NE004

Air Quality Habitat Regulations Assessment for the Fareham Borough Local Plan 2021 – 2037

Report for Fareham Borough Council

ED 12794100 | Issue Number 3 | Date 21/09/2020

Customer:

Fareham Borough Council

Contact:

Thomas Adams
Ricardo Energy & Environment
Gemini Building, Harwell, Didcot, OX11 0QR, United Kingdom

t: +44 (0) 1235 75 3517

e: thomas.adams@ricardo.com

Ricardo-AEA Ltd is certificated to ISO9001 and ISO14001

Authors:

Thomas Adams, Mark Broomfield, Charlotte Day, Eilidh Morrison, Abigail Pepler, Martha Preater and Jessica Virdo

Approved By:

Mark Broomfield

Date:

21 September 2020

Ricardo Energy & Environment reference:

Ref: ED12794100- Issue Number 3

Executive Summary

The Borough of Fareham is located in South Hampshire, and is adjacent to Eastleigh, Winchester, Gosport and the City of Portsmouth. There are approximately 117,000 people living within the Fareham Borough area of 74 km^2. The Fareham Borough Local Plan (FBLP) envisages the provision of 8,389 new homes and 130,000 square metres of new employment floorspace up to the year 2037, including a new community at Welborne of 6,000 homes. This represents a significant increase in population, and associated increases in road traffic may have the potential for significant effects on air quality both within Havant Borough and in surrounding areas.

The Transport Assessment, which forms the basis of this Air Quality Habitat Regulations Assessment (HRA), used the housing requirement for Fareham which at the time, was a minimum of 514 dwellings per annum (dpa). However, in August 2020, the Government released a consultation on a new standard methodology which affords Councils the option of using either a percentage of the Borough's existing housing stock as the calculation's starting point or the most up-to-date household projections, whichever is the higher, before an affordability uplift is applied. Fareham Borough Council (FBC) therefore considered it appropriate for the Publication Local Plan to plan for a scale of growth based on the proposed new methodology, and not one based on out-of-date household projections. This has reduced the housing need figure for Fareham to 403 dpa, based on a base date of 2021. This Air Quality HRA report therefore represents an assessment of air quality effects arising from the FBLP based upon out-of-date housing projections (previously reported as at least 11,300 new homes and 130,000 square metres of new employment floorspace in the 25-year period from 2011 to 2036). However, it can be seen in light of the new housing projections as an extra precautionary assessment of the effects of the FBLP on air quality. The FBLP plan period is still for 16 years, therefore given the base date of the new housing projections (2021), the Fareham Borough Local Plan now runs up to 2037.

Fareham Borough includes numerous nature conservation areas of national and international significance. These sites may be adversely affected by increases in air concentrations of pollutants, particularly oxides of nitrogen and ammonia, and the deposition of these pollutants within the habitats.

FBC commissioned an earlier study on air quality in relation to impacts on European-designated habitat sites from developments over the period from 2019 to 2023, in order for the Council to respond to queries being raised during the determination of planning applications. This work is referred to in this report periodically as the Habitats Regulations Assessment for 'short-term development in Fareham Borough'.

This report contains the results of an Air Quality HRA of road traffic emissions associated with the proposed development within Fareham Borough. The HRA forms part of the robust evidence base supporting FBC in connection with their emerging Fareham Borough Local Plan (FBLP) 2021-2037. This study considers the potential impacts of the FBLP in combination with anticipated development from neighbouring local authorities in the Partnership for South Hampshire (PfSH)[1] sub-region. The FBLP study area contains the designated sites with European (or equivalent international) designation, namely Ramsar sites, Special Areas of Conservation (SACs), and Special Protection Areas (SPAs) within a 10 km buffer area around Fareham Borough.

For all European-designated sites contained in the study area, a sub-regional air dispersion model (RapidAir) was used to model predicted air quality impacts at locations within the site as well as within a 500m buffer zone of the site, at a resolution of 3m x 3m. Three traffic scenarios were modelled for the purposes of this study, in order to assess the potential air quality impacts of the FBLP in isolation:

[1] The Partnership for South Hampshire (PfSH) was previously known as the Partnership for Urban South Hampshire (PUSH).

- Fareham 2015 Reference (Fareham 2015 Ref): This model was designed to replicate 2015 traffic conditions within Fareham. It was used to verify the performance of the air dispersion model.
- Fareham 2036 Do Nothing (Fareham 2036 DN): This model represents a scenario including all known current (as of 2019) completed development and infrastructure within Fareham, in addition to all committed development and infrastructure up to 2036. Development associated with the FBLP is not included in this scenario. This is a hypothetical scenario against which to test the impacts of the FBLP, as it assumes the unlikely scenario that there will be no development within Fareham up to 2036, other than at sites which already have planning permission. Outside of Fareham, development growth is assumed to continue as 'normal' and in accordance with adopted Local Plans (or equivalent) of respective neighbouring Boroughs, in accordance with TEMPRO v7.2 growth projections.
- Fareham 2036 Do Minimum (Fareham 2036 DM): This model represents a scenario which includes the FBLP housing and employment development but assumes there will be no further improvements to the transport network, aside from those which are already committed and therefore already included in the Fareham 2036 DN scenario. Development growth outside Fareham is identical to that included in the 2036 DN scenario.

Additionally, in order to assist with an assessment of in combination effects arising from emerging local plans in neighbouring authorities, two further scenarios were modelled. Traffic growth within the in combination study area was provided by Solent Transport's Sub-Regional Transport Model (SRTM)[2] and the outputs from the air dispersion modelling were scaled from the year 2034 to the year 2036. The scenarios were based on two SRTM scenarios covering the larger PfSH sub-region and presented in a previous report:[3]

- PfSH 2036 Baseline (PfSH BL): This model was designed to represent a future scenario without the proposed PfSH development, and it has all land use growth inputs removed from the PfSH sub-region from 2014 onwards. The scale and location of development are assumed to be unchanged from 2014 conditions within the PfSH sub-region. For the remaining model areas outside of the PfSH sub-region, it is assumed that development and growth would continue as expected for 2036, and in accordance with TEMPRO v7.2 growth projections.
- PfSH 2036 Do Minimum (PfSH DM): This model scenario includes development and growth within the PFSH region, equating to approximately 120,000 additional dwellings compared to the 2036 Baseline scenario. It includes transport schemes that are already committed as well as several supporting schemes that are vital to committed development sites even though the schemes themselves may not yet be committed. This scenario includes development in Fareham on the scale of that included in the FBLP, and represents a precautionary approach to the assessment of in combination air quality impacts associated with development across the PFSH sub-region.

Air quality impacts on designated sites were assessed based on predicted annual average airborne concentrations of oxides of nitrogen (NOx) and ammonia (NH_3), as well as annual deposition of nutrient nitrogen and acid. Predicted pollutant contributions associated with the proposed development in the Fareham 2036 DM (for consideration of the FBLP in isolation) and in the PfSH DM (for consideration of the FBLP in combination) scenarios were compared to pollutant screening thresholds. Where the screening analysis indicated that Likely Significant Effects (LSEs) on a designated site could not be ruled out, further analysis was undertaken in the form of an HRA Stage 2 Appropriate Assessment.

[2] Systra, "Technical Report: Push Development & Transport Interventions, 2036 PUSH Do Something Versus 2014 Base", Reference number 102827, 03/06/2016.
[3] Ricardo Energy & Environment, "Partnership for Urban South Hampshire: Air Quality Impact Assessment", Issue 3, September 2018.

This Air Quality HRA indicates that, pre-mitigation, there will be no threat to the ability of these European sites to achieve their conservation objectives or maintain their integrity as a result of the Fareham Borough Local Plan (either alone or in combination):

- Chichester and Langstone Harbours Ramsar & SPA
- New Forest Ramsar & SPA
- New Forest SAC
- Portsmouth Harbour Ramsar & SPA
- River Itchen SAC
- Solent and Dorset Coast SPA
- Solent and Isle of Wight Lagoons SAC
- Solent and Southampton Water Ramsar & SPA
- Solent Maritime SAC

Based on the results of this study, we recommend the following:

- **Development associated with the Fareham Borough Local Plan can take place as set out in this report, with no significant threat due to emissions to air to the ability of any European site to achieve their conservation objectives or maintain their integrity (either alone or in combination).**

The conclusion that development associated with the FBLP will not result in significant adverse effects with regards to NOx concentrations at Portsmouth Harbour Ramsar & SPA, River Itchen SAC, Solent and Southampton Water Ramsar & SPA, and Solent Maritime SAC takes account of forecast trends in NOx, as set out in projections carried out by Defra.

While there is currently no basis for reasonable scientific doubt in the forecast NOx levels, it is recommended that Fareham maintain a watching brief on the Defra forecasts of future trends in airborne NOx, and that a formal review take place at least once every three years. It would be appropriate for this formal review to take place as part of the programme for wider-ranging review of the Fareham Borough Local Plan HRA.

During the HRA for short-term development in Fareham Borough, adverse effects from in combination short-term development within the PfSH region, relating to increased nitrogen deposition to Perennial vegetation of stony banks (PVSB), a qualifying feature of Solent Maritime SAC, could not be ruled out without mitigation. In order to address the adverse effect of nitrogen deposition identified at Solent Maritime SAC to PVSB, a joint Nitrogen Action Plan is being developed by Havant Borough Council with Portsmouth City Council under the Duty to Co-Operate.

In the previous HRA study, Fareham Borough Council was not able to quantify the individual contribution of development within Fareham to in combination effects on the Solent Maritime PVSB. The present study has confirmed that the maximum modelled contribution from the FBLP to the pollutants of concern in this part of the site, is less than 0.025% of the relevant Critical Levels. The contribution from the FBLP is so small as to be considered nugatory. Therefore, there is no requirement for Fareham Borough Council to work with Havant Borough Council, Portsmouth City Council, or any other relevant local authorities, to further develop and implement the Nitrogen Action Plan.

The existing HRA evidence base for designated sites in the New Forest District Council area (discussed in the HRA for short term development in Fareham Borough) showed there is already a system in place to identify and mitigate any adverse effects arising from vehicle emissions within the New Forest Ramsar, SPA and SAC.

During the HRA for short-term development in Fareham Borough, the Council was not able to quantify the individual contribution of development within Fareham to the in combination effects on the New Forest Ramsar, SPA and SAC. The present study has confirmed that the maximum modelled contribution from the FBLP to all four pollutants of concern, in this part of the site, is less than 0.025% of the relevant Critical Levels. The contribution from the FBLP is so small as to be considered nugatory. Therefore, there is no requirement for Fareham Borough Council to work with New Forest District Council, the New Forest National Park Authority, or any other relevant local authorities, to identify and mitigate any adverse effects arising from vehicle emissions within the New Forest Ramsar, SPA and SAC.

Table of contents

Abbreviations

Abbreviation	Explanation
AADT	Annual Average Daily Traffic
APIS	Air Pollution Information System
ASR	Annual Status Report
AURN	Automatic Urban and Rural Network
BEIS	UK Department for Business, Energy & Industrial Strategy
BL	Baseline (a future-year model scenario)
CAZ	Clean Air Zone
CL	Critical Limit/Level
DM	Do Minimum (a future-year model scenario)
DN	Do Nothing (a future-year model scenario)
dpa	Dwellings per annum
EEA	European Environment Agency
EFT	Emissions Factor Toolkit
EMEP	European Monitoring and Evaluation Programme
FBC	Fareham Borough Council
FBLP	Fareham Borough Local Plan
GDM	Gateway Demand Model
GIS	Geographic Information System
HBIC	Hampshire Biodiversity Information Centre
HGV	Heavy Goods Vehicle
HRA	Habitat Regulations Assessment
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LEIM	Local Economic Impact Model
LES	Low Emission Strategy
LGV	Light Goods Vehicle
MDM	Main Demand Model
NAEI	National Atmospheric Emissions Inventory
NH_3	Ammonia
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (NO + NO_2)
NTEM	National Trip End Model
NTS	National Travel Survey
PHI	Priority Habitat Inventory, a GIS dataset from Natural England
$PM_{2.5}$	Particulate matter 2.5 micrometres or less in diameter
PM_{10}	Particulate matter 10 micrometres or less in diameter
PTM	Public Transport Model
PfSH	Partnership for South Hampshire; formerly known as PUSH (Partnership for Urban South Hampshire)
pSPA	Potential Special Protection Area

Abbreviation	Explanation
RMSE	Root Mean Square Error
RTM	Road Traffic Model
SAC	Special Area of Conservation
SPA	Special Protection Area
SRTM	Sub-Regional Transport Model
SSSI	Site of Special Scientific Interest

1 Introduction

The Borough of Fareham is located in South Hampshire, and is adjacent to Eastleigh, Winchester, Gosport and the City of Portsmouth. There are approximately 117,000 people living within the Fareham Borough area of 74 km^2. The Fareham Borough Local Plan (FBLP) envisages the provision of 8,389 new homes and 130,000 square metres of new employment floorspace up to the year 2037, including a new community at Welborne of 6,000 homes. This represents a significant increase in population, and associated increases in road traffic may have the potential for significant effects on air quality both within Havant Borough and in surrounding areas.

The Transport Assessment, which forms the basis of this Air Quality Habitat Regulations Assessment (HRA), used the housing requirement for Fareham which at the time, was a minimum of 514 dwellings per annum (dpa). However, in August 2020, the Government released a consultation on a new standard methodology which affords Councils the option of using either a percentage of the Borough's existing housing stock as the calculation's starting point or the most up-to-date household projections, whichever is the higher, before an affordability uplift is applied. Fareham Borough Council (FBC) therefore considered it appropriate for the Publication Local Plan to plan for a scale of growth based on the proposed new methodology, and not one based on out-of-date household projections. This has reduced the housing need figure for Fareham to 403 dpa, based on a base date of 2021. This Air Quality HRA report therefore represents an assessment of air quality effects arising from the FBLP based upon out-of-date housing projections (previously reported as at least 11,300 new homes and 130,000 square metres of new employment floorspace in the 25-year period from 2011 to 2036). However, it can be seen in light of the new housing projections as an extra precautionary assessment of the effects of the FBLP on air quality. The FBLP plan period is still for 16 years, therefore given the base date of the new housing projections (2021), the Fareham Borough Local Plan now runs up to 2037.

Half of the Borough falls within the countryside. Fareham is bordered by coasts and the Solent to the south, the River Hamble to the west, and adjacent to Portsmouth Harbour to the east; the area surrounding the Borough includes numerous nature conservation areas of national and international significance. These sites may be adversely affected by increases in air concentrations of pollutants, particularly oxides of nitrogen and ammonia, and the deposition of these pollutants within the habitats.

FBC commissioned an earlier study on air quality in relation to impacts on European-designated habitat sites from developments over the period from 2019 to 2023, in order for the Council to respond to queries being raised during the determination of planning applications. This work is referred to in this report periodically as the Habitats Regulations Assessment for 'short-term development in Fareham Borough'.

This report contains the results of an Air Quality HRA of road traffic emissions associated with the proposed development within Fareham Borough. The HRA forms part of the robust evidence base supporting FBC in connection with their emerging Fareham Borough Local Plan (FBLP) 2021-2037. This study considers the potential impacts of the FBLP in combination with anticipated development from neighbouring local authorities in the Partnership for South Hampshire (PfSH)[1] sub-region. The FBLP study area contains the designated sites with European (or equivalent international) designation, namely Ramsar sites, Special Areas of Conservation (SACs), and Special Protection Areas (SPAs) within a 10 km buffer area around Fareham Borough.

For all European-designated sites contained in the study area, a sub-regional air dispersion model (RapidAir) was used to model predicted air quality impacts at locations within the site as well as within a 500m buffer zone of the site, at a resolution of 3m x 3m. Three traffic scenarios were modelled for the purposes of this study, in order to assess the potential air quality impacts of the FBLP:

- Fareham 2015 Reference (Fareham 2015 Ref): This model was designed to replicate 2018 traffic conditions within Fareham. It was used to verify the performance of the air dispersion model.
- Fareham 2036 Do Nothing (Fareham 2036 DN): This model represents a scenario including all known current (as of 2019) completed development and infrastructure within Fareham, in addition to all committed development and infrastructure up to 2036. Development associated with the FBLP is not included in this scenario. This is a hypothetical scenario against which to test the impacts of the FBLP, as it assumes the unlikely scenario that there will be no development within Fareham up to 2036, other than at sites which already have planning permission. Outside of Fareham, development growth is assumed to continue as 'normal' and in accordance with adopted Local Plans (or equivalent) of respective neighbouring Boroughs, in accordance with TEMPRO v7.2 growth projections.
- Fareham 2036 Do Minimum (Fareham 2036 DM): This model represents a scenario which includes the FBLP housing and employment development but assumes there will be no further improvements to the transport network, aside from those which are already committed and therefore already included in the Fareham 2036 DN scenario. Development growth outside Fareham is identical to that included in the 2036 DN scenario.

Additionally, in order to assist with an assessment of in combination effects arising from emerging local plans in neighbouring authorities, two further scenarios were modelled. Traffic growth within the in combination study area was provided by Solent Transport's Sub-Regional Transport Model (SRTM)[2] and scaled from the year 2034 to the year 2036. The scenarios were based on two SRTM scenarios covering the larger PfSH sub-region and presented in a previous report:[3]

- PfSH 2036 Baseline (PfSH BL): This model was designed to represent a future scenario without the proposed PfSH development, and it has all land use growth inputs removed from the PfSH sub-region from 2014 onwards. The scale and location of development are assumed to be unchanged from 2014 conditions within the PfSH sub-region. For the remaining model areas outside of the PfSH sub-region, it is assumed that development and growth would continue as expected for 2036, and in accordance with TEMPRO v7.2 growth projections.
- PfSH 2036 Do Minimum (PfSH DM): This model scenario includes development and growth within the PFSH region, equating to approximately 120,000 additional dwellings compared to the 2036 Baseline scenario. It includes transport schemes that are already committed as well as several supporting schemes that are vital to committed development sites even though the schemes themselves may not yet be committed. This scenario includes development in Fareham on the scale of that included in the FBLP, and represents a precautionary approach to the assessment of in combination air quality impacts associated with development across the PFSH sub-region.

Air quality impacts on designated sites were assessed based on predicted annual average airborne concentrations of oxides of nitrogen (NOx) and ammonia (NH_3), as well as annual deposition of nutrient nitrogen and acid. Predicted pollutant contributions associated with the proposed development in the Fareham 2036 DM (for consideration of the FBLP in isolation) and in the PfSH DM (for consideration of the FBLP in combination) scenarios were compared to pollutant screening thresholds. Where the screening analysis indicated that Likely Significant Effects (LSEs) on a designated site could not be ruled out, further analysis was undertaken in the form of an HRA Stage 2 Appropriate Assessment.

2 Method Statement

2.1 Study Overview

This study has been carried out using air dispersion modelling to predict the air quality impacts of increased vehicle emissions arising from the FBLP. To account for in combination impacts from development within multiple local authorities, the air dispersion modelling is underpinned by a transport model which explicitly includes in combination impacts from housing development throughout the South Hampshire region. The model includes development in East Hampshire (part), Eastleigh, Fareham, Gosport, Havant, Isle of Wight, New Forest, Portsmouth, Southampton, Test Valley (part), and Winchester (part).

The in combination transport model was originally designed to account for combined development in the South Hampshire region up to the year 2034. For the purposes of this study, the outputs from the air dispersion model have been projected forward to the year 2036, using a scaling factor based on Fareham's anticipated level of development in 2036 versus the anticipated development in 2034 (an additional 3,896 dwellings). This approach has assumed that neighbouring local authorities follow a similar development trajectory in terms of their development in 2036 compared to 2034.

Aside from housing development, no other plans or projects have been identified for consideration of in combination effects.

This chapter begins by describing the transport modelling upon which the air quality modelling was based, using information from the traffic model developers (Systra). It then goes on to describe the air quality modelling methodology utilised for the three Fareham model scenarios (Fareham 2015 Ref, Fareham 2036 DN and Fareham 2036 DM), as well as the methodology for the assessment of impacts on designated sites.

The two in combination model scenarios (PfSH 2036 BL and PfSH 2036 DM) are also described in this chapter. Modelling methodology for the PfSH scenarios was described in a previous report.[3]

2.2 FBLP Transport Model

2.2.1 Transport model development

Systra Consultancy was commissioned to develop a Sub-Regional Transport Model (SRTM) that covered the South Hampshire sub-region, including the areas of Southampton and Portsmouth. The SRTM was developed to support a wide-ranging set of interventions across the sub-region, and was specifically required to be capable of the following:[4]

- Forecasting changes in travel demand, road traffic, public transport patronage and active mode (walking and cycling) use over time as a result of changing economic conditions, land-use policies and development, and transport improvements and interventions;
- Testing the impacts of land-use and transport policies; and
- Testing the impacts of individual transport interventions in the detail necessary for preparing submissions for inclusions in funding programmes.

The SRTM includes four main model regions (core, marginal, buffer and external; Figure 2-1), which have been modelled to varying levels of detail. The core region includes Test Valley (in part), New Forest (in part), Southampton, Eastleigh, Winchester (in part), Fareham, Gosport, Portsmouth, Havant,

[4] MVA Consultancy, "Transport for South Hampshire Evidence Base Model Development Report: Report 2", MVA Project Number C39344, August 2011.

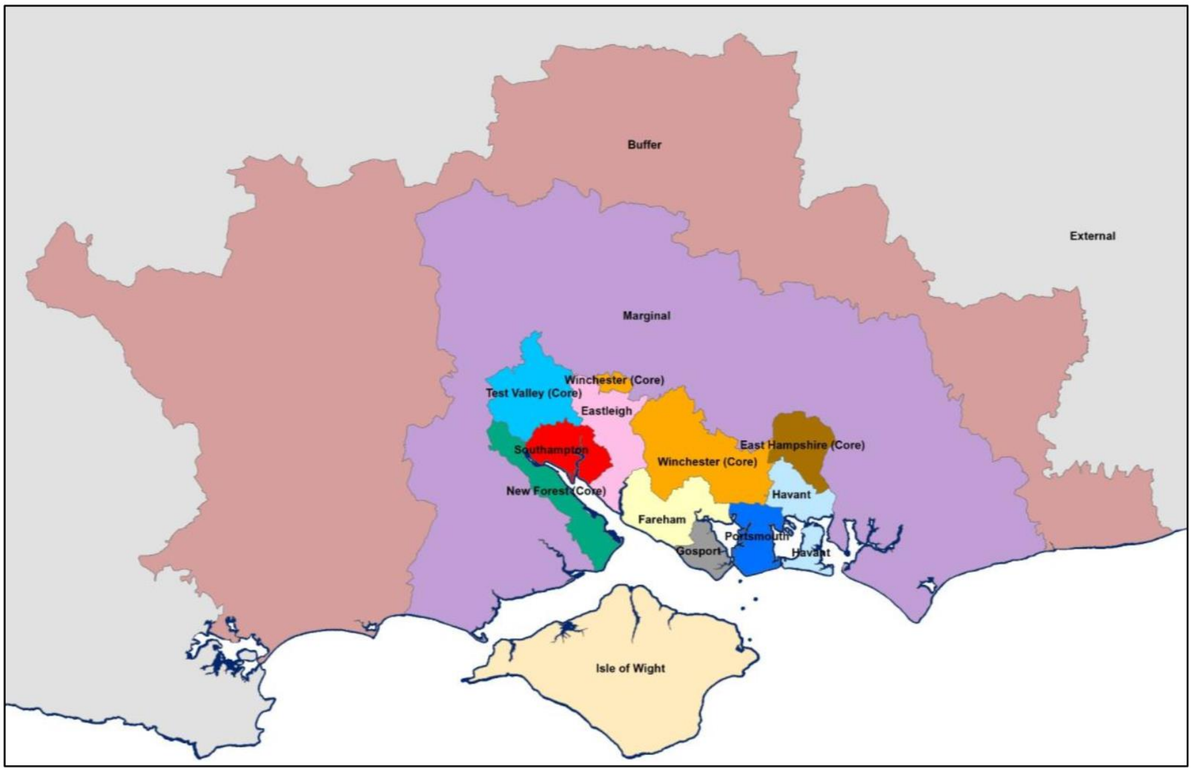
East Hampshire (in part) and Isle of Wight. Each of the four main model regions is further broken down into model zones. The zones within the core and marginal model regions are mainly based on groups of Census Output Areas (COAs) and Census Wards (CWs), respectively. Zones are based on Districts immediately outside the marginal model area, and on Counties in the model areas farther away. Key transport model parameters such as land use are specified by zone, and consequently the core model region has been modelled at the highest resolution and with the greatest level of detail; model resolution and detail decrease in zones farther away from the model core.

The SRTM is a suite of linked models comprised of the following components:

- Main Demand Model (MDM) which predicts when (frequency and time of day), where (destination choice) and how (choice of mode) journeys are made. Mode choices include car, public transportation, park & ride (a combination of car and public transportation), and active modes (walking and cycling).
- Gateway Demand Model (GDM) which predicts demand for travel from ports and airports.
- Road Traffic Model (RTM) which determines the routes taken by vehicles through the road network and journey times, accounting for congestion.
- Public Transport Model (PTM) which determines routes and services chosen by public transport passengers.
- Local Economic Impact Model (LEIM) which uses inputs including transport costs to forecast quantities and locations of households, populations and jobs.

The model components interact as demonstrated in Figure 2-2.

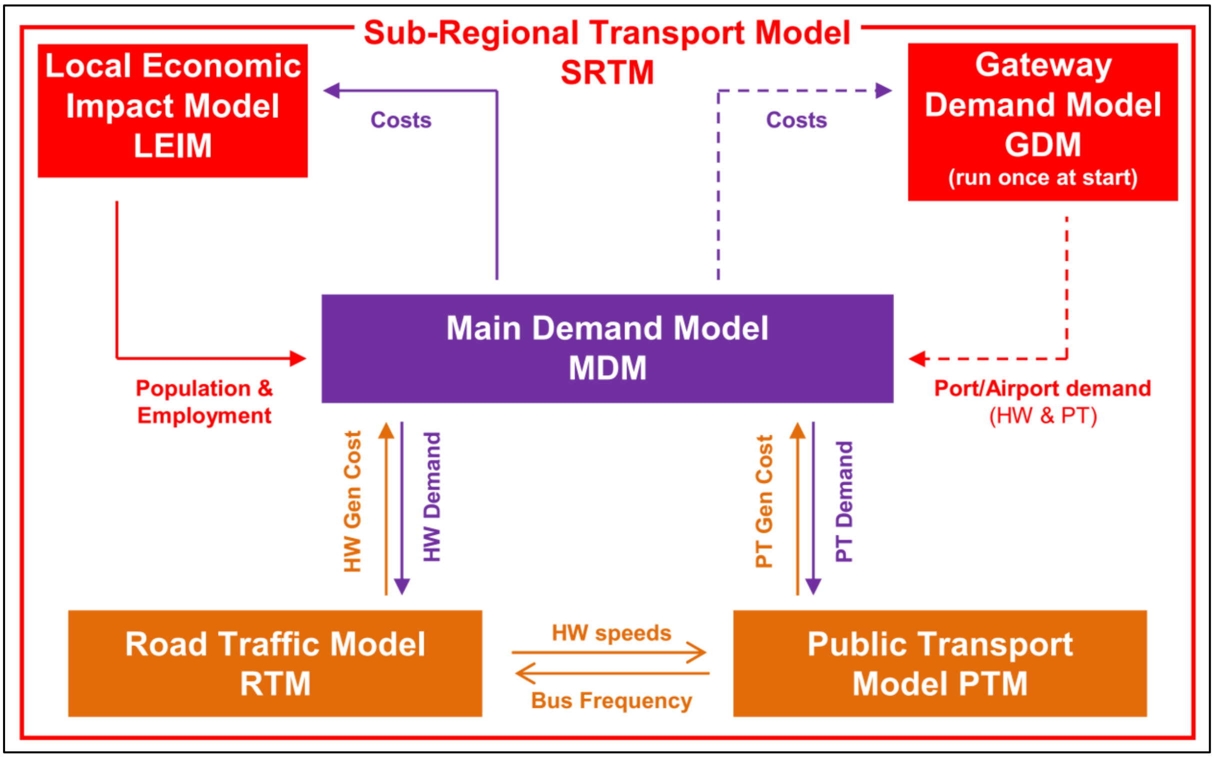
Figure 2-1 SRTM geographical coverage[2]



The SRTM is an evidence-based Land-Use and Transport Interaction model. The SRTM was originally developed, calibrated and validated against 2010 data and conditions, and included five forecast years: 2014, 2019, 2026, 2031, and 2036. Data sources included:

- Roadside interview survey data
- Rail Travel Survey
- Public transport origin destination data
- Ticket data for buses
- On board counts
- Manual and automatic traffic counts
- Journey time data
- Census Journey to Work Data
- National Travel Survey (NTS) Data
- National Trip End Model (NTEM) Data
- Population and Employment Data

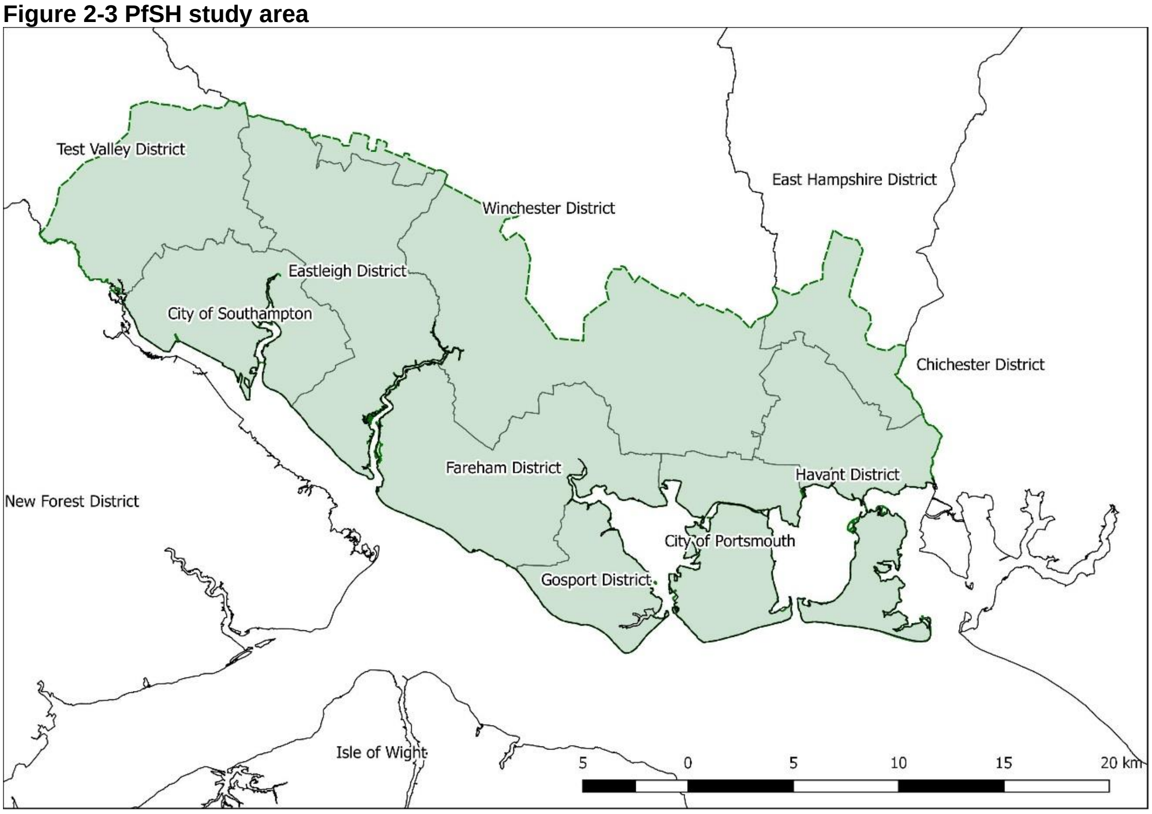
Figure 2-2 Interaction of models included in the SRTM[4]



2.2.2 Original PfSH scenarios

As previously discussed, this study utilises the transport model originally adapted from the SRTM by Systra for the recently published PfSH AQIA. The PfSH study area (Figure 2-3) includes the City of Portsmouth, City of Southampton, Eastleigh Borough, East Hampshire District (part), Fareham Borough, Gosport Borough, Havant Borough, Test Valley Borough (part), and Winchester City (part). The “Do Minimum” and “Do Something” traffic scenarios used in the assessment accounted for future proposed development and housing in the PfSH sub-region, which is a larger area encompassing the study area as well as the Isle of Wight and part of New Forest District. Air quality impacts within the study area therefore account for in combination effects from increased traffic across the larger PfSH sub-region.

Figure 2-3 PfSH study area



Traffic growth within the study area was provided by Solent Transport's Sub-Regional Transport Model (SRTM). In total, four traffic scenarios were modelled as part of the original PfSH study:

- PfSH 2014 Reference Case: This model was designed to replicate 2014 traffic conditions within the PfSH sub-region. It was used to verify the performance of the air dispersion model and investigate baseline air quality conditions within the study area.
- PfSH 2034 Baseline Scenario: This model was designed to represent a future scenario without the proposed PfSH development, and it has all land use growth inputs removed from the PfSH sub-region from 2014 onwards. The scale and location of development are assumed to be unchanged from 2014 conditions within the PfSH sub-region. For the remaining model areas outside of the PfSH sub-region, it is assumed that development and growth would continue as expected for 2034, and in accordance with TEMPRO v7.2 growth projections.
- PfSH 2034 Do Minimum Scenario: This model scenario includes development and growth within the PfSH region, equating to approximately 100,000 additional dwellings compared to the 2034 Baseline scenario. It includes transport schemes that are already committed as well as several supporting schemes that are vital to committed development sites even though the schemes themselves may not yet be committed.
- PfSH 2034 Do Something Scenario: This model scenario includes development and growth within the PfSH region, equating to approximately 100,000 additional dwellings compared to the 2034 Baseline scenario. This model scenario includes additional transport interventions, specified by the Solent Transport and PfSH authorities, which are aimed at helping to mitigate the impact of the proposed developments on the transport network.

2.2.3 Transport model update for Fareham Borough Council

Systra was commissioned by Fareham Borough Council to apply Solent Transport's Sub Regional Transport Model (SRTM) to examine the impacts of the emerging Fareham Borough Local Plan (FBLP) through to 2036.[2] In total, three scenarios were modelled using the Fareham-specific SRTM scenarios for this study:

- Fareham 2015 Reference (Fareham 2015 Ref): This model was designed to replicate 2015 traffic conditions within Fareham. It was used to verify the performance of the air dispersion model.

  Fareham 2036 Do Nothing (Fareham 2036 DN): This model represents a scenario including all known current (as of 2019) completed development and infrastructure within Fareham, in addition to all committed development and infrastructure up to 2036. Development associated with the FBLP is not included in this scenario. This is a hypothetical scenario against which to test the impacts of the FBLP, as it assumes the unlikely scenario that there will be no development within Fareham up to 2036, other than at sites which already have planning permission. Outside of Fareham, development growth is assumed to continue as 'normal' and in accordance with adopted Local Plans (or equivalent) of respective neighbouring Boroughs, in accordance with TEMPRO v7.2 growth projections.

- Fareham 2036 Do Minimum (Fareham 2036 DM): This model represents a scenario which includes the FBLP housing and employment development but assumes there will be no further improvements to the transport network, aside from those which are already committed and therefore already included in the Fareham 2036 DN scenario. Development growth outside Fareham is identical to that included in the 2036 DN scenario.

As discussed in Section 2.2.3, some links within the New Forest District were not included in the original SRTM transport model. Traffic flows for the main links running through the New Forest District were therefore calculated using DfT traffic count data[5] using methodology detailed in Section 2.3.4.

2.2.4 Factors which influence trip generation and road link speeds

Trip generation is determined at a zonal level and is a function of demographics and socio-economic characteristics. It is sensitive to changes in land use rather than changes in travel cost.[4] The SRTM accounts for 10 land use categories: residential, retail, office, industrial, warehousing, primary & secondary education, adult education, hotel & other accommodation, healthcare and leisure.

Cruise speeds between junctions in the core SRTM area were derived from GPS-based TrafficMaster data. Each modelled road link was allocated a link category, based on factors such as road type, number of lanes, speed limit, presence of buses, etc. For each link category, average speeds were calculated from all TrafficMaster data for that category. The averages were calculated such that links with high standard deviations for speeds received a lower weighting, and consequently had less influence on the average, than links with low standard deviations for average speed. In addition, major roads (dual carriageways and motorways) were coded with speed flow relationships which vary speeds on these links.

The average speeds on modelled road links, as determined by the SRTM, depend on the cruise speeds, the specified link capacity, and the occurrence of saturation conditions. Saturated conditions constrain traffic volumes at downstream locations, and queues with reduced journey speeds result at junctions which are over capacity.

2.3 Air dispersion modelling methodology

2.3.1 Air quality modelling system

The RapidAir Urban Air Quality Modelling Platform was used to predict air pollutant concentrations for this study. This is Ricardo Energy & Environment's proprietary modelling system developed for urban

[5] https://roadtraffic.dft.gov.uk/#6/55.254/-6.053/basemap-regions-countpoints

air pollution assessment, and the model that was used previously in Southampton for the Low Emission Strategy (LES) and Clean Air Zone (CAZ) studies, as well as for the PfSH AQIA completed in September 2018 and HRAs recently completed for Havant Borough Council, Eastleigh Borough Council and the Royal Borough of Windsor and Maidenhead Local Plans.

RapidAir has been developed to provide graphic and numerical outputs which are comparable with other models used widely in the United Kingdom. The model approach is based on loose-coupling of three elements:

- Road traffic emissions model conducted using fleet specific COPERT 5 (via the Defra EfT) algorithms to prepare grams/kilometre/second (g km^{-1} s^{-1}) emission rates of air pollutants originating from traffic sources.
- Convolution of an emissions grid with dispersion kernels derived from the USEPA AERMOD[6] model, at resolutions ranging from 1 m to 20 m. AERMOD provides the algorithms which govern the dispersion of the emissions and is an accepted international model for road traffic studies.
- The kernel based RapidAir model running in GIS software to prepare dispersion fields of concentration for further analysis with a set of decision support tools coded by us in Python/arcpy.

RapidAir includes an automated meteorological processor based on AERMET which obtains and processes meteorological data of a format suitable for use in AERMOD. Surface meteorological data is obtained from the NOAA online repository[7] and upper air data is downloaded from the NOAA Radiosonde database[8].

The model produces high resolution concentration fields at the city scale (down to a 1m scale) so is ideal for spatially detailed compliance modelling. The combination of an internationally recognised model code and careful parameterisation matching international best practice makes RapidAir ideal for this study. A validation study has been conducted in London using the same datasets as the 2011 Defra air quality model inter-comparison study[9]. Using the LAEI (London Atmospheric Emissions Inventory) 2008 data and the measurements for the same time period the model performance is consistent (and across some metrics performs better) than other modelling solutions currently in use in the UK.[10] This validation study has been published in *Environmental Modelling and Software*, in partnership with the University of Strathclyde[11].

2.3.2 Model domain

The study area includes all areas of European-designated sites located within a 10 km buffer area around Fareham Borough: River Itchen (SAC), Solent & Isle of Wight Lagoons (SAC), Solent Maritime (SAC), Chichester & Langstone Harbours (SPA & Ramsar), Portsmouth Harbour (SPA & Ramsar), Solent & Southampton Water (SPA & Ramsar) and Solent & Dorset Coast (SPA). Areas of some of these sites are located partially on the Isle of Wight and partially on the mainland; in this case, those areas located on the Isle of Wight were excluded from the study, as there are no direct ferry links between Fareham and the Isle of Wight, and it is considered unlikely that the Local Plan development within Fareham would have a significant contribution to an increase in vehicle numbers on the Isle of Wight.

[6] https://www3.epa.gov/ttn/scram/dispersion_prefrec.htm#aermod
[7] ftp://ftp.ncdc.noaa.gov/pub/data/noaa
[8] https://www.esrl.noaa.gov/roabs/
[9] https://uk-air.defra.gov.uk/research/air-quality-modelling?view=intercomparison
[10] The 2008 LAEI dataset was used in this context as a benchmarking study, to compare the performance of RapidAIR to other modelling systems. The 2008 LAEI dataset was not used as an input in the current modelling study.
[11] Masey, Nicola, Scott Hamilton, and Iain J. Beverland. "Development and evaluation of the RapidAir® dispersion model, including the use of geospatial surrogates to represent street canyon effects." *Environmental Modelling & Software* (2018). DOI: https://doi.org/10.1016/j.envsoft.2018.05.014

Additionally, other nearby European-designated sites were considered in terms of whether an 'exceptional impact pathway' may exist, such that a significant effect (either alone or in combination) originating from within the Fareham development areas may impact upon a designated site located beyond the 10 km buffer. It was determined that there may be an exceptional impact pathway between Fareham Borough and the New Forest designated sites (SPA, SAC & Ramsar). The M27 is a significant road connecting the two, and as it is possible to drive from western areas of Fareham to the edges of the New Forest designated sites within about 30-45 minutes (depending on traffic), it would seem plausible that people could live in Fareham and commute to New Forest District, and/or vice-versa, to a degree that there could be a significant impact due to the Fareham development plan, either alone or in combination. The New Forest designated sites (SPA, SAC & Ramsar) are also included in the study area.

Dispersion modelling was carried out to forecast levels of air pollutants at a 3m x 3m grid resolution across the entire Fareham Borough study area, including all the designated sites within a 10km buffer area around Fareham. A grid height of 1.5 m was modelled to represent human exposure at ground level. Dispersion modelling for the Local Plan in isolation was carried out for the years 2015 (as a reference year for dispersion model verification) as well as two future 2036 scenarios (Do Nothing Scenario and Do Minimum Scenario). Dispersion modelling for the Local Plan in combination was carried out for two future scenarios in the year 2036 (Baseline and Do Minimum).

Data were then extracted from the 3m x 3m grid results to provide a detailed evaluation of air quality impacts at locations within the relevant designated sites.

2.3.3 Traffic activity data

Annual average daily traffic (AADT) vehicle numbers and average vehicle speeds were extracted from the SRTM datasets provided by Systra for the three scenarios (Fareham 2015 Ref, Fareham 2036 DN and Fareham 2036 DM) used in this study. Further detailed information about the SRTM and the transport model scenarios can be found in Section 2.2.

The SRTM includes four main model regions: core, marginal, buffer and external, as outlined in Section 2.2.1. The core model region has been modelled at the highest resolution and with the greatest amount of detail; model resolution and detail decrease in zones further away from the model core.

2.3.4 Supplementary traffic data

The core region contains the New Forest in part, however, certain important road links crossing the entirety of the site (such as the M27/A31 and the A36) were only included in the marginal and buffer regions. The links travelling through the New Forest are important because they are likely to include journeys to and from Fareham. Thus, following the extension of the modelling domain to include the New Forest, the SRTM data was supplemented with Department for Transport (DfT) data to ensure that robust information was used for these road links.

Data from count points (at which total AADT was taken from manual counts by DfT) were used for relevant roads in two categories:

(a) Roads that did not have data in the original core model, and

(b) Roads that were included in the original core model.

On road links where there were DfT counts as well as core model data, three scaling factors were produced:

- A scaling factor to scale 2015 DfT count data on the road link to the 2015 Ref AADT;
- A scaling factor to scale 2018 DfT count data on the road link to the 2036 DN AADT; and
- A scaling factor to scale 2018 DfT count data on the road link to the 2034 DM AADT.

Three DfT count points on relevant road links were used to produce three separate sets of scaling factors, with each set containing a 2015 Ref, 2036 DN and 2036 DM factor. The roads without core SRTM data were then assigned the most relevant set of scaling factors, based on expert opinion and taking into account road type and neighbouring links.

As DfT count data is downloaded in total AADT, scaling factors were produced using total AADT numbers from the core model (the sum of AADT in both directions). The scaling factors were applied to total AADT for the road link, then 50% was assigned to each direction. Some road links had no core model data and no DfT count point from which to achieve a scaled AADT. In this case, AADT for each direction was extrapolated from a nearby link to complete the dataset. In some cases, where roads branch off, a slight overestimate of AADT on the link is likely.

2.3.5 Traffic speed data

For the marginal and buffer links, 24 hour averaged speed data were not included in the original model. For these links, the 12 hour averaged speed data from the PfSH transport model was applied to the road link and a sense-check completed against neighbouring links with core model data.

2.3.6 Fleet composition

Annual average daily traffic (AADT) vehicle numbers and average vehicle speeds were extracted from the SRTM datasets provided by Systra for the three FBLP scenarios (Fareham 2015 Ref, Fareham 2036 DN and Fareham 2036 DM). Further detailed information about the SRTM and the four transport model scenarios can be found in Section 2.2.

The SRTM provides a fleet composition breakdown into cars, light goods vehicles (LGVs), heavy goods vehicles (HGVs) and buses. NAEI (National Atmospheric Emissions Inventory) fleet split information can be used to further split cars into petrol and diesel categories, and HGVs into rigid HGV and articulated HGV categories, based on national average fleet composition information and depending on whether the road link is categorised as rural, urban or motorway. For this study, SRTM AADT numbers for cars and HGVs were further categorised based on mapping the SRTM road types onto the NAEI road types as shown in

Table 2-1 and Table 2-2. Non-motorway SRTM road types (i.e., A road, B road, shopping, buffer and other) were categorised as either rural or urban based on their location as compared to the 2011 Area Classifications for Output Areas (2011 OAC).[12]

The fleet compositions in Table 2-1 and Table 2-2 were calculated using the most recent set of NAEI fleet projection information available at the time of commission (base year 2018, published December 2018).[13] The UK government published a UK Air Quality Plan in 2017[14] and a draft UK Clean Air Strategy in 2018.[15] Both of these publications reaffirm the UK government's intention for the sale of new conventional petrol and diesel cars and vans to end by 2040, and for almost every car and van on the road to be a zero emission vehicle by 2050.[16] If the UK government is to achieve these objectives, by 2036 the proportion of full plug-in electric vehicles in the national fleet would likely be greater than the current fleet projection data indicates. Hence if the government is successful in its strategy, and the proportion of electric vehicles in the national fleet is greater in 2036 than indicated in Table 2-2, the transport pollutant emissions and resulting pollutant concentrations modelled in this study for the 2036 scenario are likely to be overpredicted to some extent.

[12] The National Archives, "2011 Area Classifications", http://www.ons.gov.uk/ons/guide-method/geography/products/area-classifications/ns-area-classifications/ns-2011-area-classifications/index.html , accessed 01/02/2020.
[13] National Atmospheric Emissions Inventory, "Emission factors for transport", http://naei.beis.gov.uk/data/ef-transport , accessed 19/12/2019.
[14] UK Department for Environment, Food & Rural Affairs, "Air quality plan for nitrogen dioxide (NO2) in UK (2017)", https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017
[15] Department for Environment, Food & Rural Affairs, "Clean Air Strategy 2018", https://consult.defra.gov.uk/environmental-quality/clean-air-strategy-consultation/
[16] Ultra low emission vehicles: evidence review of uptake in the UK (2015), https://www.gov.uk/government/publications/ultra-low-emission-vehicles-evidence-review-of-uptake-in-the-uk

Table 2-1 Matching SRTM fleet composition to EFT (Emission Factor Toolkit) vehicle types for 2015 Reference Case

NAEI Road Type	Petrol Car	Diesel Car	Electric Car	Rigid HGV	Articulated HGV
	58.29%	41.61%	0.10%	75.97%	

Table 2-2 Matching SRTM fleet composition to EFT vehicle types for 2036 model scenarios*

NAEI Road Type	Petrol Car	Diesel Car	Electric Car	Rigid HGV	Articulated HGV
Urban (not London)	60.75%	34.50%	4.75%	73.24%	26.76%
					52.19%
Motorway	49.99%	50.01%	–	28.61%	71.39%

*NAEI projections are only available up to 2035, therefore the data in this table are based on fleet projections for 2035. It is assumed that the fleet composition in 2036 will be very similar to that in 2035.

2.3.7 Emission factors

Vehicle emission factors for oxides of nitrogen (NOx) and particulate matter (PM_{10} and $PM_{2.5}$) were obtained from COPERT v5 emission functions.[13] Vehicle emission factors for ammonia (NH_3) were obtained from the EMEP/EEA air pollutant emission inventory guidebook.[17] Link-specific emission factors were calculated with our in-house emission calculation tool RapidEMS, which links directly to our RapidAir dispersion modelling system.

The input for RapidEMS consists of a basic fleet split based on vehicle categories (diesel cars, petrol cars, LGVs, articulated HGVs, rigid HGVs, and buses) according to the traffic activity information specified in Section 2.3.3. RapidEMS is used to provide a more detailed parameterization of vehicle fleets in 2015 and 2036, including all vehicles up to and including Euro 6/VI.

2.3.8 Meteorological data

RapidAir includes an automated meteorological processor based on AERMET which obtains and processes meteorological data of a format suitable for use in AERMOD. Surface meteorological data is obtained from the NOAA online repository[18] and upper air data is downloaded from the NOAA Radiosonde database[19].

For this study, 2015 surface meteorological data was obtained from three stations (Southampton, Thorney Island and Bournemouth) and upper air meteorological data was obtained from two stations (Herstomonceux and Larkhill). RapidMet was used to carry out data filling where necessary according to the methodology provided by the USEPA in their “Meteorological Monitoring Guidance for Regulatory Modelling Applications” guidance document[20]. Data gaps from the primary meteorological stations (Southampton and Herstomonceux) are first filled using data from the other nearby stations (Thorney Island and Bournemouth for surface stations, and Larkhill for the upper air station). Remaining data gaps were filled based on the persistence method, where a missing value is replaced by the use of data from the previous hour(s), for data gaps up to and including three hours.

[17] European Environment Agency, “EMEP/EEA air pollution emission inventory guidebook 2016”, https://www.eea.europa.eu/publications/emep-eea-guidebook-2016

[18] ftp://ftp.ncdc.noaa.gov/pub/data/noaa

[19] https://www.esrl.noaa.gov/roabs/

[20] United States Environmental Protection Agency, “Meteorological Monitoring Guidance for Regulatory Modelling Applications” available via https://www3.epa.gov/scram001/guidance/met/mmgrma.pdf

2.3.9 Reference year modelling and model verification

This section provides a summary of the model verification process and the derivation of linear adjustment factors to improve model performance. A more detailed description of the model verification process for the FBLP air quality model is presented in Appendix 1. The model verification process for the in combination modelling, using the PfSH air quality model, is described in full in the PfSH AQIA report.[3]

2.3.9.1 Oxides of nitrogen (NOx) and nitrogen dioxide (NO_2) model verification and adjustment

A combination of automatic monitoring and diffusion tube NO_2 measurements was used for model verification. NO_2 measurements were obtained from Defra's Automatic Urban and Rural Network (AURN) as well as the Annual Status Reports (ASRs) of Chichester, Eastleigh, Fareham and Gosport, Havant, the New Forest, Portsmouth, and Southampton.

Some monitoring sites were excluded from the model verification process for the following reasons:

- The monitoring station is located outside the boundaries of the Fareham study area (the 10km buffer region surrounding Fareham Borough, plus the 5km buffer region surrounding the New Forest).
- No measurement was reported for that monitoring site in 2015.
- Data capture for the monitoring site was less than 75% in 2015.

After exclusion of some monitoring sites for the above reasons, a total of 127 NO_2 measurements were carried forward into the model verification step.

