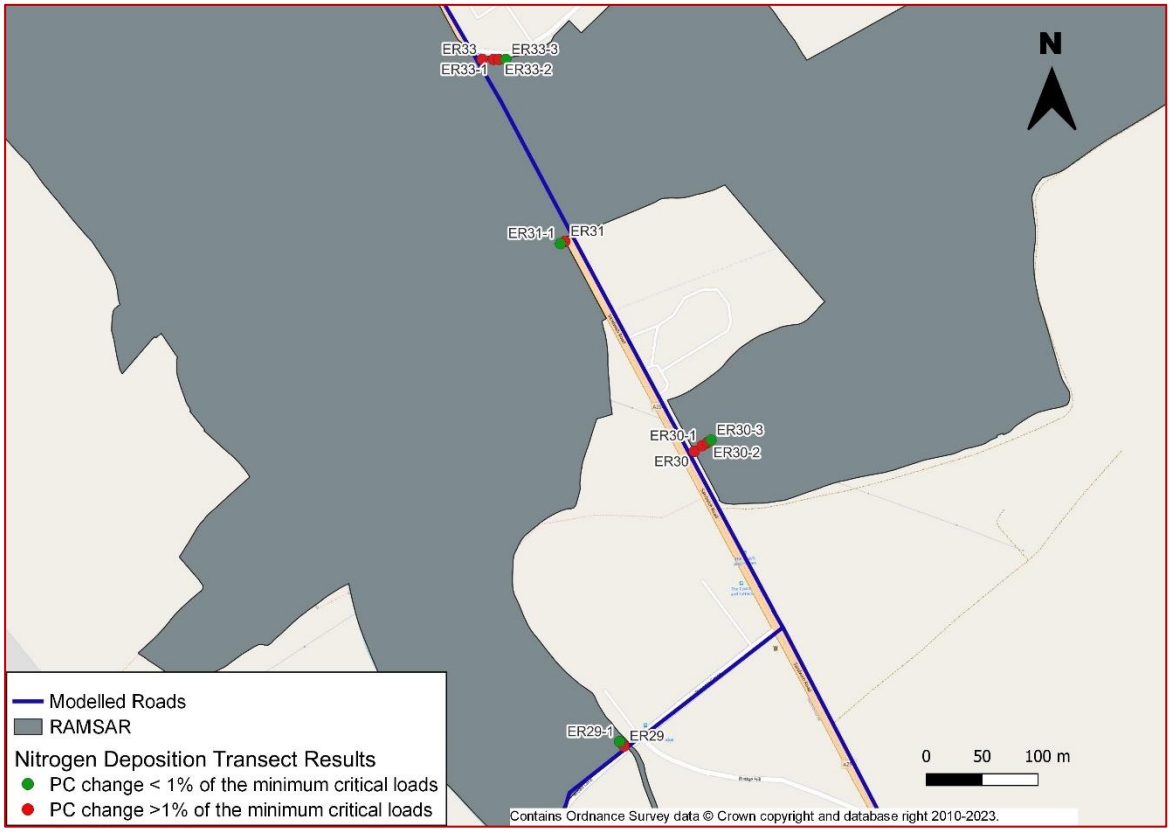
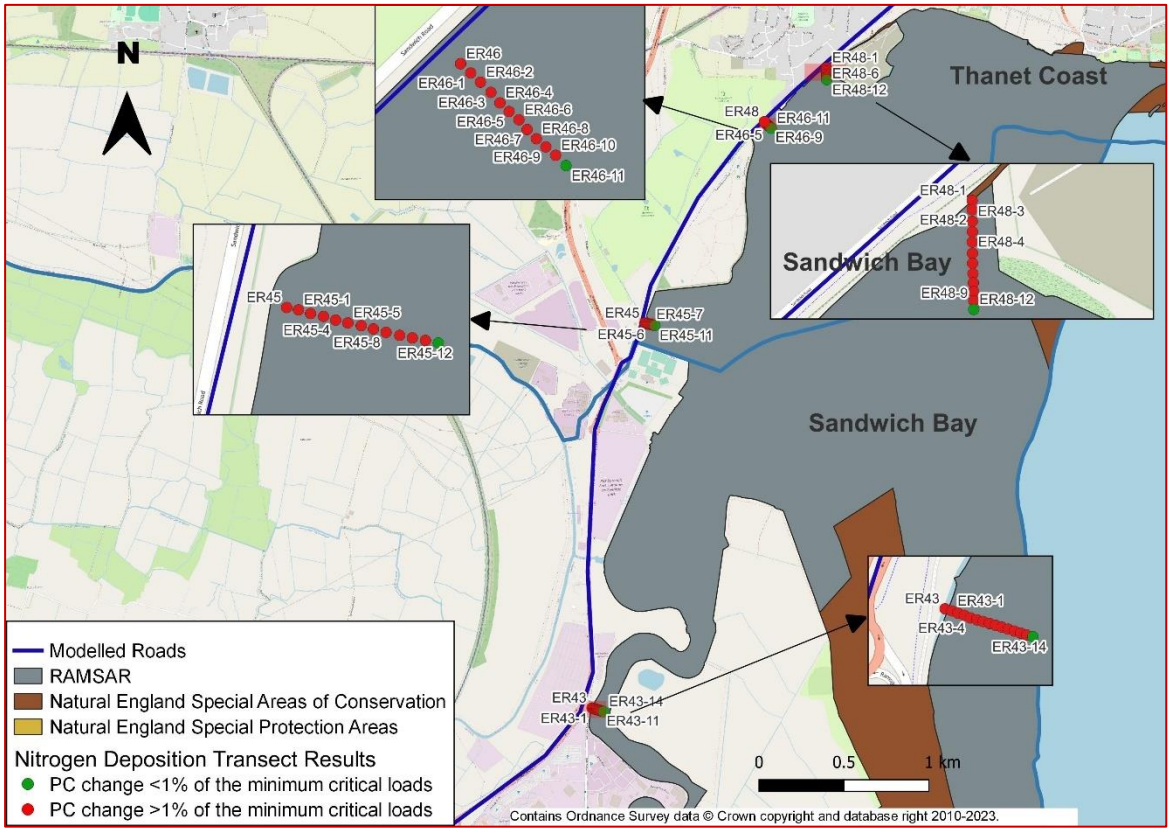


