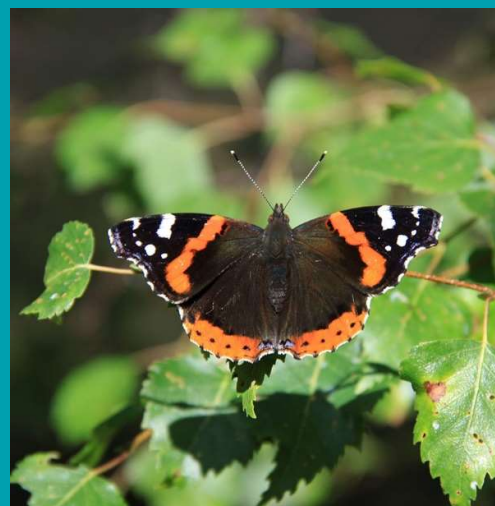




Harts Farm Way Air Quality Assessment

EL (Havant) Ltd

FINAL



Report for

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1. Introduction

El Havant has appointed Wood to undertake an air quality assessment of the development of a power plant in Havant that generates electricity to export power to the National Grid when demand outstrips supply (Hereafter referred to as 'Proposed Installation'). The Proposed Installation consists of 10 gas generators each rated at 2,535kWe.

The Proposed Installation is located off Harts Farm Way, at grid reference 470617, 105826 within the Havant Borough Council (HBC) administrative area. The location of the Proposed Installation is between the A27 to the north, with industrial units to the east and west and a Sewage Treatment Plant to the south.

There is an adjacent installation operated by Peak Gen Power Limited (Peak Gen), approximately 170m to the northwest of the Proposed Installation. The adjacent installation consists of 10 diesel (compression-ignition) engines. The two installations will operate independently and may therefore operate simultaneously.

1.1 Air dispersion modelling

Royal Haskoning DHV have previously completed an AQA of the Proposed Installation in 2017, which was approved by HBC. Emissions to air from the Proposed Installation have also been subject to a separate modelling exercise by Wood during 2020¹ to inform an assessment of the effects of the emissions on human and ecological receptors. The modelling exercise was based on all 10 engines operating simultaneously, with a total electrical export of 25 MWe. However, the Proposed Installation's export agreement is limited to 20 MWe and therefore the modelling exercise is precautionary and over-estimates the output of the installation.

Results of the previous air dispersion modelling exercise have also been reviewed separately by Wood and the likely significant effects of emissions from the proposed installation on designated biodiversity sites summarised (Wood 2020²).

The emissions of the Peak Gen installation have been accounted for in modelling the impacts of the Proposed Installation for this AQA, with a total electrical export from that installation of 20 MWe and assumed operation for a maximum of 500 hours per year (Wood 2018³).

1.2 This report

This report re-visits the dispersion modelling undertaken by Wood previously to address concern from Havant Borough Council (HBC) and Natural England on the AQA for the Proposed Installation at Harts Farm Road. The concerns are summarised below:

- Request to include results from a real-world model rather than present worst-case modelling to demonstrate that there are no exceedances under realistic operating conditions.

¹ Wood (2020). Technical note: GFP II Limited – Harts Farm Way Air Dispersion Modelling.

² Wood (2020). Technical Note: GFP II Limited – Harts Farm Way Ecological Appraisal (Emissions)

³ Wood (2018) Peak Gen Power Ltd Havant Power Plant Air Quality Impact Assessment.

- Consideration of the saltmarsh and coastal vegetated single habitats at the Solent Maritime Special Area Conservation (SAC) habitats.
- Consideration of impacts on the adjacent a Solent Wader and Brent Goose Strategy Candidate sites H09 and H130 that support the functionality of Chichester & Langstone Harbours Special Protection Area.

To address concerns, impacts from NO_x emissions, NO₂ emissions and Nitrogen deposition (N deposition) have been assessed. This report has used the existing model held by Wood and has considered further ecological receptors highlighted by HBC as sites requiring assessment. The Proposed Installation was modelled to operate at 5,840 hours per year, aligning with a daily operating schedule of 7:00 – 23:00. The model results have then been processed under a nominal number of operating hours per year of 1,500.

2. Assessment Methodology

2.1 Process emissions

The Proposed Installation as modelled here consists of 10 MTU 20V4000 GS (GG20V4000A1) gas-fired engines, each rated at 2,535kWe. Each engine sits within its own container with its own individual stack. Their total electrical export is rated at approximately 25 MWe. However, the export agreement is for 20 MW, and so the engines will either be derated or will not all operate when called. The assessment presented here assumes that all 10 engines operate at full rating and is therefore pessimistic.

The adjacent Peak Gen Power installation consists of 10 16V4000G63 diesel (compression-ignition) engines manufactured by MTU, likewise each in its own container and with its own stack. Their total electrical export is 20 MWe. It is assumed that the Peak Gen Power installation operates for a maximum of 500 hours per year.

Model input parameters are given in **Table 2.1** and **Table 2.2**. The process data has been derived from manufacturer's engine specification provided in the previous assessment undertaken by Wood² and existing process and emissions data held by Wood.