RapidAir was used to generate a map of NOx concentrations arising from road traffic sources across the entire Fareham study area at a 3m x 3m resolution, based on SRTM traffic activity data from the 2015 Reference Case and 2015 meteorological data. Background NOx values for 2015 were obtained from the 2015 reference year background maps available on the LAQM website.[21] NOx contributions arising from major roads were removed from the background map values to avoid double-counting, and the background values were then added to the RapidAir road NOx results to compare the modelled vs measured concentrations at each of the monitoring locations. This initial comparison indicated that the model was slightly under-predicting the NOx arising from road emissions at most locations. Refinements were subsequently made to the model inputs to improve model performance where possible, and a linear adjustment factor of **1.0091** was calculated for the road emissions component of the NOx model (see Appendix 1).

Total NOx was calculated as the sum of the adjusted NOx road contribution from RapidAir and the Defra 2017 background maps (with main road sources removed from the background map). Total NO_2 concentrations were derived using the following equation (see Appendix 1 for further details):

$$(NO_2 \text{ in } \mu g/m^3) = -0.000837(NOx \text{ in } \mu g/m^3)^2 + 0.5421(NOx \text{ in } \mu g/m^3) + 4.8581$$

To evaluate model performance and uncertainty, the Root Mean Square Error (RMSE) for the observed vs predicted NO_2 annual mean concentrations was calculated, as detailed in Technical Guidance LAQM.TG(16). This guidance indicates that an RMSE of up to 4 $\mu g/m^3$ is ideal, and an RMSE of up to 10 $\mu g/m^3$ is acceptable. In this case the RMSE was calculated at 7.18 $\mu g/m^3$, which is acceptable, and reasonable for a modelling study over this large a geographical region.

2.3.9.2 Ammonia (NH_3) model verification and adjustment

There are no monitoring locations for NH_3 located within the Fareham study area, and therefore it was impossible to compare measured vs modelled concentrations for NH_3. We have adopted an approach

[21] Department for Environment, Food & Rural Affairs, Background maps, https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html , accessed 20/12/2019.

based on Section 7.527 of the Technical Guidance LAQM.TG(16) which suggests that, in the absence of measured data for model verification of a traffic pollutant, it may be appropriate to apply the adjustment factor derived from another traffic pollutant to the pollutant that does not have any monitoring data available.

In order to adopt a precautionary approach, and as particulate matter (PM_{10}) monitoring data was available for the Fareham study area, the adjustment factor for PM_{10} in the study area was also determined and compared to the adjustment factor derived for NOx/NO_2. The model verification process for PM_{10} is described in full in Appendix 1.

Automatic particulate matter (PM_{10}) monitoring measurements were used for model verification. A total of seven PM_{10} measurements were obtained from the Annual Status Reports (ASRs) of Gosport, the New Forest, Portsmouth and Southampton. The initial comparison between modelled and measured PM_{10} concentrations indicated that the model was under-predicting the PM_{10} arising from road emissions at most locations. Refinements were subsequently made to the model inputs to improve model performance where possible, and a linear adjustment factor of **3.8529** was calculated for the road emissions component of the PM_{10} model (see Appendix 1).

To evaluate model performance and uncertainty, the RMSE for the observed vs predicted PM_{10} annual mean concentrations was calculated, as detailed in Technical Guidance LAQM.TG(16). In this case the RMSE was calculated at 3.7 µg/m^3, which is acceptable, and good for a modelling study over this large of a geographical region.

Of the two linear bias adjustment factors derived above, the adjustment calculated for PM_{10} (3.8529) is larger and therefore more conservative. RapidAIR was used to generate a map of NH_3 concentrations arising from road traffic sources across the Fareham study area at a 3 m x 3 m resolution, and these values were subsequently multiplied by **3.8529** to obtain adjusted NH_3 road contribution values.

There are no background maps available for NH_3 concentrations, and therefore total NH_3 concentrations could not be modelled. This does not affect the analysis of air quality impacts at designated sites, as it is the development contribution to traffic emissions that is of interest in this study, rather than the total concentration of NH_3.

2.3.10 Future scenario modelling

2.3.10.1 Airborne pollutant concentrations

For the future scenarios (Fareham 2036 DN and Fareham 2036 DM, PfSH 2036 BL and PfSH 2036 DM), RapidAir was used to generate pollutant concentration map across the entire Fareham study area at a 3m x 3m resolution. These maps were generated using SRTM traffic activity data from the appropriate future scenario, emission factors calculated using RapidEMS, and 2015 meteorological data.

Pollutant concentration maps for road-only contributions (NOx, NO_2, and NH_3) were calculated using the adjustment factors described in Section 2.3.9. Maps for total pollutant concentrations (NOx and NO_2) were calculated by adding the road-only concentration maps to the appropriate pollutant background map from the LAQM website. Background maps for the year 2030 were selected, as this is the farthest year into the future for which background maps are available.

2.3.10.2 In combination modelling using the PfSH scenarios

For the purposes of this study, the outputs from the PfSH air quality model have been extrapolated to the year 2036 using two scaling factors and the original PfSH scenarios, specifically the PfSH 2034 Baseline Scenario and PfSH 2034 Do Minimum Scenario outlined in Section 2.2.3.

The two scenarios used for this study are:

- PfSH 2036 Baseline (PfSH 2036 BL): This model was designed to represent a future scenario without the proposed PfSH development, and it has all land use growth inputs removed from the PfSH sub-region from 2014 onwards. The scale and location of development are assumed to be unchanged from 2014 conditions within the PfSH sub-region. For the remaining model areas outside of the PfSH sub-region, it is assumed that development and growth would continue as expected for 2036, and in accordance with TEMPRO v7.2 growth projections.
  The air quality modelling outputs (pollutant concentration maps for road-only contributions of NOx, NO_2, and NH_3) for the PfSH 2034 BL scenario were scaled by a factor of **1.0441**, prior to addition of background map concentrations and calculation of dry deposition rates or nitrogen and acid deposition.

- PfSH 2036 Do Minimum (PfSH 2036 DM): This model scenario includes development and growth within the PFSH region, equating to approximately 120,000 additional dwellings compared to the 2036 Baseline scenario. It includes transport schemes that are already committed as well as several supporting schemes that are vital to committed development sites even though the schemes themselves may not yet be committed. This scenario includes development in Fareham on the scale of that included in the FBLP, and represents a precautionary approach to the assessment of in combination air quality impacts associated with development across the PFSH sub-region.
  The air quality modelling outputs (pollutant concentration maps for road-only contributions of NOx, NO_2, and NH_3) for the PfSH 2034 DM scenario were scaled by a factor of **1.0441**, prior to addition of background map concentrations and calculation of dry deposition rates or nitrogen and acid deposition.

The scaling factor of 1.0441 is based on Fareham's anticipated level of development in 2036 versus the predicted level of development in the original PfSH 2034 development scenarios. In addition to accounting for housing developments two years further into the future, it also accounts for current housing projections across the PfSH sub-region being higher than the housing projections used in the original PfSH study.

2.3.10.3 Pollutant deposition

Dry deposition rates of nutrient nitrogen and acid were calculated by multiplying the ground level air concentration of the appropriate pollutants (road contribution only) by the appropriate deposition velocity, followed by multiplication with a conversion factor.

Deposition velocities and conversion factors were obtained from Environment Agency guidance,[22] and are provided in Table 2-3 and Table 2-4 respectively.

Table 2-3 Deposition velocities for NO_2 and NH_3

Pollutant	Vegetation type	Deposition velocity (m/s)
NO_2	Grassland (sites with short vegetation)	0.0015
NH_3	Grassland (sites with short vegetation)	0.02

[22] Environment Agency, "AQTAG06: Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air," March 2014

Table 2-4 Dry deposition conversion factors

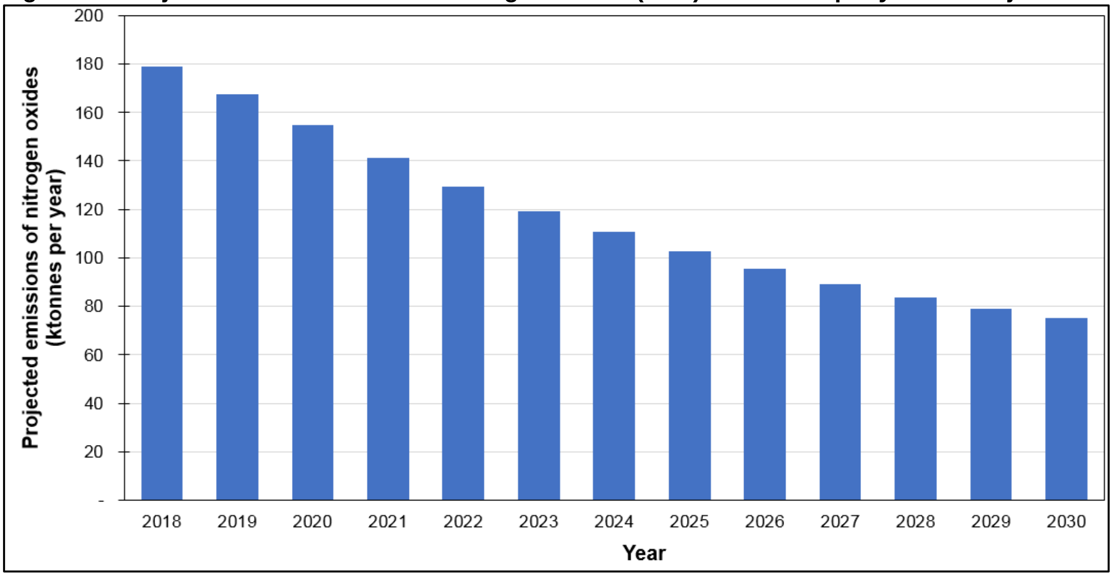
Pollutant	Conversion factor for nitrogen deposition (from µg/m² s to kgN/ha year)	Conversion factor for acid deposition (from µg/m² s to kEq/ha year)
NO_2	95.9	6.84
NH_3	260	18.5

2.3.11 Model years and considerations

This study assesses air pollution concentrations across the Fareham study area for 2015 (as a historical reference year) and for two future scenarios in 2036. The 2036 scenarios correspond to the end of the development period associated with the FBLP. A comprehensive analysis of the air quality impacts of the FBLP development is therefore constrained to the 2036 development scenarios modelled in this study.

The model results for future scenarios are particularly important to understand in the context of declining NOx emissions. Figure 2-4 presents projected road emissions of NOx for approximately 9,000 major UK roads from 2018 to 2030. The emissions in this figure are extracted from the Streamlined Pollution Climate Mapping model (SL-PCM)[23] for the baseline projection scenario, which assumes no further action beyond air quality measures that were committed across the UK by 2015. Although the emissions correspond to a subset of the UK's road network, the decrease in annual NOx emissions is indicative of the expected trend in NOx road emissions going forward, reflecting anticipated improvements in Euro emissions standards as well as changing vehicle fleet composition.

Figure 2-4 Projected road emissions of nitrogen oxides (NOx) in ktonnes per year for major UK roads



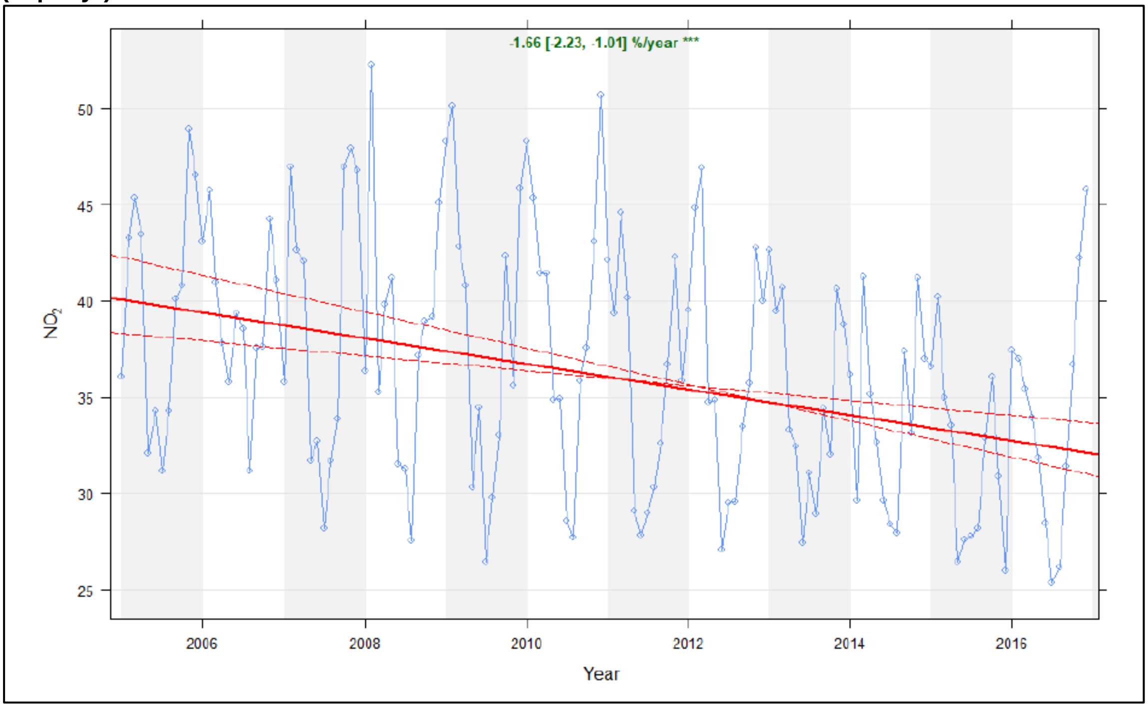
Indeed, reductions are already being realised. In the study "Nitrogen Dioxide and Nitrogen Oxides Trends in the UK 2005 to 2016"[24] an analysis of NO_2 and NOx concentrations measured across the UK showed that a reduction in concentrations of approximately 1.7% per year has been seen on average between 2005 and 2016.

Figure 2-5 presents results for monitoring sites in Southern England and Wales. The plot shows the best fit linear trend line, together with the lines representing the 90% confidence interval. The figure demonstrates a 1.66% reduction per year.

[23] SL-PCM has been developed specifically to model the effect of changes in fleet composition on NO_X emissions and NO_2 concentrations. See https://uk-air.defra.gov.uk/library/no2ten/2017-no2-projections-from-2015-data

[24] Nitrogen Dioxide and Nitrogen Oxides Trends in the UK 2005 to 2016, Air Quality Consultants, 2018. http://www.aqconsultants.co.uk/AQC/media/Reports/NO2-NOx-Trend-Report.pdf

Figure 2-5. Overall NO_2 Trend across All Sites in Southern England and Southern Wales, with TheilSen Fit (% per yr)



2.3.12 Compliance with legal judgements

Three recent judgements are relevant to this assessment.

Wealden District Council v Secretary of State for Communities and Local Government, Lewes District Council and the South Downs National Park Authority (Defendants) and Natural England (Interested Party) [2017] EWHC 351 (Admin).

This high court ruling found that traffic increases and resulting air pollution on roads within 200 m of a European site required a change in approach to assessment of in combination impacts as set out in guidance provided by Natural England at the time. This is because projects and plans that increase road traffic flow have a high likelihood of acting together, or 'in combination', with other plans or projects that would also increase traffic on the same roads. If the combined effects of different plans and projects will lead to increases of traffic of more than 1,000 cars a day, further consideration of the issue is required. This judgement therefore requires the potential impact of a Plan on roads within 200 m of each EU site both alone and in combination with relevant plans and projects to be considered.

Recent guidance from Natural England, developed following the requirements of the Wealden Judgment, advise that the screening thresholds should be applied with consideration to impacts from individual proposed developments and with consideration to in combination effects.

No screening criteria were applied in relation to changes in traffic flows in the air quality assessment: instead, the assessment was based on changes in air pollution levels due to changes in traffic flows on all modelled roads. In this way, the potential issues with applying traffic flow screening thresholds identified in the Wealden judgement were avoided.

The in combination impact of the FBLP due to changes in traffic flows on all modelled roads with the impacts of other plans and projects was assessed by considering the results of regional-scale modelling for the South Hampshire area, and by reviewing HRA reports carried out for neighbouring authorities. In combination effects were evaluated by explicitly considering modelled levels of nitrogen deposition, acid deposition, airborne ammonia and airborne oxides of nitrogen at the European sites under consideration with screening criteria applied to the in combination impacts in accordance with the requirements of the Wealden judgement.

Joined cases C-293/17 and C-294/17, The Dutch Nitrogen Case, 7th November 2018. 'Cooperatie Mobilisation' and 'Stitching Werkgroep Behoud de Peel'

Two joined cases being considered by the Dutch Courts were referred to the European Courts for a preliminary ruling. One issue under consideration was whether a plan or programme which falls below a defined threshold of impact could be excluded from consideration under the Habitats Directive. The preliminary opinion noted that thresholds could be used, provided that there is no reasonable scientific doubt as to the lack of adverse effects of those plans and projects on the integrity of the sites under consideration. In addition, the case states that an appropriate assessment cannot rely on measures that cannot be quantified with certainty.

The preliminary opinion states: "*The appropriate assessment of the implications of a plan or project of the sites concerned is not to take into account the future benefits of such 'measures' if those benefits are uncertain, inter alia because the procedures needed to accomplish them have not yet been carried out or because the level of scientific knowledge does not allow them to be identified or quantified with certainty … Article 6(3) of the Habitats Directive must be interpreted as meaning that an 'appropriate assessment' within the meaning of that provision may not take into account the existence of 'conservation measures' within the meaning of paragraph 1 of that article, 'preventive measures' within the meaning of paragraph 2 of that article, measures specifically adopted for a programme such as that at issue in the main proceedings or 'autonomous' measures, in so far as those measures are not part of that programme, if the expected benefits of those measures are not certain at the time of that assessment.*"

This HRA relies on the application of thresholds where there is no reasonable scientific doubt as to the lack of adverse effects of the Plan on the integrity of any European site. This includes the application of Natural England (NE) air quality screening thresholds in relation to air quality.

This judgement is relevant to air quality in terms of the assumptions that have been made regarding future improvements in air quality and vehicle fleet emissions. Future projections of vehicle fleet compositions and emission factors were obtained from recognised sources published by Defra and used for future policy development. There is currently no basis for reasonable scientific doubt in the forecast future improvements in vehicle fleet emissions. For some designated sites considered in this HRA, forecast NO_x concentrations have been included in the Stage 2 appropriate assessment. These air pollution concentration maps are published by Defra and the Devolved Administrations, and are used for future policy development. Again, there is no basis for reasonable scientific doubt in the forecast future NO_x concentration maps used in this assessment.

People Over Wind and Sweetman ('Sweetman II') vs Coillte Teoranta, Case C-323/17

In this case, the EU Court of Justice confirmed that any measures intended to avoid or reduce the harmful effects of a project on a site should not be taken into account at the screening stage.

The air quality assessment was based on a traffic model scenario which includes the housing and employment development set out in the FBLP, as well as further necessary improvements to the transport network. The transport mitigation schemes included in the assessed traffic model scenario would be required to mitigate the impact of the FBLP on highways and road junctions and do not include any mitigation which may be needed to mitigate the impact of the FBLP on European sites or other nature conservation sites. No mitigation measures intended to avoid or reduce the harmful effects of the plan designated sites were considered at HRA Stage 1. The air quality assessment therefore complied with the requirements imposed by the "Sweetman II" case.

2.3.13 Sources of model uncertainty

There are a number of sources of model uncertainty inherent in this type of study, as discussed below:

- A monitoring site used to derive the linear adjustment factor might be located next to a large car park, bus stop, petrol station, or taxi rank that has not been explicitly modelled due to unknown activity data. This would have the effect of artificially inflating the calculated adjustment factor, resulting in an over-prediction of impacts. Where we have identified such locations, we have removed these from the model verification process.

- A monitoring site used to derive the linear adjustment factor might be located in an area where not all of the road sources contributing to pollutant concentrations have been modelled, i.e. at a junction. This would have the effect of artificially inflating the calculated adjustment factor, resulting in an over-prediction of impacts.
- Uncertainties in the amount and distribution of development accounted for in the SRTM modelling. Household projections are revised from time to time and may vary from the values included in the SRTM model. It should also be noted that the SRTM accounts for development growth and associated increases in background traffic within the core, marginal and buffer regions of the model (see Section 2.2.1). However, there will also be future development in the 'external' region that has not been modelled explicitly by the SRTM. Furthermore, the amount and distribution of development described in the 2016 PfSH Spatial Position Statement,[25] upon which the PfSH modelling scenarios used for some of the in combination assessment were based, will be subject to refinement as individual local plans are developed in further detail.
- Uncertainties due to the need to extend the SRTM model to cover the full area of potential concern, as described in Section 2.3.4. The SRTM model was supplemented with traffic data obtained from the DfT, which is considered to be the best available data for use in this situation.
- Uncertainties in the traffic model outputs on modelled road links, with regards to number of vehicles, type of vehicles and vehicle speed. The number of low emission vehicles in the future development scenarios may be underestimated if the UK government is successful in ending the sale of all conventional diesel and petrol cars and vans by 2040, which could result in a systematic over-estimation of future air quality impacts.
- Uncertainties in the real-world emissions from Euro 6/VI vehicles. Early real-world emission test results of Euro 6 vehicles indicate mixed results, ranging from vehicles which met the Euro 6 standards under real-world driving emissions to vehicles which displayed NOx emissions up to 12 times higher than the Euro 6 standard.[26,27] However, the increasing use of real-world emissions tests is likely to intensify pressure on vehicle manufacturers to comply with more stringent Euro standards. If real-world emissions do not decrease as anticipated, Fareham Borough Council may wish to review the current study in the context of updated emission parameters at some point in the future.
- Uncertainties in the background maps used to develop model adjustment factors and predict total modelled concentrations, with regards to other sources of pollution, such as industrial sources, domestic heating, port activity and forest fires.
- Background maps for the year 2030 were used to calculate total pollutant concentrations in the 2036 scenarios, as that is the farthest year into the future for which background maps are available. Background concentrations in 2030 are not expected to differ significantly from background concentrations in 2036, taking into account the uncertainties associated with the extrapolation process and forecasting 16 years into the future. If anything, the 2030 maps are expected to be slightly conservative (i.e. over-predict) for NOx and NO_2 levels in 2036.
- Uncertainties in the background concentrations across each site, downloaded from APIS and used in calculations of total nitrogen deposition, acid deposition and airborne ammonia. The

[25] Partnership for Urban South Hampshire, "PUSH Spatial Position Statement", June 2016, https://www.push.gov.uk/wp-content/uploads/2018/05/PUSH-Spatial-Position-Statement-2016.pdf
[26] The Real Urban Emissions Initiative, https://www.trueinitiative.org/
[27] Emissions Analytics, EQUA Index, https://equaindex.com/equa-air-quality-index/

pollution concentration and deposition data in the Site Relevant Critical Load Tool uses a 3-year mean for 2016-18. Therefore, background concentrations and depositions cannot be predicted for future years (and in this case, are not representative of the reference year, 2015). Pollutant depositions and concentrations are also mapped at a 5 km resolution across the UK; this is significantly lower resolution than the NOx background maps provided by Defra (1km x 1km). In reality, the background concentration across a 5km x 5km grid square will not be the same.

- Uncertainties resulting from the lack of monitoring data for ammonia (NH_3). There are no monitoring locations for NH_3 located within the Fareham study area. We have therefore applied We have adopted a conservative approach in our analysis by using the higher of the two model adjustment factors we derived. This is expected to result in an over-prediction of the impacts associated with NH_3, including airborne NH_3 concentrations, nitrogen deposition and acid deposition. The incorporation of monitoring data for NH_3 (if available) would result in a more robust model.
- Uncertainties in the dispersion modelling process. These are accounted for so far as possible through the model verification process, but there inevitably remain some differences between modelled concentrations and the levels that would be measured in practice.

2.4 Assessment of impacts on designated sites

The assessment of impacts on sites designated for nature conservation was carried out in a stepwise process, designed to comply with Natural England's emerging requirements[35] and good practice for evaluation of the impacts of air pollution on nature conservation sites.[28] The requirements from Natural England were developed primarily for the assessment of designated sites with European (or equivalent international) designation, namely Ramsar sites, Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

2.4.1 Consideration of whether the proposed development could give rise to emissions which are likely to reach a designated site

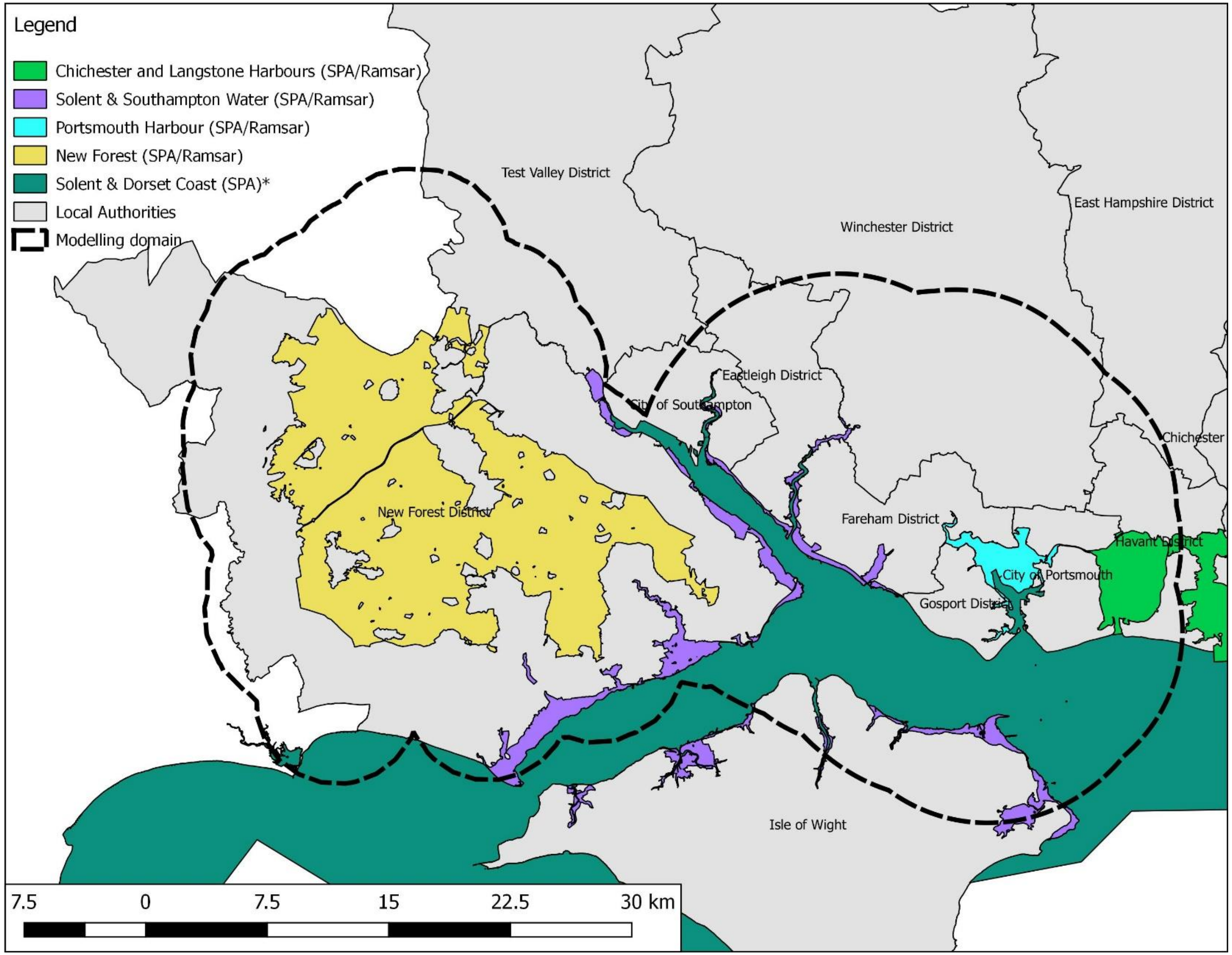
Established guidance from Natural England and Highways England indicates that protected sites falling within 200 metres of the edge of a road affected by a plan or project need to be considered further.

This assessment avoids the need for relying on the assumption of a 200 metre zone of influence by including dispersion modelling of emissions from all roads with modelled traffic flows within the Fareham study area, whether or not they are located within 200m of a designated site. All potentially relevant designated sites located within 10km of Fareham Borough were included in the subsequent stage. This approach ensured a robust assessment without relying on a distance-based screening criterion, and provided a more detailed and complete assessment for each relevant designated site.

Designated sites located within the Fareham study area are presented in Figure 2-6 and Figure 2-7.

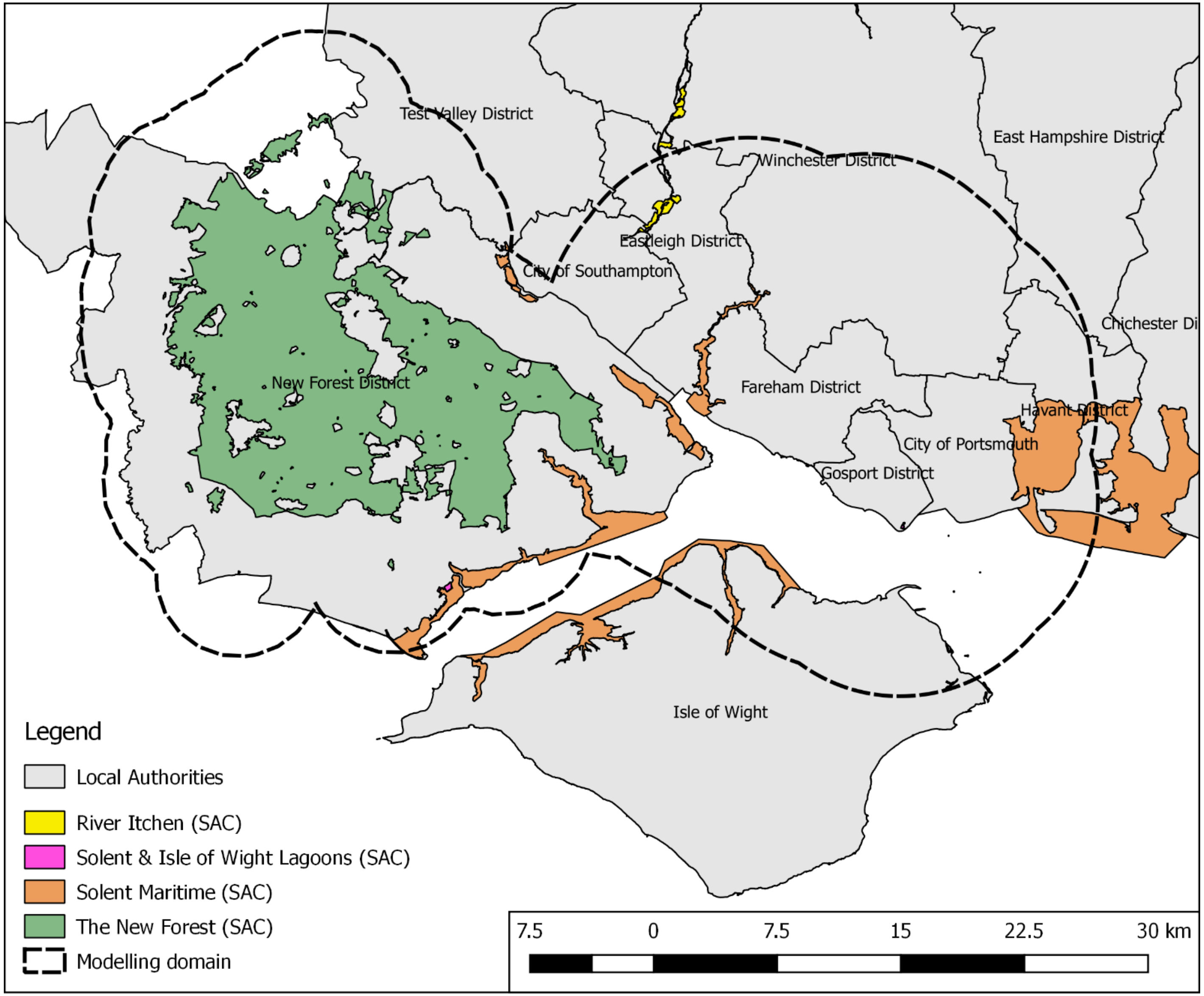
[28] Institute of Air Quality Management (IAQM), "A guide to the assessment of air quality impacts on designated nature conservation sites", Version 1.0, June 2019.

Figure 2-6 Ramsar sites and SPAs located within the Fareham study area



*Solent & Dorset Coast potential SPA was designated an SPA site on 20th January 2020

Figure 2-7 SACs located within the Fareham study area



2.4.2 Consideration of whether the qualifying features of the designated site are sensitive to air pollution impacts

Consideration was given to whether the designated site contains qualifying features that are sensitive to the emissions associated with the planned development. For increased road traffic resulting from the proposed development, the associated emissions include nutrient nitrogen deposition, acid deposition, airborne oxides of nitrogen (NOx) and airborne ammonia (NH_3).

Site screening was carried out by searching for information on the UK Air Pollution Information System (APIS, www.apis.co.uk) and identifying potential sensitivity to air pollution impacts. At this stage, the spatial distribution of qualifying features within each designated site was not considered. If a potentially sensitive feature was identified at the designated site, as determined by APIS listing a critical load or critical level for at least one pollutant associated with road traffic at that site, it was included in the subsequent stages of the study. Otherwise, the site was screened out of requiring further assessment. The results of this analysis are summarised in Table 2-5.

Consideration was also given to whether potential impacts on “functional linked land” should be considered: that is, a zone surrounding the designated site which plays a role in supporting the habitats and/or species for which each site was designated. In view of the nature of the specific designated sites under consideration in this study, and their qualifying features, there was no requirement to consider functionally linked land in an assessment of potential air quality impacts of the proposed development in the PfSH study area, which includes Fareham.

Table 2-5 European-designated sites: Assessment of sensitivity to emissions from road traffic

Site name	Ramsar site code	SPA site code	SAC site code	Does the site contain qualifying features that are sensitive to emissions from road traffic?
River Itchen (SAC)			UK0012599	Yes – include in study
				Yes – include in study
Solent Maritime (SAC)			UK0030059	Yes – include in study
				Yes – include in study
Portsmouth Harbour (Ramsar & SPA)	UK11055	UK9011051		Yes – include in study
				Yes – include in study
Solent and Dorset Coast (SPA)		UK9020330		Yes – include in study
				Yes – include in study

2.4.3 HRA Stage 1: Assessment of air quality impacts of the development against screening thresholds

The next step was to use the dispersion modelling results to predict the air quality impacts associated with changes in traffic flow resulting from the FBLP. For each set of model results (nutrient nitrogen deposition, acid deposition, airborne NOx and airborne NH_3), the contributions attributable to the FBLP development scenarios (i.e. the FBLP in isolation) were calculated as follows:

(Contribution of the Fareham 2036 DM Scenario) = (Fareham 2036 DM) – (Fareham 2036 DN)

The contributions attributable to each of the Do Minimum scenarios were then compared to a screening threshold, where the screening threshold for each pollutant / habitat combination was set to 1% of the applicable Critical Load or Critical Level. This approach is supported by online guidance published by Defra and the Environment Agency,[29] a position statement published by the Institute of Air Quality Management (IAQM), [30] and guidance previously received from Natural England.[31]

According to the position statement published by the IAQM, the 1% threshold *"was originally set at a level that was considered to be so low as to be unequivocally in the 'inconsequential' category. In other words, this can be reasonably taken to mean that an impact of this magnitude will have an insignificant effect. This would be determined as part of the HRA screening stage. Such a conclusion would eliminate the requirement to proceed to 'appropriate assessment.'*[30] The position statement indicates that the 1% criterion is intended to be a threshold below which the impact should be considered insignificant and screened out; impacts above 1% do not necessarily correspond to the onset of damage to a designated site. Impacts above 1% should be treated as potentially significant and undergo further detailed assessment.

In view of this guidance, a threshold of a contribution of 1% of the applicable Critical Load or Critical Level was used to screen out any areas where the emerging FBLP, alone or in combination, would have an insignificant impact on the relevant designated site.

2.4.3.1 Consideration of in combination effects

Recent guidance from Natural England, developed following the requirements of the Wealden Judgment, advise that the screening thresholds should be applied with consideration to impacts from individual proposed plans and projects, and with consideration of in combination effects.

The dispersion modelling results of the Fareham 2036 DM scenario account for air quality impacts associated with road traffic emissions from the Fareham Borough Local Plan 2036 in isolation. The dispersion modelling results of the updated PfSH 2036 DM scenario (scaled for development in 2036) account for in combination air quality impacts associated with road traffic emissions from the anticipated development in East Hampshire (part), Eastleigh, Fareham, Gosport, Havant, Isle of Wight, New Forest, Portsmouth, Southampton, Test Valley (part), and Winchester (part) up to 2036.

For each set of model results (nutrient nitrogen deposition, acid deposition, airborne NOx and airborne NH_3), the contributions attributable to the FBLP development in combination were calculated as follows:

(Contribution of the PfSH 2036 DM Scenario) = (PfSH 2036 DM) – (PfSH 2036 BL)

The NOx pollutant background maps[21] used in the air dispersion model account for existing industrial activity, including large combustion installations, airports and shipping activity. Known industrial sources are modelled explicitly in the baseline year of the background maps, and future-year background maps are derived by incorporating datasets from the UK Department for Business, Energy & Industrial Strategy (BEIS) regarding projected energy and economic activity data for various industrial sectors.

[29] Department for Environment, Food and Rural Affairs and Environment Agency, "Air emissions risk assessment for your environmental permit", February 2016.
[30] Institute for Air Quality Management, "Position Statement: Effect of Air Quality Impacts on Sensitive Habitats," January 2016
[31] Email communication with Natural England, 12/01/2018.

The background maps therefore account for future growth in industrial sector emissions, within the limits of current government growth projections.

The current assessment does not explicitly include in combination effects from new industrial plans and projects, particularly those which are unlikely to be included in the BEIS sector projections which underpin the background pollutant maps. Information on the National Infrastructure Planning website indicates that there are no currently proposed major infrastructure projects which require consideration. Other new industrial plans and projects seeking planning permission will need to carry out their own in combination assessment of effects, where applicable, as part of the HRA process.

2.4.4 HRA Stage 2: Appropriate assessment

Where the screening analysis indicated that Likely Significant Effects (LSEs) on a designated site could not be ruled out, further analysis was undertaken in the form of an HRA Stage 2 Appropriate Assessment.

2.4.4.1 Consultation

Consultation, via meetings and correspondence, has been undertaken with Natural England during the appropriate assessment stage of this HRA (HRA Stage 2). This has helped to determine which potential effects require more detailed, appropriate assessment provided by HRA Stage 2, as presented in this report. Confirmation of the approaches used in Stage 2 have also been sought from Natural England and the results are summarised at the end of each section.

2.4.4.2 Impact assessment

This assessment considers the potentially damaging aspects of the proposed FBLP with potential effects on a European site's qualifying features and likely achievement of the conservation objectives.

The potential for adverse effect on the integrity of the site depends on the scale and magnitude of the predicted air pollution impacts, taking into account the distribution of the designated features across the site in relation to the predicted impact.

Where qualitative and/or quantitative information is available, this has been used to inform the assessment. Where this information is not available, professional judgement has been used. In some cases, the ecological functioning of the site and the likely effects are well understood and documented elsewhere, for instance in studies commissioned to inform the Habitats Directive Review of Consents. In these cases, the assessment may simply comprise a review of this information. Where there is not sufficient information to undertake the assessment, this is recorded in this report.

For designated sites which required HRA Stage 2 Appropriate Assessment, this report aims to set out, in sufficient detail for it to be transparent and understandable, what the effects of the proposed FBLP (alone and in combination) are likely to be on each internationally-designated site's qualifying feature, referring to relevant background documents and other information on which these judgements, which are essentially ecological judgements, rely. Guidance states that the size or complexity of the HRA Stage 2 report to inform the Appropriate Assessment will not necessarily reflect the scale of the proposed FBLP, but rather the complexity of potential effects. The length of the report may not reflect the complexity of ecological judgements made to arrive at the necessary conclusions. Very complex ecological analysis and judgements may be expressed succinctly, with detailed supporting analyses contained in appendices or clearly referenced separate documents.

2.4.4.3 NOx forecast background maps

For some designated sites considered in this HRA, forecast NOx concentrations were included in the Stage 2 appropriate assessment. These air pollution concentration maps are published by Defra and the Devolved Administrations.[32] Their main purpose is to provide estimates of background

[32] https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

concentrations for specific pollutants, which can then be used in air quality assessments to better understand the contribution of local sources to total pollutant concentrations. The background maps and related tools are updated periodically by Defra due to updates to the underlying data, including emissions factors.

The total concentration of a pollutant is a combination of those from local emission sources (such as roads) as well as those transported into an area from further away (by the wind). If all the local sources were removed, the concentration remaining would be that from further away – this component is defined as the ‘background concentration’. In many situations, the background concentration represents a significant proportion of the total pollutant concentration.

The sources included in background maps for each pollutant can be found in the ‘Background Maps User Guide’ published by Defra.[33] For NOx, these include: motorway sources; trunk A and primary A road sources; minor roads and cold start sources; industry sources (e.g. combustion; energy production, fossil fuel extraction); domestic sources (e.g. heating); aircraft sources; rail sources; ‘other’ sources (e.g. ships, off-road, other); and point sources. The source sectors are split into those emitted from within a grid square and those entering the grid square from outside. This allows the individual sectors to be subtracted from the total background, if a more detailed local assessment is required for that sector.

The UK background maps are available from UK-AIR.[34] Background pollution maps at 1km x 1km resolution are modelled by European Union (EU) Member States as part of ambient air quality directives. The modelling methodology is based on the UK Pollution Climate Mapping (PCM) approach, which is used to model the annual mean background and roadside concentrations for the whole of the UK. These background pollution maps form the basis of the local authority background maps.

The most up-to-date background maps use 2017 as the reference year and are based on monitoring and meteorological data for 2017.[33] The main source of input data is the UK National Atmospheric Emissions Inventory (NAEI) 2016. Emissions projections for non-road traffic sources in the 2017 reference year background maps are based on energy projections from the Department for Business, Energy and Industrial Strategy (BEIS). COPERT 5 NOx emission factors for road emissions are taken from the European Environment Agency (EEA). Outside London, a set of traffic activity projections from the Department for Transport (DfT) are used, whereas inside London bespoke vehicle fleet information for London provided by Transport for London (TfL) is used.

Various Supporting Tools and Processes are available to support the use of the air pollution background concentration maps in air quality assessment. These include “NO_2 Adjustment for NOx Sector Removal” (e.g. for removing road traffic sectors from NOx and NO_2 background maps) and “NOx to NO_2 Calculator” (e.g. to derive NO_2 from NOx when NOx is predicted by modelling emissions from roads).

The maps are based on a combination of validated emission inventory data, validated dispersion modelling methods, and quality assured national air quality monitoring data. As well as being used for Habitats Regulations Assessments, the maps and their supporting data are used as inputs to national and international policy development, and to demonstrate compliance with national and European regulatory requirements, and with international treaty obligations. Consequently, the data in the maps are considered to be robust and not subject to significant scientific doubt. The maps are particularly robust when used to determine background levels away from individual sources, and when considering pollutants other than airborne PM_{10} and $PM_{2.5}$, as is the case for this study.

When considering forward projections to 2036, some additional uncertainty is introduced. In order to make these projections, the technical analysis process takes into account:

[33] Background Concentration Maps User Guide, Defra, May 2019, available online at https://laqm.defra.gov.uk/documents/2017-based-background-maps-user-guide-v1.0.pdf (accessed December 2019).
[34] https://uk-air.defra.gov.uk/data/laqm-background-home

- BEIS annually updated Energy Projections;
- National (Emission Factor Toolkit) and European (COPERT) projections for vehicle exhaust emissions;
- Traffic projections produced by Department for Transport and Transport for London; and
- Foreseeable changes in industrial activity and emissions, having regard to European directives on industrial process emissions.

Note that some resources, such as the background maps, are only projected forward to 2030. Others, such as the NAEI fleet projections (which feeds into the Emission Factor Toolkit), have been forecast up to the year 2035. Both of these years come before the future scenario year of 2036.

As with the mapped data, all these inputs to the projections are also used as inputs to national and international policy development, and to ensure future compliance with national and European regulatory requirements, and international treaty obligations. Consequently, the data in the projections are considered to be robust and not subject to significant scientific doubt.

2.4.4.4 Incorporated mitigation measures

The HRA Stage 2 assessment of effects takes into account any mitigation measures that may already form part of the proposed FBLP specification (i.e. that are ‘incorporated’), to determine whether they will most likely reduce the likelihood, magnitude, scale, and/or duration of the effect to a lower level. These measures can include both avoidance and reduction measures, with the former being the preferred option.

2.4.4.5 Conservation objectives

The Habitats Regulations require that the Appropriate Assessment is of “the implications for the site in view of that site’s conservation objectives.” The development of conservation objectives is required by the 1992 ‘Habitats’ Directive (92/43/EEC).

The generic conservation objectives coving all the European sites assessed in this report are:

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

- *The extent and distribution of qualifying natural habitats and habitats of qualifying species;*
- *The structure and function (including typical species) of qualifying natural habitats;*
- *The structure and function of the habitats of qualifying species;*
- *The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;*
- *The populations of qualifying species; and*
- *The distribution of qualifying species within the site.*

Site-specific conservation objectives are summarised for each designated site in Section 3.

2.4.4.6 Additional mitigation measures

Where the FBLP has been assessed as having a significant adverse effect by undermining the site’s conservation objectives, additional mitigation may be necessary to satisfy the integrity test (Section 2.4.4.7). Such mitigation is that which is in addition to the incorporated measures described in Section 2.4.4.4 above, and which is usually imposed by a Competent Authority through enforceable conditions or restrictions.

2.4.4.7 Integrity test

The integrity test is the conclusion of the Appropriate Assessment and requires the competent authority to ascertain whether the proposed FBLP (either alone or in combination with other plans or projects), will not have an adverse effect on site integrity. The following definition of site integrity is provided by Defra. The integrity of the site is:

"the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the level of populations of the species for which it was classified"

This report will conclude with a professional opinion on whether such a test can be met, but it is for the Competent Authority to make that decision in light of the information presented.

2.5 Limitations

Information provided by third parties, including publicly available information and databases, is considered correct at the time of publication. Due to the dynamic nature of the environment, conditions may change in the period between the preparation of this report, and the adoption of the FBLP.

The HRA has been undertaken in as detailed a way as possible, using all available data sources where they exist. However, the conclusions drawn from this is necessarily limited by the age, type, coverage and availability of data.

Any uncertainties and the limitations of the assessment process are acknowledged and highlighted.

Recommendations for avoidance and mitigation measures to address the potential adverse effects on European Site integrity identified by this report are also based on the information available at the time of the assessment.

3 Assessment of air quality impacts on designated sites

3.1 Chichester and Langstone Harbours Ramsar (UK11013) and SPA (UK9011011)

3.1.1 Ramsar background information and qualifying features

Underlying Sites of Special Scientific Interest (SSSI): Chichester Harbour SSSI, Langstone Harbour SSSI

Qualifying and notifiable features associated with this site include:

Ramsar Criterion 1: Two large estuarine basins linked by the channel which divides Hayling Island from the main Hampshire coastline. The site includes intertidal mudflats, saltmarsh, sand and shingle spits and sand dunes.

Ramsar Criterion 5: Assemblages of international importance: Species with peak counts in winter: 76480 waterfowl (5 year peak mean 1998/99-2002/2003).

Ramsar Criterion 6: Qualifying Species/populations (as identified at designation):

Species with peak counts in spring/autumn:	
Ringed plover, *Charadrius hiaticula*, Europe/Northwest Africa	853 individuals, representing an average of 1.1% of the population (5 year peak mean 1998/92002/3)
Black-tailed godwit, *Limosa limosa islandica*, Iceland/W Europe	906 individuals, representing an average of 2.5% of the population (5 year peak mean 1998/92002/3)
Common redshank, *Tringa totanus totanus*	2577 individuals, representing an average of 1% of the population (5 year peak mean 1998/92002/3)
Species with peak counts in winter:	
Dark-bellied brent goose, *Branta bernicla bernicla*	12987 individuals, representing an average of 6% of the population (5 year peak mean 1998/92002/3)
Common shelduck, *Tadorna tadorna*, NW Europe	1468 individuals, representing an average of 1.8% of the GB population (5 year peak mean 1998/9-2002/3)
Grey plover, *Pluvialis squatarola*, E Atlantic/W Africa -wintering	3043 individuals, representing an average of 1.2% of the population (5 year peak mean 1998/9-2002/3)
Dunlin, *Calidris alpina alpina*, W Siberia/W Europe	33436 individuals, representing an average of 2.5% of the population (5 year peak mean 1998/9-2002/3

Species/populations identified subsequent to designation for possible future consideration under criterion 6:

Species regularly supported during the breeding season:	
Little tern, *Sterna albifrons albifrons*, W Europe	130 apparently occupied nests, representing an average of 1.1% of the breeding population (Seabird 2000 Census)

The Site Improvement Plan for the overlapping SPA (Solent SIP043) states that nitrogen deposition has been identified as a pressure. Ramsar sites do not have Site Improvement Plans.

3.1.2 SPA background information and qualifying features

Underlying Sites of Special Scientific Interest (SSSI): Chichester Harbour SSSI, Langstone Harbour SSSI.

The site qualifies under **Article 4.1** of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

During the breeding season:	
Common Tern *Sterna hirundo*	33 pairs representing up to 0.3% of the breeding population in Great Britain (5 year mean, 1992-1996)
Little Tern *Sterna albifrons*	100 pairs representing up to 4.2% of the breeding population in Great Britain (5 year mean, 1992-1996)
Sandwich Tern *Sterna sandvicensis*	158 pairs representing up to 1.1% of the breeding population in Great Britain (1998)
Over winter:	
Bar-tailed Godwit *Limosa lapponica*	1,692 individuals representing up to 3.2% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)

The site also qualifies under **Article 4.2** of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:

Over winter:	
Curlew *Numenius arquata*	1861 individuals representing up to 1.6% of the European - breeding population (5 year peak mean 1991/92-1995/96)
Dark-bellied Brent Goose *Branta bernicla bernicla*	17,119 individuals representing up to 5.7% of the wintering Western Siberia/Western Europe population (5 year peak mean 1991/2 - 1995/6)
Dunlin *Calidris alpina alpina*	44,294 individuals representing up to 3.2% of the wintering Northern Siberia/Europe/Western Africa population (5 year peak mean 1991/2 - 1995/6)
Grey Plover *Pluvialis squatarola*	3,825 individuals representing up to 2.3% of the Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6)
Pintail *Anas acuta*	330 individuals representing (up to 1.2% of the North-western Europe population (5 year peak mean 1991/92-1995/96)
Redshank *Tringa totanus*	1,788 individuals representing up to 1% of the Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6)
Red-breasted Merganser *Mergus serrator*	297 individuals representing up to 3% of the North-western/Central Europe population (5 year peak mean 1991/92-1995/96)

Over winter:	
Sanderling *Calidris alba*	236 individuals representing up to 0.2% (Eastern Atlantic/Western & Southern Africa - wintering) of the Eastern Atlantic/Western & Southern Africa - wintering population (5 year peak mean 1991/92-1995/96)
Shelduck *Tadorna tadorna*	2410 individuals representing up to 3.3% of the North-western Europe population (5 year peak mean 1991/92-1995/96)
Shoveler *Anas clypeata*	100 individuals representing up to 1% of the North-western/Central Europe population (5 year peak mean 1991/92-1995/96)
Teal *Anas crecca*	1824 individuals representing up to 0.5% of the North-western Europe population (5 year peak mean 1991/92-1995/96)
Turnstone *Arenaria intrepes*	430 individuals representing up to 0.7% of the Western Palearctic – wintering population (5 year peak mean 1991/92-1995/96)
Wigeon *Anas penelope*	2055 individuals representing up to 0.7% of the Western Siberia/North-western/North-eastern Europe population (5 year peak mean 1991/92-1995/96)
Ringed Plover *Charadrius hiaticula*	846 individuals representing up to 3% of the Europe/Northern Africa - wintering population (5 year peak mean 1991/2 - 1995/6)

Assemblage qualification: A wetland of international importance:

Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl.