Figure 5.2 – In Combination Nitrogen Deposition PC Transect Study Results – ER43, ER45, ER46 and ER48



5.4 Acid Deposition Rates at Ecological Receptors – Project Alone

Table 5.9 details the results of the nitric acid deposition at ecological receptors for Project Alone scenario.

Table 5.9 – Nitric Acid Deposition Rates at Ecological Receptors – Project Alone Scenario

Receptor ID	CL (keq ha^{-1} yr^{-1})	NH_3 N PC (keq ha^{-1} yr^{-1})	NO_X N PC (keq ha^{-1} yr^{-1})	Total N PC (keq ha^{-1} yr^{-1})	% NH_3 PC of CL_{min} (%)	%Total N PC of CL_{min} (%)
ER1	0.9	<0.01	<0.01	<0.01	0.13	0.24
ER5	0.9	<0.01	<0.01	<0.01	0.17	0.31
ER8	0.9	<0.01	<0.01	<0.01	0.05	0.09
ER9	0.9	<0.01	<0.01	<0.01	0.06	0.11
ER10	0.9	<0.01	<0.01	<0.01	0.09	0.16
ER13	0.9	<0.01	<0.01	-0.01	-0.32	-0.62
ER14	0.9	<0.01	<0.01	-0.01	-0.40	-0.76
ER15	0.9	<0.01	<0.01	<0.01	0.01	0.01
ER18	0.9	<0.01	<0.01	<0.01	0.01	0.03
ER22	N/A	<0.01	<0.01	<0.01	N/A	N/A
ER24	N/A	<0.01	<0.01	<0.01	N/A	N/A
ER29	N/A	0.01	<0.01	0.01	N/A	N/A
ER30	N/A	<0.01	<0.01	<0.01	N/A	N/A

Receptor ID	CL (keq ha^{-1} yr^{-1})	NH_3 N PC (keq ha^{-1} yr^{-1})	NO_X N PC (keq ha^{-1} yr^{-1})	Total N PC (keq ha^{-1} yr^{-1})	% NH_3 PC of CL_{min} (%)	%Total N PC of CL_{min} (%)
ER31	N/A	<0.01	<0.01	<0.01	N/A	N/A
ER33	N/A	<0.01	<0.01	<0.01	N/A	N/A
ER37	N/A	<0.01	<0.01	<0.01	N/A	N/A
ER38	N/A	<0.01	<0.01	<0.01	N/A	N/A
ER40	0.9	<0.01	<0.01	<0.01	0.01	0.01
ER41	0.9	<0.01	<0.01	<0.01	0.02	0.03
ER43	N/A	<0.01	<0.01	<0.01	N/A	N/A
ER45	N/A	<0.01	<0.01	<0.01	N/A	N/A
ER46	N/A	0.01	<0.01	0.01	N/A	N/A
ER48	N/A	<0.01	<0.01	<0.01	N/A	N/A

CL = Critical load – *the CL selected for each designated site relates to its most N-sensitive habitat (or a similar surrogate) listed on the site citation for which data on Critical Loads are available and is also based on a precautionary approach using professional judgement.*

PC = Process contribution
N/A = No CL exists for these habitats

ER13 and ER14 within Lydden & Temple Ewell Downs SAC are seeing a reduction in the PC from the modelled roads. These negative PC values represent a reduction in traffic flows which is likely due changes in road layouts associated with the new Local Plan developments.