Table 2.1 Modelled stack characteristics

Parameter	Installation	Peak Gen Power Diesel
Release height (m)	8.5	4.96
Flue diameter (m)	0.47	0.5
Efflux velocity (m s ⁻¹)	45.8	39
Efflux temperature (°C)	419	491
Actual oxygen (%)	9.2	8.6
Moisture (%)	2.8	2.7

Table 2.2 Modelled stack emission rates, per engine (g s⁻¹)

Pollutant	Installations	Peak Gen Power Diesel
NO _x	0.58	1.14
CO	2.31	1.32

2.2 The ADMS dispersion model

ADMS atmospheric dispersion model (Version 5)⁴ has been used to determine concentrations of NO_x. ADMS 5 is an advanced dispersion model used to model the air quality impact of existing and proposed industrial installations. It is considered a 'new generation' dispersion model which uses two parameters to describe the atmospheric boundary layer.

A description of the science used in ADMS 5 and the supporting technical references can be found in the model's user guide⁵. The main features of ADMS 5 include the modelling of:

- The effect of plume rise;
- The effect of buildings;
- The effect of wind turbines;
- The effect of hills (complex terrain) and spatial variations in surface roughness;
- The effect of buildings in an urban area (urban canopy);
- The effect of a coastline;
- NO_x chemistry using a simple reaction scheme for NO_x, NO₂ and ozone;
- The kinetics of the uptake of gases, and the thermodynamics and chemistry of the dissolution of gases in the raindrops for wet deposition of SO₂ and HCl;
- Short-term fluctuations in concentration due to atmospheric turbulence, particularly important for the modelling of odours and concentrations for averaging times less than one hour; and
- Radioactive decay and gamma dose.

Model parameters

Surface roughness

The surface roughness length represents the aerodynamic effects of surface friction and is defined as the height at which the extrapolated surface layer wind profile tends to zero. This value is an important parameter used by meteorological pre-processors to interpret the vertical profile of wind speed and estimate friction velocities which are, in turn, used to define heat and momentum fluxes and, consequently, the degree of turbulent mixing in the boundary layer.

The surface roughness length is related to the height of surface elements; typically, the surface roughness length is approximately 10% of the height of the main surface features. Thus, it follows that surface roughness is higher in urban and congested areas than in rural and open areas. Default ADMS roughness lengths for various land use categories are listed in **Table 2.3**.

⁴ Cambridge Environmental Research Consultants (CERC), 2022. *Software*. [Online]. Available from: <http://www.cerc.co.uk/environmental-software.html>

⁵ Cambridge Environmental Research Consultants (CERC), 2022. *User guides*. [Online]. Available from: <http://www.cerc.co.uk/environmental-software/user-guides.html>

Table 2.3 Typical surface roughness lengths for use in ADMS for various land use categories in average conditions

Land use	z_0 (m)
Large urban areas	1.5
Cities, woodlands	1
Parkland, open suburbia	0.5
Agricultural areas (max)	0.3
Agricultural areas (min)	0.2
Root crops	0.1
Open grassland	0.02
Short grass	0.005
Sea	0.0001

This assessment has adopted a surface roughness length of 1 m to represent the split between large urban areas and Parkland, open suburbia land uses, concluded to be representative of the land use of the surrounding area of the Proposed Installation.

Buildings

Buildings either surrounding the stack or of which the stack is attached to can have an effect on the maximum predicted ground level concentration of pollutants modelled. Buildings have been included in the model for this assessment. The buildings added into the model are reported below in **Table 2.4** alongside their location and respective dimensions.

Table 2.4 Modelled building locations and dimensions

Building name	X (m)	Y (m)	Height (m)	Width (m)	Angle (°)
Harts 1-5	470600	105841.2	2.9	26.95	77
Harts 6-10	470620.2	105830.4	2.9	26.95	77
Havant 5-10	470430.8	105891.4	2.9	12.24	147.25
Havant 1-4	470441.8	105903.5	2.9	12.24	147.25