Over winter, the area regularly supports 93,230 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Bar-tailed godwit, curlew, dark-bellied Brent geese, dunlin, grey plover, pintail, red-breasted merganser, redshank, ringed plover, sanderling, shelduck, shoveler, teal, turnstone and wigeon.

The Site Improvement Plan (SIP043) states that nitrogen deposition has been identified as a pressure.

The conservation objectives for this site are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features,
- The structure and function of the habitats of the qualifying features,
- The supporting processes on which the habitats of the qualifying features rely,
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

3.1.3 HRA Stage 1: Assessment of air quality impacts against screening thresholds

This section comprises the outcome of the assessment described in Section 2.4.

Table 3-1 summarizes all of the critical loads for nutrient nitrogen deposition (kgN/ha-year) and acid deposition (kEq/ha-year), as well as the critical levels for airborne ammonia (µg/m^3), applicable to this designated site. In this table, the most stringent critical load or critical level (CL) for each pollutant is indicated in bold. The critical level for airborne NOx is set at 30 µg/m^3 across all designated sites.

Table 3-1 Minimum Critical Load and Critical Level (CL) values and associated sensitive features for Chichester and Langstone Harbours Ramsar and SPA

Sensitive feature	Minimum nutrient nitrogen deposition CLs (kgN/ha year)	Minimum acid deposition CLs (MinCLMaxN, kEq/ha year)	Minimum airborne NH_3 CLs (µg/m^3)
Sterna sandvicensis (Western Europe/Western Africa) - Sandwich tern	**8**	**1.123**	**3**
Sterna hirundo (Northern/Eastern Europe - breeding) - Common tern	**8**	**1.123**	**3**
Sterna albifrons (Eastern Atlantic - breeding) - Little tern	**8**	**1.123**	**3**
Tadorna tadorna (North-western Europe) - Common shelduck	20	Not sensitive	**3**
Anas penelope (Western Siberia/North-western/North-eastern Europe) - Eurasian wigeon	20	Not sensitive	**3**
Anas crecca (North-western Europe) - Eurasian teal	20	Not sensitive	**3**
Anas acuta (North-western Europe) - Northern pintail	20	Not sensitive	**3**
Mergus serrator (North-western/Central Europe) - Red-breasted merganser	20	Not sensitive	**3**
Charadrius hiaticula (Europe/Northern Africa - wintering) - Ringed plover	20	Not sensitive	**3**
Pluvialis squatarola (Eastern Atlantic - wintering) - Grey plover	20	Not sensitive	**3**
Calidris alba (Eastern Atlantic/Western & Southern Africa - wintering) - Sanderling	20	Not sensitive	**3**
Limosa lapponica (Western Palearctic - wintering) - Bar-tailed godwit	20	Not sensitive	**3**
Numenius arquata (Europe - breeding) - Eurasian curlew	20	**1.123**	**3**
Tringa totanus (Eastern Atlantic - wintering) - Common redshank	20	Not sensitive	**3**
Arenaria interpres (Western Palearctic - wintering) - Ruddy turnstone	20	Not sensitive	**3**

Sensitive feature	Minimum nutrient nitrogen deposition CLs (kgN/ha year)	Minimum acid deposition CLs (MinCLMaxN, kEq/ha year)	Minimum airborne NH_3 CLs (µg/m^3)
	20	Not sensitive	

Consideration of in combination effects

The Chichester and Langstone Harbours Ramsar and SPA designated sites are contained within the PfSH study area. The PfSH model was used to model the in combination impacts of the FBLP by scaling the air quality model outputs from the PfSH future year scenarios (for the year 2034) to 2036, as described in Section 2.3.10.2. The dispersion modelling results of the PfSH 2036 DM scenario are therefore representative of air quality impacts associated with road traffic emissions from the FBLP, as well as in combination air quality impacts associated with road traffic emissions from anticipated development up to 2036 in East Hampshire (part), Eastleigh, Gosport, Havant, Isle of Wight, New Forest, Portsmouth, Southampton, Test Valley (part), and Winchester (part).

Screening results

Table 3-2 compares the maximum modelled contribution of the FBLP in isolation (Fareham 2036 DM scenario) to the lowest applicable CL. Values highlighted in yellow exceed the 1% screening threshold. This screening exercise represents a precautionary approach, as it assumes that the most sensitive qualifying features (with the lowest CLs) are present in the areas with the highest modelled contribution (typically adjacent to the busiest road).

Table 3-2 Screening results based on dispersion modelling of the FBLP in isolation:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
Nutrient nitrogen deposition (kgN/ha-year)	Forest	8	1.3×10^{-14}	<0.001%
				<0.001%
Acid deposition (kEq/ha-year)	Forest	1.123	1.0×10^{-15}	<0.001%
				<0.001%
Airborne NOx (µg/m^3)	n/a	30	0	<0.001%
				<0.001%

This designated site is mainly characterised by marine habitats with short vegetation, and in these areas, the grassland deposition rates are applicable. There is a wedge-shaped section of the site located north of the A27, where taller vegetation is present and where forest deposition rates are applicable.

None of the four pollutants exceeded the 1% screening threshold for the Fareham 2036 DM Scenario using forest of grassland deposition rates. The contribution from the FBLP in isolation is essentially zero across all pollutants, so an in combination assessment is not required for Chichester and Langstone Harbours Ramsar and SPA.

3.2 New Forest Ramsar (UK11047) and SPA (UK9011031)

3.2.1 Ramsar background information and qualifying features

Underlying Sites of Special Scientific Interest (SSSI): Lymington River SSSI, Norely Copse and Meadow SSSI, River Avon System SSSI, The New Forest SSSI

Qualifying and notifiable features associated with this site include:

Ramsar Criterion 1: Valley mires and wet heaths are found throughout the site and are of outstanding scientific interest. The mires and heaths are within catchments whose uncultivated and undeveloped state buffer the mires against adverse ecological change. This is the largest concentration of intact valley mires of their type in Britain.

Ramsar Criterion 2: The site supports a diverse assemblage of wetland plants and animals including several nationally rare species. Seven species of nationally rare plants are found on the site, as are at least 65 British Red Data Book species of invertebrate. The higher plants *Cicendia filiformis*, *Illecebrum verticillatum* and *Myosurus minimus* are considered vulnerable by the GB Red Book; while *Mentha pulegium* and *Ranunculus tripartitus* are included as endangered; and *Pulicaria vulgaris* as critically endangered. The Dark Guest Ant *Anergates atratulus* is also considered vulnerable by the IUCN Red List.

Ramsar Criterion 3: The mire habitats are of high ecological quality and diversity and have undisturbed transition zones. The invertebrate fauna of the site is important due to the concentration of rare and scarce wetland species. The whole site complex, with its examples of semi-natural habitats is essential to the genetic and ecological diversity of southern England. The site contains a rich invertebrate fauna.

3.2.2 SPA background information and qualifying features

Underlying Sites of Special Scientific Interest (SSSI): Lymington River SSSI, Norely Copse and Meadow SSSI, River Avon System SSSI, The New Forest SSSI

The site qualifies under **Article 4.1** of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

During the breeding season:	
Dartford Warbler *Sylvia undata*	538 pairs representing at least 33.6% of the breeding population in Great Britain (1993)
Honey Buzzard *Pernis apivorus*	2 pairs representing at least 10.0% of the breeding population in Great Britain (1993)
Nightjar *Caprimulgus europaeus*	300 pairs representing at least 8.8% of the breeding population in Great Britain (1993)
Woodlark *Lullula arborea*	184 pairs representing at least 12.3% of the breeding population in Great Britain (1997)
Hobby *Falco subbuteo*	N/A
Wood warbler *Phylloscopus sibilatri*	N/A
During the non-breeding season:	
Hen Harrier *Circus cyaneus*	15 individuals representing at least 2.0% of the wintering population in Great Britain (1993)

The Site Improvement Plan (SIP141124) states that nitrogen deposition has been identified as a pressure.

The conservation objectives for this site are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features,
- The structure and function of the habitats of the qualifying features,
- The supporting processes on which the habitats of the qualifying features rely,
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

3.2.3 HRA Stage 1: Assessment of air quality impacts against screening thresholds

Table 3-3 summarizes all of the critical loads for nutrient nitrogen deposition (kgN/ha-year) and acid deposition (kEq/ha-year), as well as the critical levels for airborne ammonia (µg/m^3), applicable to this designated site. In this table, the most stringent critical load or critical level (CL) for each pollutant is indicated in bold. The critical level for airborne NOx is set at 30 µg/m^3 across all designated sites.

Table 3-3 Minimum Critical Load and Critical Level (CL) values and associated sensitive features for The New Forest Ramsar & SPA

Sensitive feature	Minimum nutrient nitrogen deposition CLs (kgN/ha year)	Minimum acid deposition CLs (MinCLMaxN, kEq/ha year)	Minimum airborne NH_3 CLs (µg/m^3)
Caprimugulus europaeus - European nightjar	**5**	**0.862**	**3**
Lulla arborea - Wood lark	**5**	**0.862**	**3**
Pernis apivorus - European honey-buzzard	10	1.062	**3**
Circus cyaneus - Hen harrier	10	**0.862**	**3**
Falco subbuteo - Eurasian hobby	10	**0.862**	**3**
Sylvia undata - Dartford warbler	10	**0.862**	**3**
Phylloscopus sibilatrix - Wood warbler	10	1.062	**3**

Consideration of in combination effects

The original PfSH study area contained portions of the New Forest Ramsar and SPA. Supplementary traffic data was incorporated into the model (see Section 2.3.4) in order to ensure that in combination development and increased traffic along the most important road links crossing the entirety of the New Forest designated sites were included in this study. The PfSH model was used to model the in combination impacts of the FBLP by scaling the air quality model outputs from the PfSH future year scenarios (for the year 2034) to 2036, as described in Section 2.3.10.2. The dispersion modelling results of the PfSH 2036 DM scenario are therefore representative of air quality impacts associated with road traffic emissions from the FBLP, as well as in combination air quality impacts associated with road traffic emissions from anticipated development up to 2036 in East Hampshire (part), Eastleigh, Gosport, Havant, Isle of Wight, New Forest, Portsmouth, Southampton, Test Valley (part), and Winchester (part).

Screening results

Table 3-4 compares the maximum modelled contribution of the FBLP in isolation (Fareham 2036 DM Scenario) and Table 3-5 compares the maximum modelled contribution of the FBLP in combination (PfSH 2036 DM Scenario) to the lowest applicable CL. Values highlighted in yellow exceed the 1% screening threshold. This screening exercise represents a precautionary approach, as it assumes that the most sensitive qualifying features (with the lowest CLs) are present in the areas with the highest modelled contribution (typically adjacent to the M27).

Table 3-4 Screening results based on dispersion modelling of the FBLP in isolation:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
Nutrient nitrogen deposition (kgN/ha-year)	Forest	5	0.000673	0.013%
				0.008%
Acid deposition (kEq/ha-year)	Forest	0.862	0.0000479	0.006%
				0.003%
Airborne NOx (µg/m^3)	n/a	30	0.00661	0.022%
				0.002%

Table 3-5 Screening results based on dispersion modelling of the FBLP in combination:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
Nutrient nitrogen deposition (kgN/ha-year)	Forest	5	2.45	49.0%
				32.0%
Acid deposition (kEq/ha-year)	Forest	0.862	0.174	20.2%
				13.2%
Airborne NOx (µg/m^3)	n/a	30	1.13	3.78%
				10.1%

The site is a mixture of areas with tall and short vegetation; both grassland and forest deposition rates apply, to different areas.

None of the four pollutants exceeded the 1% screening threshold for the FBLP in isolation. However, the contribution from the FBLP in combination exceeds the 1% screening threshold across all pollutants, and the contribution from the FBLP in isolation is greater than zero across all pollutants.

For all four pollutants, the maximum contribution of the FBLP in isolation has been calculated, as shown in Table 3-4. In all cases, the maximum contribution is less than 0.025% of the lowest applicable CL. To put this into context, with the FBLP having an individual contribution comprising less than 0.025% of the lowest CL, it would require 40 or more such individual contributions (from other plans or projects) to attain, in combination, the screening threshold of 1% of the applicable CL.

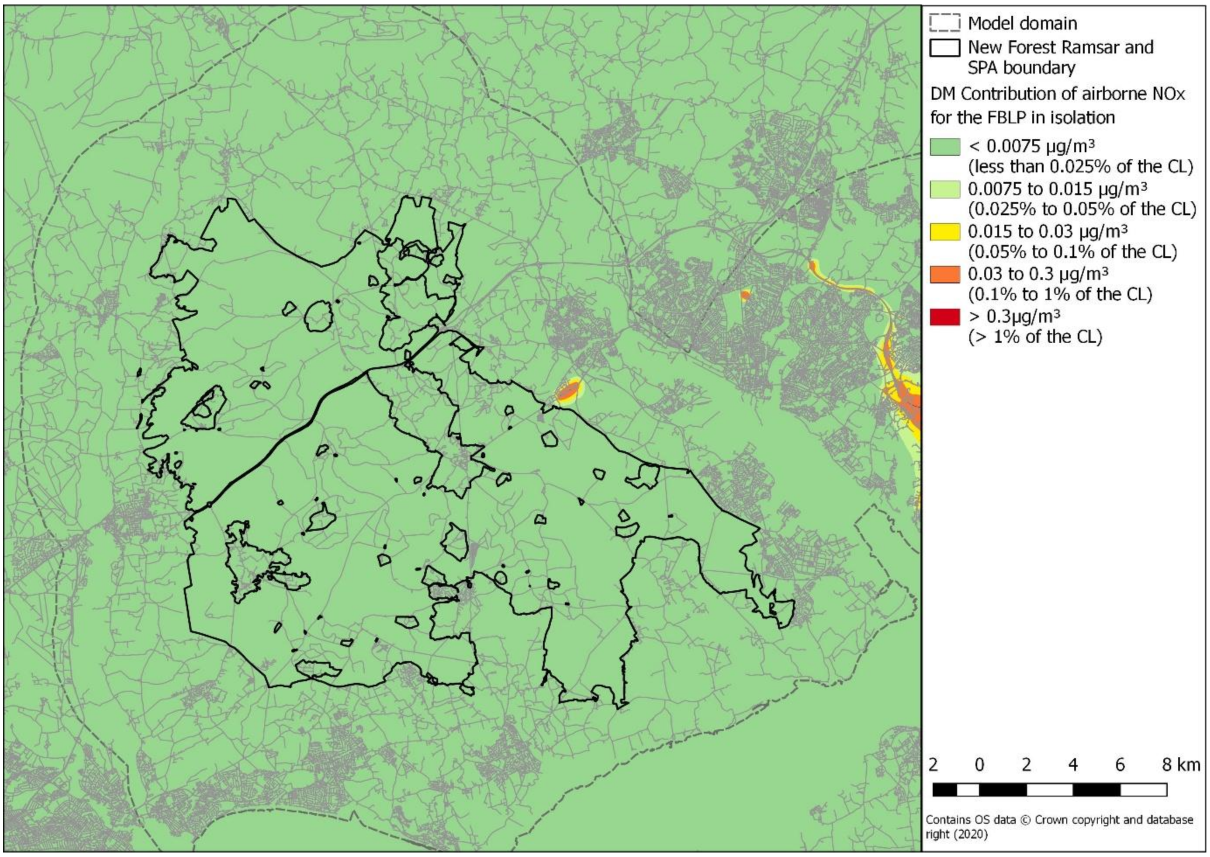
It is important to note that although the site is exceeding in combination with other plans and projects, as the contribution from the FBLP is so small, any mitigation measures incorporated into the FBLP would have an essentially negligible impact on reducing the pollutant in this area; eliminating the FBLP entirely would reduce the nitrogen deposition by less than 0.025%. This indicates that the contribution of the FBLP to all pollutants in this area is so small as to be nugatory or indistinguishable from background variations, and a contribution of this magnitude would therefore not have any appreciable effect on the designated site.

The concept of an effect which is so small as to be nugatory or indistinguishable from background variations, and which can therefore be excluded from further assessment under the Habitats Regulations, is supported by current guidance from Natural England.[35] In view of the minimal impact due to the FBLP in isolation, it is concluded that there is no plausible significant adverse effect on the integrity of the SAC due to the FBLP in combination with other plans and projects.

3.2.3.1 Airborne NOx

To demonstrate this, the worst-case pollutant (airborne NOx) was examined further. The maximum modelled contribution of the FBLP in isolation across the entirety of the site was 0.000662 μg/m^3, corresponding to 0.0220% of the CL (30 μg/m^3 for all vegetation). There are no significant adverse effects on the integrity of the SAC anticipated due to the FBLP in combination with other plans and projects.

Figure 3-1 Overview of FBLP contribution, in isolation, for oxides of nitrogen (NOx) at the New Forest Ramsar and SPA



3.2.3.2 Assessment summary and conclusions

Natural England has confirmed that as the contribution from the FBLP in isolation is less than 0.025% of the lowest CL, for all pollutants, the contribution of the FBLP to in combination impacts can be considered not significant.[36]

---

[35] Natural England, "Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations", June 2018, see paragraph 4.47.

[36] Conference call between Natural England, FBC, UEEC and Ricardo, 8 July 2020

Adverse effects (pre-mitigation) can be discounted for all qualifying features of the New Forest Ramsar and SPA, and for nitrogen deposition, acid deposition, oxides of nitrogen (NOx) and ammonia (NH_3) as causal pollutants.

On the basis of available evidence, adverse effects on this Ramsar and SPA site can be discounted and as such there will be no threat to the ability of the European site to achieve its conservation objectives or maintain its integrity as a result of the FBLP, in combination with development in other local authorities within the PfSH sub-region.

3.3 New Forest SAC (UK0012557)

3.3.1 SAC background information and qualifying features

Underlying Sites of Special Scientific Interest (SSSI): Landford Bog SSSI, Langley Wood and Homan's Copse SSSI, Loosehanger Copse and Meadows SSSI, Roydon Woods SSSI, The New Forest SSSI, Whiteparish Common SSSI

Qualifying and notifiable features associated with this site comprise: H3110 Oligotrophic water contains few minerals of sandy plains, H3130 Oligotrophic to mesotrophic standing water with vegetation, H3260 Water courses of plain to montane levels with *R. fluitantis*, H4010 Northern Atlantic wet heaths with *Erica tetralix*, H4020 Temp Atlantic wet heaths with *Erica ciliaris* and *E. tetralix*, H4030 European dry heaths, H6410 Molinia meadows on calcareous, peat or clay-silt soil, H7140 Transition mires and quaking bogs, H7150 Depressions on peat substrates of the *Rhynchosporion*, H7230 Alkaline fens, H9120 Atlantic acidophilous beech forests with Ilex, H9130 *Asperulo-Fagetum* beech forests, H9190 Old acidophilous oak woods with Q. robur on sandy plains, H91D0 Bog woodland, H91E0 Alluvial woods with *A. glutinosa*, *F. excelsior*, S1044 Southern damselfly, *Coenagrion mercurial*, S1083 Stag beetle *Lucanus cervus*, S1166 Great crested newt, *Triturus cristatus*.

The Site Improvement Plan (SIP141124) discussed in Section 3.2.2 covers both SPA and SAC. Nitrogen deposition has been identified as a pressure.

The conservation objectives for this site are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of qualifying natural habitats and habitats of qualifying species
- The structure and function (including typical species) of qualifying natural habitats
- The structure and function of the habitats of qualifying species
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely
- The populations of qualifying species, and,
- The distribution of qualifying species within the site.

3.3.2 HRA Stage 1: Assessment of air quality impacts against screening thresholds

This section comprises the outcome of the assessment described in Section 2.4.

Table 3-6 summarizes all of the critical loads for nutrient nitrogen deposition (kgN/ha-year) and acid deposition (kEq/ha-year), as well as the critical levels for airborne ammonia (µg/m^3), applicable to this designated site. In this table, the most stringent critical load or critical level (CL) for each pollutant is indicated in bold. The critical level for airborne NOx is set at 30 µg/m^3 across all designated sites.

Table 3-6 Minimum Critical Load and Critical Level (CL) values and associated sensitive features for The New Forest SAC

Sensitive feature	Minimum nutrient nitrogen deposition CLs (kgN/ha year)	Minimum acid deposition CLs (MinCLMaxN, kEq/ha year)	Minimum airborne NH_3 CLs (µg/m^3)
Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoeto-Nanojuncetea*	**3**	No CL found on APIS	3; APIS indicates no lichens or bryophytes present

Sensitive feature	Minimum nutrient nitrogen deposition CLs (kgN/ha year)	Minimum acid deposition CLs (MinCLMaxN, kEq/ha year)	Minimum airborne NH_3 CLs (μg/m³)
Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)	5	No CL found on APIS	3; APIS indicates no lichens or bryophytes present
Bog woodland	5	**0.547**	Site specific advice should be sought; APIS indicates lichens and bryophytes are present
Transition mires and quaking bogs	10	**0.547**	**1**
Depressions on peat substrates of the *Rhynchosporion*	10	**0.547**	**1**
Old acidophilous oak woods with *Quercus robur* on sandy plains	10	1.062	Site specific advice should be sought; APIS indicates lichens and bryophytes are present
Northern Atlantic wet heaths with *Erica tetralix*	10	0.862	**1**
European dry heaths	10	0.862	**1**
Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (*Quercion robori-petraeae* or *Ilici-Fagenion*)	10	1.062	Site specific advice should be sought; APIS indicates lichens and bryophytes are present
Asperulo-Fagetum beech forests	10	1.062	Site specific advice should be sought; APIS indicates lichens and bryophytes are present
Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)	15	0.586	3; APIS indicates no lichens or bryophytes present
Alkaline fens	15	Not sensitive	**1**
Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)	Not sensitive	Not sensitive	**1**
Coenagrion mercuriale - Southern damselfly	10	0.862	3

Sensitive feature	Minimum nutrient nitrogen deposition CLs (kgN/ha year)	Minimum acid deposition CLs (MinCLMaxN, kEq/ha year)	Minimum airborne NH_3 CLs (µg/m^3)
	10	1.062	

Consideration of in combination effects

The original PfSH study area contained portions of the New Forest Ramsar and SPA. Supplementary traffic data was incorporated into the model (see Section 2.3.4) in order to ensure that in combination development and increased traffic along the most important road links crossing the entirety of the New Forest designated sites were included in this study. The PfSH model was used to model the in combination impacts of the FBLP by scaling the air quality model outputs from the PfSH future year scenarios (for the year 2034) to 2036, as described in Section 2.3.10.2. The dispersion modelling results of the PfSH 2036 DM scenario are therefore representative of air quality impacts associated with road traffic emissions from the FBLP, as well as in combination air quality impacts associated with road traffic emissions from anticipated development up to 2036 in East Hampshire (part), Eastleigh, Gosport, Havant, Isle of Wight, New Forest, Portsmouth, Southampton, Test Valley (part), and Winchester (part).

Screening results

Table 3-7 compares the maximum modelled contribution of the FBLP in isolation (Fareham 2036 DM Scenario) and Table 3-8 compares the maximum modelled contribution of the FBLP in combination (PfSH 2036 DM Scenario) to the lowest applicable CL. Values highlighted in yellow exceed the 1% screening threshold. This screening exercise represents a precautionary approach, as it assumes that the most sensitive qualifying features (with the lowest CLs) are present in the areas with the highest modelled contribution (typically adjacent to the M27).

Table 3-7 Screening results based on dispersion modelling of the FBLP in isolation:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
Nutrient nitrogen deposition (kgN/ha-year)	Forest	3	0.000673	0.02%
				0.01%
Acid deposition (kEq/ha-year)	Forest	0.547	0.0000479	0.01%
				0.01%
Airborne NOx (µg/m^3)	n/a	30	0.00673	0.02%
				0.01%

Table 3-8 Screening results based on dispersion modelling of the FBLP in combination:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
Nutrient nitrogen deposition (kgN/ha-year)	Forest	3	6.10	203%
	Grassland	3	4.06	135%
Acid deposition (kEq/ha-year)	Forest	0.547	0.434	79.3%
	Grassland	0.547	0.289	52.8%
Airborne NOx (µg/m^3)	n/a	30	0.711	2.37%
Airborne NH_3 (µg/m^3)	n/a	1	0.812	81.2%

The site is a mixture of areas with tall and short vegetation; both grassland and forest deposition rates apply to different areas.

None of the four pollutants exceeded the 1% screening threshold for the FBLP in isolation. However, the contribution from the FBLP in combination exceeds the 1% screening threshold across all pollutants, and the contribution from the FBLP in isolation is greater than zero across all pollutants.

For all four pollutants, the maximum contribution of the FBLP in isolation has been calculated, as shown in Table 3-7. In all cases, the maximum contribution is less than 0.025% of the lowest applicable CL. To put this into context, with the FBLP having an individual contribution comprising less than 0.025% of the lowest CL, it would require 40 or more such individual contributions (from other plans or projects) to attain, in combination, the screening threshold of 1% of the applicable CL.

It is important to note that although the site is exceeding in combination with other plans and projects, as the contribution from the FBLP is so small, any mitigation measures incorporated into the FBLP would have an essentially negligible impact on reducing the pollutant in this area; eliminating the FBLP entirely would reduce the nitrogen deposition by less than 0.025%. This indicates that the contribution of the FBLP to all pollutants in this area is so small as to be nugatory or indistinguishable from background variations, and a contribution of this magnitude would therefore not have any appreciable effect on the designated site.

The concept of an effect which is so small as to be nugatory or indistinguishable from background variations, and which can therefore be excluded from further assessment under the Habitats Regulations, is supported by current guidance from Natural England.[37] In view of the minimal impact due to the FBLP in isolation, it is concluded that there is no plausible significant adverse effect on the integrity of the SAC due to the FBLP in combination with other plans and projects.

To demonstrate this, the worst-case pollutants (nitrogen deposition and airborne NOx) have been examined further.

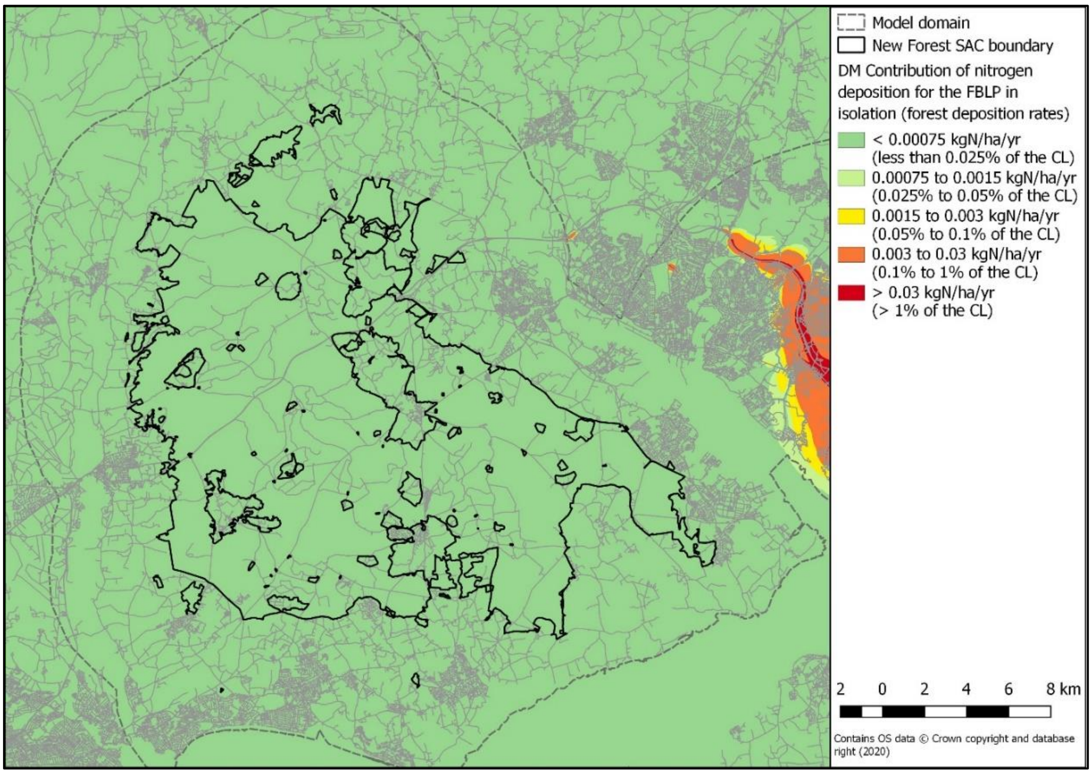
3.3.2.1 Nitrogen deposition

Figure 3-2 illustrates the modelled contributions of nitrogen deposition (assuming forest deposition rates) in isolation from the Fareham 2036 DM scenario as a percentage of the CL.

The maximum modelled contribution of the FBLP in isolation across the entirety of the site was 0.000673 kgN/ha-year, corresponding to 0.0224% of the CL. There are no significant adverse effects on the integrity of the SAC anticipated due to the FBLP in combination with other plans and projects.

[37] Natural England, "Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations", June 2018, see paragraph 4.47.

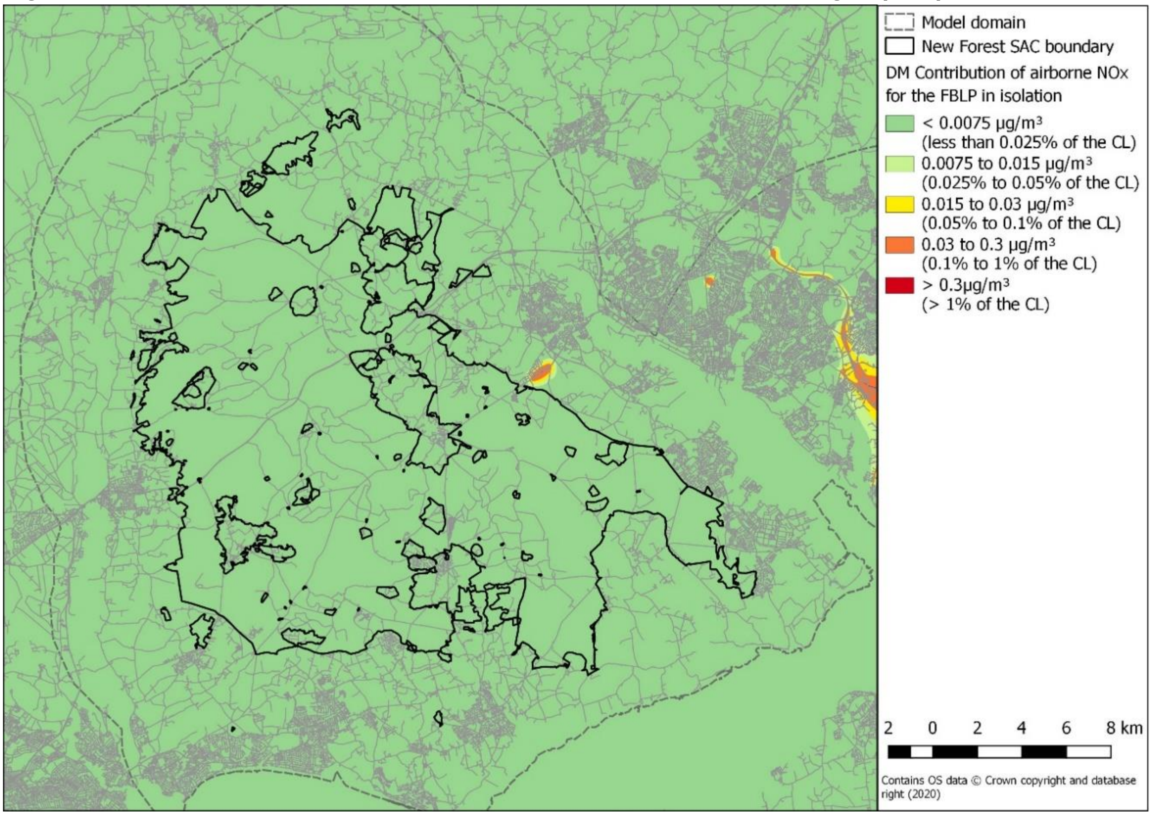
Figure 3-2 Overview of the FBLP contribution, in isolation, of nitrogen deposition at The New Forest SAC



3.3.2.2 Airborne NOx

Figure 3-3 illustrates the modelled contributions of airborne NOx from the FBLP in isolation as a percentage of the CL.

Figure 3-3 Overview of FBLP contribution, in isolation, for oxides of nitrogen (NOx) at the New Forest SAC



The maximum modelled contribution of the FBLP in isolation across the entirety of the site was 0.000673 μg/m^3, corresponding to 0.0224% of the CL (30 µg/m^3 for all vegetation). There are no significant adverse effects on the integrity of the SAC anticipated due to the FBLP in combination with other plans and projects.

3.3.2.3 Assessment summary and conclusions

Natural England has confirmed that as the contribution from the FBLP in isolation is less than 0.025% of the lowest CL, for all pollutants, the contribution of the FBLP to in combination impacts can be considered not significant.[36]

Adverse effects (pre-mitigation) can be discounted for all qualifying features of the New Forest SAC, and for nitrogen deposition, acid deposition, oxides of nitrogen (NOx) and ammonia (NH_3) as causal pollutants.

On the basis of available evidence, adverse effects on this SAC site can be discounted and as such there will be no threat to the ability of the European site to achieve its conservation objectives or maintain its integrity as a result of the FBLP, in combination with development in other local authorities within the PfSH sub-region.

3.4 Portsmouth Harbour Ramsar (UK11055) and SPA (UK9011051)

3.4.1 Ramsar background information and qualifying features

Underlying Sites of Special Scientific Interest (SSSI): Portsmouth Harbour SSSI.

Qualifying and notifiable features associated with this site include:

Ramsar Criterion 3: The intertidal mudflat areas possess extensive beds of eelgrass *Zostera angustifolia* and *Zostera noltei* which support the grazing dark-bellied brent geese *Branta bernicla bernicla* populations. The mud-snail *Hydrobia ulvae* is found at extremely high densities, which helps to support the wading bird interest of the site. Common cord-grass *Spartina anglica* dominates large areas of the saltmarsh and there are also extensive areas of green algae *Enteromorpha* spp. and sea lettuce *Ulva lactuca*. More locally the saltmarsh is dominated by sea purslane *Halimione portulacoides* which gradates to more varied communities at the higher shore levels. The site also includes a number of saline lagoons hosting nationally important species.

Ramsar Criterion 6: Species/populations occurring at levels of international importance

Qualifying Species/populations (as identified at designation): Species with peak counts in winter:	
Dark-bellied brent goose, *Branta bernicla bernicla*	2105 individuals, representing an average of 2.1% of the GB population (5 year peak mean 1998/9-2002/3)

The Site Improvement Plan for the overlapping SPA (Solent SIP043) states that nitrogen deposition has been identified as a pressure. Ramsar sites do not have Site Improvement Plans.

3.4.2 SPA background information and qualifying features

Underlying Sites of Special Scientific Interest (SSSI): Portsmouth Harbour SSSI.

The site qualifies under **Article 4.2** of the Directive (79/409/EEC) by supporting populations of European importance of the following wintering species.

Over winter:	
Dark-bellied Brent Goose *Branta bernicla bernicla*	2,847 individuals representing 0.9% of the wintering Western Siberia/Western Europe population (5 year peak mean 1991/2 - 1995/6)
Black-tailed godwit *Limosa limosa islandica*	31 individuals representing 0.4% of the population in Great Britain (5 year peak mean 1991/92-1995/96)
Dunlin *Calidris alpine alpina*	5123 individuals representing 1% of the population in Great Britain 5 year peak mean 1991/92-1995/96
Red-breasted merganser *Mergus serrator*	87 individuals representing 0.9% of the population in Great Britain (5 year peak mean 1991/92-1995/96)

The Site Improvement Plan (SIP043) states that nitrogen deposition has been identified as a pressure.

The conservation objectives for this site are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features,
- The structure and function of the habitats of the qualifying features,

- The supporting processes on which the habitats of the qualifying features rely,
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

3.4.3 HRA Stage 1: Assessment of air quality impacts against screening thresholds

This section comprises the outcome of the screening assessment described in Section 2.4.

Table 3-9 summarizes all of the critical loads for nutrient nitrogen deposition (kgN/ha-year) and acid deposition (kEq/ha-year), as well as the critical levels for airborne ammonia (µg/m^3), applicable to this designated site. The most stringent critical load or critical level (CL) for each pollutant is indicated in bold. The critical level for airborne NOx is set at 30 µg/m^3 across all designated sites.

Table 3-9 Minimum Critical Load and Critical Level (CL) values and associated sensitive features for Portsmouth Harbour Ramsar and SPA

Sensitive feature	Minimum nutrient nitrogen deposition CLs (kgN/ha year)	Minimum acid deposition CLs (MinCLMaxN, kEq/ha year)	Minimum airborne NH_3 CLs (µg/m^3)
Branta bernicla bernicla (Western Siberia/Western Europe) - Dark-bellied brent goose	**20**	Not sensitive	**3**
Mergus serrator (North-western/Central Europe) - Red-breasted merganser	**20**	Not sensitive	**3**
Calidris alpina alpina (Northern Siberia/Europe/Western Africa) - Dunlin	**20**	Not sensitive	**3**
Limosa limosa islandica (Iceland - breeding) - Black-tailed godwit	**20**	Not sensitive	**3**

Consideration of in combination effects

The Portsmouth Harbour Ramsar and SPA designated sites are contained within the PfSH study area. The PfSH model was used to model the in combination impacts of the FBLP by scaling the air quality model outputs from the PfSH future year scenarios (for the year 2034) to 2036, as described in Section 2.3.10.2. The dispersion modelling results of the PfSH 2036 DM scenario are therefore representative of air quality impacts associated with road traffic emissions from the FBLP, as well as in combination air quality impacts associated with road traffic emissions from anticipated development up to 2036 in East Hampshire (part), Eastleigh, Gosport, Havant, Isle of Wight, New Forest, Portsmouth, Southampton, Test Valley (part), and Winchester (part).

Screening results

Table 3-10 compares the maximum modelled contribution of the FBLP in isolation (Fareham 2036 DM Scenario) and Table 3-11 compares the maximum modelled contribution of the FBLP in combination (PfSH 2036 DM Scenario) to the lowest applicable CL. Values highlighted in yellow exceed the 1% screening threshold. This screening exercise represents a precautionary approach, as it assumes that the most sensitive qualifying features (with the lowest CLs) are present in the areas with the highest modelled contribution (typically adjacent to the busiest road).

Table 3-10 Screening results based on dispersion modelling of the FBLP in isolation:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
Nutrient nitrogen deposition (kgN/ha-year)	Grassland	20	0.122	0.61%
Acid deposition (kEq/ha-year)			n/a	n/a
Airborne NOx (µg/m³)	n/a	30	0.816	2.72%
		3		0.55%

Table 3-11 Screening results based on dispersion modelling of the FBLP in combination:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
Nutrient nitrogen deposition (kgN/ha-year)	Grassland	20	10.8	53.9%
Acid deposition (kEq/ha-year)	Grassland	Not sensitive	n/a	n/a
Airborne NOx (µg/m³)	n/a	30	4.03	13.4%
Airborne NH_3 (µg/m³)	n/a	3	2.12	70.7%

This site is characterised by marine habitats with short vegetation; therefore, grassland deposition rates are applicable.

None of the qualifying features of the site are sensitive to acid deposition, meaning that likely significant effects from this pollutant can be ruled out. Of the remaining three pollutants, airborne NOx is predicted to exceed the 1% screening threshold for the FBLP in isolation and therefore likely significant effects from air quality impacts cannot be ruled out in isolation or in combination. Likely significant effects also cannot be ruled out for nitrogen deposition or airborne ammonia for the FBLP in combination. Therefore, a Stage 2 Appropriate Assessment has been undertaken in the following section.

3.4.4 HRA Stage 2: Appropriate Assessment

3.4.4.1 Airborne NH_3

The modelled contribution of airborne NH_3 from the FBLP in combination (PfSH DM scenario) was added to background levels of ammonia across the site (obtained from APIS). The predicted NH_3 concentration does not exceed the CL of 3 µg/m³ anywhere within the designated site boundary. The maximum total concentration (road contribution plus background concentrations) of NH_3 for the FBLP in combination is 2.30 µg/m³, which is 76.7% of the CL of 3 µg/m³.

On the basis of available evidence and agreed thresholds, there are no adverse effects on this Ramsar and SPA site arising from increased airborne NH_3 concentrations associated with the FBLP in isolation or in combination.

3.4.4.2 Nitrogen deposition

Figure 3-4 illustrates the areas where the modelled contributions from the FBLP in combination (PfSH 2036 DM scenario, light blue outline) are predicted to exceed the screening threshold (1% of the lowest CL). Five main areas of exceedance were identified: the area in the West comprises three small zones of exceedance (Fareham Creek), there is one area in the north (Port Solent), one small area in the south (Gosport) and two larger areas in the East of the site (north and south of Tipner Lake).

Summary of critical loads:

- Black-tailed godwit is listed as "sensitive due to nutrient nitrogen impacts on broad habitat" on APIS, for a broad habitat type of pioneer, low-mid and mid-upper saltmarshes, with a CL range of 20 – 30 kgN/ha-year.
- Red-breasted merganser is listed as not being sensitive to nutrient nitrogen impacts on broad habitat, although the broad habitat itself is sensitive to nutrient nitrogen impacts. The CL range is the same (20 – 30 kgN/ha-year for broad habitat type – Pioneer, low-mid, upper-mid saltmarshes).
- APIS[38] provides additional guidance for nitrogen deposition on saltmarshes for detailed assessments: "*Effects are most likely to be found in the tall vegetation of the closed upper marsh communities where inter-specific competition is at its greatest. Therefore, it is suggested that the value of 30 kgN/ha-year is applied to most of the mash with the lower level of 20 kgN/ha-year being applied to the more densely vegetated upper marsh and to areas of marsh subjected to direct run-off from adjacent catchments.*"

Figure 3-4 Overview of the screening results for nitrogen deposition at Portsmouth Harbour Ramsar & SPA, assuming grassland deposition rates and a CL of 20 kgN/ha-year

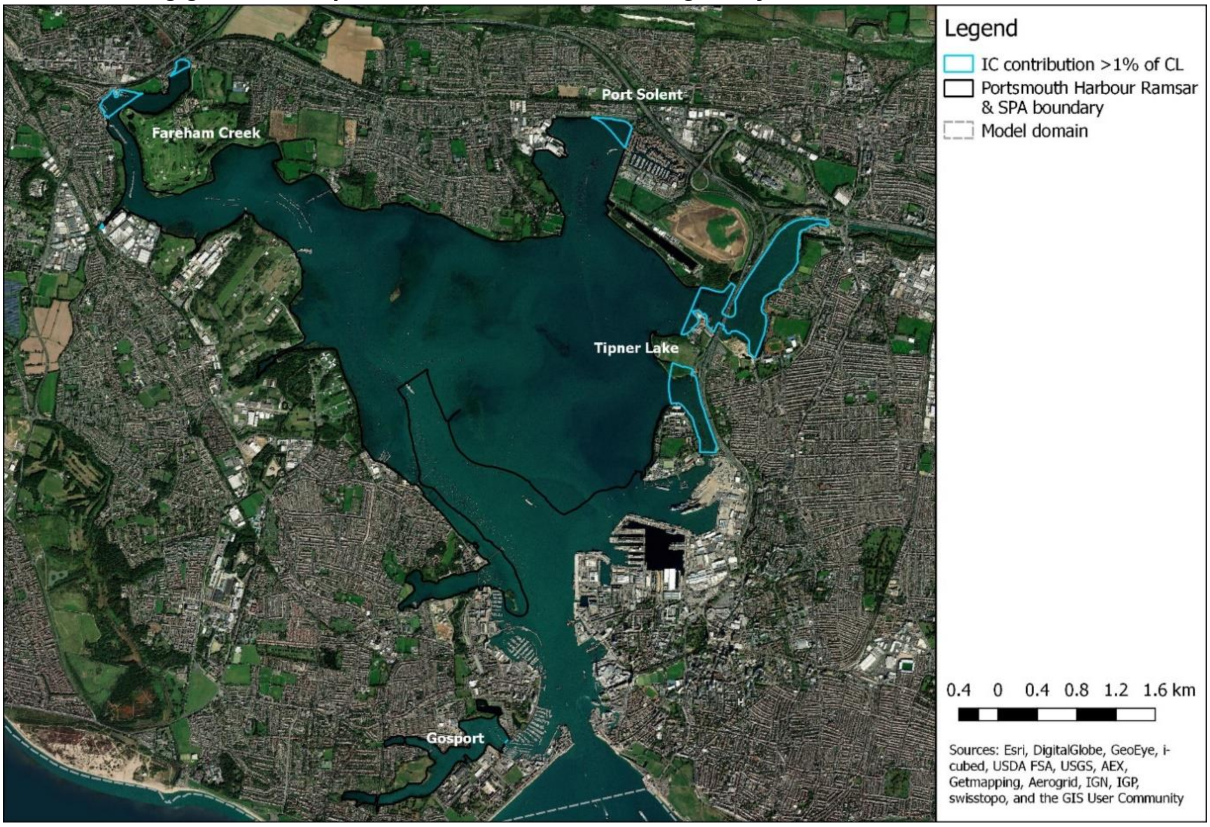


Figure 3-5 shows the modelled contribution of nitrogen deposition from the FBLP in combination (PfSH 2036 DM scenario) added to the background concentrations[39] of nitrogen deposition throughout the site.

The predicted total nitrogen deposition (assuming grassland deposition rate) is 23.96 kEq/ha/yr which exceeds the CL (119.8% of the CL of 20 kgN/ha-year). However, these concentrations only fall within the centre of the road, as shown in Figure 3-6. For the majority of the site, and all areas not including the roads, total modelled nitrogen deposition does not exceed 90% of the CL.

[38] http://www.apis.ac.uk/sites/default/files/downloads/APIS%20critical_load_range_document.pdf, p. 1

[39] Site/Feature Information, Portsmouth Harbour, http://www.apis.ac.uk/popup/gridded-concentration-deposition-2019?sitecode=UK9011051&deptype=G&featurecode=A069&accode=NSH, accessed 16/08/2019.

On the basis of available evidence, including the current background levels of nitrogen deposition, there are no adverse effects on this Ramsar and SPA site arising from the increased nitrogen deposition associated with the FBLP in combination.

Figure 3-5 Areas where the modelled contribution of the FBLP in combination exceeds 1% of the CL, overlain with the total modelled nitrogen deposition for the FBLP in combination, assuming grassland deposition rates and a CL of 20 kgN/ha-year, at Portsmouth Harbour Ramsar & SPA

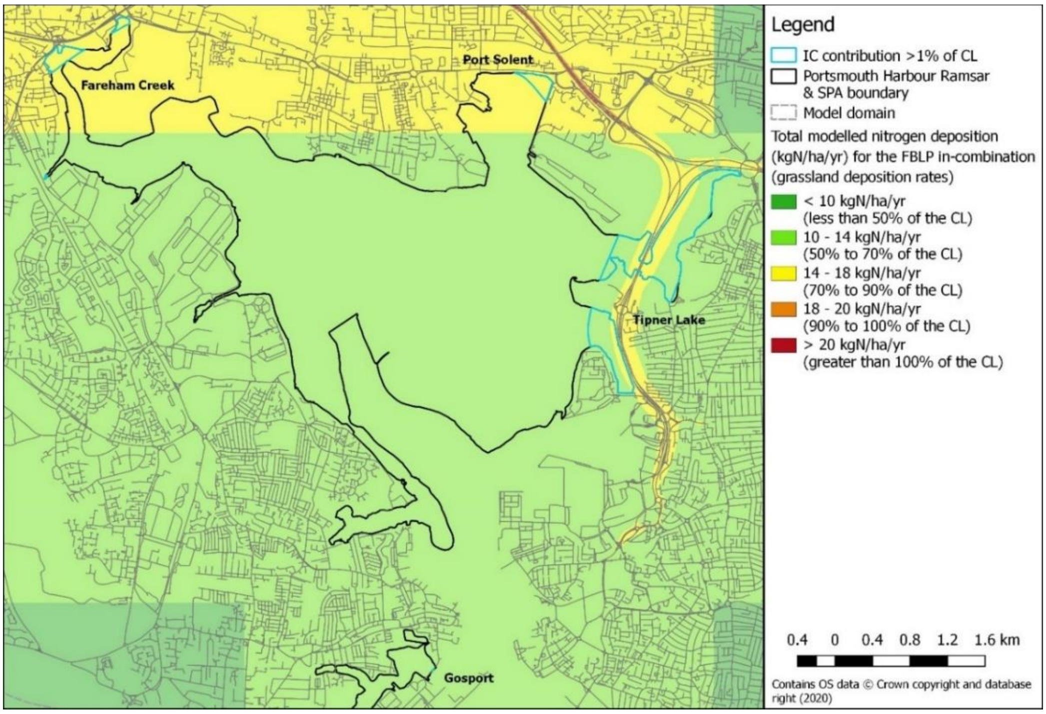
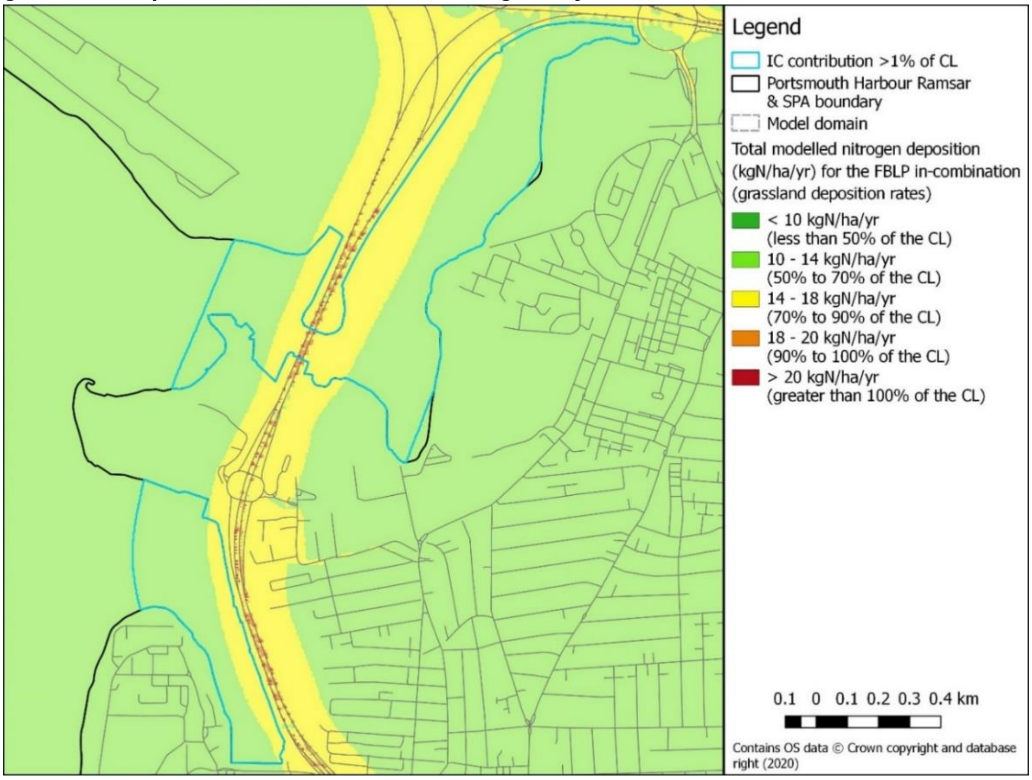


Figure 3-6 Centre of the road at Tipner Lake where the modelled FBLP in combination contribution exceeds 1% of the CL, overlain with the total modelled nitrogen deposition for the FBLP in combination, assuming grassland deposition rates and a CL of 20 kgN/ha-year, at Portsmouth Harbour Ramsar & SPA



3.4.4.3 Airborne NOx

The relevant CL for Portsmouth Harbour Ramsar and SPA is 30 µg/m³ for all vegetation.