Table 5.9 indicates that the total PC towards the acid deposition rates attributed by the Local Development Plan is less than 1% of the minimum critical load at all 11 ecological sites which has habitats sensitive to acid deposition. The main habitat within Thanet Coast and Sandwich Bay Ramsar site are not sensitive to acid deposition. Therefore, acid deposition attributed by the Local Development Plan can be regarded as not significant at all the ecological receptors.

5.5 Acid Deposition Rates at Ecological Receptors – In Combination

Table 5.10 details the results of the acid deposition at ecological receptors for In Combination scenario. Manston Airport nitric acid deposition rates PCs have been calculated and added to the relevant receptors, ER43, ER45, ER46 and ER48.

Table 5.10 – Nitric Acid Deposition Rates at Ecological Receptors – In Combination Scenario

Receptor ID	CL (keq ha^{-1} yr^{-1})	NH_3 PC (keq ha^{-1} yr^{-1})	NO_X PC (keq ha^{-1} yr^{-1})	Manston Airport PC (keq ha^{-1} yr^{-1})	Total PC (keq ha^{-1} yr^{-1})	% NH_3 PC of CL_{min} (%)	%Total PC of CL_{min} (%)
ER1	0.9	<0.01	<0.01	-	0.01	0.34	0.62
ER5	0.9	<0.01	<0.01	-	0.01	0.32	0.58
ER8	0.9	<0.01	<0.01	-	<0.01	0.08	0.15
ER9	0.9	<0.01	<0.01	-	<0.01	0.12	0.21
ER10	0.9	<0.01	<0.01	-	<0.01	0.12	0.21
ER13	0.9	<0.01	<0.01	-	<0.01	0.19	0.34
ER14	0.9	<0.01	<0.01	-	<0.01	0.22	0.39
ER15	0.9	<0.01	<0.01	-	<0.01	0.07	0.12
ER18	0.9	<0.01	<0.01	-	<0.01	0.06	0.11
ER22	N/A	<0.01	<0.01	-	<0.01	N/A	N/A

Receptor ID	CL (keq ha^{-1} yr^{-1})	NH_3 PC (keq ha^{-1} yr^{-1})	NO_X PC (keq ha^{-1} yr^{-1})	Manston Airport PC (keq ha^{-1} yr^{-1})	Total PC (keq ha^{-1} yr^{-1})	% NH_3 PC of CL_{min} (%)	%Total PC of CL_{min} (%)
ER24	N/A	<0.01	<0.01	-	<0.01	N/A	N/A
ER29	N/A	0.01	<0.01	-	0.01	N/A	N/A
ER30	N/A	0.01	0.01	-	0.01	N/A	N/A
ER31	N/A	<0.01	<0.01	-	0.01	N/A	N/A
ER33	N/A	0.01	0.01	-	0.01	N/A	N/A
ER37	N/A	<0.01	<0.01	-	<0.01	N/A	N/A
ER38	N/A	<0.01	<0.01	-	<0.01	N/A	N/A
ER40	0.9	<0.01	<0.01	-	<0.01	0.03	0.05
ER41	0.9	<0.01	<0.01	-	<0.01	0.05	0.08
ER43	N/A	<0.01	<0.01	0.01	0.01	N/A	N/A
ER45	N/A	0.01	0.01	0.01	0.02	N/A	N/A
ER46	N/A	0.02	0.01	0.01	0.04	N/A	N/A
ER48	N/A	0.01	0.01	0.01	0.02	N/A	N/A
	CL = Critical load – *the CL selected for each designated site relates to its most N-sensitive habitat (or a similar surrogate) listed on the site citation for which data on Critical Loads are available and is also based on a precautionary approach using professional judgement.* PC = Process contribution N/A = No CL exists for these habitats						

Table 5.10 indicates that the total PC towards acid deposition attributed by the Local Development Plan in combination with other developments is less than 1% of the minimum critical load at all 11 ecological sites which has habitats sensitive to acid depositions. Main habitats within Thanet Coast and Sandwich Bay Ramsar site are not sensitive to acid deposition. Therefore, nitric acid deposition attributed by the Local Development Plan in combination with other developments can be regarded as not significant at all the ecological receptors.

6. Conclusions

Bureau Veritas UK Ltd has been commissioned by Dover District Council to complete an additional Air Quality Assessment for ammonia to supplement the Council's New Local Plan, following the requirement of Natural England. The Local Plan covers the proposed development across Dover District, the modelling assessment has therefore included all major roads and roads that are relevant to the proposed development sites. Additionally, the model domain was extended into Thanet, to ensure that proposed development was not adversely affecting air quality in the neighbouring Local Authority.

This assessment has been completed based upon the requirements outlined by Natural England and the Council. The methodology for assessing ammonia concentrations has been agreed by Natural England.

The assessment of air quality effects in relation to the operation of the developments outlined in the Local Plan has been undertaken quantitatively in accordance with the impact designations presented within the Natural England Guidance. The assessment considered ambient NH_3 concentrations to which ecological receptors may be exposed to if the Local Plan were to proceed. This was based on a review of current site layout plans, pollutant concentrations and the predicted traffic generated from the development, supported by the relevant guidance.

From the Project Alone predicted results it has been shown that the Local Development Plan is unlikely to have a significant effect upon annual mean concentrations of NH_3 at all receptor

locations, as all the receptors have a predicted PC attributed by the Local Development Plan below 1% of the minimum environmental assessment level.

From the In Combination predicted results it has been shown that the Local Development Plan in combination with other developments in the region is unlikely to have a significant effect upon annual mean concentrations of NH_3 at all receptor locations, as all but one receptor ER46 has a predicted In Combination PC below 1% of the minimum environmental assessment level. However, for the receptor ER46, the In Combination PEC is predicted to be below 70% of the minimum environmental assessment level, therefore, the impact at ER46 can also be considered not significant with regard to NH_3 concentrations.

The assessment has also considered the ammonia component of nitrogen and acid deposition rates. There are exceedances of the CL_{min} at all sites. However, in each case the background deposition rate alone exceeds the CL_{min} prior to the addition of the road contribution. Each of the exceedances are therefore primarily attributed to the background deposition rate. The background deposition rates used in the assessment are derived from the 2019-2021 3-year average APIS dataset. The use of 2019-2021 average background deposition rates is a conservative approach as it is likely that the background deposition rate in the future year 2040 will be lower.

From the Project Alone predicted results, it has been shown that the Local Development Plan is unlikely to have a significant effect upon nitrogen deposition at most receptor locations as the PC attributed by the Local Development Plan is below 1% of the minimum critical loads. However, further assessment was needed for one receptor location, ER46, with both the PC towards nitrogen deposition is greater than 1% of the minimum critical loads and the PEDR is greater than 70% of the minimum critical loads. A transect study was conducted to assess the changes of impact with the distance to roadside on this receptors. A conclusion on the predicted results of the designation areas is as below with regard to nitrogen deposition:

- All receptors within the Dover to Kingsdown Cliffs SAC – **Unlikely to have significant impact**.
- All receptors within the Lydden & Temple Ewell Downs SAC – **Unlikely to have significant impact**.
- ER46 within the Thanet Coast & Sandwich SPA / RAMSAR and Sandwich Bay SAC - Unlikely to have significant impact beyond **10m from roadside**.
- All other receptors within the Thanet Coast & Sandwich Bay SPA / RAMSAR and Sandwich Bay SAC – **Unlikely to have significant impact**.

From the In Combination predicted results, it has been shown that the Local Development Plan in combination with other developments in the region is unlikely to have a significant effect upon nitrogen deposition at most receptor locations as the PC attributed by the Local Development Plan is below 1% of the minimum critical loads. However, further assessment was needed for the eight receptor locations with both the PC towards nitrogen deposition is greater than 1% of the minimum critical loads and the PEDR is greater than 70% of the minimum critical loads. A transect study was conducted to assess the changes of impact with the distance to roadside on the eight receptors. A conclusion on the predicted results of the designation areas is as below with regard to nitrogen deposition:

- All receptors within the Dover to Kingsdown Cliffs SAC – **Unlikely to have significant impact**.
- All receptors within the Lydden & Temple Ewell Downs SAC – **Unlikely to have significant impact**.
- ER29 within the Thanet Coast & Sandwich Bay RAMSAR - Unlikely to have significant impact beyond **5m from roadside**.
- ER30 within the Thanet Coast & Sandwich Bay RAMSAR - Unlikely to have significant impact beyond **20m from roadside**.