Figure 3-7 illustrates the areas where the modelled contribution from the FBLP, in isolation and in combination, is predicted to exceed 0.3 µg/m³ (1% of 30 µg/m³). Five main areas of exceedance were identified: the area in the West comprises three small zones of exceedance (Fareham Creek), there is one area in the north (Port Solent), one small area in the south (Gosport) and two larger areas in the East of the site (north and south of Tipner Lake).

Figure 3-7 Overview of screening results for airborne NOx, assuming grassland deposition rates and a CL of 20 kgN/ha-year, at Portsmouth Harbour Ramsar & SPA

The areas predicted to exceed the screening threshold in Port Solent (northern middle area) and Gosport correspond to areas of the site that are intertidal mudflats. These would be regularly flushed with tidal water; this is supported by the Mean High Water mark[40], which these habitats lie below. Therefore, it is not anticipated that air pollution would be able to build up in these areas. For the remaining areas, which would not be routinely flushed with water, total NOx concentrations are considered.

The areas of exceedance which would not routinely be flushed with water are at Fareham Creek, including Hoeford Lake (south of Fareham Creek) and both the southern and northern parts of Tipner Lake.

Fareham Creek including Hoeford Lake

As shown in Figure 3-8, although the mean high water mark shows that most of the areas of exceedance at Fareham Creek are regularly inundated with water, the area of exceedance in the north-western part of the creek that does not fall beneath the mean high water mark (circled in white) shows modelled total

[40] Regions (December 2017) Full Clipped Boundaries in England; Full resolution - clipped to the coastline (Mean High Water mark), available online at https://data.gov.uk/dataset/ff1f0c7d-acbf-4b9a-bc77-b8c0fd095070/regions-december-2017-full-clipped-boundaries-in-england (accessed 29/04/2020).

NOx concentrations significantly lower than the CL of 30 µg/m³, under the FBLP in isolation and in combination. At Hoeford Lake, the total NOx concentrations are less than the CL (Figure 3-9).

Figure 3-8 Area where modelled contribution from the FBLP in isolation (left) and in combination (right) exceeds 1% of the CL, overlain with the total modelled concentration of airborne NOx (in combination) at Portsmouth Harbour Ramsar & SPA: Fareham Creek

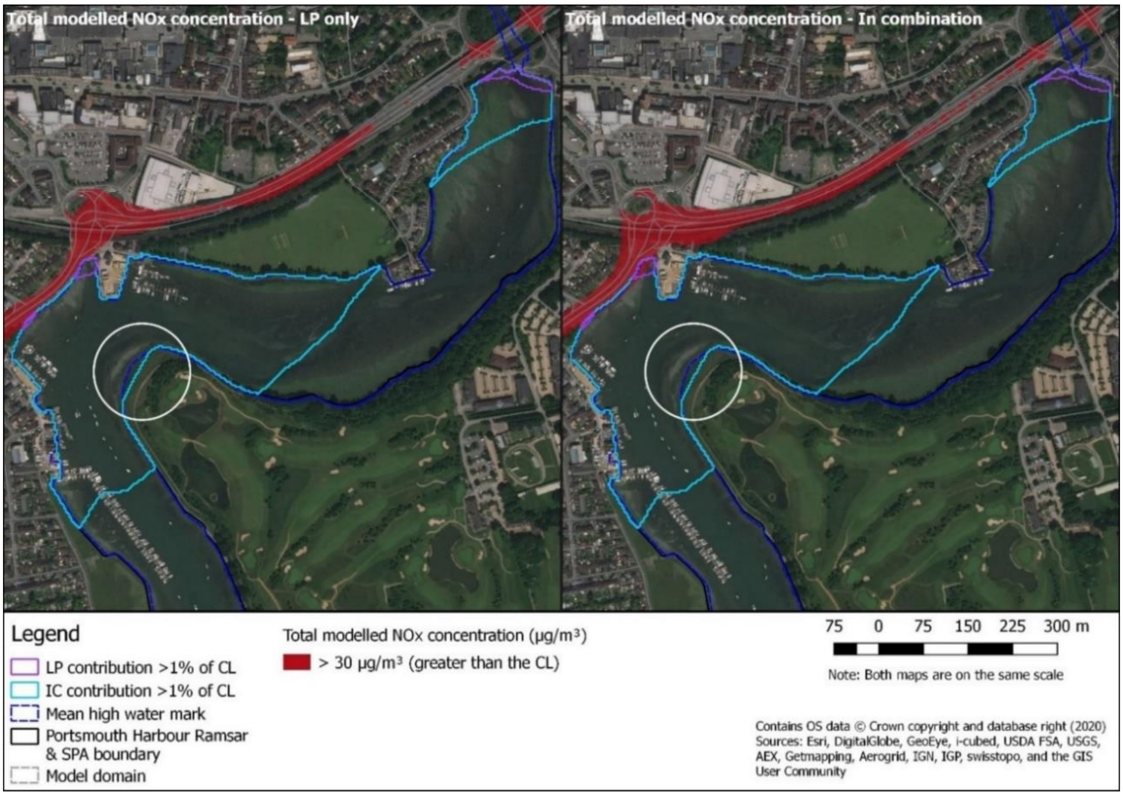
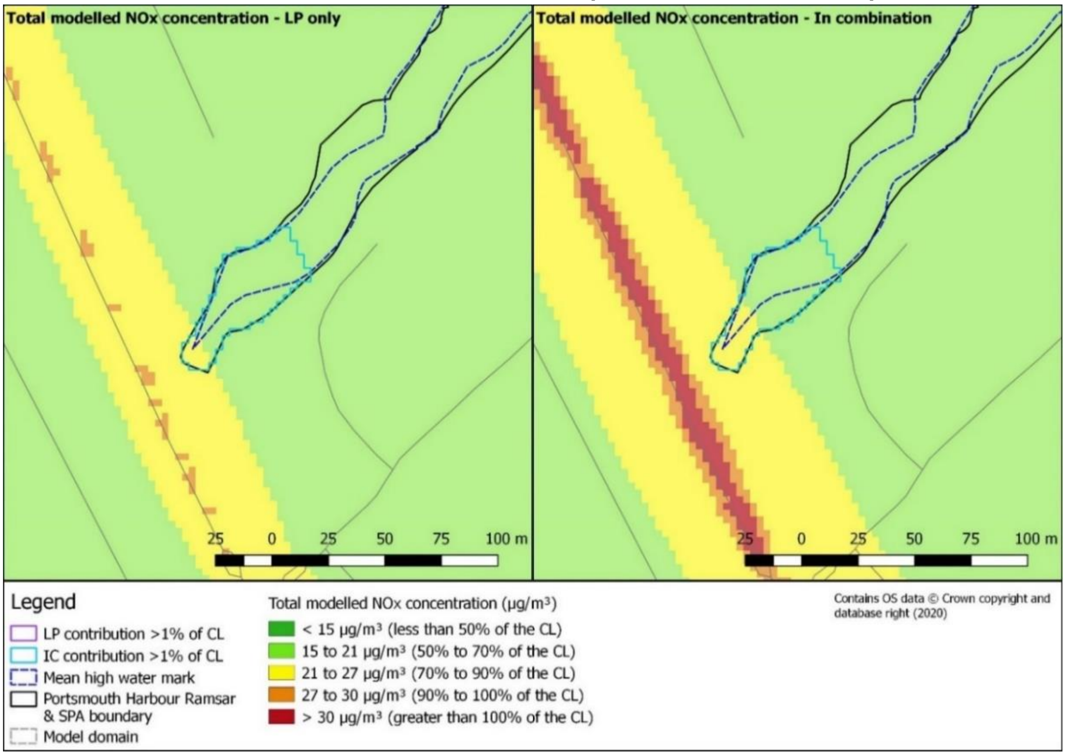


Figure 3-9 Area where modelled contribution from the FBLP in isolation (left) and in combination (right) exceeds 1% of the CL, overlain with the total modelled concentration of airborne NOx (in combination) at Portsmouth Harbour Ramsar & SPA: Hoeford Lake (south of Fareham Creek)

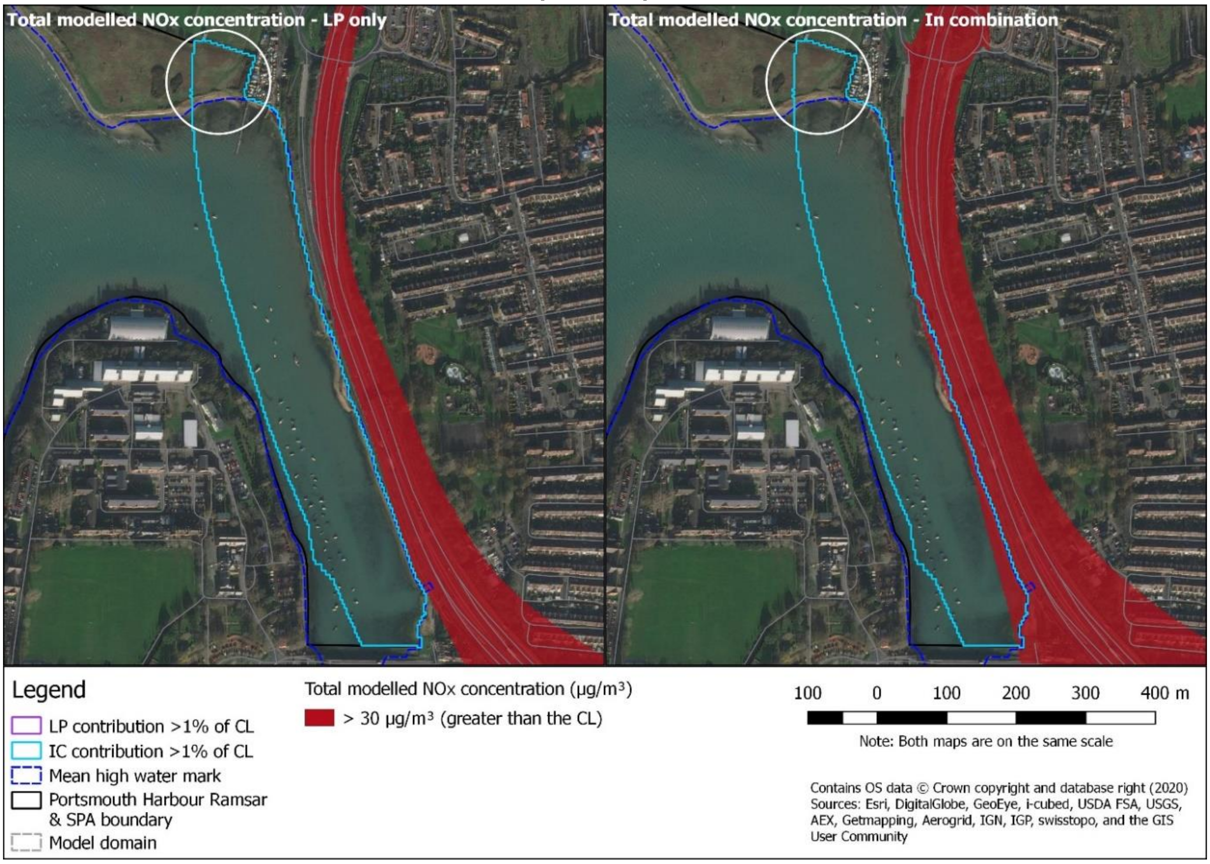


On the basis of available evidence, there are no adverse effects on this Ramsar and SPA site arising from the increased airborne NOx associated with the FBLP in isolation or in combination. Total NOx concentrations greater than the CL are concentrated in the centre of the adjacent road, and although they do extend to some parts of the site, this is only to those areas regularly inundated with water. Therefore, there are no likely significant effects resulting from airborne NOx concentrations due to the FBLP in isolation or in combination in the Fareham Creek part of the site.

Southern part of Tipner Lake

Although the mean high water mark[40] shows that most of the areas of exceedance at the southern part of Tipner Lake are regularly inundated with water, the area of exceedance that does not fall beneath the mean high water mark (circled in white) shows modelled total NOx concentrations lower than the CL of 30 µg/m³ under the FBLP, in isolation and in combination.

Figure 3-10 Area where modelled contribution from the FBLP in isolation (left) and in combination (right) exceeds 1% of the CL, overlain with the total modelled concentration of airborne NOx (in combination) at Portsmouth Harbour Ramsar & SPA: Southern part of Tipner Lake



On the basis of available evidence, there are no adverse effects on this Ramsar and SPA site arising from the increased airborne NOx associated with the FBLP in combination. Total NOx concentrations greater than the CL are concentrated in the centre of the adjacent road, and do extend to some parts of the site, but only to those areas regularly inundated with water. We conclude no likely significant effects resulting from airborne NOx concentrations due to the FBLP in isolation or in combination in the southern part of Tipner Lake, within this site.

Northern part of Tipner Lake

Although the mean high water mark[40] shows that most of the areas of exceedance at the northern part of Tipner Lake are regularly inundated with water, there are areas of exceedance that do not fall beneath the mean high water mark; these have been highlighted with white arrows. The areas show modelled total NOx concentrations lower than the CL of 30 µg/m³ under the LP in isolation, but not in combination.

Figure 3-11 Area where modelled contribution from the FBLP in isolation (left) and in combination (right) exceeds 1% of the CL, and total modelled concentration exceeds 30 µg/m³ for NOx at Portsmouth Harbour Ramsar & SPA: Northern part of Tipner Lake

Two small areas of land fall above the mean high water mark, but within the area of exceedance of 1% of the CL for airborne NOx, for the FBLP in combination. These areas comprise approximately 0.1108 ha of land with no habitat type, but which appears to be open water, intertidal mudflats and a path from satellite imagery, as well as 0.003 ha of coastal saltmarsh. This amount of coastal saltmarsh constitutes an extremely small percentage of the total area of coastal saltmarsh in the designated site that might be used by the qualifying features.

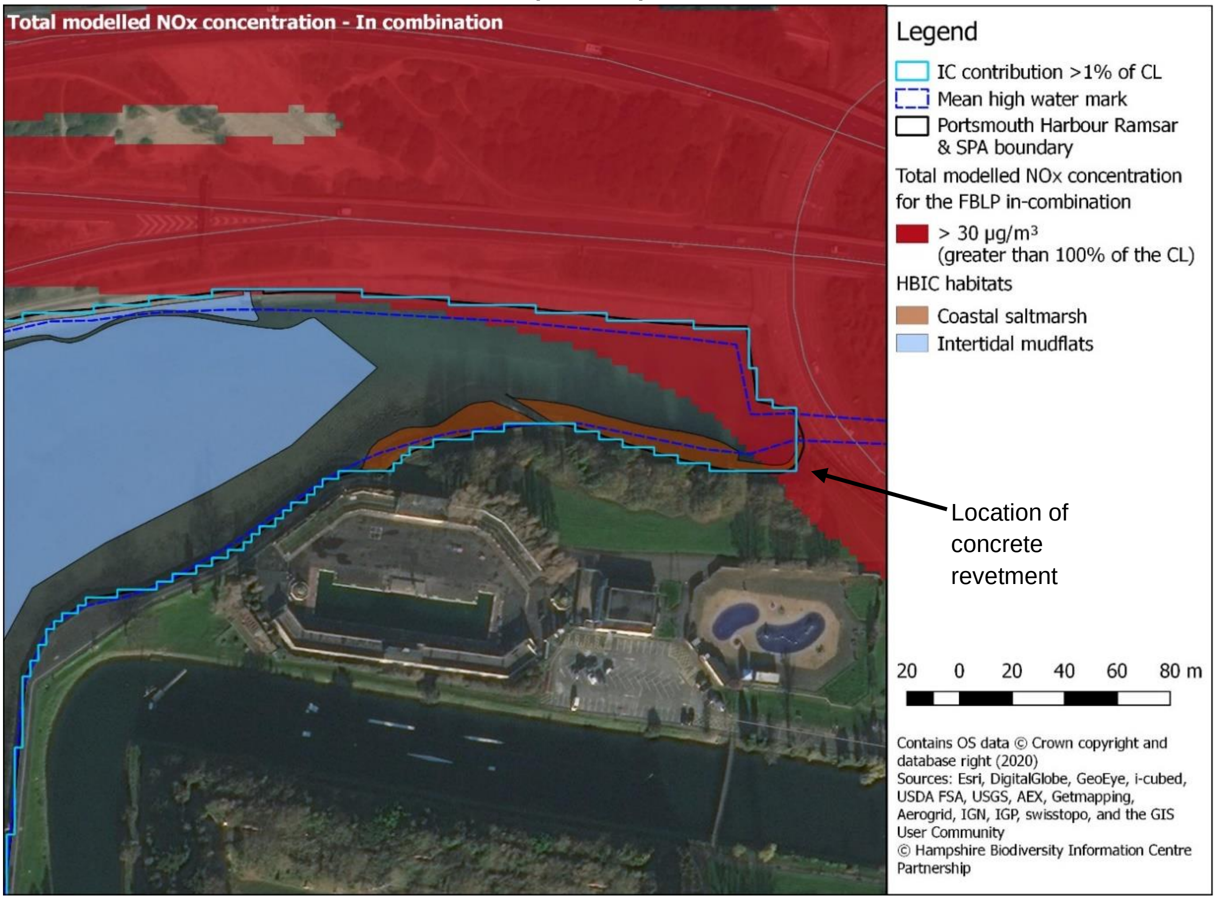
The Eastern Solent Coastal Partnership has confirmed that all of the coastal saltmarsh (shown in brown in Figure 3-13) was removed to facilitate the construction of coastal defences in that part of the site, including a concrete revetment (the revetment is shown in Figure 3-12 and its location is labelled in Figure 3-13). Since the completion of the defences, efforts have been made to re-establish saltmarsh as part of the mitigation package.[41] The Ramsar designation of Portsmouth Harbour does not list coastal saltmarsh as a qualifying feature.[42]

[41] Email from the Eastern Solent Coastal Partnership, 21.07.2020

[42] Ramsar Information Sheet (RIS), Portsmouth Harbour, https://rsistest.ramsar.org/RISapp/files/RISrep/GB720RIS.pdf

Figure 3-12 Photograph showing concrete revetment constructed adjacent to the Ports Creek roundabout, provided by the Eastern Solent Coastal Partnership[41]

Figure 3-13 Area where the modelled contribution for the FBLP in combination exceeds 1% of the CL, and the total modelled concentration for the FBLP in combination exceeds 30 µg/m³ for airborne NOx at Portsmouth Harbour Ramsar & SPA: Northern part of Tipner Lake



In the HRA for short-term development in Fareham Borough, Natural England confirmed that small areas of exceedance of airborne NOx at Hoeford Lake and the southern part of Tipner Lake would not have adverse effects on this Ramsar and SPA site, taking into consideration that they fall outside of key SPA roosting and foraging areas as identified by the Solent Waders and Brent Goose Strategy.[43,44]

The area under discussion in this report is located very close to multiple areas of land defined as "Primary and Secondary Support Areas" by the Solent Waders and Brent Goose Strategy.[44] Primary Support Areas are defined as sites that score 3 – 6 in three metrics (GB Importance, SPA Importance and SPA Assemblage) and Secondary Support Areas are defined as sites that score 1 – 2 in three metrics (GB Importance, SPA Importance and SPA Assemblage) and/or have max counts of 100 plus birds for any species.[45]

The portion of the M27 that runs along this part of the site is raised, and there is also a buffer of trees between the road and the designated site boundary. Consequently, modelled airborne NOx concentrations are likely to be overpredicted at this location. From satellite imagery and photographs, the land within the area potentially exceeding 30 µg/m³ consists of concrete blocks with sparse vegetation, as well as intertidal mudflats.

Figure 3-14 Photograph showing area of land adjacent to the M27, provided by the Eastern Solent Coastal Partnership[41]

Natural England has confirmed that due to the size of the area affected, the habitats present, and the abundance of coastal saltmarsh elsewhere in the site, no adverse effects should be expected arising from increased airborne NOx as a result of the FBLP in isolation or in combination. [36]

3.4.4.4 Detailed consideration of qualifying features

Each qualifying feature of Portsmouth Harbour is considered in-turn in Table 3-12.

[43] Ricardo Energy & Environment, "Air Quality Habitat Regulations Assessment (HRA) for Short-Term Development in Fareham Borough", Issue 1, December 2019.
[44] Solent Waders and Brent Goose Strategy webpage on Strategy, Maps and Data, available online at: https://solentwbgs.wordpress.com/page-2/ (accessed 04/06/2020)
[45] Whitfield, D (May 2019) Solent Waders and Brent Goose Strategy 2019, Interim Project Report: Year Two, Hampshire and Isle of Wight Wildlife Trust, Curdridge, available online at: https://solentwbgs.files.wordpress.com/2019/05/swbgs-2019-interim-report-year-two-dw.pdf

Table 3-12 Detailed consideration of qualifying features for Portsmouth Harbour Ramsar & SPA

Qualifying Feature	Potential Effects	Adverse Effect Before Mitigation? (on conservation objectives and site integrity)
Ramsar Criterion 3:	The intertidal mudflat areas possess extensive beds of eelgrass *Zostera angustifolia* and *Zostera noltei* which support the grazing dark-bellied brent geese *Branta bernicla bernicla* populations. The mud-snail *Hydrobia ulvae* is found at extremely high densities, which helps to support the wading bird interest of the site. Common cord-grass *Spartina anglica* dominates large areas of the saltmarsh and there are also extensive areas of green algae *Enteromorpha* spp. and sea lettuce *Ulva lactuca*. More locally the saltmarsh is dominated by sea purslane *Halimione portulacoides* which gradates to more varied communities at the higher shore levels. The site also includes a number of saline lagoons hosting nationally important species. Saltmarsh is listed on APIS as supporting habitat for dark-bellied Brent goose which is sensitive to air pollution impacts. As such, the common cord-grass, sea purslane, green algae and sea lettuce will be considered under the saltmarsh habitat type along with dark bellied Brent goose under Ramsar Criterion 6 below. A review of HBIC and priority habitat mapping (PHI) datasets did not identify any eelgrass beds within the areas of exceedance and as such adverse impacts from pollutants to this qualifying feature habitat as a result of the FBLP are considered unlikely. The mud-snail occupies habitats between the upper littoral fringe and the lower infralittoral zone. Given that the species occupies the littoral zone at its upper extent, impacts to supporting habitat will be under the saltmarsh habitat type along with dark bellied Brent goose under Ramsar Criterion 6 below. A review of HBIC and priority habitat mapping did not identify any saline lagoons within the areas of exceedance and as such adverse impacts from pollutants to this qualifying feature habitat as a result of the FBLP are considered unlikely.	No
Ramsar Criterion 6: Dark-bellied Brent Goose	Analysis in the preceding sections determined that there would be no adverse effect related to nitrogen deposition, acid deposition, or airborne NH_3. <u>NOx</u> Species is sensitive to impacts to supporting habitat from airborne NOx. There is a small area of exceedance in the northern part of Tipner lake, however the area appears to consist of open water and a path from satellite imagery and falls outside of key SPA roosting and foraging areas as identified by the Solent Waders and Brent Goose Strategy. There are also existing coastal defences in the area which have replaced much of the coastal saltmarsh seen in the HBIC layer. As such, adverse impacts from pollutants to this qualifying feature and its habitat, resulting from the FBLP, are considered unlikely.	No
Black Tailed godwit	Supporting habitat type and habitat sensitivities as per Dark-bellied Brent goose.	No

Qualifying Feature	Potential Effects	Adverse Effect Before Mitigation? (on conservation objectives and site integrity)
Dunlin	Analysis in the preceding sections determined that there would be no adverse effect related to nitrogen deposition, acid deposition, or airborne NH_3. <u>NOx</u> APIS indicates that although the supporting habitat is sensitive to air pollutants, the species itself is not impacted through impact to habitat.	No
Red-breasted merganser	Analysis in the preceding sections determined that there would be no adverse effect related to nitrogen deposition, acid deposition, or airborne NH_3. <u>NOx</u> APIS indicates that there is “no expected negative impact on species due to impacts on the species’ broad habitat”.	No

3.4.4.5 Assessment summary and conclusions

Adverse effects (pre-mitigation) can be discounted for all qualifying features of the Portsmouth Harbour Ramsar and SPA, and for nitrogen deposition, acid deposition, oxides of nitrogen (NOx) and ammonia (NH_3) as causal pollutants.

On the basis of available evidence, adverse effects on this Ramsar and SPA site can be discounted and as such there will be no threat to the ability of the European site to achieve its conservation objectives or maintain its integrity as a result of the FBLP, in combination with development in other local authorities within the PfSH sub-region.

3.5 River Itchen SAC (UK0012599)

3.5.1 SAC background information and qualifying features

Underlying Sites of Special Scientific Interest (SSSI): River Itchen SSSI

Qualifying and notifiable features associated with this site comprise: 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion vegetation,* 1044 (*Coenagrion mercuriale*) Southern damselfly, 1092 (*Austropotamobius pallipes)* White-clawed (or Atlantic stream) crayfish, 1096 (*Lampetra planeri*) Brook lamprey, 1106 (*Salmo salar*) Atlantic salmon, 1163 (*Cottus gobio*) Bullhead and 1355 (*Lutra lutra*) Otter.

The conservation objectives stated for this are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of qualifying natural habitats and habitats of qualifying species
- The structure and function (including typical species) of qualifying natural habitats
- The structure and function of the habitats of qualifying species
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely
- The populations of qualifying species, and,
- The distribution of qualifying species within the site.

3.5.2 HRA Stage 1: Assessment of air quality impacts against screening thresholds

This section comprises the outcome of the screening assessment described in Section 2.4.

Table 3-13 summarizes all of the critical loads for nutrient nitrogen deposition (kgN/ha-year) and acid deposition (kEq/ha-year), as well as the critical levels for airborne ammonia (µg/m^3), applicable to this designated site. The most stringent critical load or critical level (CL) for each pollutant is indicated in bold. The critical level for airborne NOx is set at 30 µg/m^3 across all designated sites.

Table 3-13 Minimum Critical Load and Critical Level (CL) values and associated sensitive features for River Itchen SAC

Sensitive feature	Minimum nutrient nitrogen deposition CLs (kgN/ha year)	Minimum acid deposition CLs (MinCLMaxN, kEq/ha year)	Minimum airborne NH_3 CLs (µg/m^3)
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	No data – Site specific advice should be sought	No data	**3**; APIS indicates no lichens or bryophytes present
Coenagrion mercuriale - Southern damselfly	**15** [a]	Not sensitive [a]	**3**
Austropotamobius pallipes - White-clawed (or Atlantic stream) crayfish	No data – Site specific advice should be sought	No data – Site specific advice should be sought	**3**
Lampetra planeri - Brook lamprey	No data – Site specific advice should be sought	No data	**3**
Salmo salar - Atlantic salmon	No data – Site specific advice should be sought	No data	**3**

Sensitive feature	Minimum nutrient nitrogen deposition CLs (kgN/ha year)	Minimum acid deposition CLs (MinCLMaxN, kEq/ha year)	Minimum airborne NH_3 CLs (µg/m^3)
Cottus gobio - Bullhead	No data – Site specific advice should be sought	No data	**3**

[a] *Coenagrion mercuriale* - Southern damselfly (S1044) is the only feature listed on APIS with a CL for nutrient nitrogen deposition (CL range is 10-20 kgN/ha-year) and acid deposition (MinCLMaxN is 0.922 kEq/ha-year), both associated with the broad habitat Dwarf shrub heath. Within the River Itchen SAC, the Southern damselfly is found in a managed chalk-river flood plain[46], which is better described as the EUNIS habitat classification Rich fens (EUNIS D4.1) rather than Dwarf shrub heath (EUNIS F4.11). According to APIS, the Rich fens habitat has a CL for nutrient nitrogen of 15-30 kgN/ha-year and is not sensitive to acid deposition. This approach has been confirmed with Natural England and is consistent with the approach taken in the Eastleigh Local Plan HRA.[47]

Consideration of in combination effects

The River Itchen SAC designated sites is contained within the PfSH study area. The PfSH model was used to model the in combination impacts of the FBLP by scaling the air quality model outputs from the PfSH future year scenarios (for the year 2034) to 2036, as described in Section 2.3.10.2. The dispersion modelling results of the PfSH 2036 DM scenario are therefore representative of air quality impacts associated with road traffic emissions from the FBLP, as well as in combination air quality impacts associated with road traffic emissions from anticipated development up to 2036 in East Hampshire (part), Eastleigh, Gosport, Havant, Isle of Wight, New Forest, Portsmouth, Southampton, Test Valley (part), and Winchester (part).

Screening results

Table 3-14 compares the maximum modelled contribution of the FBLP in isolation (Fareham 2036 DM Scenario) and Table 3-15 compares the maximum modelled contribution of the FBLP in combination (PfSH 2036 DM Scenario) to the lowest applicable CL. Values highlighted in yellow exceed the 1% screening threshold. This screening exercise represents a precautionary approach, as it assumes that the most sensitive qualifying features (with the lowest CLs) are present in the areas with the highest modelled contribution (typically adjacent to the busiest road).

Table 3-14 Screening results based on dispersion modelling of the FBLP in isolation:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
		15*	0.243	1.62%
	Grassland			1.06%
				N/A
				N/A
				0.47%
				0.96%

[46] JNCC, "1044 Southern damselfly *Coenagrion mercuriale*", https://sac.jncc.gov.uk/species/S1044/

[47] Urban Edge Environmental Consulting, "Habitats Regulations Assessment for the Eastleigh Borough Local Plan 2016 – 2036, Revised HRA Report following representations on the Proposed Submission Plan", October 2018.

Table 3-15 Screening results based on dispersion modelling of the FBLP in combination:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
Nutrient nitrogen deposition (kgN/ha-year)	Forest	15*	17.1	114%
				75.8%
Acid deposition (kEq/ha-year)	Forest	Not sensitive*	N/A	N/A
				N/A
Airborne NOx (µg/m^3)	n/a	30	3.02	10.1%
				75.0%

**Coenagrion mercuriale* - Southern damselfly (S1044) is the only feature listed on APIS with a CL for nutrient nitrogen deposition (CL range is 10-20 kgN/ha-year) and acid deposition (MinCLMaxN is 0.922 kEq/ha-year), both associated with the broad habitat Dwarf shrub heath. Within the River Itchen SAC, the Southern damselfly is found in a managed chalk-river flood plain[48], which is better described as the EUNIS habitat classification Rich fens (EUNIS D4.1) rather than Dwarf shrub heath (EUNIS F4.11). According to APIS, the Rich fens habitat has a CL for nutrient nitrogen of 15-30 kgN/ha-year and is not sensitive to acid deposition. This is consistent with the approach taken in the Eastleigh Local Plan HRA[47].

This designated site is mainly characterised by short vegetation and in those areas the grassland deposition rates are applicable. There are also small areas where trees are present and in these areas forest deposition rates are applicable.

None of the qualifying features of the site are sensitive to acid deposition, meaning that likely significant effects from this pollutant can be ruled out. Of the remaining three pollutants, nitrogen deposition is predicted to exceed the 1% screening threshold for the FBLP in isolation, and therefore likely significant effects from air quality impacts cannot be ruled out in isolation or in combination. Likely significant effects also cannot be ruled out for airborne NOx or airborne ammonia for the FBLP in combination. A Stage 2 Appropriate Assessment has been undertaken in the following section.

3.5.3 HRA Stage 2: Appropriate Assessment

3.5.3.1 Airborne NH_3

The modelled FBLP in combination contribution of airborne NH_3 was added to background levels of ammonia across the site (obtained from APIS[49]). The maximum total concentration (road contribution plus background concentrations) of NH_3 for the FBLP in combination is 2.29 µg/m^3, which is 76.2% of the CL of 3 µg/m^3.

On the basis of available evidence, including background ammonia concentrations, there are no adverse effects on this SAC site arising from increased ammonia associated with the FBLP in combination.

3.5.3.2 Nitrogen deposition

The only quantified CL on APIS is for *Coenagrion mercuriale* (Southern damselfly) due to impacts on their habitat, with the CL range 10 – 20 kgN/ha-yr for broad habitat type Dwarf shrub heath (Northern wet heath: Erica tetralix dominated wet heath). As discussed earlier in this chapter, this habitat type is best described as Rich fens, with a CL range 15 – 30 kgN/ha-year. All of the other sensitive features listed on APIS are aquatic species with the "rivers and streams" broad habitat; it is not anticipated that air pollution impacts from road traffic would accumulate to a significant degree in this broad habitat.

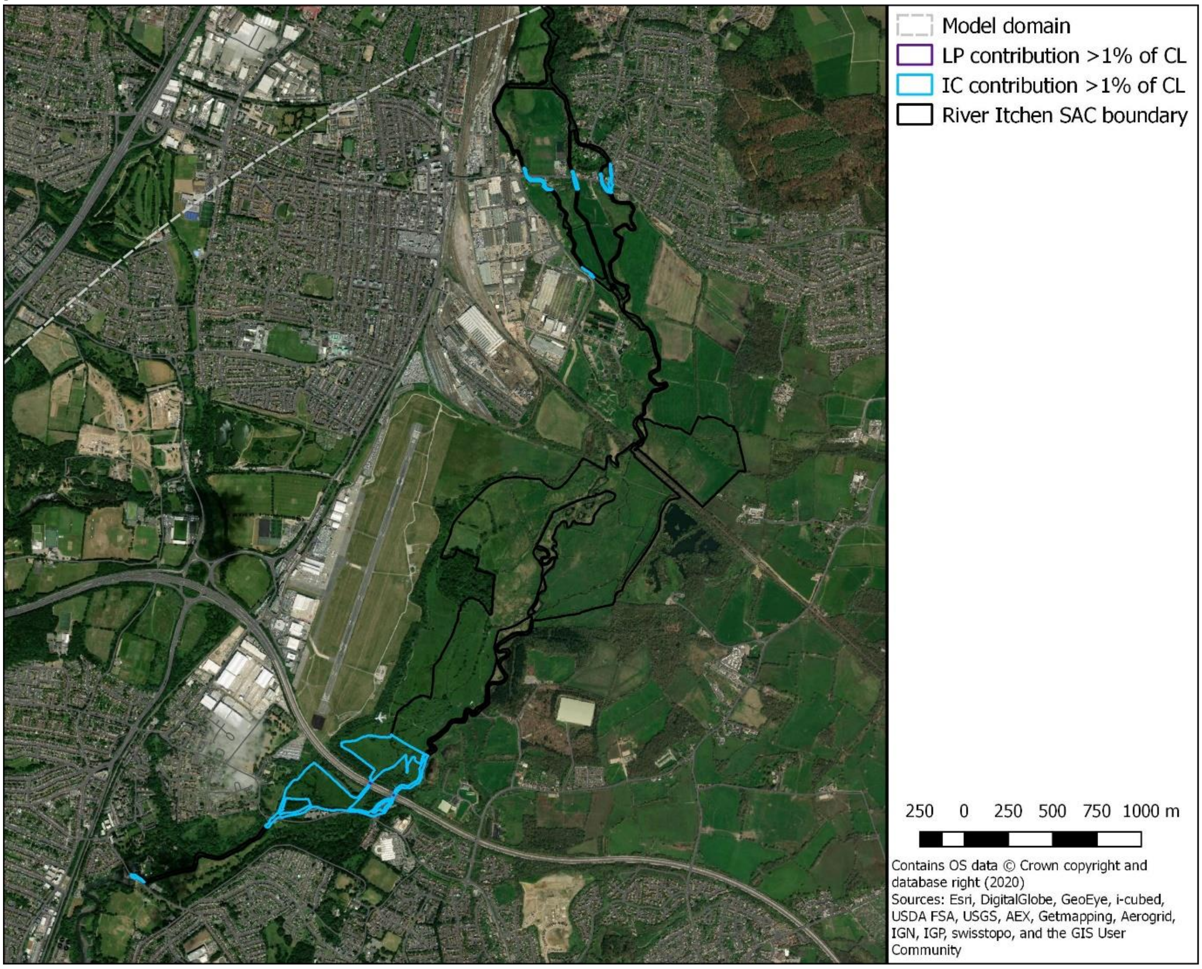
[48] JNCC, "1044 Southern damselfly *Coenagrion mercuriale*", https://sac.jncc.gov.uk/species/S1044/, accessed 12/08/2019.

[49] http://www.apis.ac.uk/popup/gridded-concentration-deposition-2015?sitecode=UK9011011&deptype=M&featurecode=A137&accode=AG (accessed 10/09/2019)

APIS indicates that the current background nitrogen deposition levels at River Itchen SAC range from 16.01 to 19.85 kgN/ha-year, indicating that the minimum CL for the Southern damselfly (15 kgN/ha-year) is exceeded throughout the site.

Figure 3-15 shows the areas where the contribution from the FBLP, in isolation and in combination, exceeds 1% of the CL for nitrogen deposition (assuming grassland deposition rates and a CL of 15 kgN/ha-year). The FBLP in isolation exceedances are shown in dark purple and comprise two very small areas in the centre of the M27, where it crosses the River Itchen. The FBLP in combination exceedances are shown in light blue; there are four main areas of exceedance.

Figure 3-15 Overview of screening results for the FBLP contribution, in isolation and in combination, for nitrogen deposition at the River Itchen SAC, assuming grassland deposition rates and a CL of 15 kgN/ha-year

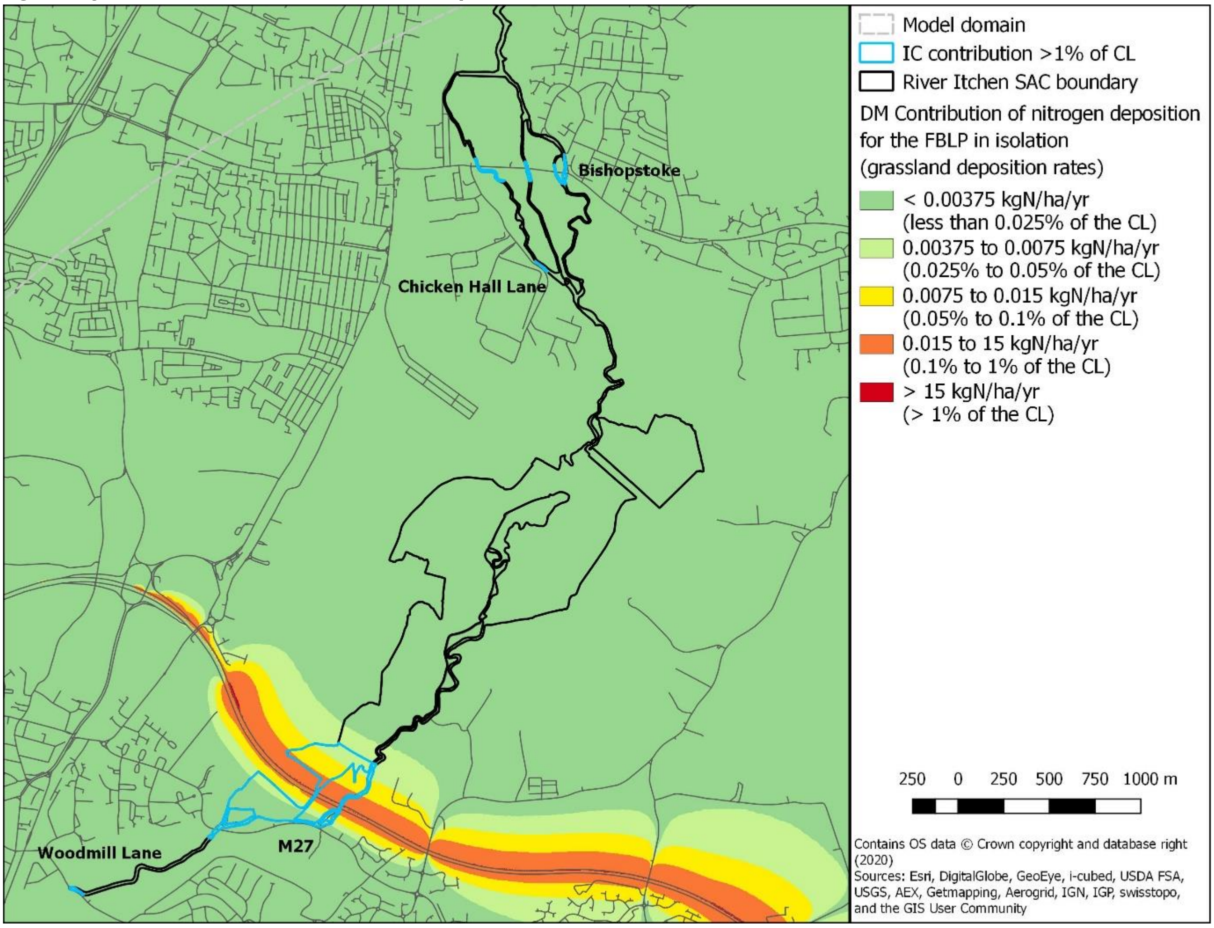


The Rich Fens habitat would be classified as a Grassland type habitat, so grassland deposition rates are appropriate.[43] When grassland deposition rates are assumed, and the FBLP in combination contribution is considered, two larger exceedance areas are found at Bishopstoke and where the M27 crosses the river further south. In addition, there are two smaller exceedance areas adjacent to Chicken Hall Lane (behind Barton Park Industrial Estate) and where Woodmill Lane crosses the river at Woodmill Outdoor Activities Centre.

In three of the exceedance areas at Bishopstoke, Chicken Hall Lane, and where Woodmill Lane crosses the river at Woodmill Outdoor Activities Centre, the FBLP contribution is not predicted to exceed the screening thresholds for nitrogen deposition (assuming grassland deposition rates) in isolation, only in combination.

The areas where the in combination contribution exceeds 1% of the CL are shown again in light blue in Figure 3-16. The contribution of the FBLP in isolation has been overlain, demonstrating that the maximum contribution in these three exceedance areas is less than 0.00375 kgN/ha/yr (or <0.025% of the lowest CL).

Figure 3-16 Areas where the FBLP in combination contribution exceeds 1% of the CL, overlain with FBLP contribution in isolation for nitrogen deposition, assuming grassland deposition rates and a CL of 15 kgN/ha-year, at River Itchen SAC: Bishopstoke, Chicken Hall Lane and Windmill Lane



To put this into context, with the FBLP having an individual contribution comprising less than 0.025% of the lowest CL, it would require 40 or more such individual contributions (from other plans or projects) to attain, in combination, the screening threshold of 1% of the applicable CL. Additionally, as the contribution from the FBLP is so small, any mitigation measures incorporated into the FBLP would have an essentially negligible impact on reducing the nitrogen deposition in this area; eliminating the FBLP entirely would reduce the nitrogen deposition by less than 0.00375 kgN/ha/yr. This indicates that the contribution of the FBLP to nitrogen deposition in this area is so small as to be nugatory or indistinguishable from background variations, and a contribution of this magnitude would therefore not have any appreciable effect on the designated site.

The concept of an effect which is so small as to be nugatory or indistinguishable from background variations, and which can therefore be excluded from further assessment under the Habitats Regulations, is supported by current guidance from Natural England.[50] In view of the minimal impact due to the FBLP in isolation, it is concluded that there is no plausible significant adverse effect on the

[50] Natural England, "Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations", June 2018, see paragraph 4.47.

integrity of the SAC due to the FBLP in combination with other plans and projects, in the Bishopstoke, Chicken Hall Lane, and Woodmill Lane exceedance areas.

Natural England has confirmed that as the contribution from the FBLP in isolation is less than 0.025% of the lowest CL in these areas, the contribution of the FBLP to in combination impacts can be considered not significant. [36]

The remaining area of concern is the M27 exceedance area, where the road crosses the River Itchen. Previous work undertaken on HRAs for the River Itchen SAC includes the Eastleigh HRA Report[47] which considered potential impacts due to changes in air quality, associated with the draft 2016-2036 Eastleigh Borough Local Plan (and in combination with other anticipated housing development), against the River Itchen SAC conservation objectives. The HRA report concluded that changes in air quality were not likely to have a significant effect on any of the site's conservation objectives.

The Eastleigh HRA Report[47] includes an appropriate assessment of the air quality impacts of nutrient nitrogen deposition on the Southern damselfly. The appropriate assessment included mapping of the area predicted to exceed the 1% screening threshold (for the draft 2016-2036 Eastleigh Borough Local Plan, in combination with other anticipated housing development); consideration of population transects for the Southern damselfly recorded by Rushbrook in 2017;[51] and site visits conducted in support of the Eastleigh HRA appropriate assessment.

Figure 3-17 compares the areas predicted to exceed the 1% screening threshold in the Eastleigh study (red shading) with the areas predicted to exceed the 1% screening threshold for this study (light blue outlines). This figure was constructed by using GIS software to georeference the results of the Eastleigh study with the results of this study. Further analysis focuses on a comparison of impacts from the FBLP (in combination with other development) with the Eastleigh Borough LP development up to 2036 (in combination with other development):

- The exceedance area for the M27 in 2036 closely matches the exceedance area for the Fareham short-term development scenario in 2023.[43] The M27 areas of exceedance remain slightly different between the Eastleigh and Fareham modelling studies, however, overall, the areas of exceedance are considerably smaller for the FBLP in combination scenario (extending up to approximately 280m from the road edge, slightly larger than for the 2023 development scenario) than those given in the Eastleigh HRA report (extending up to approximately 1000m from the road edge).

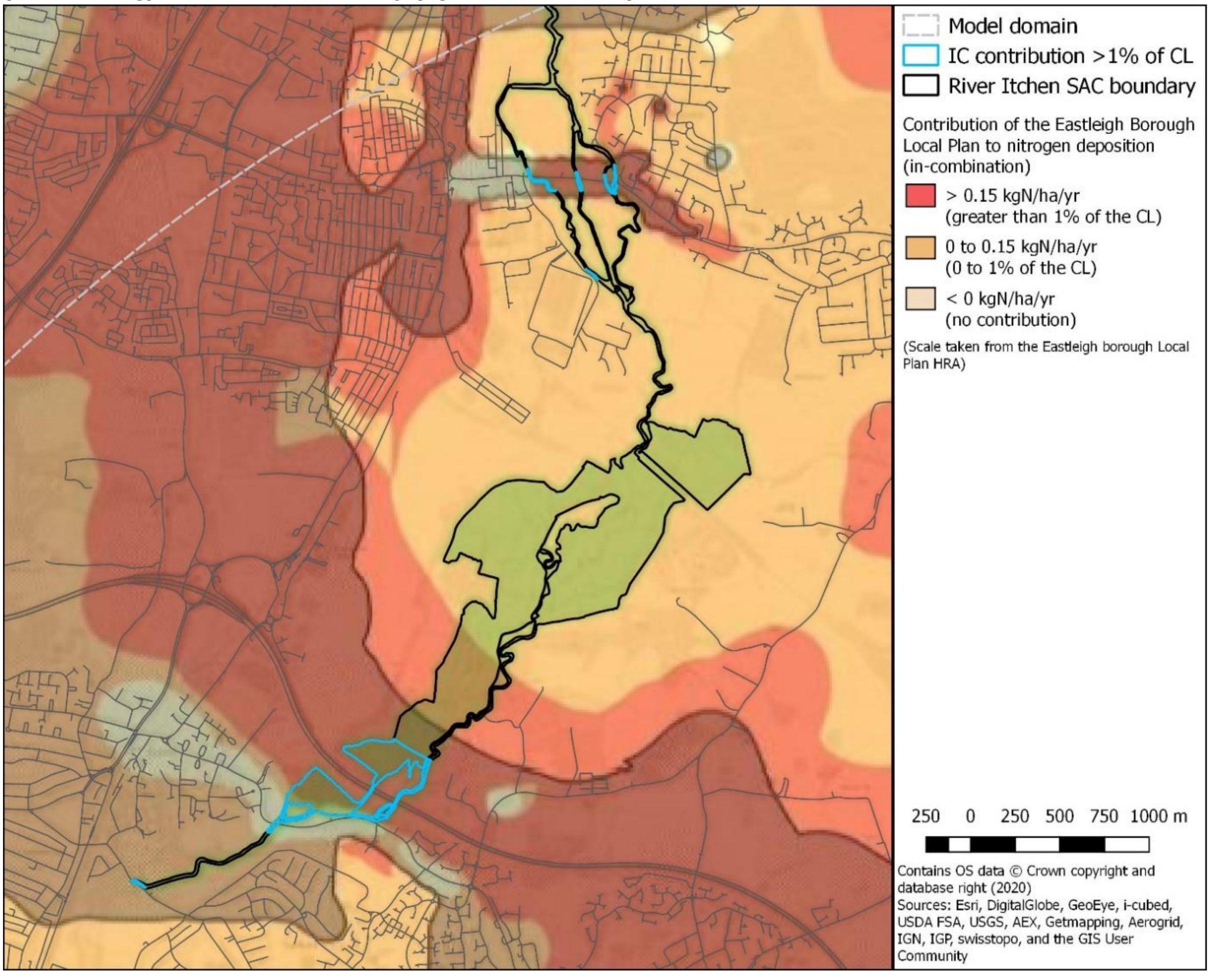
- Therefore, we would again expect no adverse effects in those areas resulting from changes in nitrogen deposition, given the conclusions from the Eastleigh HRA.

Further information regarding the Eastleigh HRA Report analysis can be found in the HRA report for Short-Term Development in Fareham Borough.[43] The Eastleigh HRA is currently going through an examination and Natural England has no live objections to the HRA.

Natural England has confirmed that the conclusions from the Eastleigh HRA Report and the HRA for Short-Term Development in Fareham Borough also apply to the nitrogen deposition exceedance areas identified for the FBLP, i.e. that on the basis of available evidence, there are no adverse effects on this SAC site arising from the increased nitrogen deposition associated with the FBLP. [36]

[51] Rushbrook, B. (2017): Southern damselfly survey and habitat assessment study: Eastleigh Borough. Arcadian Ecology & Consulting Ltd, Curdridge https://www.eastleigh.gov.uk/media/3459/southern-damselfly-survey.pdf, accessed 10/09/2019.