- ER31 beyond the Thanet Coast & Sandwich Bay RAMSAR - Unlikely to have significant impact from **10m from roadside**.
- ER33 within the Thanet Coast & Sandwich Bay RAMSAR - Unlikely to have significant impact beyond **20m from roadside**.
- ER43 within the Thanet Coast & Sandwich SPA / RAMSAR and Sandwich Bay SAC - Unlikely to have significant impact beyond **125m from roadside**.
- ER45 within the Thanet Coast & Sandwich SPA / RAMSAR - Unlikely to have significant impact beyond **75m from roadside**.
- ER46 within the Thanet Coast & Sandwich SPA / RAMSAR and Sandwich Bay SAC - Unlikely to have significant impact beyond **60m from roadside**.
- ER48 within the Thanet Coast & Sandwich SPA / RAMSAR and Sandwich Bay SAC - Unlikely to have significant impact beyond **75m from roadside**.
- All other receptors within the Thanet Coast & Sandwich Bay SPA / RAMSAR and Sandwich Bay SAC – **Unlikely to have significant impact**.

From the Project Alone predicted results, it has also been shown that the Local Development Plan is unlikely to have a significant effect upon nitric acid deposition at all the 11 receptor locations which have habitat sensitive to acid deposition, as the PC attributed by the Local Development Plan is below 1% of the minimum critical loads.

From the In Combination predicted results, it has also been shown that the Local Development Plan in combination with other developments is unlikely to have a significant effect upon nitric acid deposition at all the 11 receptor locations which have habitat sensitive to acid deposition, as the In Combination PC is below 1% of the minimum critical loads.

Appendices

Appendix – Example NH_3:NO_X Ratio Calculations

Table A. 1 – 2019 NAEI Traffic Emission Database for Hot Exhaust by Vehicle Type in Urban Area

Vehicle Type	NO_x g/km	NH_3 g/km	NH_3: NO_x Ratio
Petrol cars	0.074	0.003	0.036
Diesel cars	0.582	0.003	0.005
Petrol LGVs	0.068	0.004	0.052
Diesel LGVs	0.915	0.003	0.003
Rigid HGVs	1.712	0.009	0.005
Artic HGVs	1.140	0.009	0.008
Buses	2.954	0.009	0.003
M/cycle	0.081	0.002	0.024

Table A. 2 – NAEI Default Traffic Fleet Composition in 2035 used for Normalisation

Vehicle Type	Percentage Composition %
Petrol cars	45.82
Diesel cars	20.60
Petrol LGVs	0.13
Diesel LGVs	14.70
Rigid HGVs	0.81
Artic HGVs	0.43
Buses	0.72
M/cycle	0.90
Electric car	14.07
Electric LGV	1.82

The NH_3: NO_x ratios have been calculated for each road link used in the Dover Local Plan Modelling based on the adjusted traffic fleet composition. The traffic fleet composition for each road link has been adjusted based on the HGV percentage by normalisation. An example calculation for Road Link ID1 is provided below.

Table A. 3 – Example Calculation for NH_3:NO_x for Road Link ID 1 in Dover Local Plan Modelling for 2040 DM Scenario

Road Link 1 – HGV 1.98% Adjusted Vehicle Composition from Default by Normalisation	
Vehicle Type	**Normalised Percentage Composition %**
Petrol cars	47.47
Diesel cars	33.49
Petrol LGVs	0.22
Diesel LGVs	15.36
Rigid HGVs	0.85
Artic HGVs	0.40
Buses	0.74
M/cycle	1.06
Electric car	0.38
Electric LGV	0.03
Fleet Weighted NH_3: NO_x Ratio = Normalised Percentage Composition% × NH_3: NO_x Ratio by Vehicle Type in Table A. 1	
Vehicle Type	**Fleet Weighted NH_3: NO_x Ratio**
Petrol cars	0.017
Diesel cars	0.002
Petrol LGVs	<0.001
Diesel LGVs	<0.001
Rigid HGVs	<0.001

Artic HGVs	<0.001
Buses	<0.001
M/cycle	<0.001
Electric car	0.000
Electric LGV	0.000
Total NH_3: NO_x Ratio for Road Link ID 1 = Sum of all the Fleet Weighted NH_3: NO_x Ratio	
Total NH_3: NO_x Ratio	0.019
NH_3 Emission Rate to Input into Model = NO_x Emission Rate from EFT × NH_3: NO_x Ratio	
NO_x Emission Rate g/km/s	0.0264
NH_3 Emission Rate g/km/s	0.0005