Figure 3-17 Comparison of FBLP in combination exceedances of the 1% screening threshold for nitrogen deposition for the River Itchen SAC, assuming a CL of 15 kgN/ha-year, between Eastleigh HRA report[47] (red shading) and the current study (light blue outlines)



3.5.3.3 Airborne NOx

The relevant CL for River Itchen SAC is 30 µg/m^3 for all vegetation. Qualifying and notifiable features associated with this site comprise:

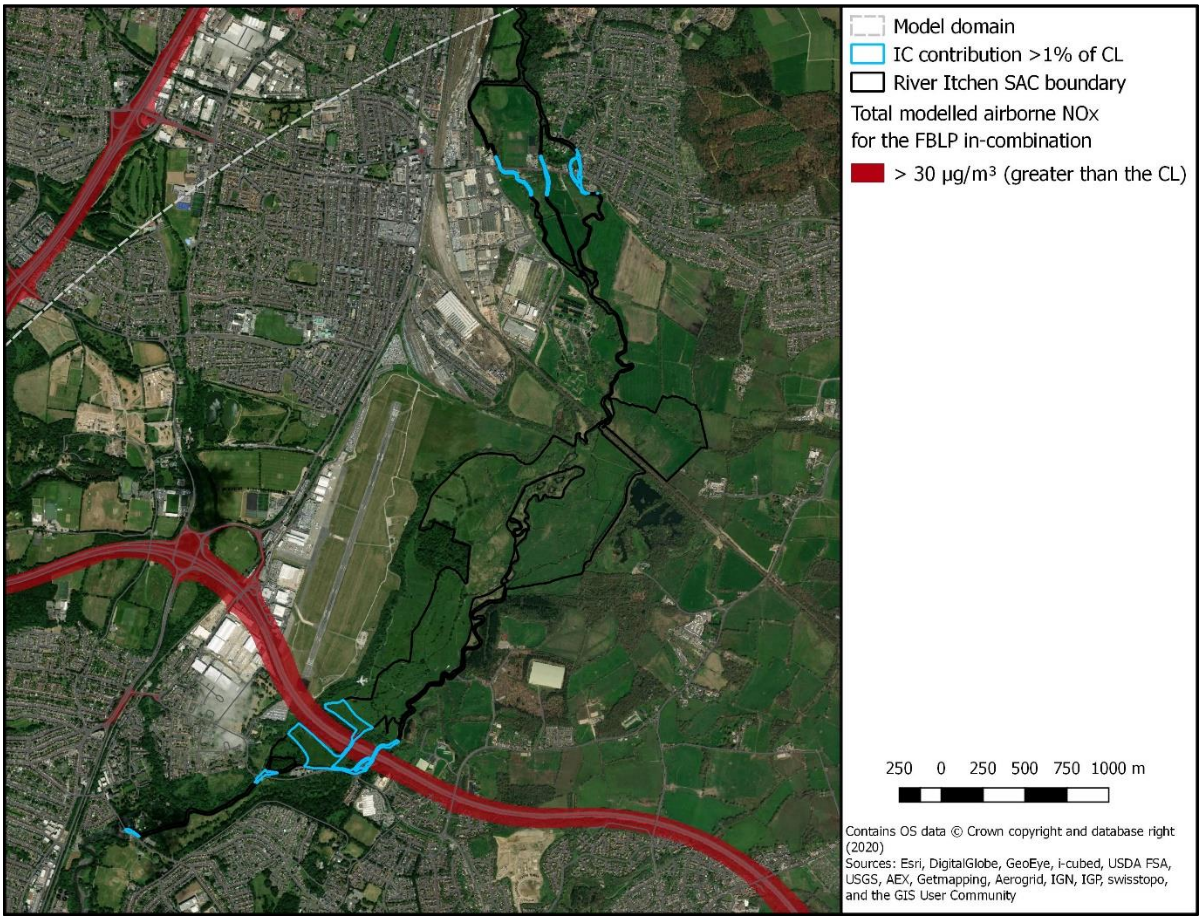
- 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
- 1044 (*Coenagrion mercuriale*) Southern damselfly
- 1092 (*Austropotamobius pallipes*) White-clawed (or Atlantic stream) crayfish
- 1096 (*Lampetra planeri*) Brook lamprey
- 1106 (*Salmo salar*) Atlantic salmon
- 1163 (*Cottus gobio*) Bullhead
- 1355 (*Lutra lutra*) Otter

As discussed earlier in this chapter, with the exception of the Southern damselfly, all of the other sensitive features listed on APIS are aquatic species with the “rivers and streams” broad habitat; it is not anticipated that air pollution impacts from road traffic would accumulate to a significant degree in this broad habitat.

The FBLP contribution in isolation was not predicted to exceed the screening threshold for airborne NOx, only in combination. Total NOx concentrations were calculated by adding the road contribution of airborne NOx for the FBLP in combination, to the Defra NOx background map for the year 2030 (the furthest year into the future for which this data is available).

Figure 3-18 illustrates the exceedance areas where the modelled contribution for the FBLP in combination is predicted to exceed 0.3 µg/m^3 (1% of the CL), as well as the total modelled NOx concentration for the FBLP in combination across the site.

Figure 3-18 Overview of screening results for the FBLP contribution, in combination, for airborne NOx, and total modelled concentrations for the FBLP in combination, for airborne NOx, at the River Itchen SAC



These areas predicted to exceed the 1% screening threshold and have total NOx concentrations greater than 30 µg/m^3 in 2036, match closely to those identified for development up to 2023,[43] and are smaller than the areas already considered for nutrient nitrogen deposition impacts. From this, there are no anticipated adverse effects on the Southern damselfly.

Natural England has confirmed that the conclusions from the Eastleigh HRA Report and the HRA for Short-Term Development in Fareham Borough also apply to the airborne NOx exceedance areas identified for the FBLP, i.e. that on the basis of available evidence, there are no adverse effects on this SAC site arising from the increased airborne NOx associated with the FBLP. [36]

3.5.3.4 Detailed consideration of qualifying features

Each qualifying feature of the River Itchen SAC is considered in-turn in Table 3-16.

Table 3-16 Detailed consideration of qualifying features for River Itchen SAC

Qualifying Feature	Potential Effects	Adverse Effect Before Mitigation? (on conservation objectives and site integrity)
3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Vegetation is affected more greatly by fluvial processes such as sediment deposition, bank shading and vegetation management intervention rather than nitrogen deposition. Therefore, the predicted changes in nitrogen deposition and airborne NOx are considered to be insignificant. The maximum total modelled contribution of airborne ammonia was 2.29 µg/m^3, which represents 76.2% of the CL and as such a likely significant effect can be discounted.	No
1044 Southern damselfly	Analysis in the preceding sections determined that there would be no adverse effect related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
1163 Bullhead	Supporting habitat is sensitive to pollutants, but species itself is not impacted through impact to habitat and significantly more sensitive to water quality than air quality. Analysis in the preceding sections determined that there would be no adverse effect related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
1092 White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*	Supporting habitat is sensitive to pollutants, but species itself is not impacted through impact to habitat and significantly more sensitive to water quality than air quality. Analysis in the preceding sections determined that there would be no adverse effect related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
1096 Brook lamprey *Lampetra planeri*	Supporting habitat is sensitive to pollutants, but species itself is not impacted through impact to habitat and significantly more sensitive to water quality than air quality. Analysis in the preceding sections determined that there would be no adverse effect related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No

Qualifying Feature	Potential Effects	Adverse Effect Before Mitigation? (on conservation objectives and site integrity)
1106 Atlantic salmon *Salmo salar*	Supporting habitat is sensitive to pollutants, but species itself is not impacted through impact to habitat and significantly more sensitive to water quality than air quality. Analysis in the preceding sections determined that there would be no adverse effect related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
1355 Otter *Lutra lutra*	Supporting habitat is sensitive to pollutants, but species itself is not impacted through impact to habitat and significantly more sensitive to water quality than air quality. Analysis in the preceding sections determined that there would be no adverse effect related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No

3.5.3.5 Assessment summary and conclusions

Adverse effects (pre-mitigation) can be discounted for all qualifying features of the River Itchen SAC, and for nitrogen deposition, acid deposition, oxides of nitrogen (NOx) and ammonia (NH_3) as causal pollutants.

On the basis of available evidence, adverse effects on this SAC site can be discounted and as such there will be no threat to the ability of the European site to achieve its conservation objectives or maintain its integrity as a result of the FBLP, in combination with development in other local authorities within the PfSH sub-region.

3.6 Solent and Dorset Coast SPA (UK9020330)

3.6.1 Background information and qualifying features

Underlying Sites of Special Scientific Interest (SSSI):

South Dorset Coast SSSI, Townsend SSSI, Purbeck Ridge (West & East) SSSI, Studland Cliffs SSSI, Studland & Godlingson SSSI, Poole Bay Cliffs SSSI, Christchurch Harbour SSSI, Avon Valley (Bickton to Christchurch) SSSI, River Avon SSSI, Christchurch Harbour SSSI, Highcliffe to Milford Cliffs SSSI, Hurst Castle and Lymington River Estuary SSSI, North Solent SSSI, Dibden Bay SSSI, Hythe to Calshot Marshes SSSI, Lee-on-Solent to Itchen Estuary SSSI, Titchfield Haven SSSI, Browndown SSSI, Portsmouth Harbour SSSI, Chichester Harbour SSSI, Langstone Harbour SSSI, Sinah Common SSSI, Bracklesham Bay SSSI, Pagham Harbour SSSI, Bognor Reef SSSI, Compton Chine to Steephill Cove SSSI, Compton Down SSSI, Headon Warren and West High Down SSSI, Colwell Bay SSSI, Yar Estuary SSSI, Bouldnor and Hamstead Cliffs SSSI, Newtown Harbour SSSI, Thorness Bay SSSI, King's Quay Shore SSSI, Ryde Sands and Wootton Creek SSSI, Brading Marshes to St Helen's Ledges SSSI, Whitecliff Bay and Bembridge Ledges SSSI, Bembridge Down SSSI.

Qualifying and notifiable features associated with this site include: Sandwich tern *Sterna sandvicensis* (4.01% of GB breeding population), common tern *Sterna hirundo* (4.77% of GB breeding population) and little tern *Sterna albifrons* (3.31% of GB breeding population).

As of 16th January 2020, the Solent and Dorset Coast has been classified as a Special Protection Area.[52] The updated SPA site boundary published by Natural England is identical to the pSPA site boundary used in previous analysis of the site, within our modelling domain. The site does not yet have a Site Improvement Plan, as it was previously classed as a potential SPA.

The conservation objectives for this site were updated following the change of designation from a pSPA to an SPA. The objectives are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

3.6.2 HRA Stage 1: Assessment of air quality impacts against screening thresholds

This section comprises the outcome of the assessment described in Section 2.4.

Table 3-17 summarizes all of the critical loads and critical levels (CLs) used for the screening assessment of this SPA. As this was previously a potential designated site, CLs are not yet listed on APIS. The CLs in the table were agreed with Natural England for screening purposes, based on the qualifying features of this site (tern species) and critical loads applicable to terns at adjacent designated sites.

[52] Consultation outcome, Solent and Dorset Coast potential Special Protection Area: outcome, available online at: https://www.gov.uk/government/consultations/solent-and-dorset-coast-potential-special-protection-area-comment-on-proposals

Table 3-17 Minimum Critical Load and Critical Level (CL) values and associated sensitive features for Solent and Dorset Coast SPA

Pollutant	Critical load or critical level (CL)	Rationale
		supporting habitats at nearby designated site: Solent & Southampton Water SPA. A higher CL l (1.123) is set for Chichester & Langstone Harbours SPA

Consideration of in combination effects

The Solent and Dorset Coast SPA designated site is contained within the PfSH study area. The PfSH model was used to model the in combination impacts of the FBLP by scaling the air quality model outputs from the PfSH future year scenarios (for the year 2034) to 2036, as described in Section 2.3.10.2. The dispersion modelling results of the PfSH 2036 DM scenario are therefore representative of air quality impacts associated with road traffic emissions from the FBLP, as well as in combination air quality impacts associated with road traffic emissions from anticipated development up to 2036 in East Hampshire (part), Eastleigh, Gosport, Havant, Isle of Wight, New Forest, Portsmouth, Southampton, Test Valley (part), and Winchester (part).

Screening results

Table 3-18 compares the maximum modelled contribution of the FBLP in isolation (Fareham 2036 DM scenario) and Table 3-19 compares the maximum modelled contribution of the FBLP in combination (PfSH 2036 DM Scenario) to the lowest applicable CL. Values highlighted in yellow exceed the 1% screening threshold. This screening exercise represents a precautionary approach, as it assumes that the most sensitive qualifying features (with the lowest CLs) are present in the areas with the highest modelled contribution (typically adjacent to the busiest road).

Table 3-18 Screening results based on dispersion modelling of the FBLP in isolation:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
	Grassland	8*	0.397	4.96%
Acid deposition (kEq/ha-year)				4.51%
Airborne NOx (µg/m^3)				4.17%
				2.07%

Table 3-19 Screening results based on dispersion modelling of the FBLP in combination:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
Nutrient nitrogen deposition (kgN/ha-year)	Grassland	8*	17.6	220%

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
Acid deposition (kEq/ha-year)	Grassland	0.626*	1.25	200%
Airborne NOx (µg/m^3)	n/a	30	13.3	44.4%
Airborne NH_3 (µg/m^3)	n/a	3*	3.44	115%

*CLs not yet listed on APIS; for screening purposes, CLs are taken to be the lowest CLs from nearby European-designated sites.

This site is characterised by marine habitats with short vegetation; therefore grassland deposition rates are applicable.

All four pollutants exceeded the 1% screening threshold for the FBLP in isolation and in combination, and therefore likely significant effects from air quality impacts cannot be ruled out for any pollutants in isolation or in combination. A Stage 2 Appropriate Assessment has been undertaken in the following section.

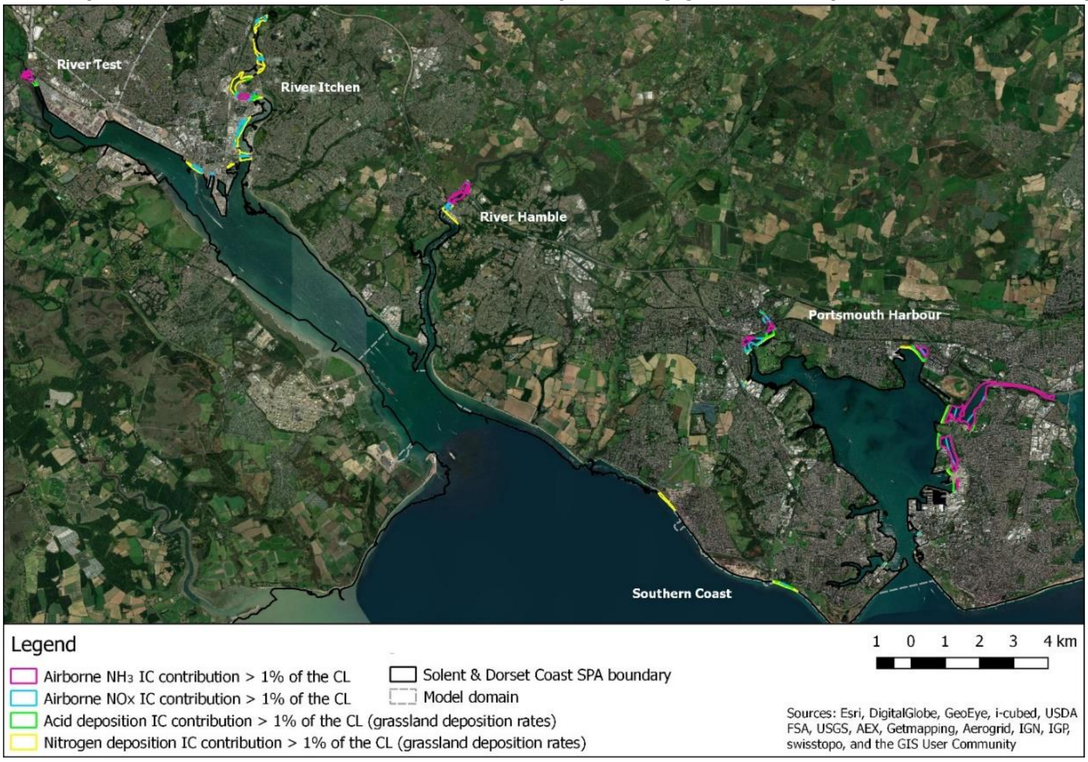
3.6.3 HRA Stage 2: Appropriate Assessment

3.6.3.1 Assessment of areas

Figure 3-19 illustrates where the modelled contributions from the FBLP in combination are predicted to exceed 1% of the CL for nitrogen and acid deposition, and airborne NOx and ammonia. The relevant CL assumed for the Solent and Dorset Coast SPA's terrestrial habitats are listed in Table 3-17.

Five main areas of exceedance were identified, although not every pollutant shows an exceedance at each area. The appropriate assessment analysis has been undertaken using the nitrogen deposition screening results, as nitrogen deposition was modelled to have the largest area of impact. All other pollutants' exceedance areas fell within the nitrogen deposition areas of exceedance, as can be seen in the figure below.

Figure 3-19 Overview of screening results for the FBLP in combination for NOx, airborne NH_3, nitrogen and acid deposition at Solent and Dorset Coast SPA (assuming grassland deposition rates where applicable)



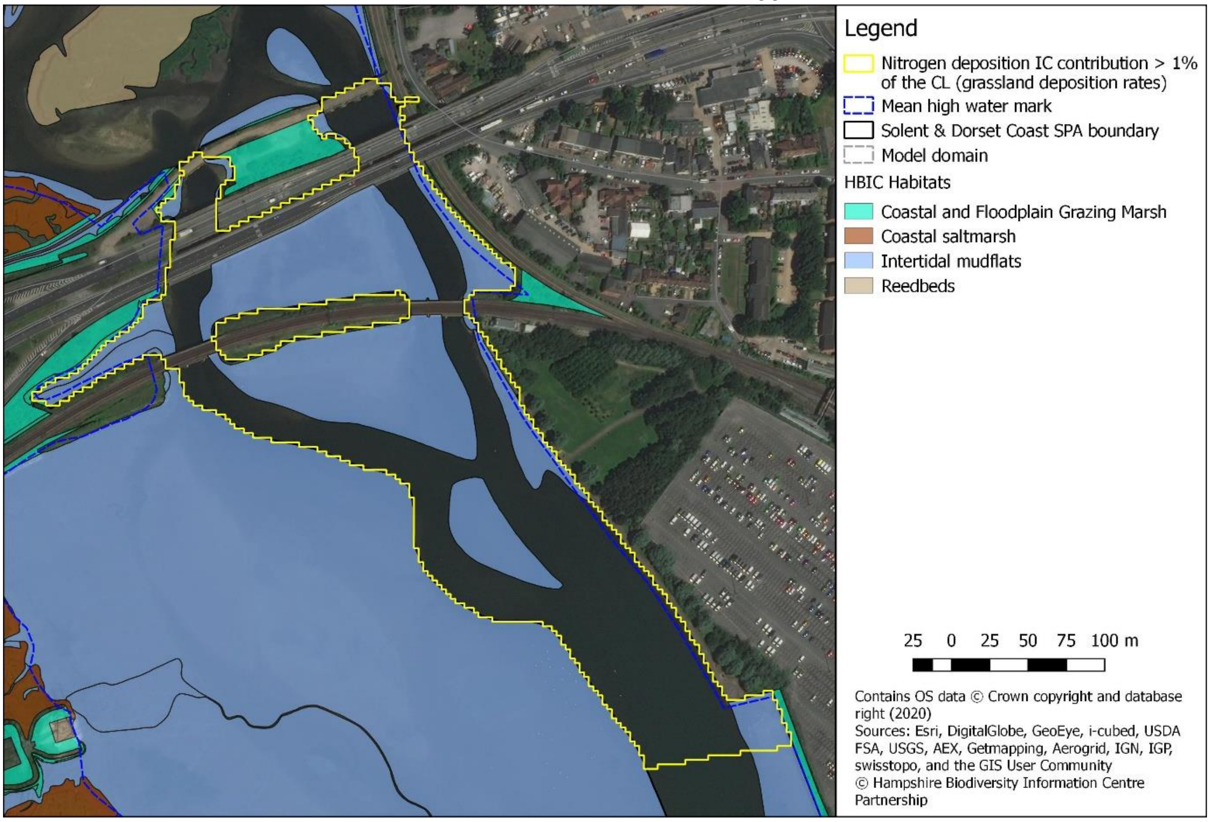
3.6.3.2 Area 1: River Test

The areas predicted to exceed the 1% screening threshold for nitrogen deposition (Figure 3-20) are entirely comprised of road surfaces, open water and intertidal mudflats. All habitats identified also fall under the Mean High Water mark[40] so would be regularly inundated with tidal water. These conclusions follow on from the conclusions for this area of the site in the HRA for short-term development in Fareham Borough.[43]

This area was also predicted to exceed the screening thresholds for acid deposition, airborne NOx and airborne NH_3, however, the areas exceeding the screening thresholds for those pollutants are smaller and contained within the larger area already considered for nitrogen deposition.

On the basis of available evidence, there are no adverse effects on this area of the Solent and Dorset Coast SPA site arising from increased nitrogen deposition, acid deposition, airborne NOx or airborne NH_3 associated with the FBLP in isolation or in combination.

Figure 3-20 Areas where the modelled contribution from the FBLP in combination for nitrogen deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 8 kgN/ha-year, and HBIC habitats identified in the Solent and Dorset Coast SPA: River Test/Totton Bypass



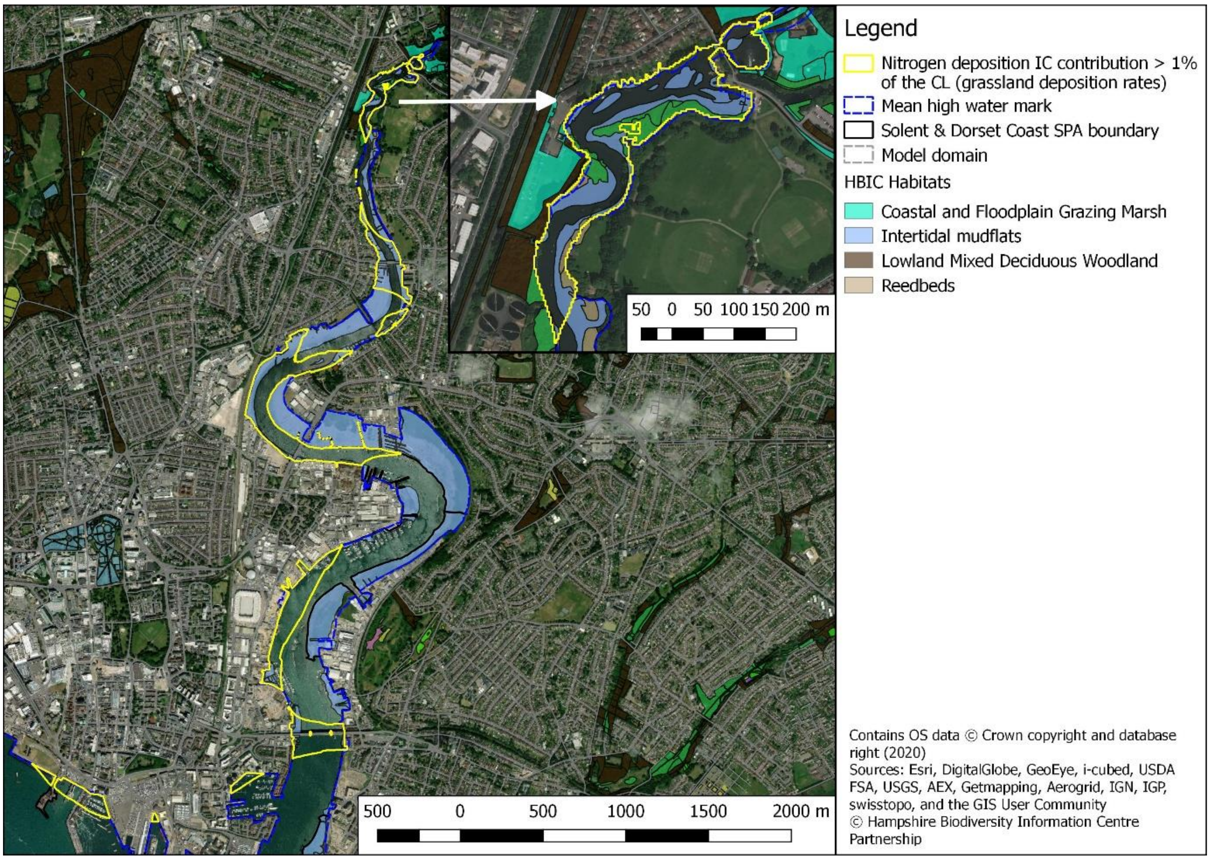
3.6.3.3 Area 2: River Itchen

The areas predicted to exceed the 1% screening threshold for nitrogen deposition (Figure 3-21) are entirely comprised of road surfaces, open water and intertidal mudflats, which would be regularly inundated with tidal water as supported by the Mean High Water mark[40]. These conclusions follow on from the conclusions for this area of the site in the HRA for short-term development in Fareham Borough.[43]

This area was also predicted to exceed the screening thresholds for acid deposition, airborne NOx and airborne NH_3, however, the areas exceeding the screening thresholds for those pollutants are smaller and contained within the larger area already considered for nitrogen deposition.

On the basis of available evidence, there are no adverse effects on this area of the Solent and Dorset Coast SPA site arising from increased nitrogen deposition, acid deposition, airborne NOx or airborne NH_3 associated with the FBLP in isolation or in combination.

Figure 3-21 Areas where the modelled contribution from the FBLP in combination for nitrogen deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 8 kgN/ha-year, and HBIC habitats identified in the Solent and Dorset Coast SPA: River Itchen



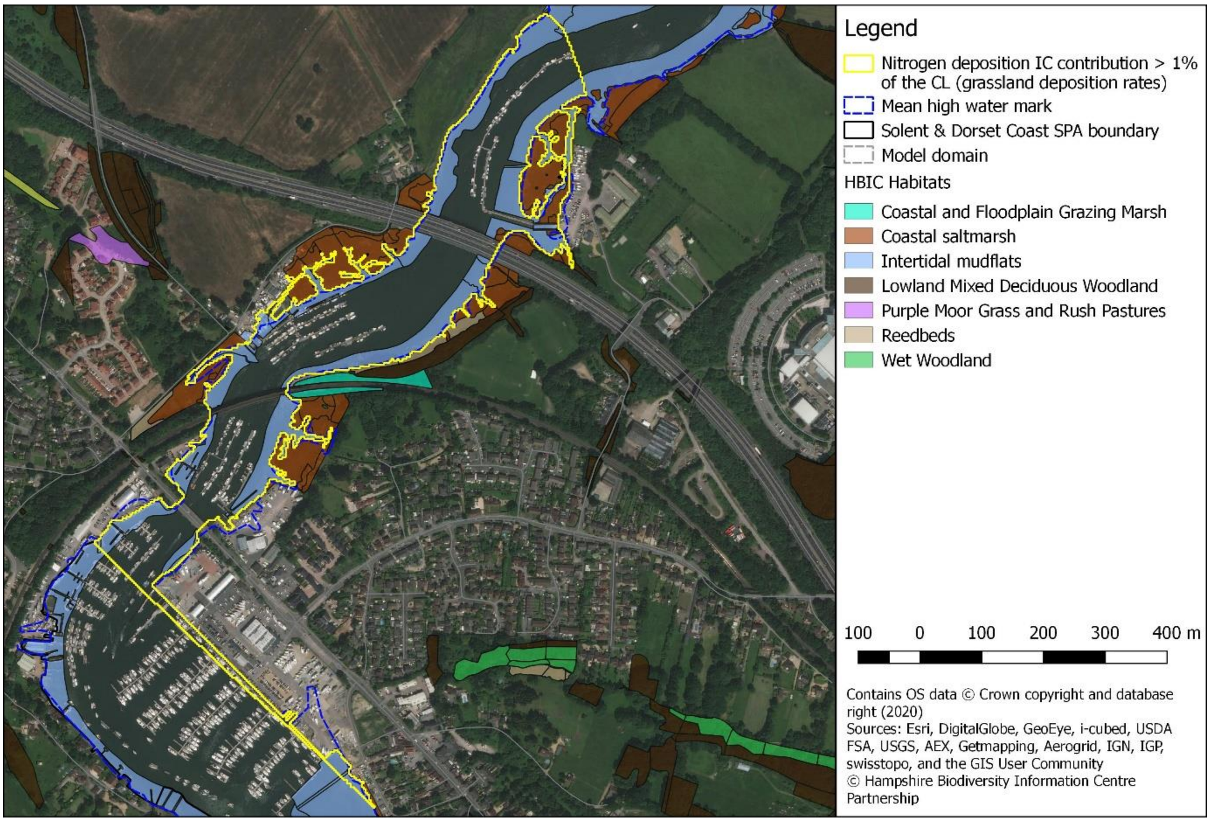
3.6.3.4 Area 3: River Hamble

Of the areas predicted to exceed the 1% screening threshold for nitrogen deposition (Figure 3-22), the majority consist of road surfaces, open water and intertidal mudflats, which would be regularly inundated with tidal water as supported by the Mean High Water mark[40]. There two small areas identified in the HBIC layer as coastal saltmarsh, but these also fall below the Mean High Water Mark. These conclusions follow on from the conclusions for this area of the site in the HRA for short-term development in Fareham Borough.[43]

This area is also predicted to exceed the screening threshold for the other three pollutants (acid deposition, airborne NOx and NH_3), however the areas exceeding the screening thresholds for those pollutants are smaller and contained within the larger area already considered for nitrogen deposition, and so no significant effects are expected.

On the basis of available evidence, there are no adverse effects on this area of the Solent and Dorset Coast SPA site arising from increased nitrogen deposition, acid deposition, airborne NOx or airborne NH_3 associated with the FBLP in isolation or in combination.

Figure 3-22 Areas where the modelled contribution from the FBLP in combination for nitrogen deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 8 kgN/ha-year, and HBIC habitats identified in the Solent and Dorset Coast SPA: River Hamble



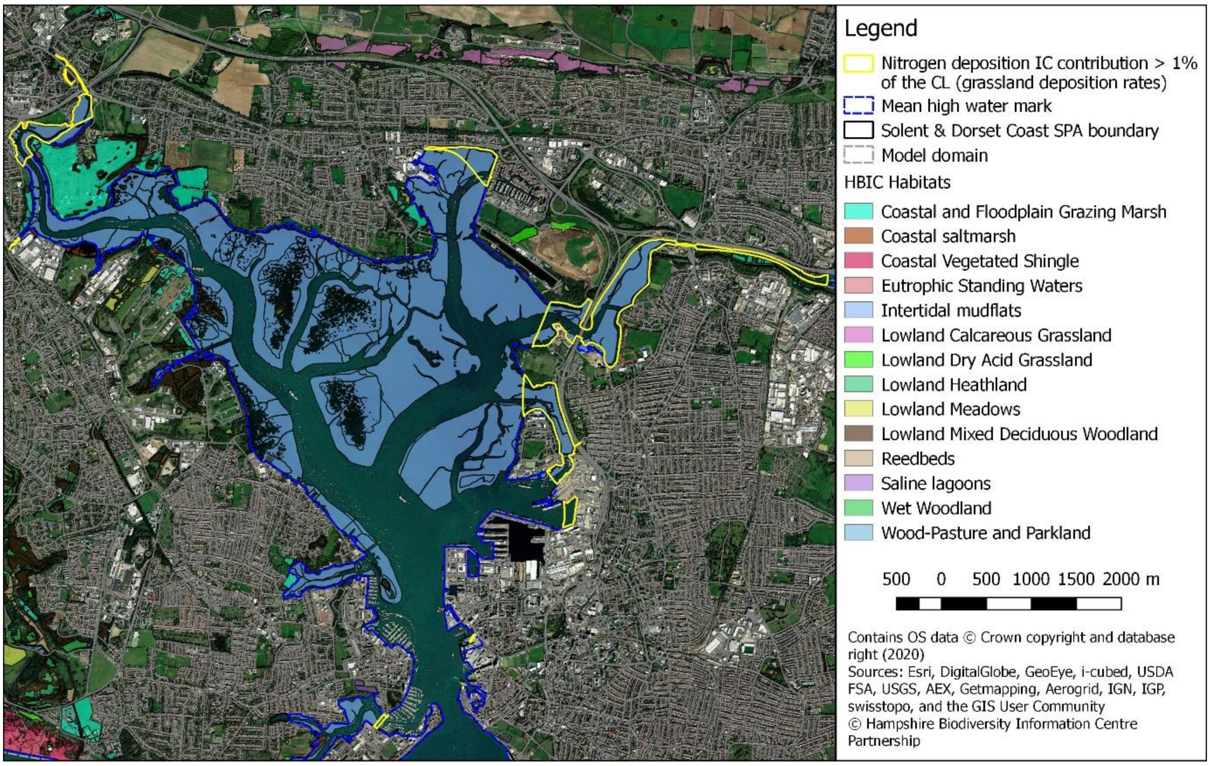
3.6.3.5 Area 4: Portsmouth Harbour

The areas predicted to exceed the 1% screening threshold for nitrogen deposition (Figure 3-23) are entirely comprised of road surfaces, open water and intertidal mudflats, which would be regularly inundated with tidal water as supported by the Mean High Water mark[40]. These conclusions follow on from the conclusions for this area of the site in the HRA for short-term development in Fareham Borough.[43]

This area was also predicted to exceed the screening thresholds for acid deposition, airborne NOx and airborne NH_3, however the areas exceeding the screening thresholds for those pollutants are smaller and contained within the larger area already considered for nitrogen deposition.

On the basis of available evidence, there are no adverse effects on this area of the Solent and Dorset Coast SPA site arising from increased nitrogen deposition, acid deposition, airborne NOx or airborne NH_3 associated with the FBLP in isolation or in combination.

Figure 3-23 Areas where the modelled contribution from the FBLP in combination for nitrogen deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 8 kgN/ha-year, and HBIC habitats identified in the Solent and Dorset Coast SPA: Portsmouth Harbour



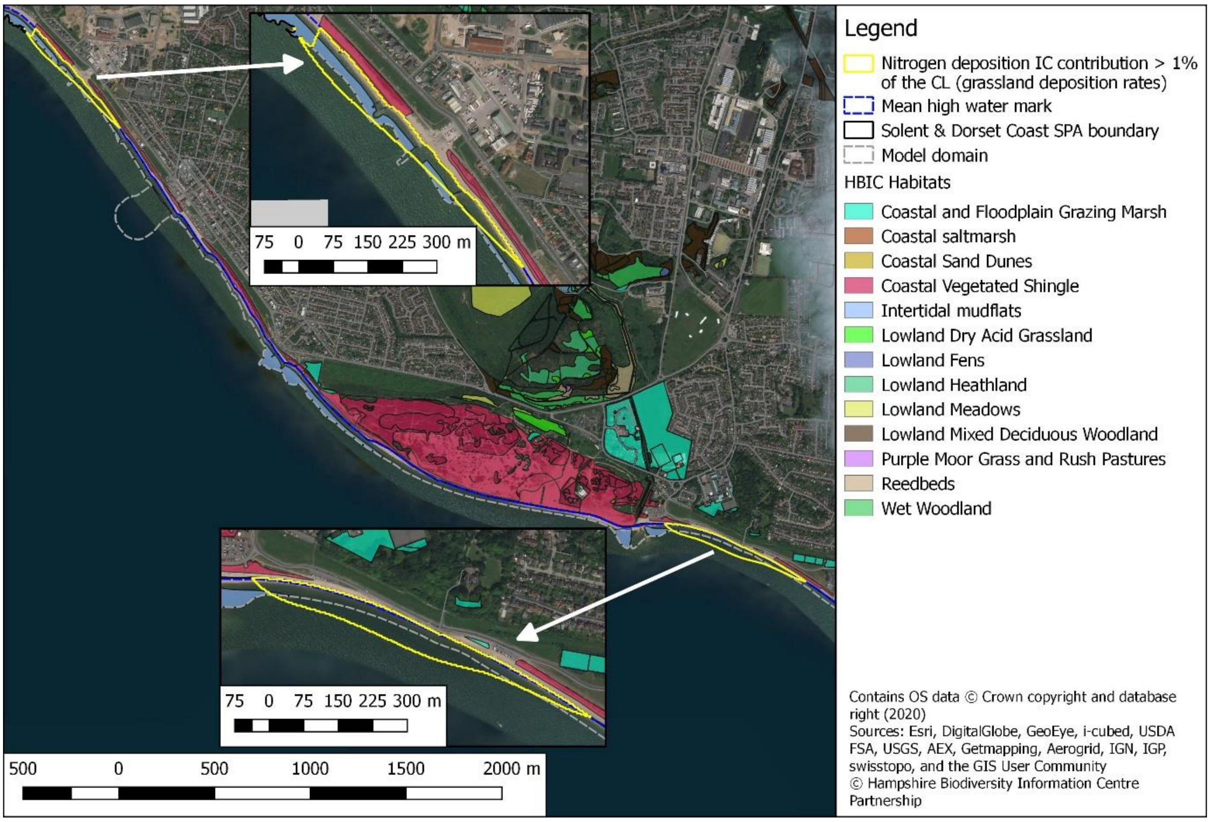
3.6.3.6 Area 5: Southern Coast

The areas predicted to exceed the 1% screening threshold for nitrogen deposition are shown in Figure 3-24. Both of these areas of exceedance occur along the shoreline, and the HBIC dataset does not contain any information about the priority habitats present. However, due to their proximity to the edge of the Solent they are likely to be regularly inundated with water; this is supported by the Mean High Water mark[40].

Neither of the areas along the southern coast are predicted to exceed the screening thresholds for airborne NH_3, and the area on the left is not predicted to exceed the screening thresholds for airborne NOx. These conclusions follow on from the conclusions for this area of the site in the HRA for short-term development in Fareham Borough.[43]

On the basis of available evidence, there are no adverse effects on this area of the Solent and Dorset Coast SPA site arising from increased nitrogen deposition, acid deposition, airborne NOx or airborne NH_3 associated with the FBLP in isolation or in combination.

Figure 3-24 Areas where the modelled contribution from the FBLP in combination for nitrogen deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 8 kgN/ha-year, and HBIC habitats identified in the Solent and Dorset Coast SPA: Southern Coast



3.6.3.7 Overall considerations

This SPA is designated for its tern species, with its predominant supporting feature being the sea surrounding their breeding colonies which forms a valuable plunge-diving foraging resource. As the site is predominantly designated for its marine foraging resource, there is very little in the way of terrestrial habitat within the designation boundary. The CLs on APIS, and used for preliminary analysis in the screening stage, are applicable to terrestrial habitat. The majority of the designated site boundary, and the majority of the area predicted to exceed the screening thresholds, is comprised of open water and intertidal mudflats which would be regularly inundated with tidal water as supported by the Mean High Water mark[40]. These areas have been individually discussed in the preceding sections, and it has been found that no adverse effects are anticipated as a result of the FBLP in isolation or in combination.

3.6.3.8 Assessment summary and conclusions

Adverse effects (pre-mitigation) can be discounted for all qualifying features of the Solent and Dorset Coast SPA, and for nitrogen deposition, acid deposition, oxides of nitrogen (NOx) and ammonia (NH_3) as causal pollutants.

On the basis of available evidence, adverse effects on this SPA site can be discounted and as such there will be no threat to the ability of the European site to achieve its conservation objectives or maintain its integrity as a result of the FBLP, in combination with development in other local authorities within the PfSH sub-region.

3.7 Solent and Isle of Wight Lagoons SAC (UK0017073)

3.7.1 Background information and qualifying features

Underlying Sites of Special Scientific Interest (SSSI): Brading Marshes to St Helen's Ledges SSSI, Langstone Harbour SSSI, Hurst Castle & Lymington River Estuary SSSI, Gilkicker Lagoon SSSI.

Qualifying and notifiable features associated with this site include: **1150 Coastal lagoons.** The Solent on the south coast of England encompasses a series of Coastal lagoons, including percolation, isolated and sluiced lagoons. The site includes a number of lagoons in the marshes in the Keyhaven – Pennington area, at Farlington Marshes in Chichester Harbour, behind the sea-wall at Bembridge Harbour and at Gilkicker, near Gosport. The lagoons show a range of salinities and substrates, ranging from soft mud to muddy sand with a high proportion of shingle, which support a diverse fauna including large populations of three notable species: the nationally rare foxtail stonewort *Lamprothamnium papulosum*, the nationally scarce lagoon sand shrimp *Gammarus insensibilis*, and the nationally scarce starlet sea anemone *Nematostella vectensis*. The lagoons in Keyhaven – Pennington Marshes are part of a network of ditches and ponds within the saltmarsh behind a sea-wall. Farlington Marshes is an isolated lagoon in marsh pasture that, although separated from the sea by a sea-wall, receives sea water during spring tides. The lagoon holds a well-developed low-medium salinity insect-dominated fauna. Gilkicker Lagoon is a sluiced lagoon with marked seasonal salinity fluctuation and supports a high species diversity. The lagoons at Bembridge Harbour have formed in a depression behind the sea-wall and sea water enters by percolation. Species diversity in these lagoons is high and the fauna includes very high densities of *N. vectensis*.

The Site Improvement Plan (SIP 270) states that nitrogen deposition has been identified as a threat.

The conservation objectives for this site are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of qualifying natural habitats,
- The structure and function (including typical species) of qualifying natural habitats, and
- The supporting processes on which qualifying natural habitats rely.

3.7.2 HRA Stage 1: Assessment of air quality impacts against screening thresholds

This section comprises the outcome of the assessment described in Section 2.4.

Table 3-20 summarizes all of the critical loads for nutrient nitrogen deposition (kgN/ha-year) and acid deposition (kEq/ha-year), as well as the critical levels for airborne ammonia (µg/m^3), applicable to this designated site. The critical level for airborne NOx is set at 30 µg/m^3 across all designated sites.

Table 3-20 Minimum Critical Load and Critical Level (CL) values and associated sensitive features for Solent and Isle of Wight Lagoons

Sensitive feature	Minimum nutrient nitrogen deposition CLs (kgN/ha year)	Minimum acid deposition CLs (MinCLMaxN, kEq/ha year)	Minimum airborne NH_3 CLs (µg/m^3)
Coastal lagoons	**20**	Not sensitive	**3***

* Not listed on APIS; value indicated by Natural England via email

Consideration of in combination effects

The Solent and Isle of Wight Lagoons SAC designated site is contained within the PfSH study area. The PfSH model was used to model the in combination impacts of the FBLP by scaling the air quality model outputs from the PfSH future year scenarios (for the year 2034) to 2036, as described in Section

2.3.10.2. The dispersion modelling results of the PfSH 2036 DM scenario are therefore representative of air quality impacts associated with road traffic emissions from the FBLP, as well as in combination air quality impacts associated with road traffic emissions from anticipated development up to 2036 in East Hampshire (part), Eastleigh, Gosport, Havant, Isle of Wight, New Forest, Portsmouth, Southampton, Test Valley (part), and Winchester (part).

Screening results

Table 3-21 compares the maximum modelled contribution of the FBLP in isolation (Fareham 2036 DM Scenario) to the lowest applicable CL. Values highlighted in yellow exceed the 1% screening threshold. This screening exercise represents a precautionary approach, as it assumes that the most sensitive qualifying features (with the lowest CLs) are present in the areas with the highest modelled contribution (typically adjacent to the busiest road).

Table 3-21 Screening results based on dispersion modelling of the FBLP in isolation:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
Nutrient nitrogen deposition (kgN/ha-year)	Grassland	20	5.8×10^{-7}	<0.001%
Acid deposition (kEq/ha-year)			4.1×10^{-8}	<0.001%
Airborne NOx (µg/m^3)	n/a	30	9.5×10^{-7}	<0.001%
				<0.001%

*APIS indicates that site specific advice should be sought. The site was screened using a CL of 3 µg/m^3 throughout the site, as indicated by Natural England via email.

This site is characterised by marine habitats with short vegetation; therefore grassland deposition rates are applicable.

None of the four pollutants exceeded the 1% screening threshold for the FBLP in isolation. The contribution from the FBLP in isolation is essentially zero across all pollutants, so an in combination assessment is not required for Solent and Isle of Wight Lagoons SAC.

3.8 Solent and Southampton Water Ramsar (UK11063) and SPA (UK9011061)

3.8.1 Ramsar background information and qualifying features

Underlying Sites of Special Scientific Interest (SSSI): Brading Marshes to St. Helen's Ledges SSSI, Eling and Bury Marshes SSSI, Hurst Castle and Lymington River Estuary SSSI, Hythe to Calshot Marshes SSSI, King's Quay Shore SSSI, Lee-on-The-Solent to Itchen Estuary SSSI, Lincegrove and Hackett's Marshes SSSI, Lower Test Valley SSSI, Lymington River Reedbeds SSSI, Medina Estuary SSSI, Newtown Harbour SSSI, North Solent SSSI, Ryde Sands and Wootton Creek SSSI, Sowley Pond SSSI, Thorness Bay SSSI, Titchfield Haven SSSI, Upper Hamble Estuary and Woods SSSI, Whitecliff Bay and Bembridge Ledges SSSI and Yar Estuary SSSI.

Qualifying and notifiable features associated with this site include:

Ramsar Criterion 1: The site is one of the few major sheltered channels between a substantial island and mainland in European waters, exhibiting an unusual strong double tidal flow and has long periods of slack water at high and low tide. It includes many wetland habitats characteristic of the biogeographic region: saline lagoons, saltmarshes, estuaries, intertidal flats, shallow coastal waters, grazing marshes, reedbeds, coastal woodland and rocky boulder reefs.

Ramsar Criterion 2: The site supports an important assemblage of rare plants and invertebrates. At least 33 British Red Data Book invertebrates and at least eight British Red Data Book plants are represented on site.

Ramsar Criterion 5: Assemblages of international importance:

Species with peak counts in winter:	
51343 waterfowl	(5 year peak mean 1998/99-2002/2003)

Ramsar Criterion 6: Species/populations occurring at levels of international importance.

Species with peak counts in spring/autumn:	
Ringed plover, *Charadrius hiaticula*, Europe/Northwest Africa	397 individuals, representing an average of 1.2% of the GB population (5 year peak mean 1998/92002/3)
Species with peak counts in winter:	
Dark-bellied brent goose, *Branta bernicla bernicla*	6456 individuals, representing an average of 3% of the population (5 year peak mean 1998/92002/3)
Eurasian teal, *Anas crecca*, NW Europe	5514 individuals, representing an average of 1.3% of the population (5 year peak mean 1998/9-2002/3)
Black-tailed godwit, *Limosa limosa islandica*, Iceland/W Europe	1240 individuals, representing an average of 3.5% of the population (5 year peak mean 1998/9-2002/3)

The Site Improvement Plan for the overlapping SPA (Solent SIP043) states that nitrogen deposition has been identified as a pressure. Ramsar sites do not have Site Improvement Plans.

Areas of Solent and Southampton Water (Ramsar & SPA) overlap with Solent Maritime (SAC).

3.8.2 SPA background information and qualifying features

Underlying Sites of Special Scientific Interest (SSSI): Brading Marshes to St. Helen's Ledges SSSI, Eling and Bury Marshes SSSI, Hurst Castle and Lymington River Estuary SSSI, Hythe to Calshot Marshes SSSI, King's Quay Shore SSSI, Lee-on-The-Solent to Itchen Estuary SSSI, Lincegrove and Hackett's Marshes SSSI, Lower Test Valley SSSI, Lymington River Reedbeds SSSI, Medina Estuary

SSSI, Newtown Harbour SSSI, North Solent SSSI, Ryde Sands and Wootton Creek SSSI, Sowley Pond SSSI, Thorness Bay SSSI, Titchfield Haven SSSI, Upper Hamble Estuary and Woods SSSI, Whitecliff Bay and Bembridge Ledges SSSI, Yar Estuary SSSI.

The site qualifies under **Article 4.1** of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

During the breeding season:	
Common Tern *Sterna hirundo*	267 pairs representing at least 2.2% of the breeding population in Great Britain (5 year peak mean, 1993-1997)
Little Tern *Sterna albifrons*	49 pairs representing at least 2.0% of the breeding population in Great Britain (5 year peak mean, 1993-1997)
Mediterranean Gull *Larus melanocephalus*	2 pairs representing at least 20.0% of the breeding population in Great Britain (5 year peak mean, 1994-1998)
Roseate Tern *Sterna dougallii*	2 pairs representing at least 3.3% of the breeding population in Great Britain (5 year peak mean, 1993-1997)
Sandwich Tern *Sterna sandvicensis*	231 pairs representing at least 1.7% of the breeding population in Great Britain (5 year peak mean, 1993-1997)

The site also qualifies under **Article 4.2** of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:

Over winter:	
Black-tailed Godwit *Limosa limosa* islandica	1,125 individuals representing at least 1.6% of the wintering Iceland - breeding population (5 year peak mean, 1992/3-1996/7)
Dark-bellied Brent Goose *Branta bernicla bernicla*	7,506 individuals representing at least 2.5% of the wintering Western Siberia/Western Europe population (5 year peak mean, 1992/3-1996/7)
Ringed Plover *Charadrius hiaticula*	552 individuals representing at least 1.1% of the wintering Europe/Northern Africa - wintering population (5 year peak mean, 1992/3-1996/7)
Teal *Anas crecca*	4,400 individuals representing at least 1.1% of the wintering Northwestern Europe population (5 year peak mean, 1992/3-1996/7)

Assemblage qualification: A wetland of international importance. The area qualifies under **Article 4.2** of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl.

Over winter, the area regularly supports 53,948 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Gadwall *Anas strepera*, Teal *Anas crecca,* Ringed Plover *Charadrius hiaticula*, Black-tailed Godwit *Limosa limosa islandica*, Little Grebe *Tachybaptus ruficollis*, Great Crested Grebe *Podiceps cristatus*, Cormorant *Phalacrocorax carbo*, Dark-bellied Brent Goose *Branta bernicla bernicla*, Wigeon *Anas penelope*, Redshank *Tringa totanus*, Pintail *Anas acuta*, Shoveler *Anas clypeata*, Red-breasted Merganser *Mergus serrator*, Grey Plover *Pluvialis squatarola*, Lapwing *Vanellus vanellus*, Dunlin *Calidris alpina alpina*, Curlew *Numenius arquata*, Shelduck *Tadorna tadorna*.

The Site Improvement Plan for the SPA (Solent SIP043) states that nitrogen deposition has been identified as a pressure.

The conservation objectives for this site are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

Areas of Solent and Southampton Water (Ramsar & SPA) overlap with Solent Maritime (SAC).

3.8.3 HRA Stage 1: Assessment of air quality impacts against screening thresholds

This section comprises the outcome of the assessment described in Section 2.4.

Table 3-22 summarizes all of the critical loads for nutrient nitrogen deposition (kgN/ha-year) and acid deposition (kEq/ha-year), as well as the critical levels for airborne ammonia (µg/m^3), applicable to this designated site. In this table, the most stringent critical load or critical level (CL) for each pollutant is indicated in bold. The critical level for airborne NOx is set at 30 µg/m^3 across all designated sites.

Table 3-22 Minimum Critical Load and Critical Level (CL) values and associated sensitive features for Solent and Southampton Water Ramsar and SPA

Sensitive feature	Minimum nutrient nitrogen deposition CLs (kgN/ha year)	Minimum acid deposition CLs (MinCLMaxN, kEq/ha year)	Minimum airborne NH_3 CLs (µg/m^3)
Sterna sandvicensis (Western Europe/Western Africa) - Sandwich tern	**8**	**0.626**	**3**
Sterna dougallii (Europe - breeding) - Roseate tern	**8**	**0.626**	**3**
Sterna hirundo (Northern/Eastern Europe - breeding) - Common tern	**8**	**0.626**	**3**
Sterna albifrons (Eastern Atlantic - breeding) - Little tern	8	**0.626**	**3**
Branta bernicla bernicla (Western Siberia/Western Europe) - Dark-bellied brent goose	20	Not sensitive	**3**
Anas crecca (North-western Europe) - Eurasian teal	20	Not sensitive	**3**
Charadrius hiaticula (Europe/Northern Africa - wintering) - Ringed plover	20	Not sensitive	**3**
Limosa limosa islandica (Iceland - breeding) - Black-tailed godwit	20	Not sensitive	**3**
Larus melanocephalus - Mediterranean gull	20	Not sensitive	**3**

Consideration of in combination effects

The Solent and Southampton Water Ramsar and SPA designated sites are contained within the PfSH study area. The PfSH model was used to model the in combination impacts of the FBLP by scaling the air quality model outputs from the PfSH future year scenarios (for the year 2034) to 2036, as described in Section 2.3.10.2. The dispersion modelling results of the PfSH 2036 DM scenario are therefore representative of air quality impacts associated with road traffic emissions from the FBLP, as well as in combination air quality impacts associated with road traffic emissions from anticipated development up to 2036 in East Hampshire (part), Eastleigh, Gosport, Havant, Isle of Wight, New Forest, Portsmouth, Southampton, Test Valley (part), and Winchester (part).

Screening results

Table 3-23 compares the maximum modelled contribution of the FBLP in isolation (Fareham 2036 DM scenario) and Table 3-24 compares the maximum modelled contribution of the FBLP in combination (PfSH 2036 DM Scenario) to the lowest applicable CL. Values highlighted in yellow exceed the 1% screening threshold. This screening exercise represents a precautionary approach, as it assumes that the most sensitive qualifying features (with the lowest CLs) are present in the areas with the highest modelled contribution (typically adjacent to the busiest road).

Table 3-23 Screening results based on dispersion modelling of the FBLP in isolation:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
Nutrient nitrogen deposition (kgN/ha-year)	Grassland	8	0.0274	0.34%
Acid deposition (kEq/ha-year)			0.00195	0.31%
Airborne NOx ($\mu g/m^3$)	n/a	30	0.0662	0.22%
				0.15%

Table 3-24 Screening results based on dispersion modelling of the FBLP in combination:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
Nutrient nitrogen deposition (kgN/ha-year)	Grassland	8	1.89	23.6%
Acid deposition (kEq/ha-year)	Grassland	0.626	0.134	21.5%
Airborne NOx ($\mu g/m^3$)	n/a	30	2.83	9.4%
Airborne NH_3 ($\mu g/m^3$)	n/a	3	0.339	11.3%

Although there are isolated pockets of trees within the Ramsar and SPA boundary, these are not associated with the qualifying and notifiable features of the designated site. The rest of the site is mainly characterised by marine habitats with short vegetation, and in these areas, the grassland deposition rates are applicable.

None of the pollutants are predicted to exceed the 1% screening threshold for the FBLP in isolation. However, the contribution from the FBLP in combination exceeds the 1% screening threshold across all pollutants, and the contribution from the FBLP in isolation is greater than zero across all pollutants, significant effects cannot be screened out. Therefore, a Stage 2 Appropriate Assessment has been undertaken in the following section.

3.8.4 HRA Stage 2: Appropriate Assessment

3.8.4.1 Airborne NH_3

The relevant CL for Solent and Southampton Water Ramsar and SPA is 3 µg/m^3 for all features.

The contribution of airborne NH_3 from the FBLP in combination was added to background levels of ammonia across the site. The maximum total concentration (road contribution plus background concentrations) of NH_3 measured by zonal statistics was 1.67 µg/m^3, considerably below the CL (55.7%).

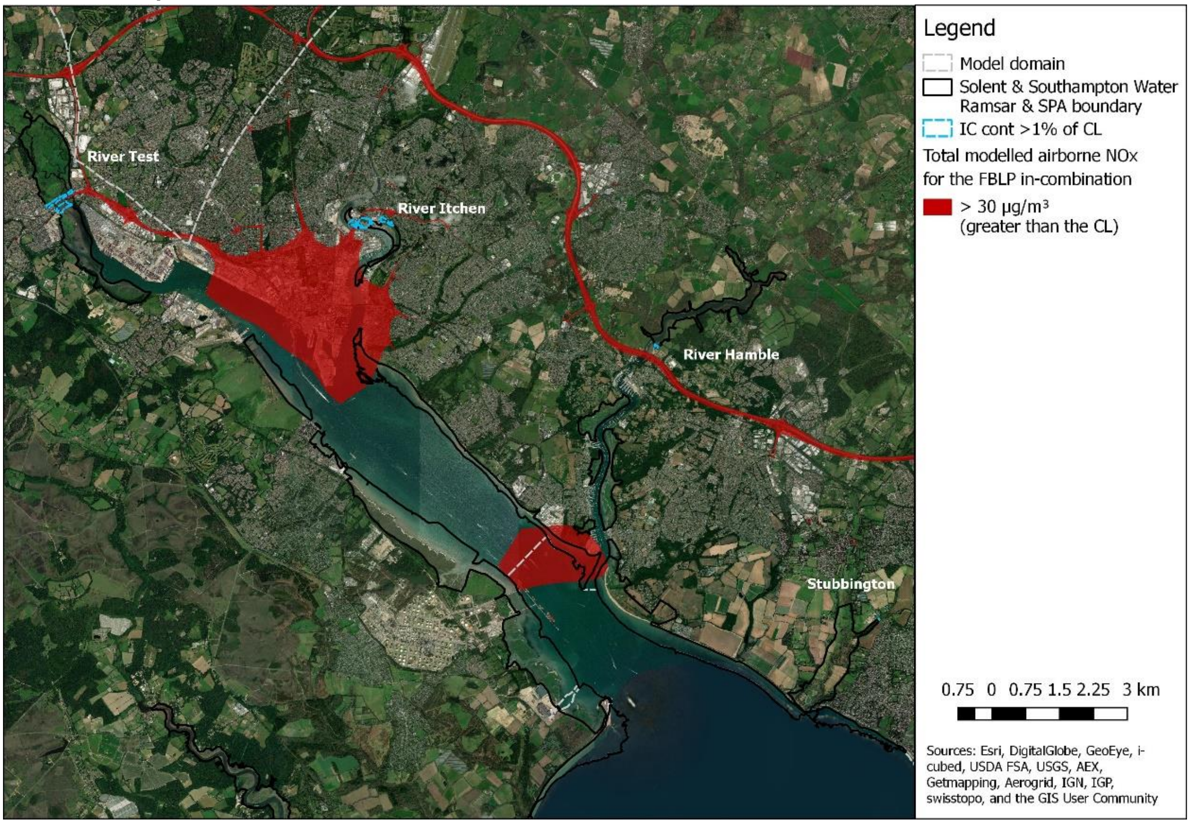
There are no adverse effects on this Ramsar and SPA site arising from airborne NH_3, as the total predicted concentration for the FBLP in combination is less than the CL.

3.8.4.2 Airborne NOx

The relevant CL for Solent and Southampton Water Ramsar and SPA is 30 µg/m^3 for all vegetation.

The areas of the site predicted to exceed the screening threshold for the FBLP in combination are shown in a light blue outline in Figure 3-25. There are four areas of exceedance located at the River Test, River Itchen, River Hamble, and Stubbington.

Figure 3-25 Areas where the modelled contribution from the FBLP in combination for airborne NOx exceeds 1% of the CL, overlain with the total modelled NOx concentration for the FBLP in combination at Solent and Southampton Water Ramsar & SPA

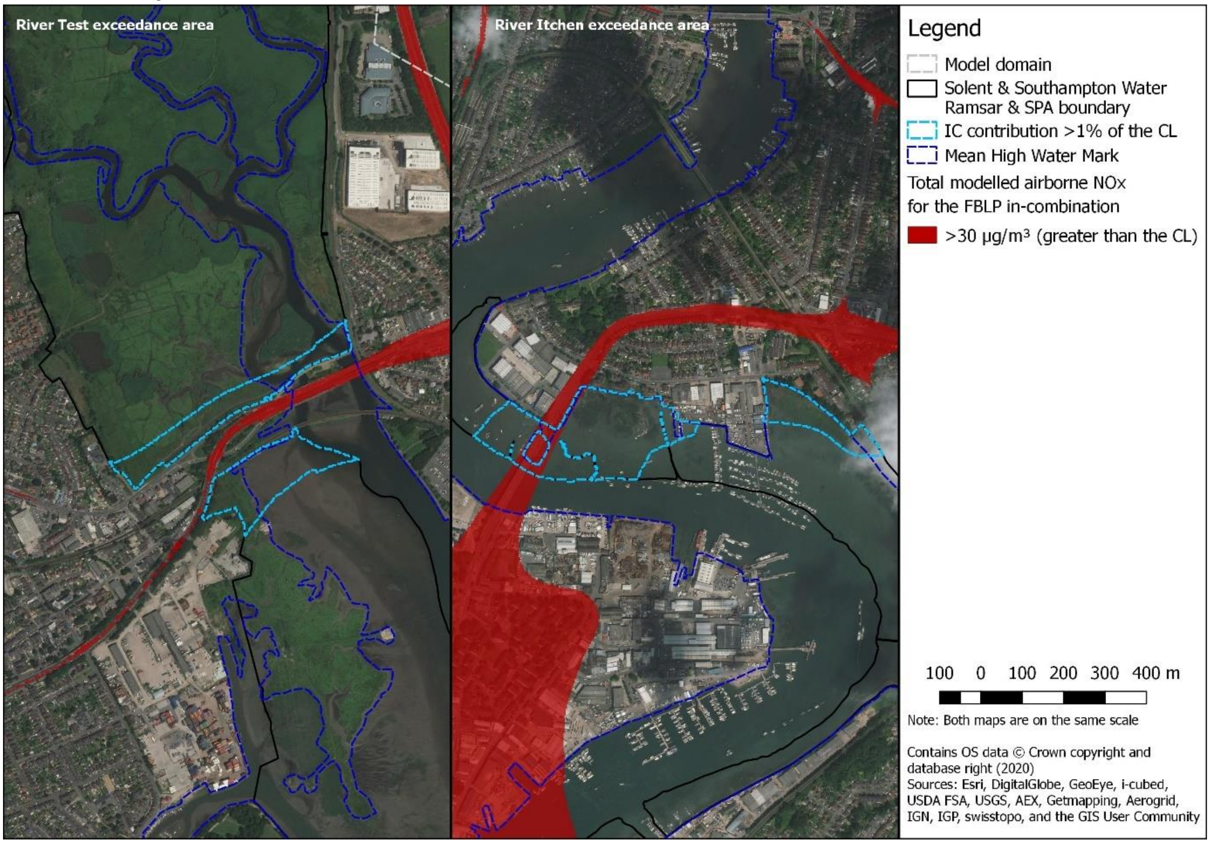


Total NOx concentrations have been calculated by adding the road contribution of NOx to the Defra NOx background map for the year 2030 (the furthest year into the future for which this data is available).

The exceedance areas (greater than 1% of the CL) at Stubbington and the River Hamble are not close to areas where the total modelled NOx concentration, in combination, is near to or greater than the CL. We anticipate no significant effects on the site's integrity at these locations.

For the exceedance areas at the River Test and River Hamble, Figure 3-26 provides more detail on the total modelled NOx concentration for the FBLP in combination:

Figure 3-26 Areas where the modelled contribution from the FBLP in combination for airborne NOx exceeds 1% of the CL, overlain with the total modelled NOx concentration for the FBLP in combination at Solent and Southampton Water Ramsar & SPA: River Test and River Itchen



At the River Test, the areas where the contribution from the FBLP in combination exceed 1% of the CL do not overlap with the areas where the total modelled airborne NOx concentration for the FBLP in combination exceed 30 µg/m^3. At the River Itchen, there is some overlap. However, all overlapping areas consist of road surfaces or open water, as indicated by the mean high water mark (dark blue outline). We conclude that no adverse effects on the site's integrity are expected from airborne NOx.

3.8.4.3 Acid Deposition

Summary of critical loads for acid deposition:

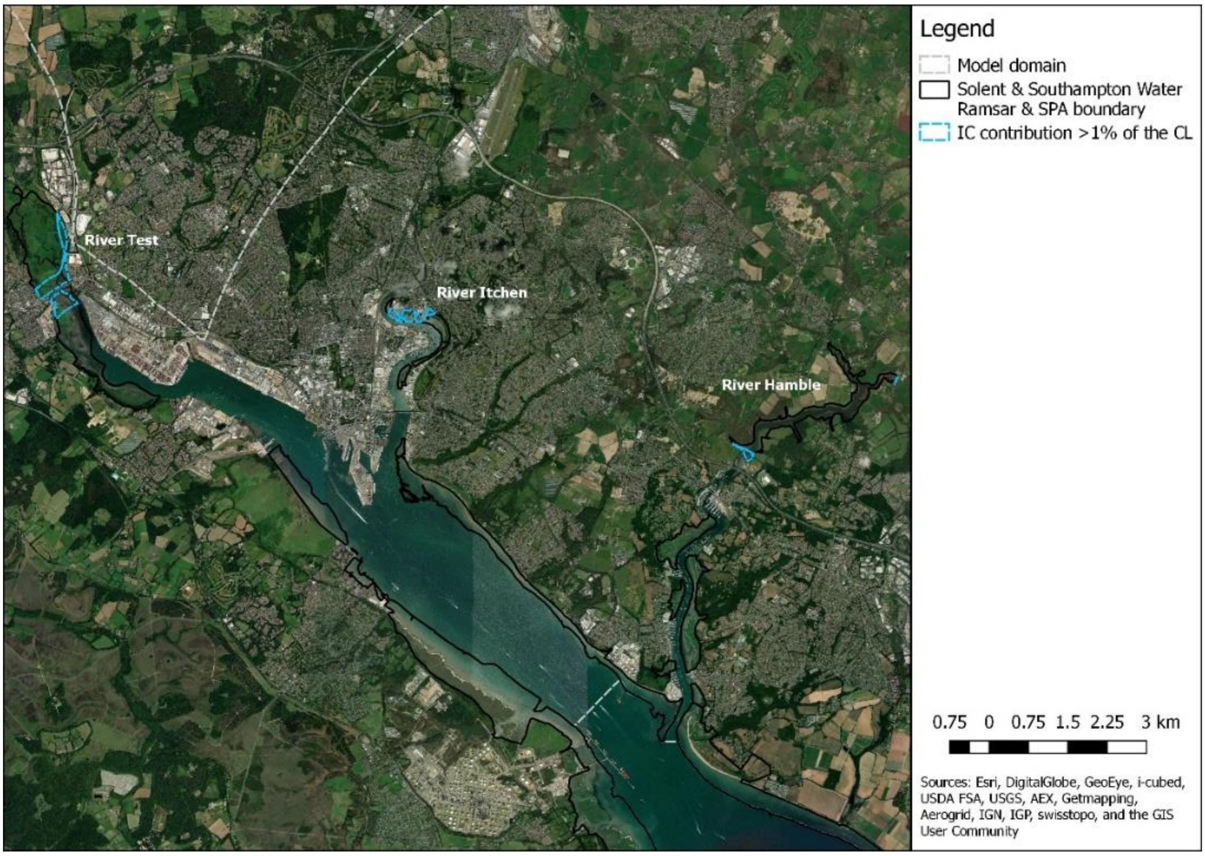
The lowest CLs are set for the four species of tern (Sandwich tern, Roseate tern, Common tern and Little tern) for the broad habitat used for reproducing (Supralittoral sediment – acidic type; acid grassland, MinCLMaxN = 0.626 kEq/ha-year). For the same tern species in the broad habitat Supralittoral sediment – calcareous type, a higher CL is set (calcareous grassland, MinCLMaxN = 4.856 kEq/ha-year). The Common tern is the only feature listed on APIS as having "Potential negative impact on species due to impacts on the species' broad habitat"; the other three tern species are listed as having "No expected negative impact on the species due to impacts on the species' broad habitat".

No CLs are listed on APIS for the broad habitats of the Eurasian teal, Ringed plover, Mediterranean gull, Dark-bellied brent goose or Black-tailed godwit.

Further analysis:

Figure 3-27 provides an overview of areas where the screening threshold for acid deposition has been exceeded for the FBLP in combination (assuming a CL of 0.626 kEq/ha/yr and grassland deposition rates):

Figure 3-27 Areas where the modelled in combination contribution for acid deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 0.626 kEq/ha/yr, at Solent and Southampton Water Ramsar & SPA



There are three areas of exceedance of the screening threshold for acid deposition, at the River Test, River Itchen and River Hamble.

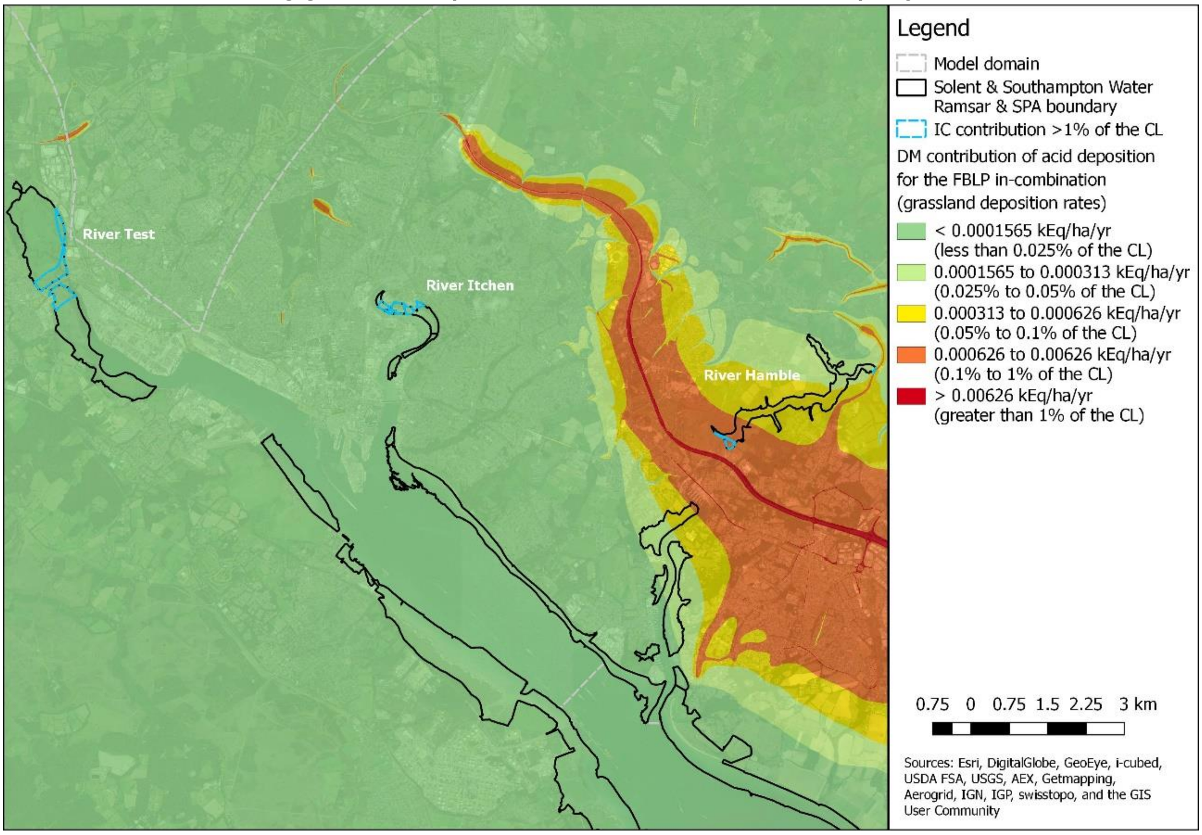
The areas where the in combination contribution exceeds 1% of the CL are shown again in light blue in Figure 3-28. The contribution of the FBLP in isolation has been overlain, demonstrating that the maximum contribution in two of the three exceedance areas (the River Test and River Itchen) is less than 0.0001565 kEq/ha/yr (or <0.025% of the lowest CL).

To put this into context, with the FBLP having an individual contribution comprising <0.025% of the lowest CL, it would require 40 or more such individual contributions (from other plans or projects) to attain, in combination, the screening threshold of 1% of the applicable CL. Additionally, as the contribution from the FBLP is so small, any mitigation measures incorporated into the FBLP would have an essentially negligible impact on reducing the acid deposition in this area; eliminating the FBLP entirely would reduce the acid deposition by less than 0.0001565 kEq/ha/yr. This indicates that the contribution of the FBLP to acid deposition in these areas is so small as to be nugatory or indistinguishable from background variations, and a contribution of this magnitude would therefore not have any appreciable effect on the designated site.

The concept of an effect which is so small as to be nugatory or indistinguishable from background variations, and which can therefore be excluded from further assessment under the Habitats Regulations, is supported by current guidance from Natural England.[50] In view of the minimal impact due to the FBLP in isolation, it is concluded that there is no plausible significant adverse effect on the integrity of the Ramsar and SPA site at the River Test and River Itchen due to the FBLP in combination with other plans and projects.

Natural England has confirmed that as the contribution from the FBLP in isolation is less than 0.025% of the lowest CL in these areas, the contribution of the FBLP to in combination impacts can be considered not significant. [36]

Figure 3-28 Areas where the FBLP in combination contribution for acid deposition exceeds 1% of the CL, overlain with the FBLP contribution, in isolation, of acid deposition at Solent and Southampton Water Ramsar & SPA, assuming grassland deposition rates and a CL of 0.626 kEq/ha/yr



The remaining area of exceedance is located at the River Hamble. In this location, the contribution from the FBLP in isolation is significant. Therefore, further analysis of the impact of the FBLP in combination has been completed below.

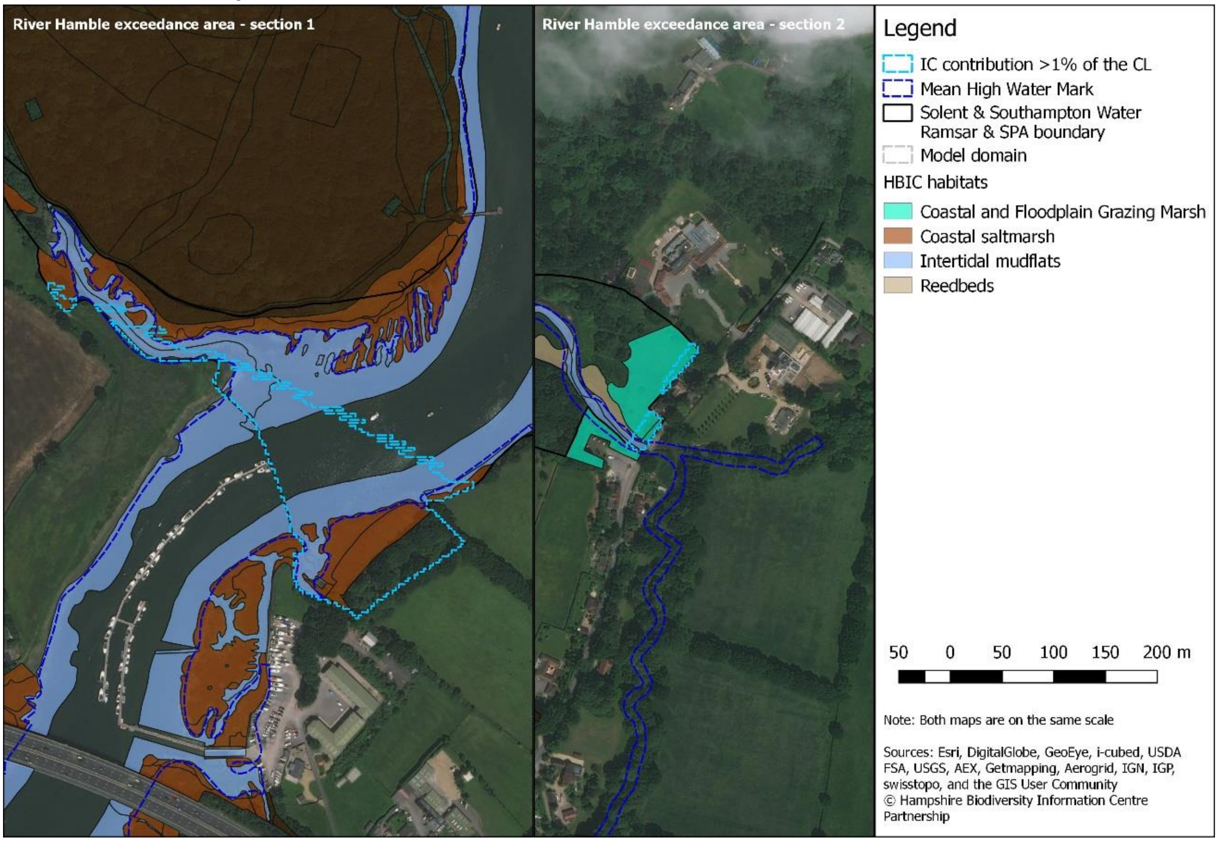
<u>Larger area of exceedance at the River Hamble, where the River Hamble and the M27 cross</u>

A large portion of this area of exceedance falls below the mean high water mark (dark blue outline in Figure 3-29) and/or is comprised of intertidal mudflats. In both cases, those areas are regularly inundated with water, and significant impacts from pollution would not be expected.

Three small areas of land fall above the mean high water mark[40], but within the area of exceedance of 1% of the CL for acid deposition, for the FBLP in combination. These areas of land comprise coastal saltmarsh, and land with no habitat type, but which appears to be deciduous woodland from satellite imagery.

Natural England has previously confirmed that breeding terns are unlikely to be found in this area of exceedance, shown on the left in Figure 3-29, which matches closely to the area examined during the short-term assessment for development in Fareham Borough.[43] Natural England has subsequently confirmed that breeding terns are still unlikely to be found in this area of exceedance.[36] We expect no adverse effects on this part of the site as a result of increased acid deposition from the FBLP in isolation or in combination with other plans and projects.

Figure 3-29 Areas where the in combination contribution for acid deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 0.626 kEq/ha-yr, overlain with HBIC habitats present at Solent and Southampton Water Ramsar & SPA: River Hamble



<u>Smaller area of exceedance at the River Hamble, at Curbridge Creek</u>

The area of exceedance on the right has not previously been examined during the short-term assessment for development in Fareham Borough.[43] The area is comprised of approximately 0.0818 ha of coastal and floodplain grazing marsh and 0.0027 ha of reedbeds. As previously mentioned at the screening stage, although there are isolated pockets of trees within the Ramsar and SPA boundary, these are not associated with the qualifying and notifiable features of the designated site (hence, the grassland deposition rates are applicable). As this area of the site is mostly comprised of woodland, we would not expect it to support breeding terns.

Natural England has confirmed that breeding terns are unlikely to be found in this area of exceedance.[36] We expect no adverse effects on this part of the site as a result of increased acid deposition from the FBLP in isolation or in combination with other plans and projects.

3.8.4.4 Nitrogen Deposition

Summary of critical loads for nitrogen deposition:

The lowest Critical Loads are listed for potential impacts to four species of tern (Sandwich tern, Roseate tern, Common tern and Little tern) due to impacts on the broad habitat used for reproducing (Supralittoral sediment – acidic type).

- 8 – 10 kgN/ha-year if found on Coastal stable dune grasslands (acid type)
- 10 – 15 kgN/ha-year if found on Coastal stable dune grasslands (calcareous type)
- 10 – 20 kgN/ha-year if found on Shifting coastal dunes

The higher CL of 20 – 30 kgN/ha-year applies for other birds and their associated habitats, such as Eurasian teal (broad habitat type – pioneer, low-mid, mid-upper saltmarshes).

Figure 3-30 Areas where the modelled in combination contribution for nitrogen deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 8 kgN/ha-year, at Solent and Southampton Water Ramsar & SPA

There are four main areas of exceedance of nitrogen deposition, at the River Test, River Itchen, River Hamble, and Stubbington.

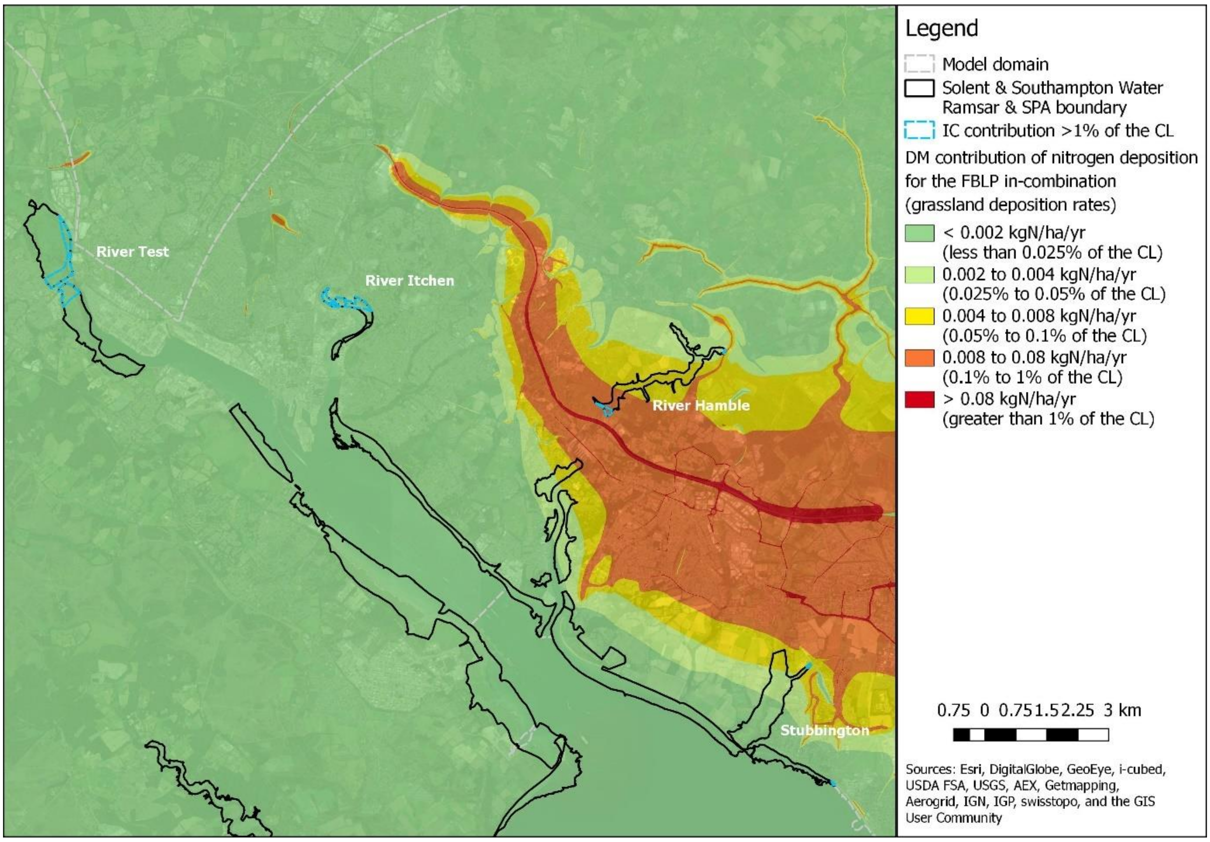
The areas where the in combination contribution exceeds 1% of the CL are shown again in light blue on Figure 3-31. The contribution of the FBLP in isolation has been overlain, demonstrating that the maximum contribution in three of the exceedance areas (the River Test and River Itchen, as well as the small exceedance area in the bottom right at Lee-on-the-Solent) is less than 0.002 kgN/ha/yr (or <0.025% of the lowest CL).

To put this into context, with the FBLP having an individual contribution comprising less than 0.025% of the lowest CL, it would require 40 or more such individual contributions (from other plans or projects) to attain, in combination, the screening threshold of 1% of the applicable CL. Additionally, as the contribution from the FBLP is so small, any mitigation measures incorporated into the FBLP would have an essentially negligible impact on reducing the nitrogen deposition in this area; eliminating the FBLP entirely would reduce the nitrogen deposition by less than 0.002 kgN/ha/yr. This indicates that the contribution of the FBLP to nitrogen deposition in these areas is so small as to be nugatory or indistinguishable from background variations, and a contribution of this magnitude would therefore not have any appreciable effect on the designated site.

The concept of an effect which is so small as to be nugatory or indistinguishable from background variations, and which can therefore be excluded from further assessment under the Habitats Regulations, is supported by current guidance from Natural England.[50] In view of the minimal impact due to the FBLP in isolation, it is concluded that there is no plausible significant adverse effect on the integrity of the Ramsar and SPA site at the River Test and River Itchen due to the FBLP in combination with other plans and projects.

Natural England has confirmed that as the contribution from the FBLP in isolation is less than 0.025% of the lowest CL in these areas, the contribution of the FBLP to in combination impacts can be considered not significant. [36]

Figure 3-31 Areas where the in combination contribution for nitrogen deposition exceeds 1% of the CL, overlain with the contribution of the FBLP in isolation, at the Solent & Southampton Water Ramsar & SPA assuming grassland deposition rates and a CL of 8 kgN/ha-year



The remaining areas of exceedance are located at the River Hamble, and at Stubbington. In these locations, the contribution from the FBLP in isolation is significant. Therefore, further analysis of the impact of the FBLP in combination has been completed below.

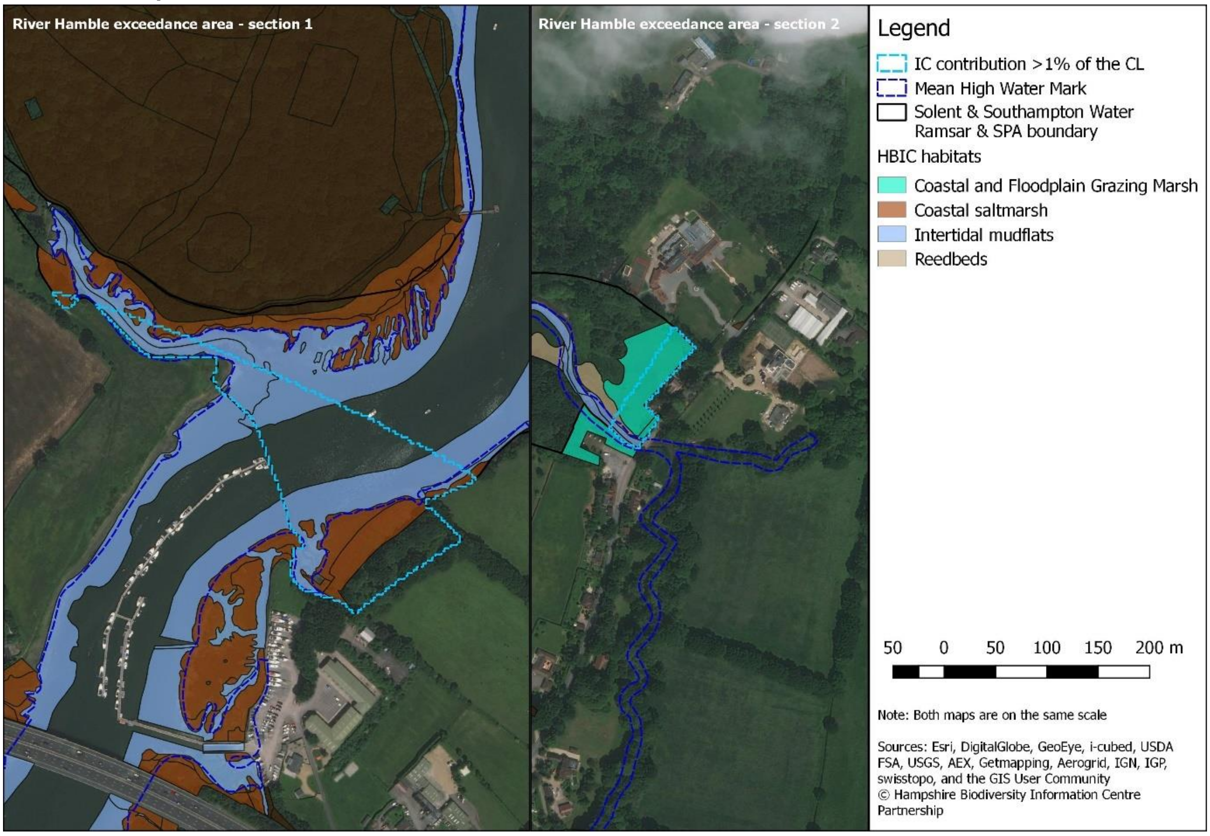
<u>Larger area of exceedance at the River Hamble, where the River Hamble and the M27 cross</u>

A large portion of this area of exceedance falls below the mean high water mark (dark blue outline in Figure 3-32) and/or is comprised of intertidal mudflats. In both cases, those areas are regularly inundated with water, and significant impacts from pollution would not be expected.

Three small areas of land fall above the mean high water mark[40], but within the area of exceedance of 1% of the CL for acid deposition, for the FBLP in combination. These areas of land comprise coastal saltmarsh, and land with no habitat type, but which appears to be deciduous woodland from satellite imagery.

Natural England has previously confirmed that breeding terns are unlikely to be found in this area of exceedance, shown on the left in Figure 3-29, which matches closely to the area examined during the short-term assessment for development in Fareham Borough.[43] Natural England has confirmed that breeding terns are still unlikely to be found in this area of exceedance. [36] We expect no adverse effects on this part of the site as a result of increased acid deposition from the FBLP in isolation or in combination with other plans and projects.

Figure 3-32 Areas where the in combination contribution for nitrogen deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 8 kgN/ha-yr, overlain with HBIC habitats present at Solent and Southampton Water Ramsar & SPA: River Hamble



Smaller area of exceedance at the River Hamble, at Curbridge Creek

The area of exceedance on the right has not previously been examined during the short-term assessment for development in Fareham Borough.[43] The area is comprised of approximately 0.0818 ha of coastal and floodplain grazing marsh and 0.0008 ha of reedbeds. As previously mentioned at the screening stage, although there are isolated pockets of trees within the Ramsar and SPA boundary, these are not associated with the qualifying and notifiable features of the designated site (hence, the grassland deposition rates are applicable). As this area of the site is mostly comprised of woodland, we would not expect it to support breeding terns.

Natural England has confirmed that breeding terns are unlikely to be found in this area of exceedance.[36] We expect no adverse effects on this part of the site as a result of increased acid deposition from the FBLP in isolation or in combination with other plans and projects.

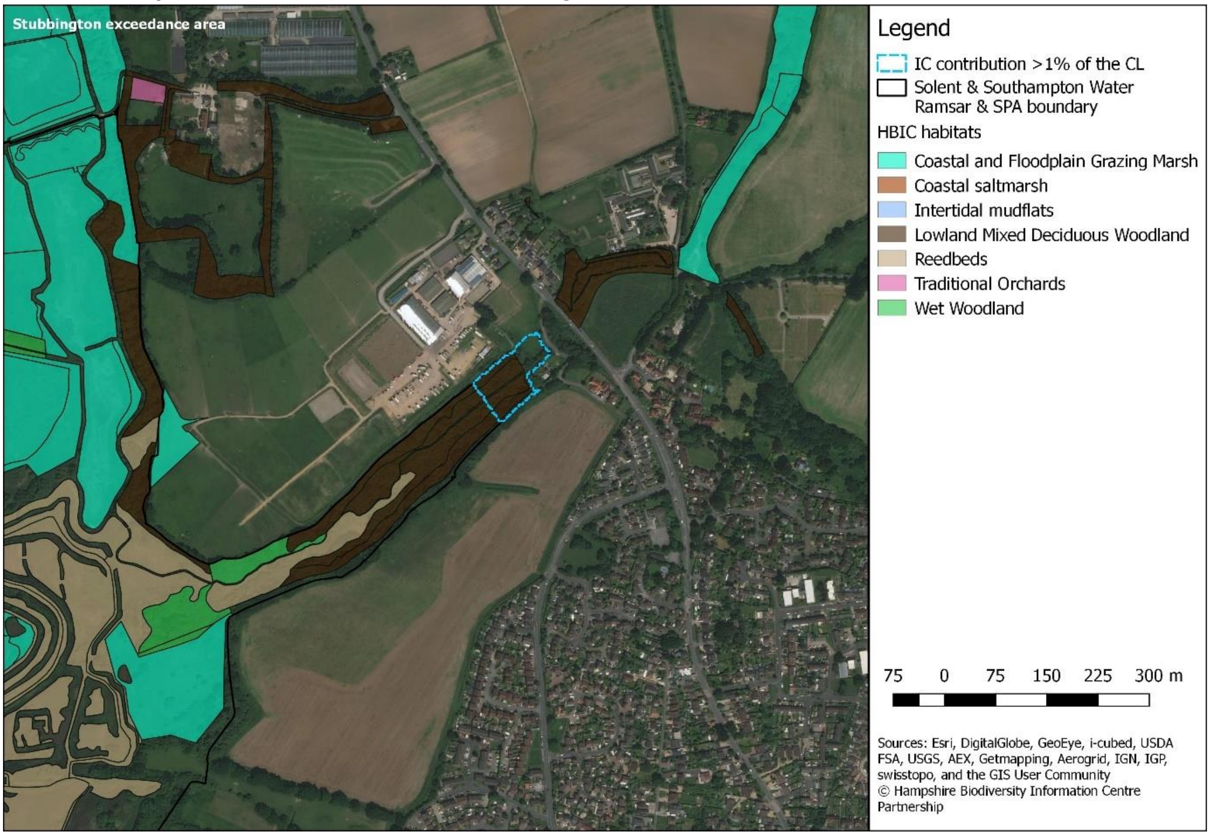
Area of exceedance at Stubbington

The remaining exceedance area at Stubbington was not predicted to exceed the screening threshold for nitrogen deposition for short-term development in Fareham Borough, nor was it predicted to exceed the screening threshold for acid deposition in this report; therefore, it has not yet been examined.

The area of exceedance in Figure 3-33 does not fall below the mean high water mark, and is comprised of approximately 0.454 ha of lowland mixed deciduous woodland, and 0.213 ha of land with no habitat type, but which appears to be a mixture of grassland and deciduous woodland from satellite imagery. As previously mentioned at the screening stage, although there are isolated pockets of trees within the Ramsar and SPA boundary, these are not associated with the qualifying and notifiable features of the designated site (hence, the grassland deposition rates are applicable). As this area of the site is mostly comprised of woodland, we would not expect it to support breeding terns.

Natural England has confirmed that breeding terns are unlikely to be found in this area of exceedance.[53] We expect no adverse effects on this part of the site as a result of increased acid deposition from the FBLP in isolation or in combination with other plans and projects.

Figure 3-33 Areas where the in combination contribution for nitrogen deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 8 kgN/ha-yr, overlain with HBIC habitats present at Solent and Southampton Water Ramsar & SPA: Stubbington



3.8.4.5 Detailed consideration of qualifying features

Due to the complexity of Solent and Southampton Water, each qualifying feature is considered in-turn in Table 3-25.

[53] Email correspondence with Natural England, 13/08/2020.

Table 3-25 Detailed consideration of qualifying features for Solent and Southampton Water Ramsar & SPA

Qualifying Feature	Potential Effects	Adverse Effect Before Mitigation? (on conservation objectives and site integrity)
Ramsar Criterion 1: The site is one of the few major sheltered channels between a substantial island and mainland in European waters, exhibiting an unusual strong double tidal flow and has long periods of slack water at high and low tide. It includes many wetland habitats characteristic of the biogeographic region: saline lagoons, saltmarshes, estuaries, intertidal flats, shallow coastal waters, grazing marshes, reedbeds, coastal woodland and rocky boulder reefs.	**Saline Lagoons** Saline lagoons are routinely inundated as a result of the daily tidal influence. As a result, any accumulation of airborne pollutants would be flushed away and/or diluted by the washing over of the tide. Significant adverse impacts as a result of the proposed development in Fareham Borough are therefore not anticipated for this feature.	No
	Estuaries Estuaries are routinely inundated as a result of the daily tidal influence. As a result, any accumulation of airborne pollutants would be flushed away and/or diluted by the washing over of the tide. Significant adverse impacts as a result of the proposed development in Fareham Borough are therefore not anticipated for this feature.	No
	Saltmarsh Small areas of saltmarsh are present within the areas predicted to exceed the screening thresholds of all four pollutants. Given saltmarsh is a supporting habitat of the qualifying bird species, the impact of increased airborne air pollution concentrations upon saltmarsh was considered for birds. Analysis in the preceding sections determined that there would be no adverse effects on bird species related to nitrogen deposition, acid deposition, airborne NH_3 or NOx. The areas of saltmarsh included in the areas predicted to exceed the screening thresholds are also small in comparison to the large areas of saltmarsh available elsewhere in the site.	No
	Shallow coastal waters Shallow coastal waters are routinely inundated as a result of the daily tidal influence. As a result, any accumulation of airborne pollutants would be flushed away and/or diluted by the washing over of the tide. Significant adverse impacts as a result of the proposed development in Fareham Borough are therefore not anticipated for this feature.	No
	Rocky boulder reefs Rocky boulder reefs are routinely inundated as a result of the daily tidal influence. As a result, any accumulation of airborne pollutants would be flushed away and/or diluted by the washing over of the tide. Significant adverse impacts as a result of the proposed development in Fareham Borough are therefore not anticipated for this feature.	No
	Coastal woodland A review of HBIC and priority habitat mapping did not identify any coastal woodland within the areas of exceedance and as such adverse impacts from pollutants to this qualifying feature habitat as a result of the development in Fareham Borough are considered unlikely.	No
	Reedbeds Reedbeds commonly occur on ground which is waterlogged for most of the year and subject to tidal influences. As a result, any accumulation of airborne pollutants would be flushed away and/or diluted by the washing over of the tide.	No

Qualifying Feature	Potential Effects	Adverse Effect Before Mitigation? (on conservation objectives and site integrity)
	Significant adverse impacts as a result of the proposed development in Fareham Borough are therefore not anticipated for this feature.	
	Intertidal flats Intertidal flats are routinely inundated as a result of the daily tidal influence. As a result, any accumulation of airborne pollutants would be flushed away and/or diluted by the washing over of the tide. Significant adverse impacts as a result of the proposed development in Fareham Borough are therefore not anticipated for this feature.	No
	Grazing marshes Small areas of grazing marsh are present within the areas predicted to exceed the screening thresholds of nitrogen deposition and acid deposition (at Curbridge Creek). The areas of grazing marsh included in the areas predicted to exceed the screening thresholds are small in comparison to the large areas of this habitat available elsewhere in the site. Additionally, grazing marsh is dependent on periodic inundation with tidal waters and high water levels, and as such adverse impacts as a result of the proposed development in Fareham Borough are not anticipated for this feature.	No
Ramsar Criterion 2: The site supports an important assemblage of rare plants and invertebrates. At least 33 British Red Data Book invertebrates and at least eight British Red Data Book plants are represented on site.	No species list is provided for the Ramsar assemblage qualification however, an assemblage list is provided for the SPA designation. The impacts to all bird species listed within the SPA assemblage list are considered individually therefore any adverse impacts identified for SPA bird species would represent an adverse impact on this assemblage qualification.	No
Ramsar Criterion 5: Individual qualifying bird species: 51343 waterfowl (5 year peak mean 1998/99-2002/2003)	No species list is provided for the Ramsar assemblage qualification however, an assemblage list is provided for the SPA designation. The impacts to all bird species listed within the SPA assemblage list are considered individually therefore any adverse impacts identified for SPA bird species would represent an adverse impact on this assemblage qualification.	No

Qualifying Feature	**Potential Effects**	**Adverse Effect Before Mitigation? (on conservation objectives and site integrity)**
Ramsar Criterion 6: Individual qualifying bird species.	All individual qualifying birds are considered under the SPA designation.	N/A
SPA Article 4.1: Little Tern	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.1: Sandwich Tern	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.1: Mediterranean Gull	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	
SPA Article 4.1: Roseate Tern	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Black-tailed Godwit	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Ringed Plover	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Dark-bellied Brent Goose	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Dunlin	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Grey Plover	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Redshank	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Little Grebe	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Great Crested Grebe	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Cormorant	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No

Qualifying Feature	Potential Effects	Adverse Effect Before Mitigation? (on conservation objectives and site integrity)
SPA Article 4.2: Shelduck	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.1: Common Tern	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Curlew	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Pintail	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Red-breasted merganser	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Lapwing	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Gadwall	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Shoveler	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Teal	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No
SPA Article 4.2: Wigeon	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	No

Qualifying Feature	Potential Effects	Adverse Effect Before Mitigation? (on conservation objectives and site integrity)
SPA Article 4.2: Waterbird Assemblage: Gadwall, Teal, Ringed Plover, Black-tailed Godwit, Little Grebe, Great Crested Grebe, Cormorant, Dark-bellied Brent Goose, Wigeon, Redshank, Pintail, Shoveler, Red-breasted Merganser, Grey Plover, Lapwing, Dunlin,Curlew, Shelduck.	All of these birds are considered individually above.	No

3.8.4.6 Assessment summary and conclusions

Adverse effects (pre-mitigation) can be discounted for all qualifying features of the Solent and Southampton Water Ramsar and SPA, and for nitrogen deposition, acid deposition, oxides of nitrogen (NOx) and ammonia (NH_3) as causal pollutants.

On the basis of available evidence, adverse effects on this Ramsar and SPA site can be discounted and as such there will be no threat to the ability of the European site to achieve its conservation objectives or maintain its integrity as a result of the FBLP, in combination with development in other local authorities within the PfSH sub-region.

3.9 Solent Maritime SAC (UK0030059)

3.9.1 Background information and qualifying features

Underlying Sites of Special Scientific Interest (SSSI): Hythe to Calshot Marshes SSSI, Lee-on-the Solent to Itchen Estuary SSSI, Upper Hamble Estuary & Woods SSSI, Bouldnor & Hamstead Cliffs SSSI, Newtown Harbour SSSI, Bracklesham Bay SSSI, Chichester Harbour SSSI, North Solent SSSI, Lower Test Valley SSSI, Langstone Harbour SSSI, Thorness Bay SSSI, Hurst Castle & Lymington River Estuary SSSI, Yar Estuary SSSI, Medina Estuary SSSI, King's Quay Shore SSSI, Eling & Bury Marshes SSSI, Lincegrove & Hackett's Marshes SSSI.

Qualifying and notifiable features associated with this site include: **1130 Estuaries**, **1320 Spartina swards (Spartinion maritimae)**, **1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)**, **1110 Sandbanks which are slightly covered by sea water all the time**, **1140 Mudflats and sandflats not covered by seawater at low tide**, **1150 Coastal lagoons**, **1210 Annual vegetation of drift lines**, **1220 Perennial vegetation of stony banks**, **1310 Salicornia and other annuals colonizing mud and sand**, **2120 "Shifting dunes along the shoreline with Ammophila arenaria (""white dunes"")"**, **1016 Desmoulin`s whorl snail *Vertigo moulinsiana***

The Site Improvement Plan for the SPA (Solent SIP043) states that nitrogen deposition has been identified as a pressure.

The conservation objectives for this site are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of qualifying natural habitats and habitats of qualifying species
- The structure and function (including typical species) of qualifying natural habitats
- The structure and function of the habitats of qualifying species
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely
- The populations of qualifying species, and,
- The distribution of qualifying species within the site.

Areas of Solent Maritime (SAC) overlap with Solent and Southampton Water (Ramsar & SPA) and Chichester and Langstone Harbours (Ramsar and SPA).

3.9.2 HRA Stage 1: Assessment of air quality impacts against screening thresholds

This section comprises the outcome of the assessment described in Section 2.4.

Table 3-26 summarizes all of the critical loads for nutrient nitrogen deposition (kgN/ha-year) and acid deposition (kEq/ha-year), as well as the critical levels for airborne ammonia (µg/m^3), applicable to this designated site. In this table, the most stringent critical load or critical level (CL) for each pollutant is indicated in bold. The critical level for airborne NOx is set at 30 µg/m^3 across all designated sites.

Table 3-26 Minimum Critical Load and Critical Level (CL) values and associated sensitive features for Solent Maritime SAC

Sensitive feature	Minimum nutrient nitrogen deposition CLs (kgN/ha year)	Minimum acid deposition CLs (MinCLMaxN, kEq/ha year)	Minimum airborne NH_3 CLs (µg/m^3)
Perennial vegetation of stony banks	**8**	**0.626**	**3**; APIS indicates no lichens or

Sensitive feature	Minimum nutrient nitrogen deposition CLs (kgN/ha year)	Minimum acid deposition CLs (MinCLMaxN, kEq/ha year)	Minimum airborne NH_3 CLs ($\mu g/m^3$)
			bryophytes present
Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")	10	Not sensitive	**3**; APIS indicates no lichens or bryophytes present
Estuaries	20	Not sensitive	**3**; APIS indicates no lichens or bryophytes present
Coastal lagoons	20	Not sensitive	**3**; APIS indicates no lichens or bryophytes present
Salicornia and other annuals colonizing mud and sand	20	Not sensitive	**3**; APIS indicates no lichens or bryophytes present
Spartina swards (*Spartinion maritimae*)	20	Not sensitive	**3**; APIS indicates no lichens or bryophytes present
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	20	Not sensitive	**3**; APIS indicates no lichens or bryophytes present
Sandbanks which are slightly covered by sea water all the time	Not sensitive	Not sensitive	Not sensitive
Mudflats and sandflats not covered by seawater at low tide	No data	Not sensitive	**3**; APIS indicates no lichens or bryophytes present
Annual vegetation of drift lines	Not sensitive	Not sensitive	Not sensitive
Vertigo moulinsiana - Desmoulin`s whorl snail	No data – site specific	No data – site specific	**3**

Consideration of in combination effects

The Solent Maritime SAC designated site is contained within the PfSH study area. The PfSH model was used to model the in combination impacts of the FBLP by scaling the air quality model outputs from the PfSH future year scenarios (for the year 2034) to 2036, as described in Section 2.3.10.2. The dispersion modelling results of the PfSH 2036 DM scenario are therefore representative of air quality impacts associated with road traffic emissions from the FBLP, as well as in combination air quality impacts associated with road traffic emissions from anticipated development up to 2036 in East Hampshire (part), Eastleigh, Gosport, Havant, Isle of Wight, New Forest, Portsmouth, Southampton, Test Valley (part), and Winchester (part).

Screening results

Table 3-27 compares the maximum modelled contribution of the FBLP in isolation (Fareham 2036 DM scenario) and Table 3-28 compares the maximum modelled contribution of the FBLP in combination (PfSH 2036 DM Scenario) to the lowest applicable CL. Values highlighted in yellow exceed the 1% screening threshold. This screening exercise represents a precautionary approach, as it assumes that the most sensitive qualifying features (with the lowest CLs) are present in the areas with the highest modelled contribution (typically adjacent to the busiest road).

Table 3-27 Screening results based on dispersion modelling of the FBLP in isolation:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
	Grassland	8	0.396	4.96%
Acid deposition (kEq/ha-year)				4.51%
Airborne NOx (µg/m^3)				4.17%
				2.07%

Table 3-28 Screening results based on dispersion modelling of the FBLP in combination:

Pollutant	Deposition type	Minimum CL	Maximum modelled contribution	% of CL
Nutrient nitrogen deposition (kgN/ha-year)	Grassland	8	16.3	204%
Acid deposition (kEq/ha-year)				185%
Airborne NOx (µg/m^3)	n/a	30	13.2	44.2%
				104.5%

Although there are pockets of trees within the SAC boundary, these are not associated with the qualifying and notifiable features of the designated site. This site is mainly characterised by marine habitats with short vegetation, and the grassland deposition rates are applicable**.**

All four pollutants exceeded the 1% screening threshold for the FBLP in isolation and in combination, and therefore likely significant effects from air quality impacts cannot be ruled out for any pollutants in isolation or in combination. A Stage 2 Appropriate Assessment has been undertaken in the following section.

3.9.3 HRA Stage 2: Appropriate Assessment

3.9.3.1 Airborne NH_3

The relevant CL for Solent Maritime SAC is 3 µg/m^3 for all features.

Figure 3-34 illustrates the areas where the modelled contributions from the FBLP in isolation and in combination are predicted to exceed 0.03 µg/m^3 (1% of the CL). Note that the FBLP in isolation only exceeds the screening thresholds in the middle area (River Hamble), whereas there are three areas of in combination exceedance. The three areas of exceedance are located at Farlington Marshes in the East, River Hamble in the centre, and River Test/Totton Bypass in the West.

Figure 3-34 Overview of screening results for the FBLP contribution for airborne ammonia at Solent and Southampton Water Ramsar & SPA, assuming a CL of 3 µg/m^3

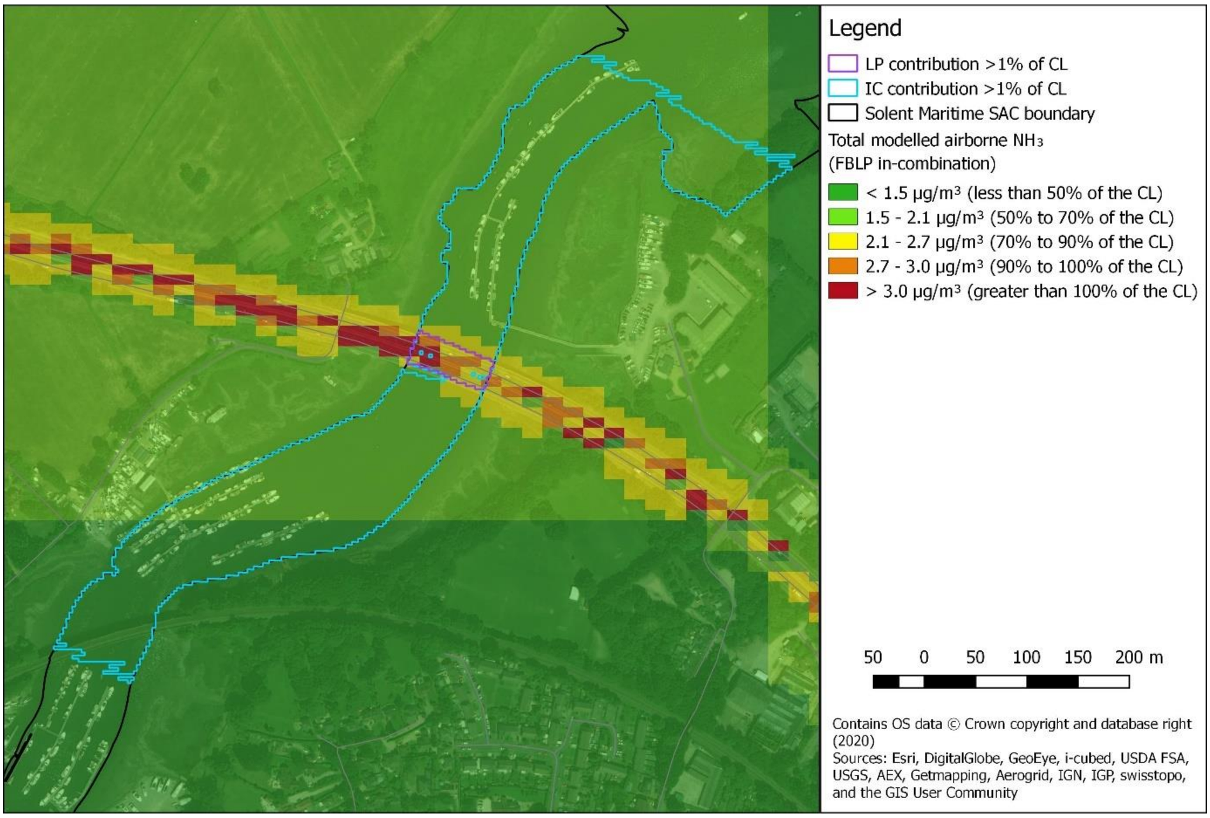
Figure 3-35 shows the FBLP in isolation contribution of airborne NH_3 added to the background NH_3 concentrations from APIS[54]. The NH_3 concentrations from APIS are on a 5 km x 5 km grid, hence some parts of the figure appear pixelated. The maximum modelled concentration (road contribution plus background concentrations) of airborne NH_3 for the FBLP in isolation was 1.68 µg/m^3, which is considerably below the CL (55.9%).

The maximum modelled concentration of airborne NH_3 for the FBLP in combination was 4.20 µg/m^3, which is greater than the CL (140%). However, the only areas where total concentrations are greater than the CL are located in the centre of the M27 where it crosses the River Hamble, as shown in Figure 3-35. The total modelled airborne ammonia in combination does not exceed the CL in parts of the site where qualifying features might be present.

On the basis of available evidence and agreed thresholds, there are no adverse effects on this SAC from airborne NH_3 concentrations as the total predicted concentration, other than on the tarmac area of roads, in isolation and in combination, is less than the CL.

[54] http://www.apis.ac.uk/popup/gridded-concentration-deposition-2015?sitecode=UK0030059&deptype=M&featurecode=H1220&accode=AG (accessed 10/09/2019)

Figure 3-35 Areas where the modelled contribution from the FBLP, in isolation and in combination, for airborne ammonia exceeds 1% of the CL, overlain with the total modelled airborne ammonia concentration for the FBLP in combination, at Solent Maritime SAC: River Hamble



3.9.3.2 Other pollutants

Due to the size of the Solent Maritime SAC, the analysis for acid deposition, nitrogen deposition and NOx have been organized by geographical location, followed by consideration for each pollutant at that location.

The relevant CL for airborne NOx at Solent Maritime SAC is 30 µg/m3 for all vegetation.

Figure 3-36 provides an overview of areas predicted to exceed the respective screening thresholds for nitrogen deposition, acid deposition, and airborne NOx. Note again that the FBLP in isolation only exceeds the screening thresholds in the middle area (River Hamble), whereas there are three areas of in combination exceedance. This applies to all three of the remaining pollutants.

Summary of critical loads for nitrogen deposition:

- The lowest CL is 8 – 15 kgN/ha-year for Perennial vegetation of stony banks; equivalent class coastal stable dune grasslands.
- A higher CL of 10 – 20 kgN/ha-year is set for Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); equivalent class shifting coastal dunes.

A CL of 20 – 30 kgN/ha-year applies for other features, such as Atlantic salt meadows and Spartina swards.

Summary of critical loads for acid deposition:

- Perennial vegetation of stony banks is the only feature listed as being sensitive to acid deposition, with the corresponding acidity class of 'acid grassland' and a CLMaxN ranging from 0.626 – 4.608 kEq/ha-year.

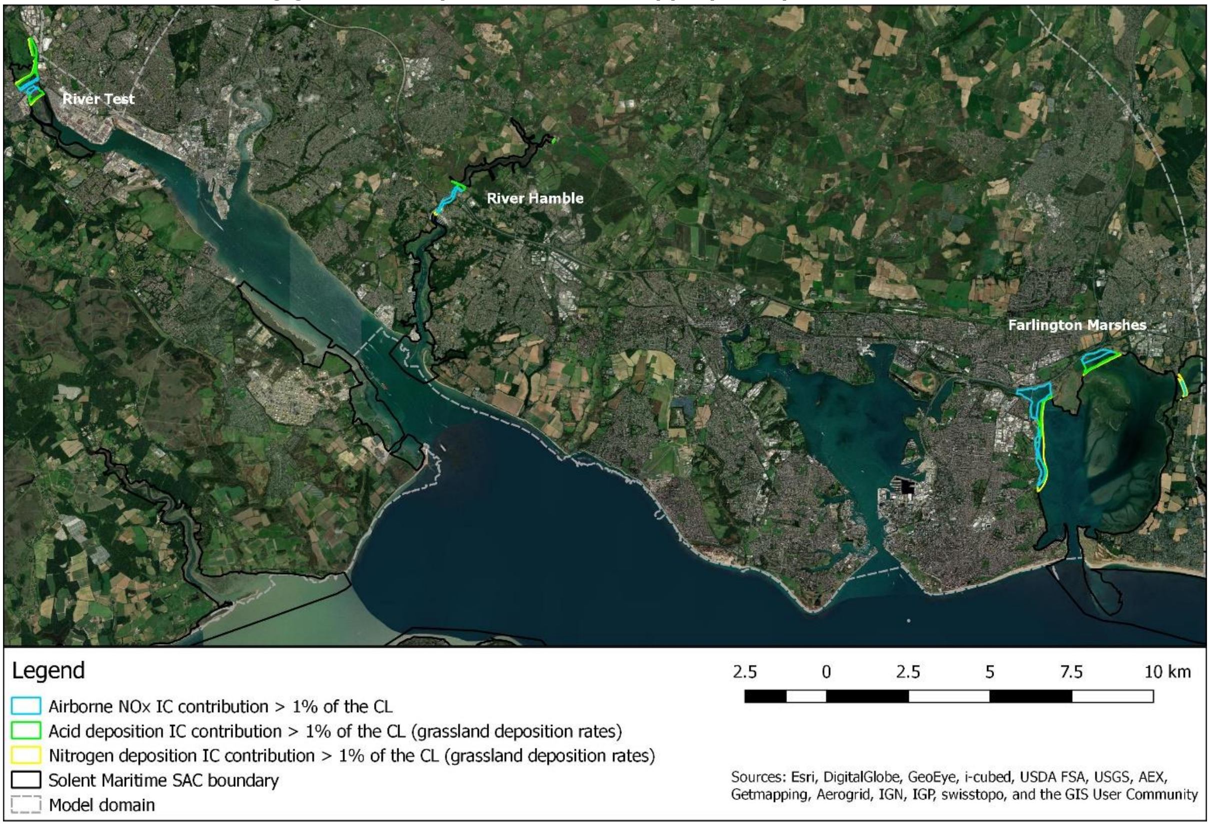
- For *Vertigo moulinsiana* (Desmoulin's whorl snail) there are no CLs set for acid deposition, however, APIS directs that a site-specific judgement should be made on the feature's sensitivity to acid deposition.

All other features are listed on APIS as not sensitive to acidification.

Critical load for airborne NOx:

The relevant CL for airborne NOx at Solent Maritime SAC is 30 µg/m^3 for all vegetation.

Figure 3-36 Overview of screening results for the FBLP in combination contribution for nitrogen deposition (CL = 8 kgN/ha-yr), acid deposition (CL = 0.626 kEq/ha-yr), and airborne NOx (CL = 30 µg/m^3) at Solent Maritime SAC, assuming grassland deposition rates for appropriate pollutants

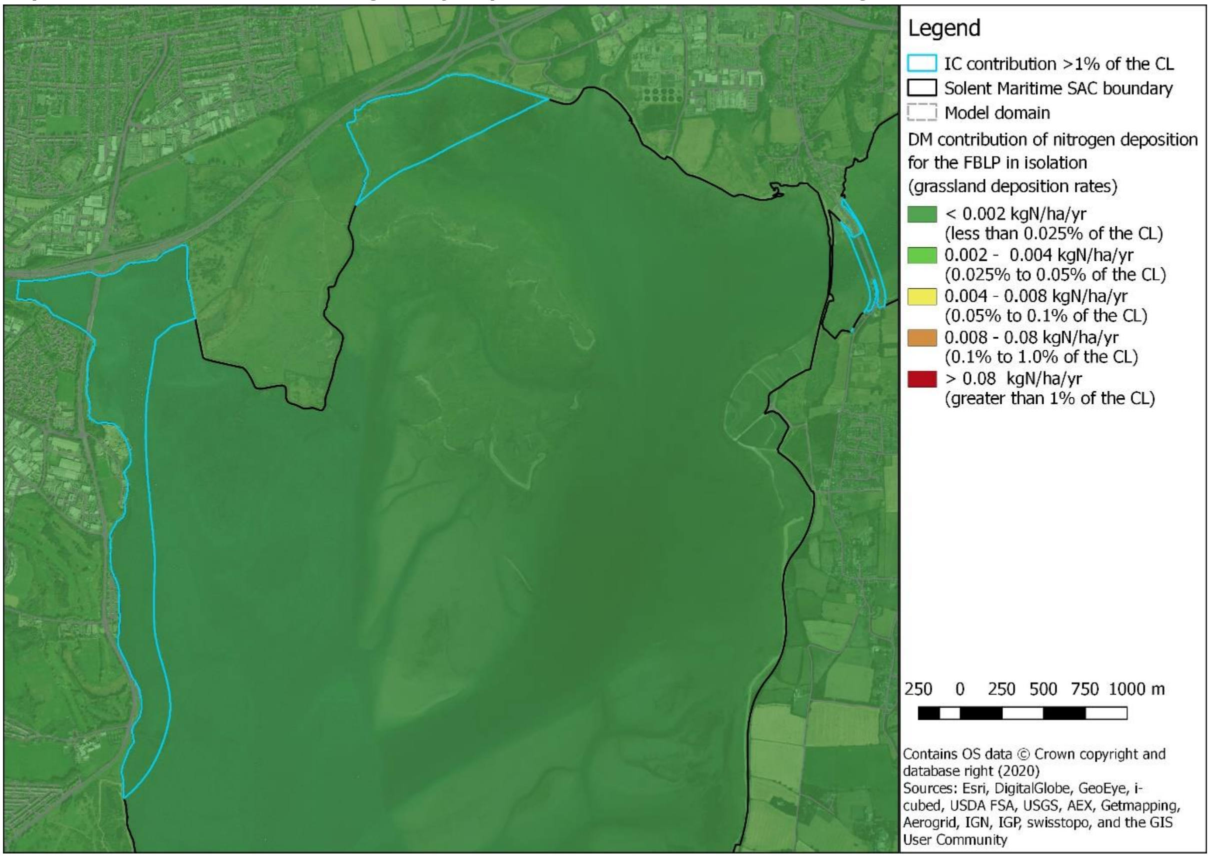


3.9.3.2.1 Area 1: Farlington Marshes / A27

3.9.3.2.1.1 Nitrogen deposition

Figure 3-37 illustrates the Farlington Marshes area where the modelled contributions to nitrogen deposition from the FBLP in combination are predicted to exceed 0.08 kgN/ha-year (1% of the lowest CL) (shown in light blue) overlain with the FBLP contribution in isolation.

Figure 3-37 Areas where the FBLP contribution, in combination, for nitrogen deposition exceeds 1% of the CL, overlain with the FBLP contribution, in isolation, for nitrogen deposition (assuming grassland deposition rates and a CL of 8 kgN/ha-year), at Solent Maritime SAC: Farlington Marshes / A27



In the Farlington Marshes exceedance area (adjacent to the A27), the FBLP is not predicted to exceed the screening thresholds for nitrogen deposition (assuming grassland deposition rates) in isolation, only in combination. The contribution of the FBLP in isolation has been overlain, demonstrating that the maximum contribution in this area is less than 0.002 kgN/ha/yr (or less than 0.025% of the lowest CL).

To put this into context, with the FBLP having an individual contribution comprising less than 0.025% of the lowest CL, it would require 40 or more such individual contributions (from other plans or projects) to attain, in combination, the screening threshold of 1% of the applicable CL. Additionally, as the contribution from the FBLP is so small, any mitigation measures incorporated into the FBLP would have an essentially negligible impact on reducing the nitrogen deposition in this area; eliminating the FBLP entirely would reduce the nitrogen deposition by less than 0.002 kgN/ha/yr. This indicates that the contribution of the FBLP to nitrogen deposition in this area is so small as to be nugatory or indistinguishable from background variations, and a contribution of this magnitude would therefore not have any appreciable effect on the designated site.

The concept of an effect which is so small as to be nugatory or indistinguishable from background variations, and which can therefore be excluded from further assessment under the Habitats Regulations, is supported by current guidance from Natural England.[50] In view of the minimal impact due to the FBLP in isolation, it is concluded that there is no plausible significant adverse effect on the integrity of the SAC due to the FBLP in combination with other plans and projects.

Natural England has confirmed that as the contribution from the FBLP in isolation is less than 0.025% of the lowest CL in these areas, the contribution of the FBLP to in combination impacts can be considered not significant.[36]

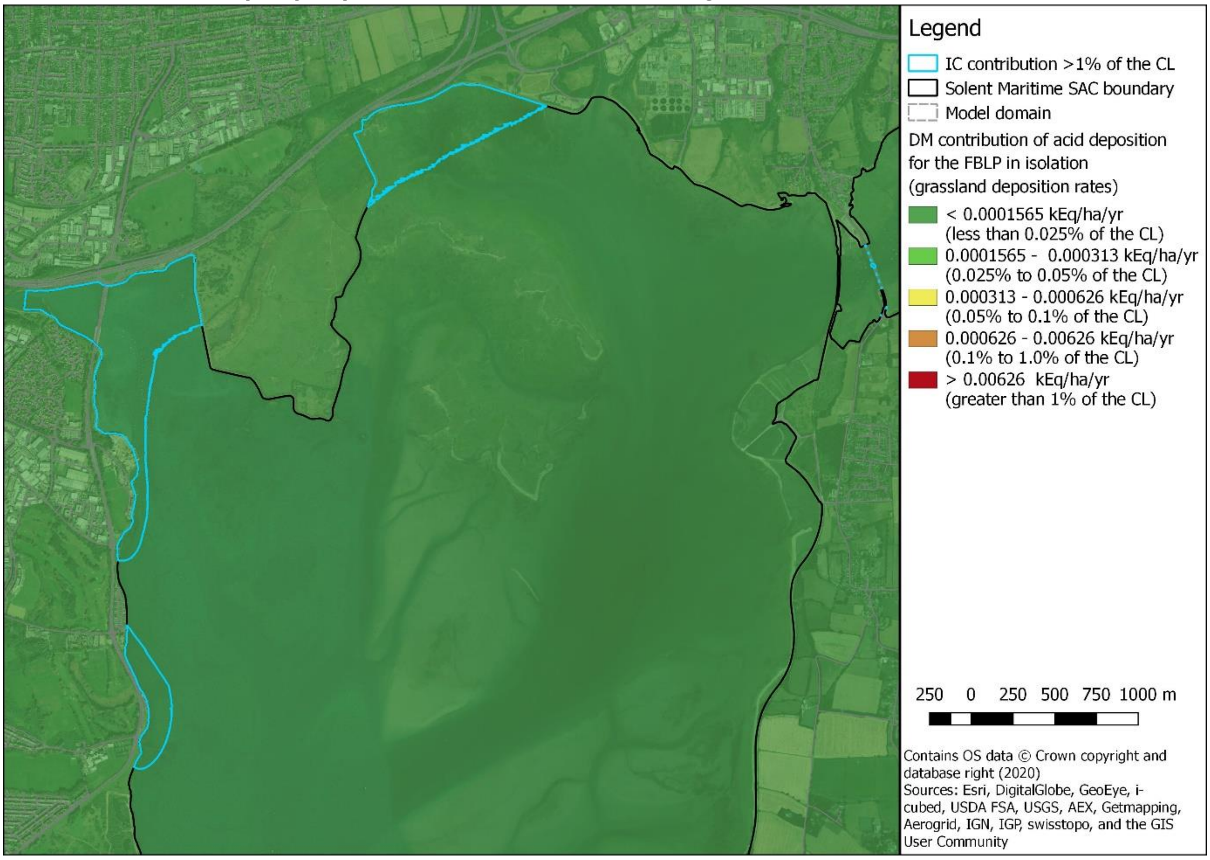
It is also worth mentioning that a Nitrogen Action Plan for this area is already under development, as described in the Havant Borough Local Plan HRA study.[55]

3.9.3.2.1.2 Acid deposition

In the Farlington Marshes exceedance area adjacent to the A27, the FBLP is not predicted to exceed the screening thresholds for acid deposition (assuming grassland deposition rates) in isolation, only in combination.

The areas where the in combination contribution exceeds 1% of the CL are shown in light blue in Figure 3-38. The contribution of the FBLP in isolation has been overlain, demonstrating that the maximum contribution in this area is less than 0.0001565 kEq/ha/yr (or less than 0.025% of the lowest CL).

Figure 3-38 Areas where the FBLP contribution, in combination, for acid deposition exceeds 1% of the CL, overlain with the FBLP contribution, in isolation, for acid deposition (assuming grassland deposition rates and a CL of 0.626 kEq/ha-year) at Solent Maritime SAC: Farlington Marshes / A27



To put this into context, with the FBLP having an individual contribution comprising less than 0.025% of the lowest CL, it would require 40 or more such individual contributions (from other plans or projects) to attain, in combination, the screening threshold of 1% of the applicable CL.

Additionally, as the contribution from the FBLP is so small, any mitigation measures incorporated into the FBLP would have an essentially negligible impact on reducing the acid deposition in this area; eliminating the FBLP entirely would reduce the acid deposition by less than 0.0001565 kEq/ha/yr. This indicates that the contribution of the FBLP to acid deposition in this area is so small as to be nugatory or indistinguishable from background variations, and a contribution of this magnitude would therefore not have any appreciable effect on the designated site.

[55] Ricardo Energy & Environment, "Air Quality Habitat Regulations Assessment for Havant Borough Local Plan 2036", Issue 3, January 2019.

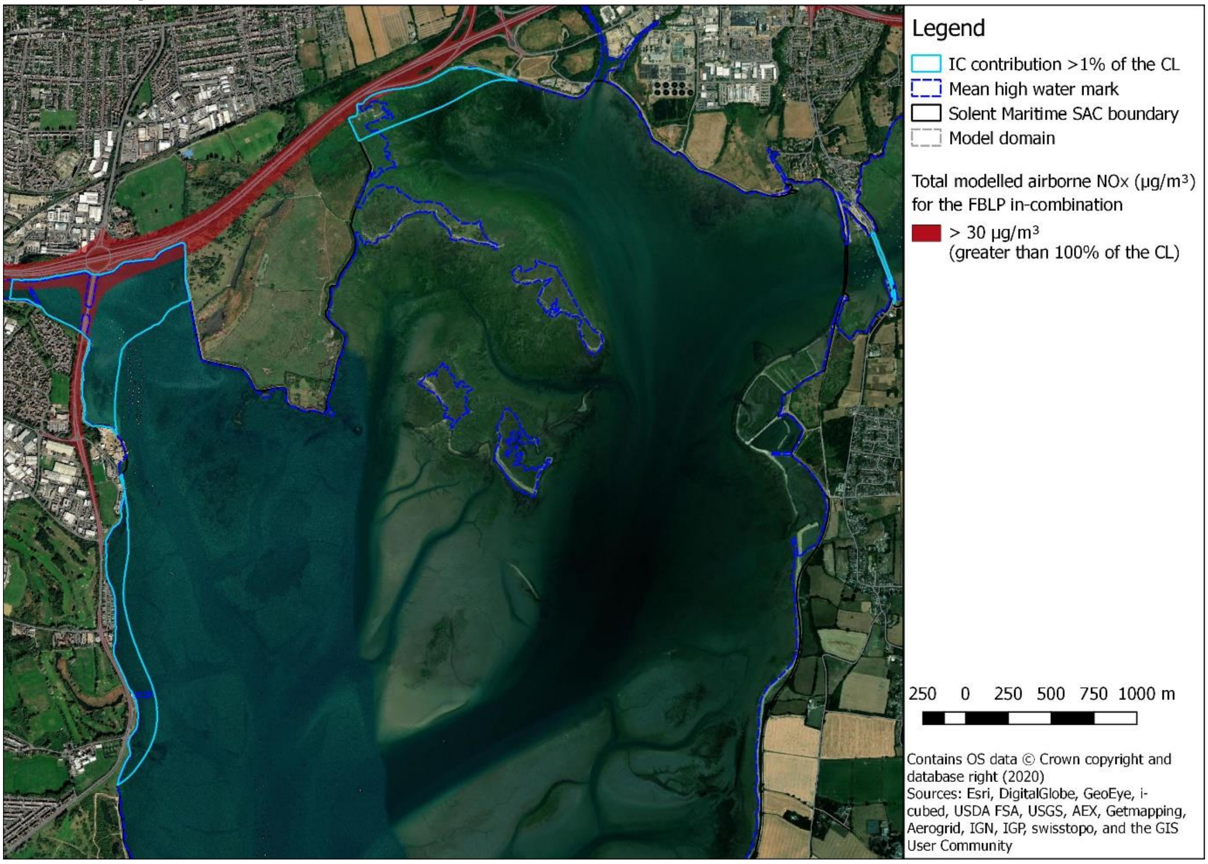
The concept of an effect which is so small as to be nugatory or indistinguishable from background variations, and which can therefore be excluded from further assessment under the Habitats Regulations, is supported by current guidance from Natural England.[50] In view of the minimal impact due to the FBLP in isolation, it is concluded that there is no plausible significant adverse effect on the integrity of the SAC due to the FBLP in combination with other plans and projects.

Natural England has confirmed that as the contribution from the FBLP in isolation is less than 0.025% of the lowest CL in these areas, the contribution of the FBLP to in combination impacts can be considered not significant. [36]

3.9.3.2.1.3 Airborne NOx

Figure 3-39 illustrates the Farlington Marshes area where the modelled contribution from the FBLP in combination is predicted to exceed 0.3 µg/m³ (1% of the CL).

Figure 3-39 Areas where the modelled FBLP contribution, in combination, for airborne NOx exceeds 1% of the CL, overlain with the total modelled NOx concentration for the FBLP in combination at Solent Maritime SAC: Farlington Marshes / A27



The areas in Farlington Marshes which overlap with the red portions of the map, where total predicted concentrations for the FBLP in combination in 2036 exceed 30 µg/m³, are classified as intertidal mudflats. Intertidal mudflats are regularly inundated by tidal waters, as supported by the Mean High Water mark[40] and thus air pollution impacts are not expected to be significant.

Due to the intertidal nature of the area, there are no adverse effects on this part of the SAC site arising from increased airborne NOx concentrations associated with the FBLP in combination.

3.9.3.2.2 Area 2: River Hamble / M27

3.9.3.2.2.1 Nitrogen deposition

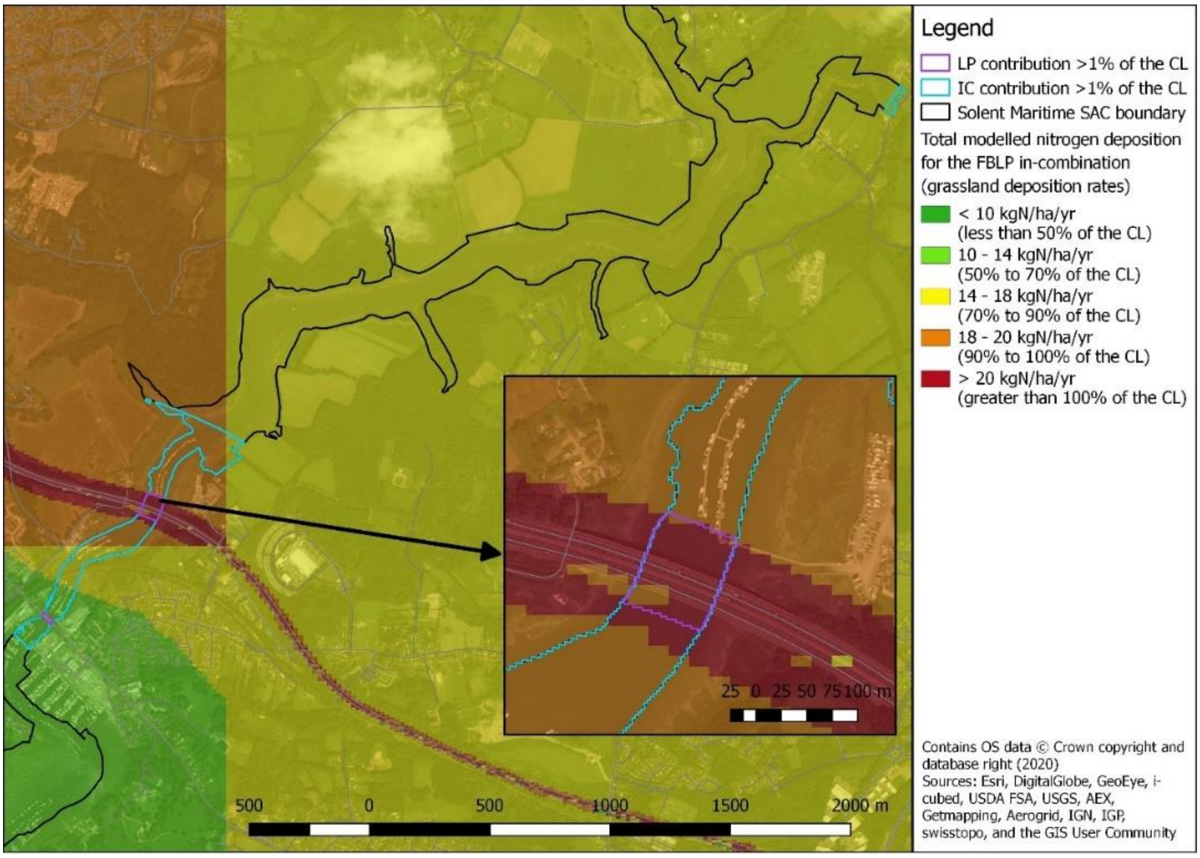
Figure 3-40 illustrates the River Hamble area where the modelled contributions to nitrogen deposition from the FBLP in isolation and in combination are predicted to exceed 0.08 kgN/ha-year (1% of the lowest CL).

For those areas predicted to exceed the 1% screening threshold (with a CL of 8 kgN/ha-year), APIS indicates that the current background nitrogen deposition in this area of the Solent Maritime site[54] ranges from 11.44 to 18.40 kgN/ha-year.

Figure 3-40 Areas where the FBLP contribution, in isolation and in combination, for nitrogen deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 8 kgN/ha-year, at Solent Maritime SAC: River Hamble / M27

The greatest total predicted deposition rate for the FBLP in combination is 31.91 kgN/ha/yr, however, this occurs in the centre of the M27 where it crosses the River Hamble. The areas where the total nitrogen deposition exceeds 20 kgN/ha-year consist of the road and river running beneath it, shown in Figure 3-41. These are areas either where sensitive features would not be present (the road surface) or where air pollution would not be likely to accumulate (the open river). Based on this analysis, we can conclude that there will not be an adverse effect on features of the designated site with a CL of 20 or above.

Figure 3-41 Areas where the FBLP contribution of nitrogen deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 8 kgN/ha-year, overlain with the total modelled nitrogen deposition for FBLP in combination, assuming grassland deposition rates and a CL of 20 kgN/ha-year, at Solent Maritime SAC: River Hamble / M27



To assess air quality impacts on qualifying features of the SAC that have a CL less than 20, areas that are not expected to be regularly inundated with water were investigated more closely.

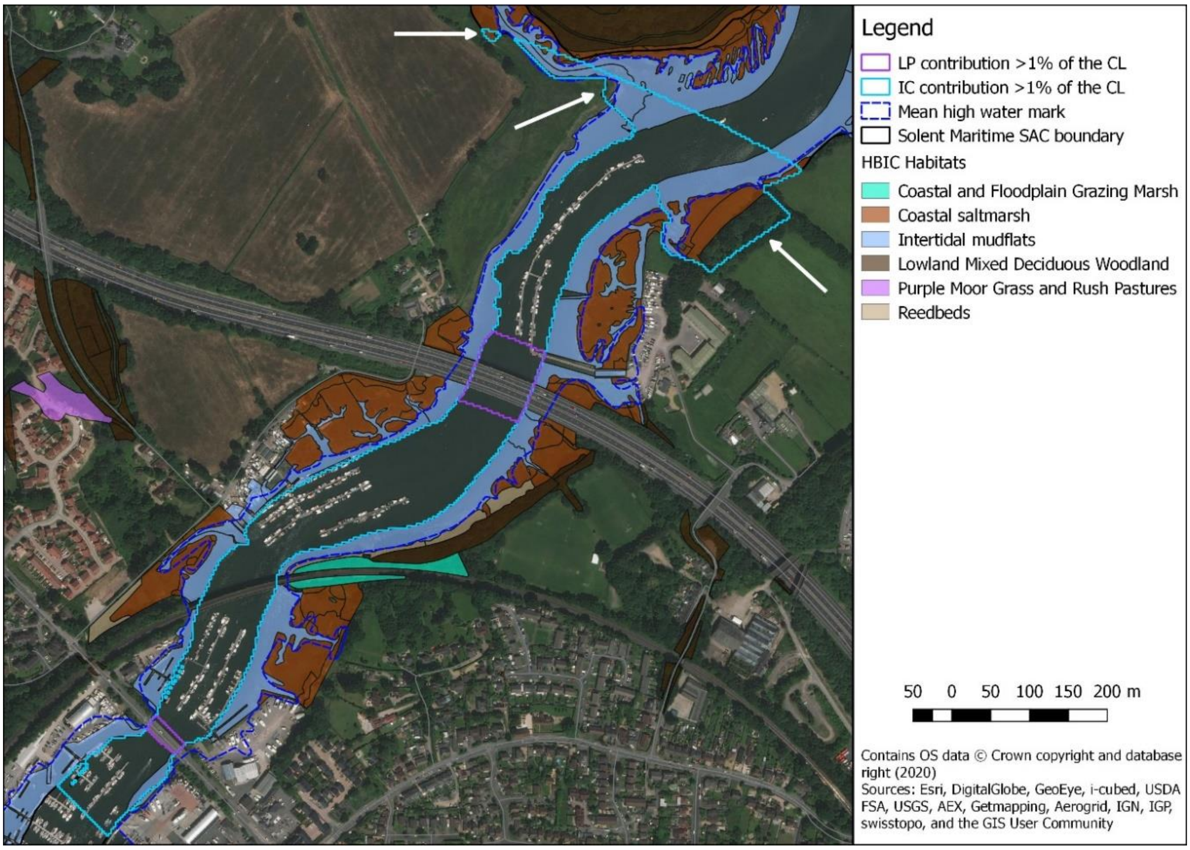
<u>Larger area of exceedance, where the River Hamble and the M27 cross</u>

A large portion of this area of exceedance falls below the mean high water mark (dark blue outline in Figure 3-42) and/or is comprised of intertidal mudflats. In both cases, those areas are regularly inundated with water, and significant impacts from pollution would not be expected.

Three small areas of land fall above the mean high water mark[40], but within the area of exceedance of 1% of the CL for nitrogen deposition, for the FBLP in combination. The left arrow points to 0.0202 ha of coastal saltmarsh. The middle arrow points to 0.4913 ha of coastal saltmarsh, and 0.4662 ha of land with no habitat type, but which appears to be deciduous woodland from satellite imagery. The right arrow points to 0.0224 ha of coastal saltmarsh, and 0.0363 ha of land with no habitat type, but which appears to be deciduous woodland from satellite imagery.

Regarding the larger area of the River Hamble on the left, Natural England previously confirmed that PVSB and shifting dunes are unlikely to be found in this area of exceedance, which matches closely to the area examined during the short-term assessment for development in Fareham Borough.[43] Natural England has confirmed that PVSB and shifting dunes are still unlikely to be found in this area of exceedance. [36] We expect no adverse effects on this part of the site as a result of increased acid deposition from the FBLP in isolation or in combination with other plans and projects.

Figure 3-42 Area of exceedance where the FBLP contribution for nitrogen deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 8 kgN/ha-year, at Solent Maritime SAC: River Hamble where the M27 crosses the river



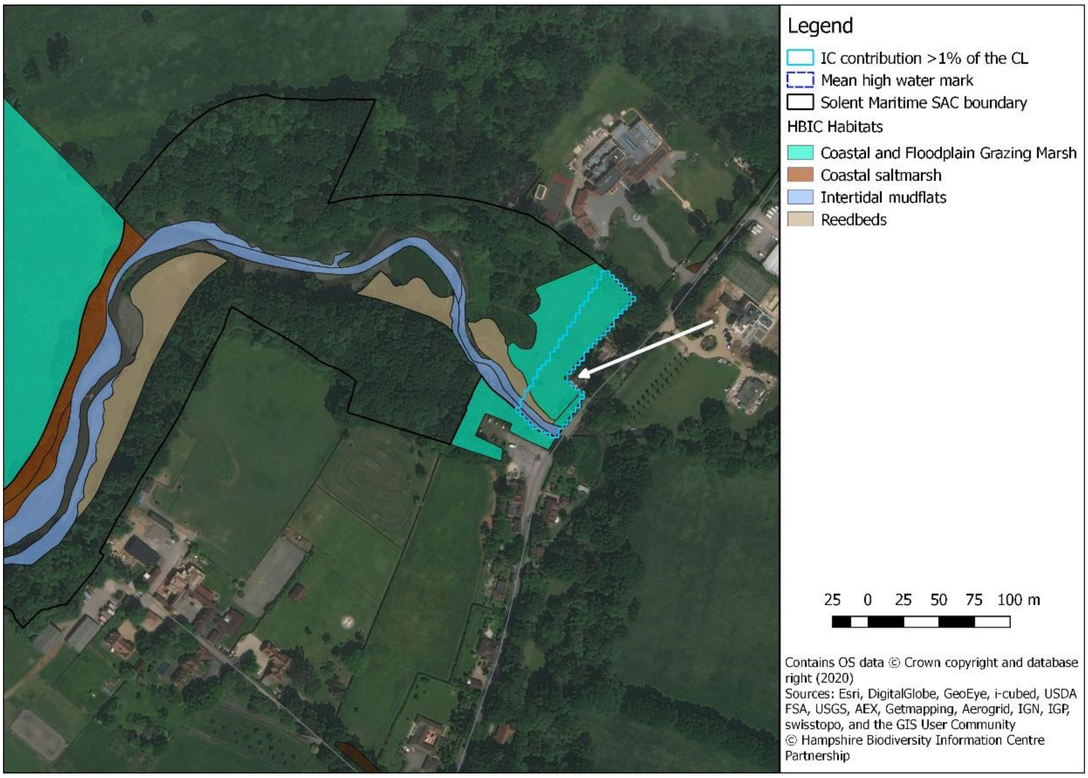
<u>Smaller area of exceedance, at Curbridge Creek</u>

A small part of this area of exceedance falls beneath the mean high water mark[40] (Figure 3-43), but the remainder comprises 0.2626 ha of coastal and floodplain grazing marsh and 0.0008 ha of reedbeds.

The area of exceedance on the right has not previously been examined during the short-term assessment for development in Fareham Borough,[43] although it has been considered in Section 3.8.4.4 during analysis of the Solent and Southampton Water Ramsar and SPA sites. The satellite imagery suggests that this area consists of deciduous woodland. We would not expect PVSB and/or shifting dunes to be present in this area of exceedance.

Natural England has confirmed that PVSB and shifting dunes are unlikely to be found in this area of exceedance. [36] We expect no adverse effects on this part of the site as a result of increased acid deposition from the FBLP in isolation or in combination with other plans and projects.

Figure 3-43 Area where the FBLP contribution for nitrogen deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 8 kgN/ha-year, at Solent Maritime SAC: River Hamble at Curbridge Creek



3.9.3.2.2.2 Acid deposition

Areas exceeding the screening threshold for acid deposition rates, using grassland deposition rates, and assuming a CL of 0.626 kEq/ha/yr are shown in Figure 3-44.

Figure 3-44 Areas where the FBLP contribution for acid deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 0.626 kEq/ha-year, at Solent Maritime SAC: River Hamble / M27

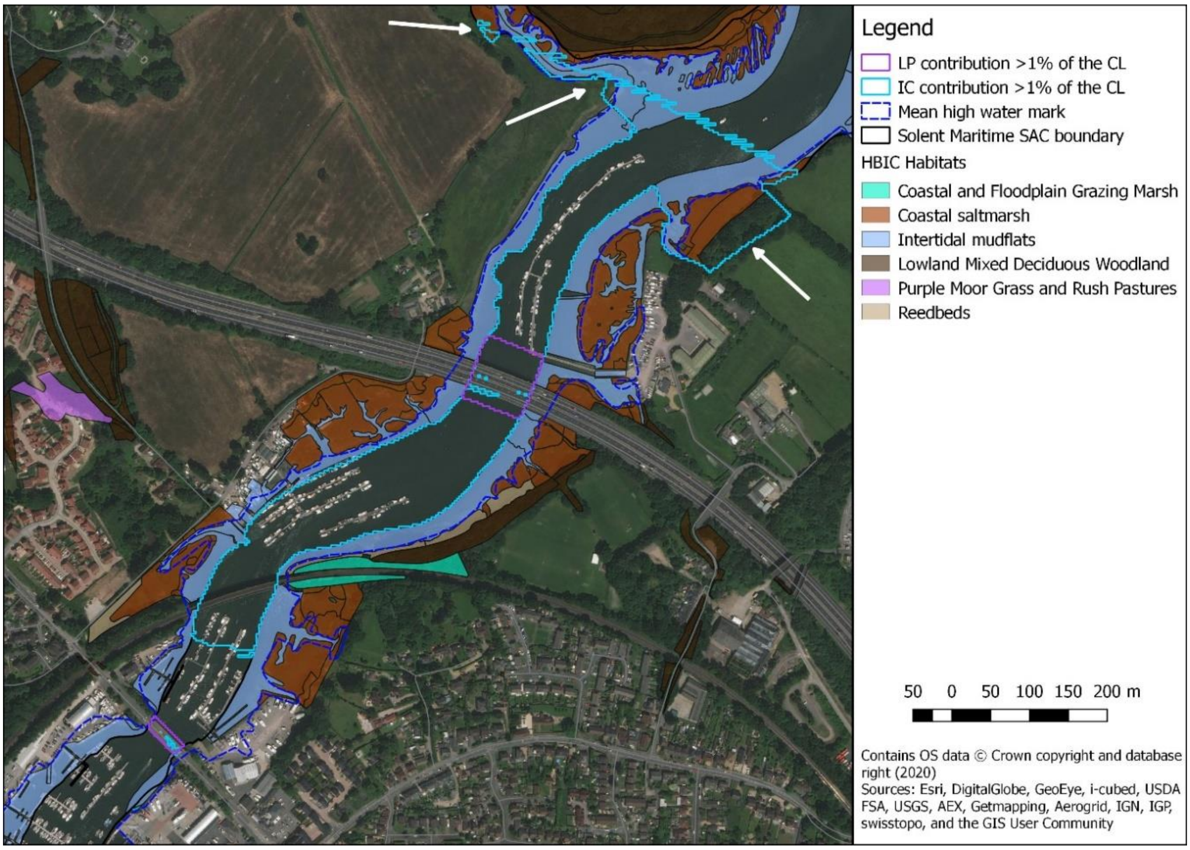
Larger area of exceedance where the River Hamble and the M27 cross

A large portion of this area of exceedance falls below the mean high water mark (dark blue outline in Figure 3-45) and/or is comprised of intertidal mudflats. In both cases, those areas are regularly inundated with water, and significant impacts from pollution would not be expected.

Three small areas of land fall above the mean high water mark, but within the area of exceedance of 1% of the CL for acid deposition, for the FBLP in combination. The left arrow points to 0.0240 ha of coastal saltmarsh. The middle arrow points to 0.4892 ha of coastal saltmarsh, and 0.4568 ha of land with no habitat type, but which appears to be deciduous woodland from satellite imagery. The right arrow points to 0.0055 ha of coastal saltmarsh, and 0.0379 ha of land with no habitat type, but which appears to be deciduous woodland from satellite imagery.

Natural England previously confirmed that PVSB and shifting dunes are unlikely to be found in this area of exceedance, which matches closely to the area examined during the short-term assessment for development in Fareham Borough.[43] Natural England has confirmed that PVSB is still unlikely to be found in this area of exceedance. [36] We expect no adverse effects on this part of the site as a result of increased acid deposition from the FBLP in isolation or in combination with other plans and projects.

Figure 3-45 Area where the FBLP contribution for acid deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 0.626 kEq/ha-year, at Solent Maritime SAC: River Hamble where the M27 crosses the river



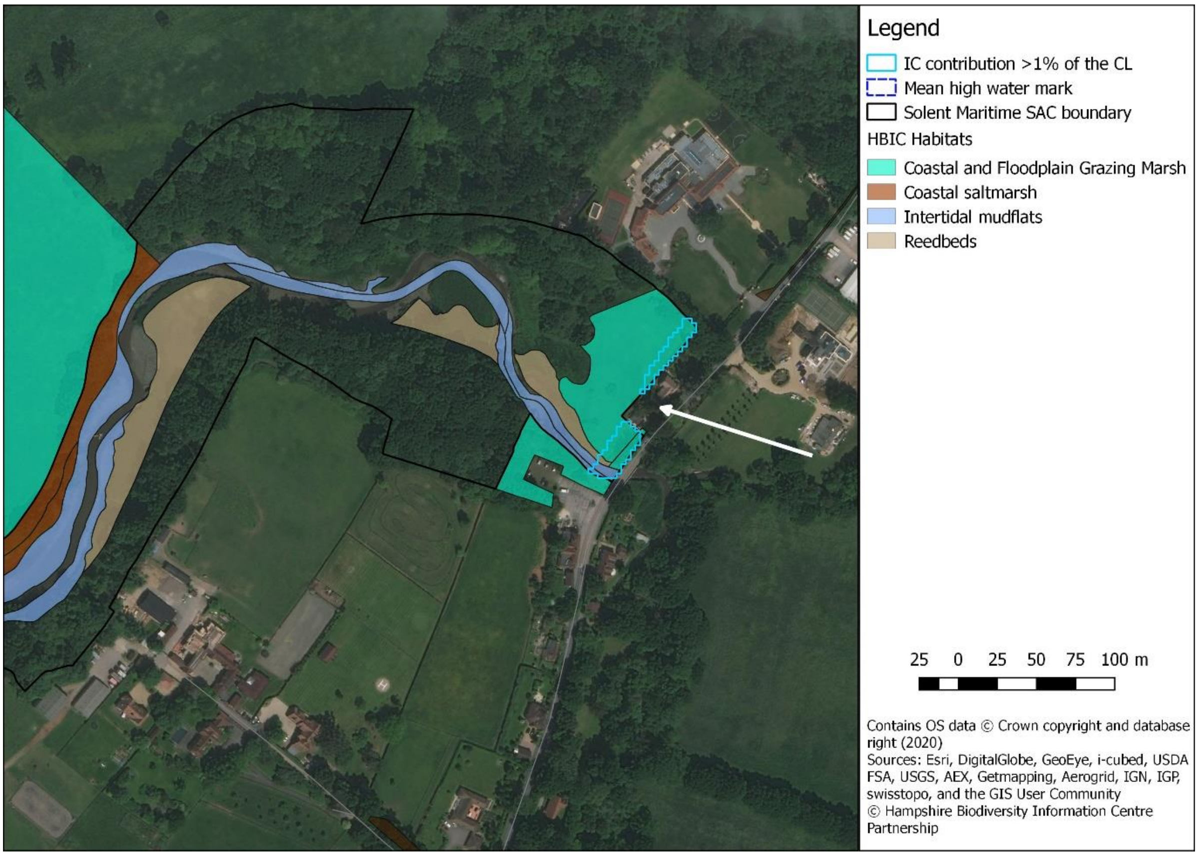
Smaller area of exceedance at Curbridge Creek

A small part of this area of exceedance falls beneath the mean high water mark (dark blue outline in Figure 3-46), but the remainder comprises 0.0818 ha of coastal and floodplain grazing marsh and 0.0008 ha of reedbeds.

The area of exceedance on the right has not previously been examined during the short-term assessment for development in Fareham Borough,[43] although it has been considered in Section 3.8.4.3 during analysis of the Solent and Southampton Water Ramsar and SPA sites. The satellite imagery suggests that this area consists of deciduous woodland. We would not expect PVSB and/or shifting dunes to be present in this area of exceedance.

Natural England has confirmed that PVSB is unlikely to be found in this area of exceedance. [36] We expect no adverse effects on this part of the site as a result of increased acid deposition from the FBLP in isolation or in combination with other plans and projects.

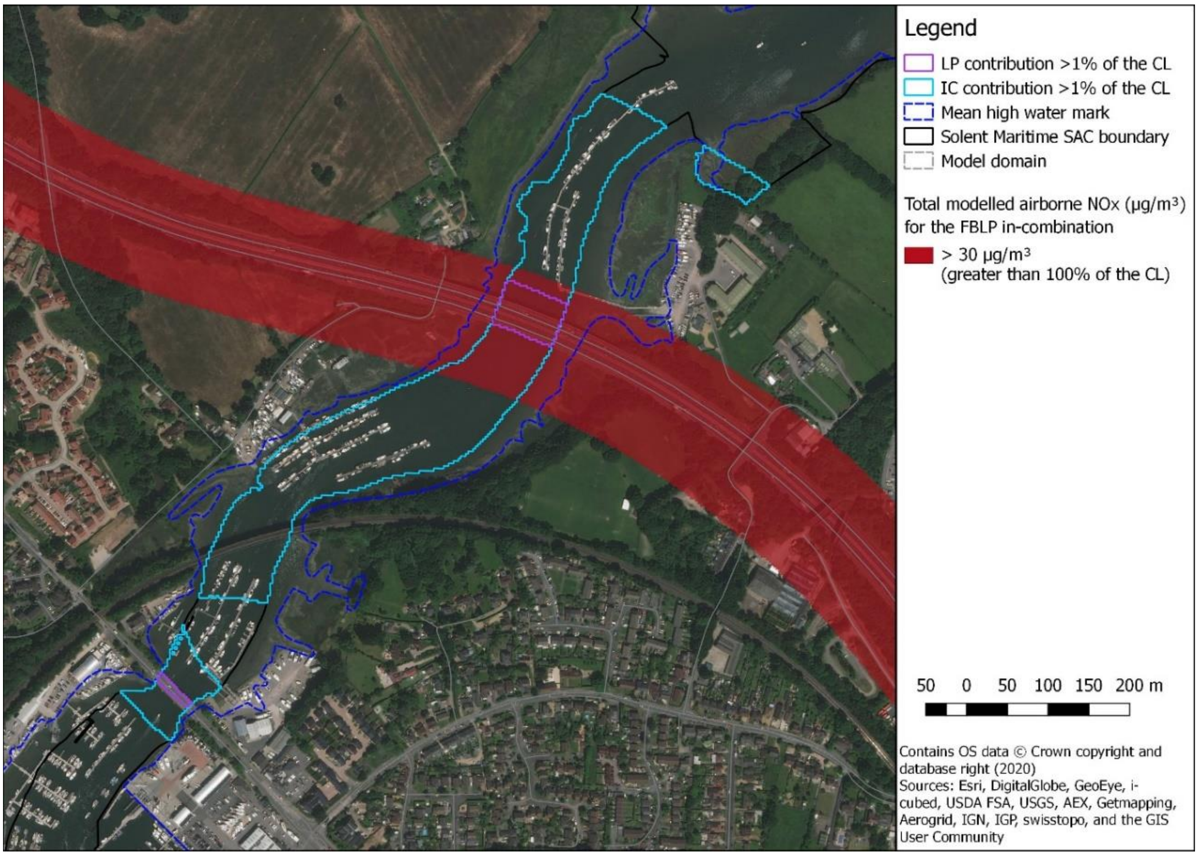
Figure 3-46 Area where the FBLP contribution for acid deposition exceeds 1% of the CL, assuming grassland deposition rates and a CL of 8 kEq/ha-year, at Solent Maritime SAC: River Hamble at Curbridge Creek



3.9.3.2.2.3 Airborne NOx

The modelled road NOx, for the FBLP in combination, was added to the forecast (2030) background NOx concentrations across the site to give total modelled airborne NOx concentrations in 2036. Figure 3-47 illustrates the River Hamble area where the modelled contribution from the Fareham 2036 DM scenario is predicted to exceed 0.3 µg/m^3 (1% of the CL).

Figure 3-47 Areas where the FBLP contribution for airborne NOx exceeds 1% of the CL, overlain with the total modelled NOx concentration for the FBLP in combination at Solent Maritime SAC: River Hamble/M27



The areas of the River Hamble which overlap with the red portions of the map, where total predicted concentrations in 2036 exceed 30 µg/m^3, correspond with road surfaces (the M27 and the A27) and areas of the River Hamble covered by water. This is supported by the mean high water mark[40]. Air pollution impacts are not expected to be significant.

On the basis of available evidence, there are no adverse effects on this part of the SAC site arising from increased airborne NOx concentrations associated with the FBLP in isolation or in combination.

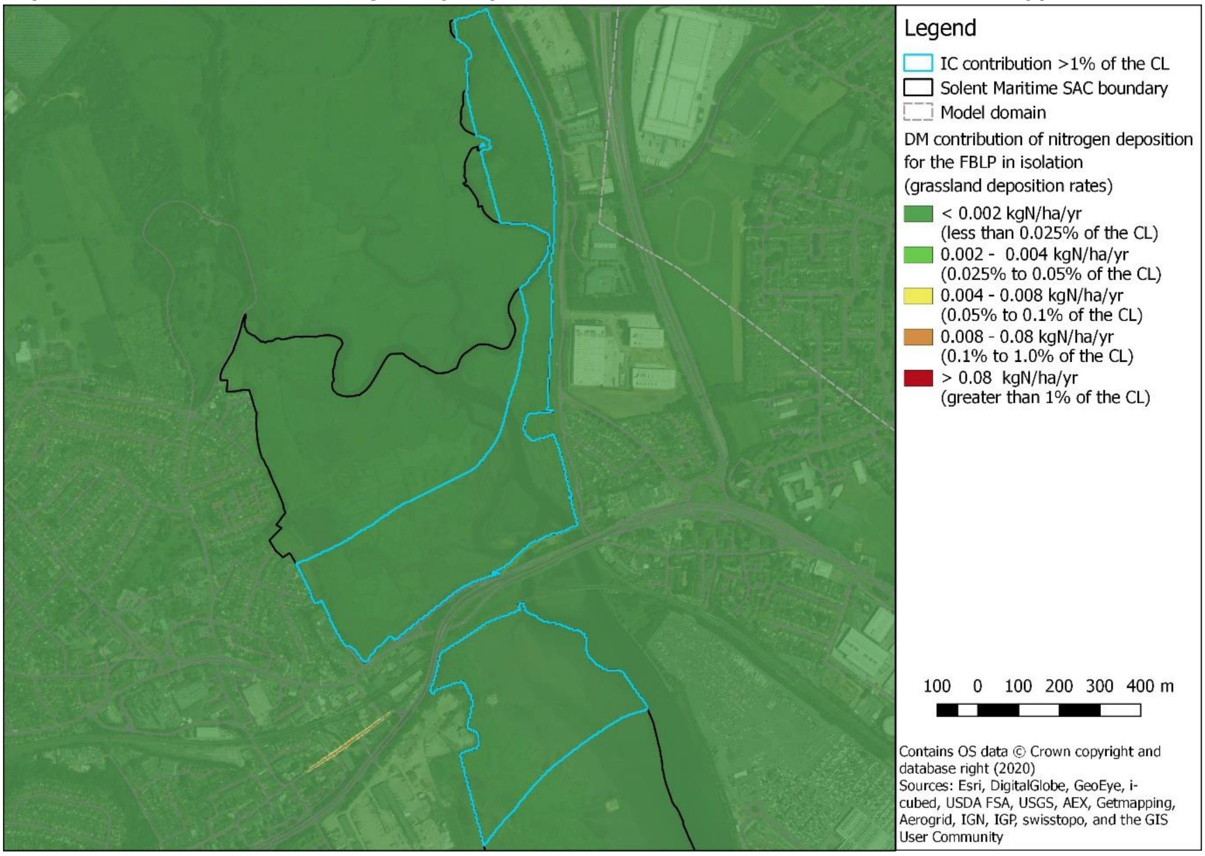
3.9.3.2.3 Area 3: River Test / Totton Bypass

3.9.3.2.3.1 Nitrogen deposition

Figure 3-48 illustrates the River Test area where the modelled contributions to nitrogen deposition from the FBLP in combination are predicted to exceed 0.08 kgN/ha-year (1% of the lowest CL).

In the exceedance area where the Totton Bypass crosses the river, the FBLP is not predicted to exceed the screening thresholds for nitrogen deposition (assuming grassland deposition rates) in isolation, only in combination.

Figure 3-48 Areas where the FBLP contribution, in combination, for nitrogen deposition exceeds 1% of the CL, overlain with the FBLP contribution, in isolation, of nitrogen deposition (assuming grassland deposition rates and a CL of 8 kgN/ha-year), at Solent Maritime SAC: River Test / Totton Bypass



For those areas predicted to exceed the 1% screening threshold (with a CL of 8 kgN/ha-year), APIS indicates that the current background nitrogen deposition in this area of the Solent Maritime site[49] is 15.96 kgN/ha-year. The areas where the in combination contribution exceeds 1% of the CL are shown in light blue on Figure 3-48. The contribution of the FBLP in isolation has been overlain, demonstrating that the maximum contribution in this area is less than 0.002 kgN/ha/yr (or less than 0.025% of the lowest CL).

To put this into context, with the FBLP having an individual contribution comprising <0.025% of the lowest CL, it would require 20 or more such individual contributions (from other plans or projects) to attain, in combination, the screening threshold of 1% of the applicable CL. Additionally, as the contribution from the FBLP is so small, any mitigation measures incorporated into the FBLP would have an essentially negligible impact on reducing the acid deposition in this area; eliminating the FBLP entirely would reduce the nitrogen deposition by less than 0.002 kgN/ha/yr. This indicates that the contribution of the FBLP to nitrogen deposition in this area is so small as to be nugatory or indistinguishable from background variations, and a contribution of this magnitude would therefore not have any appreciable effect on the designated site.

The concept of an effect which is so small as to be nugatory or indistinguishable from background variations, and which can therefore be excluded from further assessment under the Habitats Regulations, is supported by current guidance from Natural England[50]. In view of the minimal impact due to the FBLP in isolation, it is concluded that there is no plausible significant adverse effect on the integrity of the SAC due to the FBLP in combination with other plans and projects.

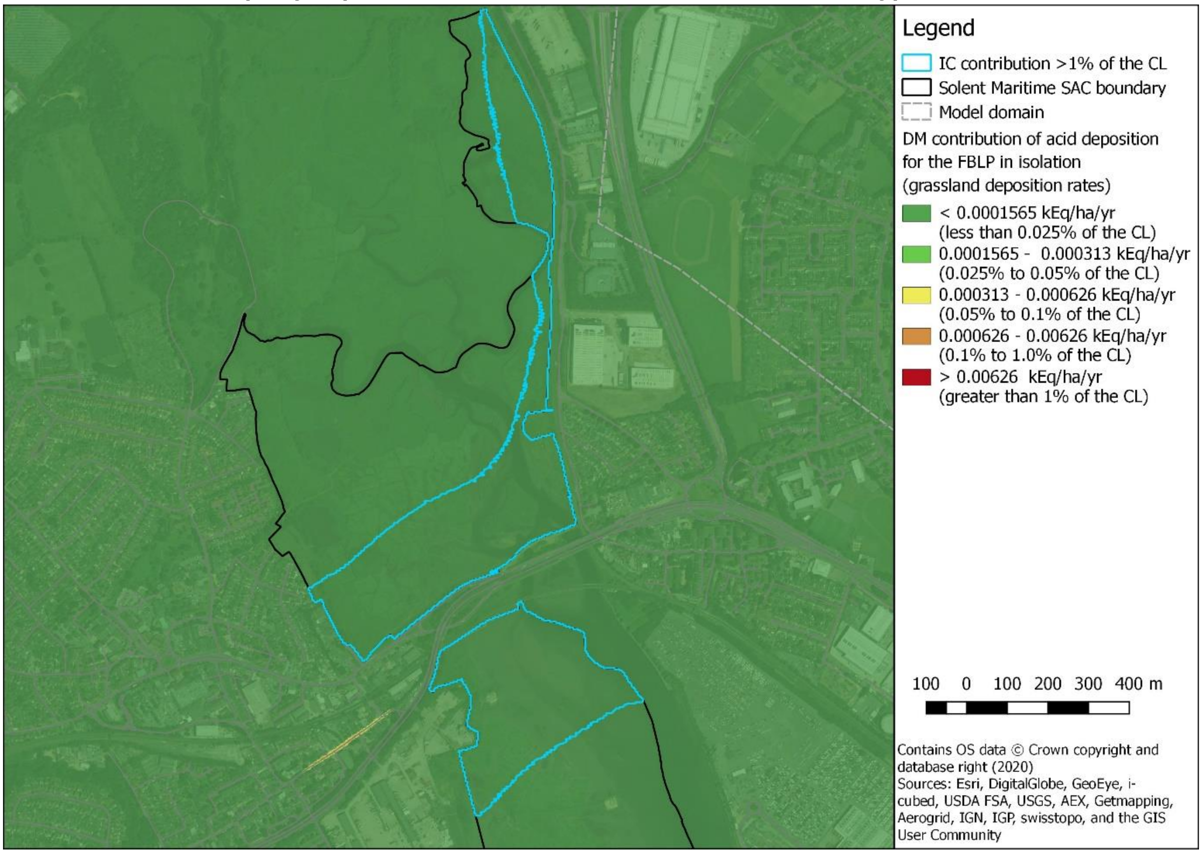
Natural England has confirmed that as the contribution from the FBLP in isolation is less than 0.025% of the lowest CL in these areas, the contribution of the FBLP to in combination impacts can be considered not significant. [36] Natural England has also previously confirmed the absence of shifting dunes and PVSB in the majority of this area of exceedance.[43]

3.9.3.2.3.2 Acid deposition

In the River Test exceedance area where the Totton Bypass crosses the river, the FBLP is not predicted to exceed the screening thresholds for acid deposition (assuming grassland deposition rates) in isolation, only in combination.

The areas where the in combination contribution exceeds 1% of the CL are shown in light blue in Figure 3-49. The contribution of the FBLP in isolation has been overlain, demonstrating that the maximum contribution in this area is less than 0.0001565 kEq/ha/yr (or less than 0.025% of the lowest CL).

Figure 3-49 Areas where the FBLP contribution, in combination, for acid deposition exceeds 1% of the CL, overlain with the FBLP contribution, in isolation, of acid deposition (assuming grassland deposition rates and a CL of 0.626 kEq/ha-year), at Solent Maritime SAC: River Test / Totton Bypass



To put this into context, with the FBLP having an individual contribution comprising less than 0.025% of the lowest CL, it would require 40 or more such individual contributions (from other plans or projects) to attain, in combination, the screening threshold of 1% of the applicable CL. Additionally, as the contribution from the FBLP is so small, any mitigation measures incorporated into the FBLP would have an essentially negligible impact on reducing the acid deposition in this area; eliminating the FBLP entirely would reduce the nitrogen deposition by less than 0.0001565 kEq/ha/yr. This indicates that the contribution of the FBLP to nitrogen deposition in this area is so small as to be nugatory or indistinguishable from background variations, and a contribution of this magnitude would therefore not have any appreciable effect on the designated site.

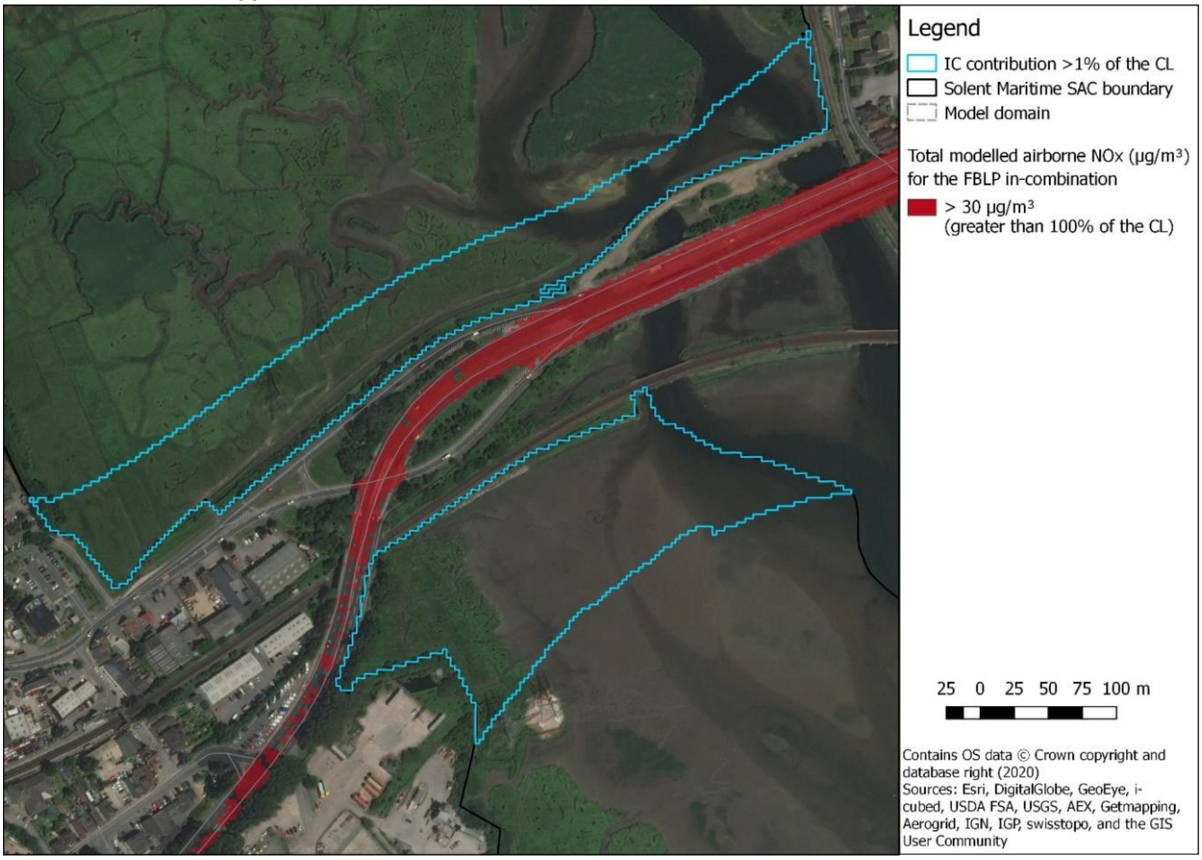
The concept of an effect which is so small as to be nugatory or indistinguishable from background variations, and which can therefore be excluded from further assessment under the Habitats Regulations, is supported by current guidance from Natural England.[50] In view of the minimal impact due to the FBLP in isolation, it is concluded that there is no plausible significant adverse effect on the integrity of the SAC due to the FBLP in combination with other plans and projects.

Natural England has confirmed that as the contribution from the FBLP in isolation is less than 0.025% of the lowest CL in these areas, the contribution of the FBLP to in combination impacts can be considered not significant. [36] Natural England has also confirmed the absence of shifting dunes and PVSB in the majority of this area of exceedance.[43]

3.9.3.2.3.3 Airborne NOx

The modelled road NOx, for the FBLP in combination, was added to the forecast (2030) background NOx concentrations across the site to give total modelled airborne NOx concentrations in 2036. Figure 3-50 illustrates the Redbridge Causeway area where the modelled contribution from the Fareham 2036 DM scenario is predicted to exceed 0.3 µg/m³ (1% of the CL).

Figure 3-50 Areas where the FBLP contribution, in combination, for airborne NOx exceeds 1% of the CL, overlain with the total modelled NOx concentration for the FBLP in combination at Solent Maritime SAC: River Test / Totton Bypass



The areas of the River Test/Totton Bypass that exceed 1% of the CL do not overlap with the red portions of the map, where total predicted concentrations in 2036 exceed 30 µg/m³.

Natural England has confirmed that there are no sensitive features (shifting dunes or PVSB) present in the areas where the FBLP in combination contribution exceeds 1% of the CL and the total modelled NOx for the scenario exceeds the CL. [36] Therefore, on the basis of available evidence, there are no adverse effects on this area of the SAC site arising from increased NOx associated with the FBLP in combination.

3.9.3.3 Detailed consideration of qualifying features

Due to the complexity of Solent Maritime SAC, each qualifying feature is considered in-turn in Table 3-29.

Table 3-29 Detailed consideration of qualifying features for Solent Maritime SAC

Qualifying Feature	Potential Effects	Adverse Effect Before Mitigation? (on conservation objectives and site integrity)
Coastal saltmarsh habitats: **H1320 Spartina swards (*Spartinion maritimae*)** **H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)** **H1310 Salicornia and other annuals colonizing mud and sand**	A small area of coastal saltmarsh is present within the areas predicted to exceed the screening thresholds for all four pollutants. <u>Nitrogen deposition</u> The CL applicable to saltmarsh is 20-30 kgN/ha-year. At all areas within the designated site where saltmarsh could be present, the background level of nitrogen deposition plus the contribution from the FBLP in combination was <20 kgN/ha-year, and therefore no adverse effects are anticipated for saltmarsh. <u>Acid deposition</u> APIS states that Spartina swards (*Spartinion maritimae*) and Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), are not sensitive to acidification. <u>NOx</u> Dispersion modelling of the FBLP in combination and analysis using aerial imagery identified three locations where NOx exceeded the 1% screening threshold. Further analysis using forecast background levels of NOx indicated that saltmarsh habitats were not present in the areas predicted to experience total NOx concentrations > 30 µg/m^3 in 2036. Adverse effects on the integrity of the site are not anticipated. <u>NH_3</u> Dispersion modelling of the FBLP in combination and analysis using aerial imagery identified three locations where NH_3 exceeded the 1% screening threshold. Further analysis using the current background levels of NH_3 indicated that the total modelled NH_3 did not exceed the CL 3 µg/m^3 anywhere within the designated site boundary. As the total modelled concentration is not predicted to exceed the CL, no adverse effects are anticipated.	No
1130 Estuaries	Estuaries are routinely inundated as a result of the daily tidal influence. As a result, any accumulation of airborne pollutants would be flushed away and/or diluted by the washing over of the tide. Significant adverse impacts as a result of the proposed development in Fareham Borough are therefore not anticipated for this feature.	No

Qualifying Feature	Potential Effects	Adverse Effect Before Mitigation? (on conservation objectives and site integrity)
1110 Sandbanks which are slightly covered by sea water all the time	APIS states that this habitat is not sensitive to any of the four pollutants, therefore adverse impacts as a result of development in Fareham Borough are considered highly unlikely.	No
1140 Mudflats and sandflats not covered by seawater at low tide	This habitat is routinely inundated as a result of the daily tidal influence. As a result, any accumulation of airborne pollutants would be flushed away and/or diluted by the washing over of the tide. Adverse impacts as a result of development in Fareham Borough are therefore not anticipated for this feature.	No
1150 Coastal lagoons	The SAC includes two coastal lagoons on the Isle of Wight, namely Newtown Quay and Yar Bridge Lagoon. Both lagoons in the Solent Maritime SAC are sluiced lagoons, with water flow controlled via culverts and pipes or sluices. Although the habitat is sensitive to nitrogen deposition and airborne NOx/NH_3, the locations of the lagoons are not within the exceedance areas for any of the pollutants. Therefore, significant adverse effects are considered highly unlikely for coastal lagoons.	No
1210 Annual vegetation of drift lines	APIS states that this habitat is not sensitive to any of the four pollutants.	No
1220 Perennial vegetation of stony banks	Four small areas of perennial vegetation of stony banks (PVSB) were identified at the western shore of Langstone Harbour during targeted field survey to inform the Appropriate Assessment for the Havant Borough Local Plan.[55] These areas of PVSB cover an area of approximately 0.15ha. These areas are present in the exceedance area of Farlington Marshes where the contribution to nitrogen deposition from the FBLP in combination is greater than 1% of the CL, but the contribution from the FBLP in isolation is less than 0.025% of the CL (i.e. where the contribution from the FBLP is considered nugatory) and so no adverse effects are expected on these sections of PVSB. Natural England confirmed that PVSB was not present in the areas of exceedance for nitrogen deposition and acid deposition at the River Hamble where the M27 crosses the river, as well as at Curbridge Creek.	**No**

Qualifying Feature	Potential Effects	Adverse Effect Before Mitigation? (on conservation objectives and site integrity)
	Analysis in the preceding sections determined that there would be no adverse effect on bird species related to nitrogen deposition, acid deposition, airborne NOx or airborne NH_3.	
2120 "Shifting dunes along the shoreline with Ammophila arenaria (""white dunes"")"	This habitat is not present within any of the areas predicted to exceed the screening thresholds.	No
1016 Desmoulin`s whorl snail *Vertigo moulinsiana*	The site supports a small population of the rare Desmoulin's whorl snail in the freshwater fen and brackish reedbeds at the top of the Fishbourne Channel in Chichester Harbour[56]. This species was last recorded within the Solent Maritime SAC in 2005 and no individuals have been found during subsequent surveys in 2009 and 2010. Although the species' broad habitat is sensitive to airborne NH_3, nitrogen deposition and acid deposition, the location of the population and the required habitats are not within the areas predicted to exceed the screening thresholds. Therefore, adverse effects are unlikely for the Desmoulin's whorl snail.	No

[56] English Nature (EN). 2005. EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora: Citation for Special Area of Conservation (SAC) - Solent Maritime [Online]. (accessed 10/10/2019).

3.9.3.4 Assessment summary and conclusions

Adverse effects (pre-mitigation) can be discounted for all qualifying features of the Solent Maritime SAC, and for nitrogen deposition, acid deposition, oxides of nitrogen (NOx) and ammonia (NH_3) as causal pollutants.

On the basis of available evidence, adverse effects on this SAC site can be discounted and as such there will be no threat to the ability of the European site to achieve its conservation objectives or maintain its integrity as a result of the FBLP, in combination with development in other local authorities within the PfSH sub-region.

4 Summary of HRA results and conclusions

4.1 Conclusions

For ease of reference, the overall results of the HRA are summarized in the table below.

Table 4-1 Summary of HRA results

Designated Site	Nitrogen deposition	Acid deposition	Airborne NOx	Airborne NH_3
Chichester & Langstone Harbours (Ramsar & SPA)	**Conclusions:** Screened out at HRA Stage 1, as the contribution from the FBLP is essentially zero.			
New Forest (Ramsar & SPA)	**Conclusions:** HRA Stage 1 indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, based on the contribution from the FBLP being nugatory (less than 0.025% of the lowest relevant Critical Level).			
The New Forest (SAC)	**Conclusions:** HRA Stage 1 indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, based on the contribution from the FBLP being nugatory (less than 0.025% of the lowest relevant Critical Level).			
Portsmouth Harbour (Ramsar & SPA)	**Conclusions:** HRA Stage 2 Appropriate Assessment indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, as the total Predicted Environmental Concentration (PEC) did not exceed the applicable Critical Loads (CLs).	**Conclusions:** Screened out at HRA Stage 1, as APIS indicates the qualifying features are not sensitive to acid deposition.	**Conclusions:** HRA Stage 2 Appropriate Assessment indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, based on the distribution of qualifying features and the total predicted concentration in 2036.	**Conclusions:** HRA Stage 2 Appropriate Assessment indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, as the total Predicted Environmental Concentration (PEC) did not exceed the applicable Critical Level (CL).
River Itchen (SAC)	**Conclusions:** HRA Stage 2 Appropriate Assessment indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, based on	**Conclusions:** Screened out at HRA Stage 1, as APIS indicates the qualifying features are not sensitive to acid deposition.	**Conclusions:** HRA Stage 2 Appropriate Assessment indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, based on	**Conclusions:** HRA Stage 2 Appropriate Assessment indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, as the

Designated Site	Nitrogen deposition	Acid deposition	Airborne NOx	Airborne NH_3
	the distribution of qualifying features and existing background levels within the site.		the distribution of qualifying features and existing background levels within the site.	total Predicted Environmental Concentration (PEC) did not exceed the applicable Critical Level (CL).
Solent & Dorset Coast (SPA)	**Conclusions:** HRA Stage 2 Appropriate Assessment indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, based on the intertidal nature of the areas affected.			
Solent & Isle of Wight Lagoons (SAC)	**Conclusions:** Screened out at HRA Stage 1, as the contribution from the FBLP is essentially zero.			
Solent & Southampton Water (Ramsar & SPA)	**Conclusions:** HRA Stage 2 Appropriate Assessment indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, based on the distribution of qualifying features and existing background levels within the site.	**Conclusions:** HRA Stage 2 Appropriate Assessment indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, based on the distribution of qualifying features and existing background levels within the site.	**Conclusions:** HRA Stage 2 Appropriate Assessment indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, as the total Predicted Environmental Concentration (PEC) did not exceed the applicable Critical Level (CL).	**Conclusions:** HRA Stage 2 Appropriate Assessment indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, as the total Predicted Environmental Concentration (PEC) did not exceed the applicable Critical Level (CL).
Solent Maritime (SAC)	**Conclusions:** HRA Stage 2 Appropriate Assessment indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, based on the distribution of qualifying features and existing background levels within the site.	**Conclusions:** HRA Stage 2 Appropriate Assessment indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, based on the distribution of qualifying features and existing background levels within the site.	**Conclusions:** HRA Stage 2 Appropriate Assessment indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, as the total Predicted Environmental Concentration (PEC) did not exceed the applicable Critical Level (CL).	**Conclusions:** HRA Stage 2 Appropriate Assessment indicates that adverse effects (pre-mitigation) can be discounted for all qualifying features, as the total Predicted Environmental Concentration (PEC) did not exceed the applicable Critical Level (CL).

4.2 Recommendations

Based on the results of this study, it is recommended that development in the Fareham Borough Local Plan can take place as set out in this report, with no threat due to emissions to air to the ability of any European site to achieve their conservation objectives or maintain their integrity (either alone or in combination).

The conclusion that development associated with the FBLP will not result in significant adverse effects with regards to NOx concentrations at Portsmouth Harbour Ramsar & SPA, River Itchen SAC, Solent and Southampton Water Ramsar & SPA, and Solent Maritime SAC takes account of forecast trends in NOx, as set out in projections carried out by Defra.

While there is currently no basis for reasonable scientific doubt in the forecast NOx levels, it is recommended that Fareham maintain a watching brief on the Defra forecasts of future trends in airborne NOx, and that a formal review take place at least once every three years. It would be appropriate for this formal review to take place as part of the programme for wider-ranging review of the Fareham Borough Local Plan HRA.

During the HRA for short-term development in Fareham Borough, adverse effects from in combination short-term development within the PfSH region, relating to increased nitrogen deposition to Perennial vegetation of stony banks (PVSB), a qualifying feature of Solent Maritime SAC, could not be ruled out without mitigation. In order to address the adverse effect of nitrogen deposition identified at Solent Maritime SAC to PVSB, a joint Nitrogen Action Plan is being developed by Havant Borough Council with Portsmouth City Council under the Duty to Co-Operate.

Fareham Borough Council was not able to quantify the individual contribution of development within Fareham to the in combination effects on the Solent Maritime PVSB during the previous HRA for short-term development in Fareham Borough. The present study has confirmed that the maximum modelled contribution from the FBLP to nitrogen deposition and acid deposition (the pollutants of concern), in this part of the site, is less than 0.025% of the relevant Critical Levels. The contribution from the FBLP is so small as to be considered nugatory.

Therefore, there is no requirement for Fareham Borough Council to work with Havant Borough Council, Portsmouth City Council, or any other relevant local authorities, to further develop and implement the Nitrogen Action Plan on a proportionate basis.

The existing HRA evidence base for designated sites in the New Forest District Council area (discussed in the HRA for short term development in Fareham Borough) showed there is already a system in place to identify and mitigate any adverse effects arising from vehicle emissions within the New Forest Ramsar, SPA and SAC.

During the HRA for short-term development in Fareham Borough, the Council was not able to quantify the individual contribution of development within Fareham to the in combination effects on the New Forest Ramsar, SPA and SAC. The present study has confirmed that the maximum modelled contribution from the FBLP to all four pollutants of concern, in this part of the site, is less than 0.025% of the relevant Critical Levels. The contribution from the FBLP is so small as to be considered nugatory.

Therefore, there is no requirement for Fareham Borough Council to work with New Forest District Council, the New Forest National Park Authority, or any other relevant local authorities, on a proportionate basis, to identify and mitigate any adverse effects arising from vehicle emissions within the New Forest Ramsar, SPA and SAC.

Natural England has agreed that the approaches in this HRA are appropriate. [36]

Appendices

Appendix 1 - Air dispersion model verification and adjustment

Verification of the model involves comparison of the modelled results with any local monitoring data at relevant locations; this helps to identify how the model is performing and if any adjustments should be applied. The verification process involves checking and refining the model input data to try and reduce uncertainties and produce model outputs that are in better agreement with the monitoring results. This can be followed by adjustment of the modelled results if required. The LAQM.TG(16) guidance recommends making the adjustment to the road contribution of the pollutant only and not the background concentration these are combined with.

NOx model verification

The approach outlined in LAQM.TG(16) section 7.508 – 7.534 (also in Box 7.14 and 7.15) has been used in this case. To verify the model, the predicted annual mean Road NOx concentrations were compared with concentrations measured at the various monitoring sites during 2015.

The model output of Road NOx (the total NOx originating from road traffic) was compared with measured Road NOx, where the measured Road NOx contribution is calculated as the difference between the total measured NOx and the background NOx value. Total measured NOx for each monitoring site was calculated from the measured NO_2 concentration using Version 6.1 of the Defra NOx/NO_2 calculator available from the LAQM website[57]. Background NOx values for 2015 were obtained from the 2015 reference year background maps available on the LAQM website.

The initial comparison of the modelled vs measured Road NOx identified that the model was slightly under-predicting the Road NOx contribution at most locations. Refinements were subsequently made to the model inputs to improve model performance where possible.

The gradient of the best fit line for the modelled Road NOx contribution vs. measured Road NOx contribution was then determined using linear regression and used as a global/domain wide Road NOx adjustment factor. This factor was then applied to the modelled Road NOx concentration at each discretely modelled receptor point to provide adjusted modelled Road NOx concentrations. A linear regression plot comparing modelled and monitored Road NOx concentrations before and after adjustment is presented in Figure A1-1. A primary NOx adjustment factor (PAdj) of **1.0091** based on model verification using all of the included 2015 NO_2 measurements was applied to all modelled Road NOx data prior to calculating an NO_2 annual mean.

The total annual mean NO_2 concentrations were then determined at points within the model domain using the NOx/NO_2 calculator to combine background and adjusted road contribution concentrations. For this step of the process, regional concentrations of ozone, oxides of nitrogen and nitrogen dioxide were set to those of the local authority where the calibration point was located. The following relationship was determined for conversion of total NOx concentrations to total NO_2 concentrations:

$$(NO_2 \text{ in } \mu g/m^3) = -\,0.0008370\,(NOx \text{ in } \mu g/m^3)^2 + 0.5421\,(NOx \text{ in } \mu g/m^3) + 4.8581$$

A plot comparing modelled and monitored total NO_2 concentrations during 2015 is presented in Figure A1-1.

To evaluate the model performance and uncertainty, the Root Mean Square Error (RMSE) for the observed vs predicted NO_2 annual mean concentrations was calculated, as detailed in Technical Guidance LAQM.TG(16). The calculated RMSE is presented in Table A1-1. In this case the RMSE was calculated at **7.175 µg/m³**.

57 https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

Figure A1-1: Predicted annual average NO_2 concentrations against measured concentrations at monitoring locations in 2015. The 30% confidence intervals are also plotted.

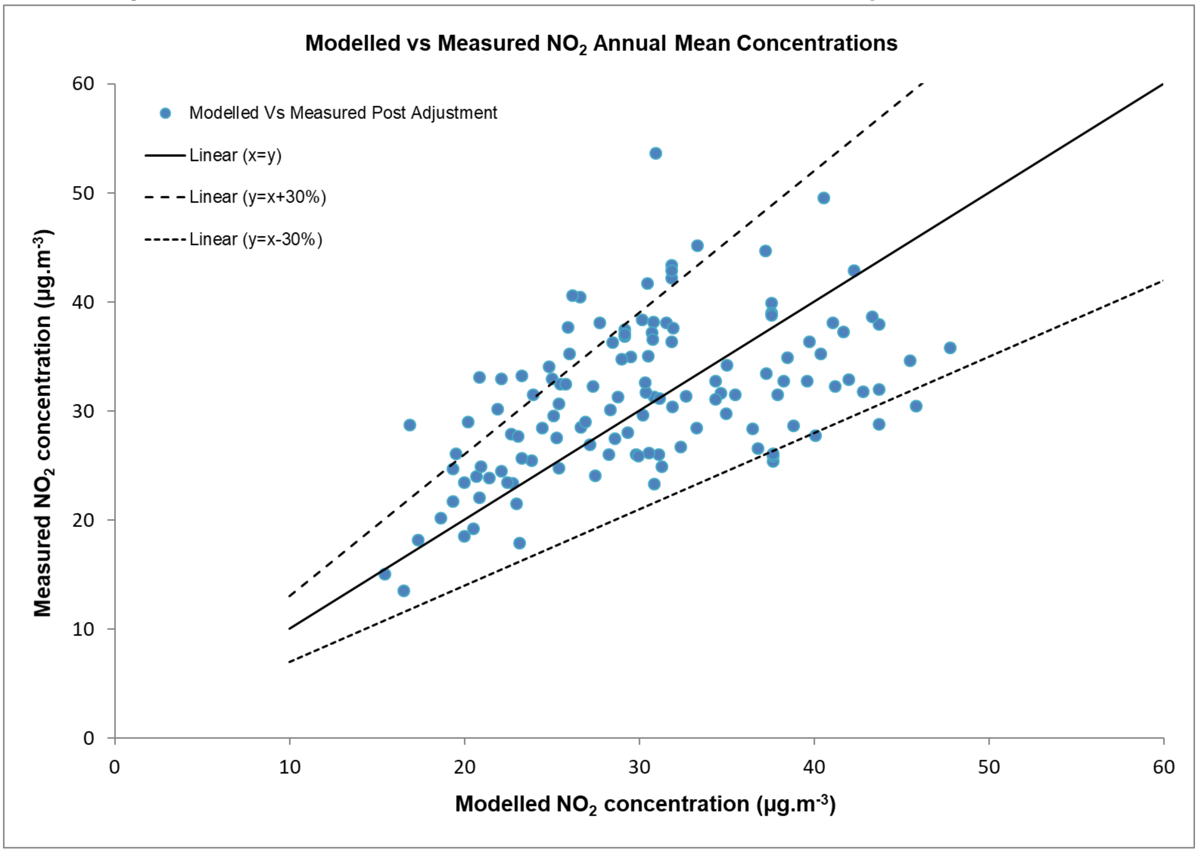


Table A1-1: Modelled and measured NO_2 concentrations for the 2015 reference year and calculated RMSE value

Council	Site ID	Easting	Northing	NO_2 annual mean in 2015 (µg/m³) Measured	Modelled
Eastleigh	AL	445912	115544	26.1	28.3
Eastleigh	BR	446604	119149	33.0	25.0
Eastleigh	BR2	446051	119175	33.3	23.3
Eastleigh	CA	445339	118110	24.7	19.3
Eastleigh	FOR	447427	118774	21.7	19.3
Eastleigh	HSB	451431	113025	31.5	23.9
Eastleigh	HSB2	451185	113032	27.7	23.0
Eastleigh	MS	445708	119619	28.6	26.6
Eastleigh	SRAN	445495	118237	34.1	24.8
Eastleigh	TP	445311	119147	23.5	20.0
Fareham	BL1	458376	106109	40.5	26.6
Fareham	G1A	457732	105625	35.8	47.8
Fareham	G2A	457627	105138	33.5	37.2
Fareham	G4	457598	105213	31.5	35.5
Fareham	G7	457583	105354	45.2	33.3
Fareham	G10	457675	105616	41.7	30.4
Fareham	G11	457668	105461	31.3	28.7
Fareham	G12	457684	105630	38.2	30.8

Council	Site ID	Easting	Northing	NO_2 annual mean in 2015 (μg/m^3)	
				Measured	Modelled
Fareham	HR2	457822	106107	33.1	20.8
Fareham	HR3A	457787	106140	29.0	20.2
Fareham	HR4	457860	106077	33.0	22.1
Fareham	PS1/1A/1B	457939	106012	36.9	29.1
Fareham	PS1A	457939	106012	37.5	29.1
Fareham	PS1B	457939	106012	37.1	29.1
Fareham	PS2	457937	106021	38.1	27.7
Fareham	PS3	457935	106033	40.6	26.1
Fareham	PS4	457954	106027	42.2	31.8
Fareham	PS5	457954	106027	43.4	31.8
Fareham	PS6	457954	106027	42.9	31.8
Fareham	E1	457590	105281	39.9	37.6
Fareham	E2	457590	105281	39.0	37.6
Fareham	E3	457590	105281	38.8	37.6
Fareham	DC1	457182	106203	30.2	21.9
Fareham	RM1	455745	107825	29.6	25.1
Fareham	GR/RL	457564	105300	26.7	32.4
Fareham	AQ8A	451618	109015	29.8	34.9
Havant	1	471610	105592	28.5	24.4
Havant	2	471742	105794	24.8	25.4
Havant	3	472198	102048	28.7	16.9
Havant	6	471555	106298	24.9	31.3
Havant	7	471180	106063	27.9	22.7
Havant	8	467322	107976	23.5	22.5
Havant	9	468305	109548	30.4	31.9
Havant	10	470032	110043	20.2	18.6
Havant	12	471611	105680	25.5	23.8
Havant	15	471894	108403	13.5	16.5
Havant	19	471640	105794	34.2	35.0
Havant	20	471693	105920	26.1	31.1
Havant	21	471589	106132	31.3	30.8
Havant	22	471573	106200	29.7	30.2
Havant	23	471571	106374	32.3	41.2
Havant	25	468479	107721	21.5	23.0
Havant	26	467228	107849	17.9	23.1
Havant	W10	471368	106805	30.1	28.3
New Forest	28	436457	113354	23.3	30.9
New Forest	30	435927	113226	23.4	22.7
New Forest	31	436374	112929	19.2	20.5
New Forest	34	438765	111006	18.2	17.3
New Forest	36	438363	109694	18.5	20.0
New Forest	38	445881	103247	15.1	15.4
New Forest	CM1	436188	113237	24.0	20.7
New Forest	20	436189	113235	23.9	31.1
New Forest	21	436210	113210	24.5	30.8
New Forest	22	436232	113156	25.0	30.2

Council	Site ID	Easting	Northing	NO_2 annual mean in 2015 (µg/m^3)	
				Measured	Modelled
New Forest	23	436205	113019	26.1	41.2
New Forest	24	436307	113077	25.7	28.5
New Forest	26	436476	113214	22.1	23.1
Portsmouth	3	463408	99460	24.1	16.9
Portsmouth	5	464230	102194	27.5	28.6
Portsmouth	7	464291	102279	26.1	22.7
Portsmouth	8	466690	104355	28.4	22.5
Portsmouth	9	465621	105528	35.0	31.9
Portsmouth	15	466120	101324	26.2	16.5
Portsmouth	16	465474	104205	32.0	43.7
Portsmouth	18	466097	101332	26.9	27.2
Portsmouth	19	466392	100226	35.1	35.0
Portsmouth	20	466712	99415	27.6	31.1
Portsmouth	21	465209	98964	35.3	30.8
Portsmouth	22	464778	99306	28.1	30.2
Portsmouth	24	465111	100737	36.3	28.5
Portsmouth	32	464559	100980	31.7	34.6
Portsmouth	34	464425	100893	34.7	17.3
Portsmouth	35	463837	99759	28.5	33.3
Portsmouth	36	464501	99329	29.0	20.0
Southampton	N101	437543	113726	44.7	37.2
Southampton	N103	438807	112908	31.7	30.4
Southampton	N104	439218	112850	38.4	30.1
Southampton	N107	442367	112896	53.7	30.9
Southampton	N109	442585	113251	37.2	30.7
Southampton	N110	442591	112240	25.4	37.7
Southampton	N111	442591	112240	25.9	37.7
Southampton	N112	442591	112240	26.1	37.7
Southampton	N113	444124	113290	34.9	38.4
Southampton	N114	444131	113326	32.8	34.3
Southampton	N115	437939	113473	36.4	39.7
Southampton	N116	437951	113407	38.1	31.5
Southampton	N117	443751	111122	36.4	31.8
Southampton	N118	442472	113068	34.8	29.0
Southampton	N120	442555	111021	38.0	43.7
Southampton	N122	439998	112634	31.5	37.9
Southampton	N123	442351	112302	32.8	38.2
Southampton	N124	439741	112746	37.3	41.7
Southampton	N125	443126	112645	35.3	40.3
Southampton	N126	442369	112283	32.8	39.6
Southampton	N129	442554	111022	28.8	43.7
Southampton	N133	438608	113018	30.7	25.4
Southampton	N134	438953	112866	37.6	31.9
Southampton	N135	443714	111052	31.4	32.6
Southampton	N136	443731	111053	31.1	34.3
Southampton	N140	441629	112332	49.6	40.6

Council	Site ID	Easting	Northing	NO_2 annual mean in 2015 (µg/m^3)	
				Measured	Modelled
Southampton	N141	441915	110993	30.5	45.8
Southampton	N144	443147	112709	31.8	42.8
Southampton	N146	443164	112741	28.7	38.8
Southampton	N149	441552	115247	32.5	25.5
Southampton	N153	437325	113860	31.2	31.1
Southampton	N154	442234	111081	32.9	42.0
Southampton	N155	442405	111083	26.6	36.8
Southampton	N157	442375	110970	27.8	40.1
Southampton	N158	443801	111111	36.6	30.8
Southampton	N159	443745	111151	25.9	29.9
Southampton	N160	442218	112890	32.6	30.3
Southampton	N161	442703	114127	32.5	25.8
Southampton	N162	442877	114342	37.7	25.9
Southampton	N165	442767	114184	32.3	27.3
Southampton	N166	442210	112140	38.1	41.1
Southampton	N170	442461	110996	38.7	43.3
Southampton	N172	442203	112125	42.9	42.3
RMSE (all sites in this table)					**7.1747**

PM_{10} model verification

The model output of Road PM_{10} (the total PM_{10} originating from road traffic) was compared with measured Road PM_{10}, where the measured Road PM_{10} contribution is calculated as the difference between the total measured PM_{10} and the background PM_{10} value.

The initial comparison of the modelled vs measured Road PM_{10} identified that the model was under-predicting the Road PM_{10} contribution at most locations. Refinements were subsequently made to the model inputs to improve model performance where possible.

The gradient of the best fit line for the modelled Road PM_{10} contribution vs. measured Road PM_{10} contribution was then determined using linear regression and used as a global/domain wide Road PM_{10} adjustment factor. This factor was then applied to the modelled Road PM_{10} concentration at each discretely modelled receptor point to provide adjusted modelled Road PM_{10} concentrations. A primary PM_{10} adjustment factor (PAdj) of **3.8529** based on model verification using all of the included 2015 PM_{10} measurements was applied to all modelled Road PM_{10} data prior to calculating an PM_{10} annual mean.

A plot comparing modelled and monitored total PM_{10} concentrations during 2015 is presented in Figure A1-2.

To evaluate the model performance and uncertainty, the Root Mean Square Error (RMSE) for the observed vs predicted PM_{10} annual mean concentrations was calculated, as detailed in Technical Guidance LAQM.TG(16). The calculated RMSE is presented in Table A1-2. In this case the RMSE was calculated at **3.773 µg/m^3**.

Figure A1-2: Predicted annual average PM_{10} concentrations against measured concentrations at monitoring locations in 2015. The 30% confidence intervals are also plotted.

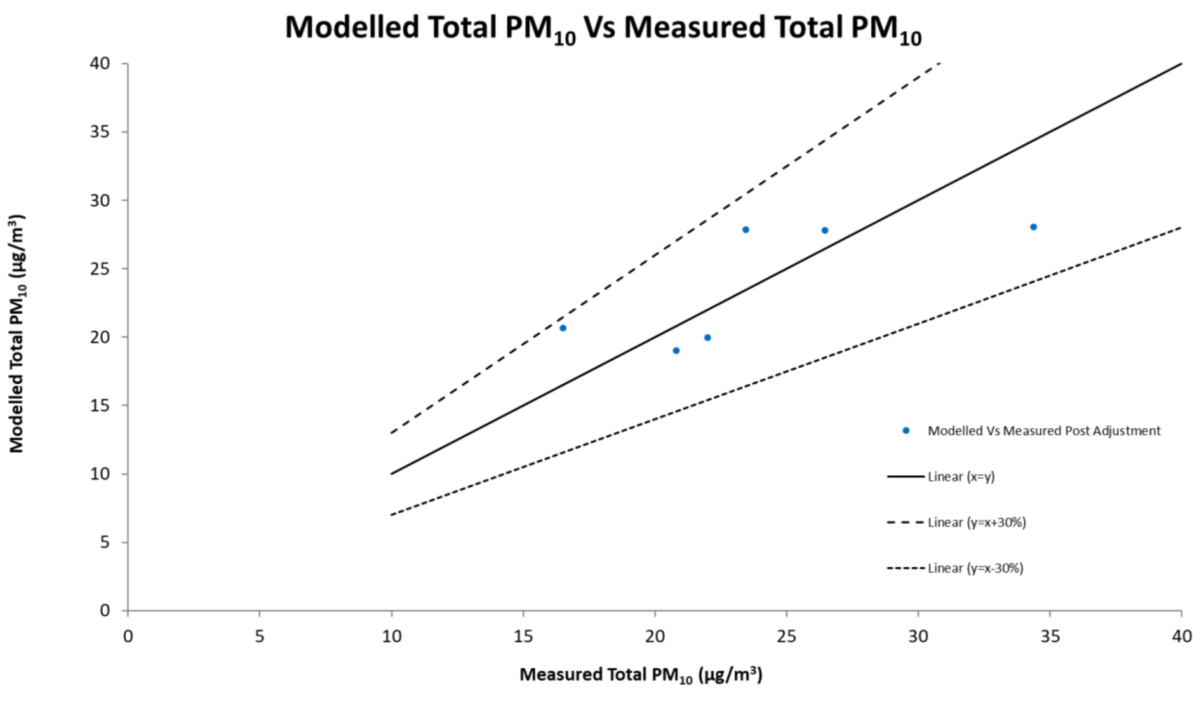


Table A1-2 Modelled and measured PM_{10} concentrations for the 2015 reference year and calculated RMSE value

Council	Site ID	Easting	Northing	PM_{10} annual mean in 2015 ($\mu g/m^3$)	
				Measured	Modelled
Gosport	GOS1	458987	102786	20.8	19.0
New Forest	CM1	436188	113237	22.0	20.7
Portsmouth	C2	464925	102129	34.4	28.1
Portsmouth	C6	466004	102348	26.5	27.8
Portsmouth	C7	464397	101270	23.5	27.8
Southampton	CM1	442583	112248	16.5	20.7
RMSE (all included sites)					**3.773 $\mu g/m^3$**

Ricardo
Energy & Environment

The Gemini Building
Fermi Avenue
Harwell
Didcot
Oxfordshire
OX11 0QR
United Kingdom

t: +44 (0)1235 753000
e: enquiry@ricardo.com

ee.ricardo.com