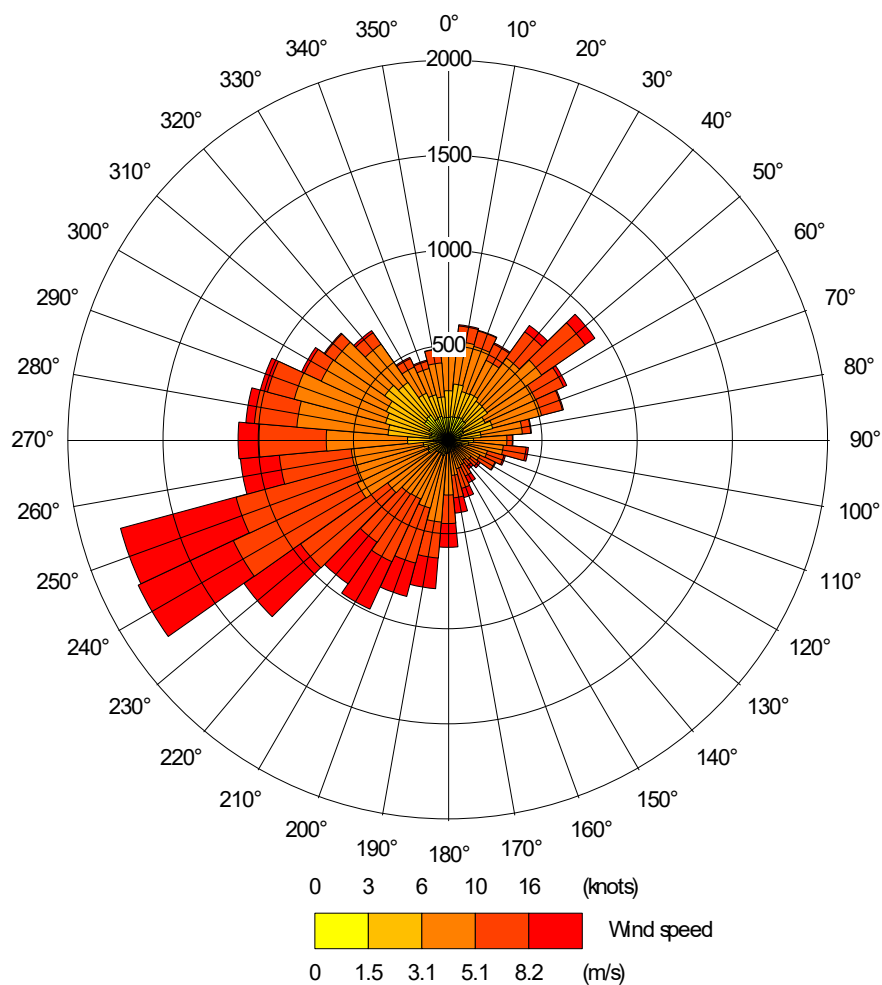
Meteorological data

Detailed dispersion modelling requires hourly sequential meteorological data from a representative synoptic observing station. Hourly sequential meteorological data was obtained for Thornbury Island observing station, which is situated approximately 35 km south-west of the Proposed Installation.

The meteorological data for 2015, 2016 and 2017 has been used for this AQA.

Figure 2.1 summarises the hourly wind speed and wind direction as a wind rose and is representative of all modelled years combined.

Figure 2.1 Combined wind rose for Thornbury Island meteorological station (2015-2017)



2.3 Pollutant concentrations

NO_x to NO₂ conversion

The concentration of NO₂ expected from modelled concentrations of NO_x has been calculated based upon guidance provided by the Environment Agency (EA)⁶. This guidance reports that a worse case conversion ratio to NO₂ is 35% for short-term averages and 70% for long-term averages. All annual mean NO_x concentrations were therefore multiplied by 0.7 to obtain annual mean concentrations of NO₂. All hourly NO_x concentrations were multiplied by a conversion factor of 0.35 to obtain hourly concentrations of NO₂.

Deposition

The predominant route by which emissions will affect land in the vicinity of a process is by deposition of atmospheric emissions. Ecological receptors can potentially be sensitive to the deposition of pollutants, particularly nitrogen and sulphur compounds, which can affect the character of the habitat through eutrophication and acidification.

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

To calculate nitrogen deposition, the dry deposition flux was first calculated for the annual mean NO₂ concentrations at each modelled receptor. Dry deposition is the portion of total deposition that is deposited through processes such as settling, impaction and adsorption and is quantified in terms of flux, which is dependent on the dry deposition velocity and concentration of a pollutant in the air. The annual mean NO₂ concentrations at each modelled receptor was multiplied by the dry deposition velocities reported below in **Table 2.5**.

Environment Agency guidance AQTAG06 (Environment Agency, 2011) recommends deposition velocities for various pollutants dependent upon the habitat type and includes conversion factors. To convert concentrations to kilograms of nitrogen per hectare per year deposition for NO_x (**Table 2.5**).

Table 2.5 Dry deposition velocities and NO_x conversion factor

Pollutant	Area	Dry deposition velocity (m s ⁻¹)	Conversion factor
NO _x	Grassland	0.0015	96
NO _x	Forrest	0.003	96

⁶ Environment Agency, 2019. *Specified generators: dispersion modelling assessment*. [Online]. Available from: Specified generators: dispersion modelling assessment - GOV.UK (www.gov.uk)

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

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

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

The critical loads used to assess the impact of compounds deposited to land which result in eutrophication and acidification are expressed in terms of kilograms of nitrogen deposited per hectare per year ($\text{kg N ha}^{-1} \text{y}^{-1}$) and kilo-equivalents deposited per hectare per year ($\text{keq ha}^{-1} \text{y}^{-1}$). The unit of 'equivalents' (eq) is used for the purposes of assessing acidification, rather than a unit of mass. The unit eq ($1 \text{ keq} \equiv 1,000 \text{ eq}$) refers to molar equivalent of potential acidity resulting from e.g. sulphur, oxidised and reduced nitrogen, as well as base cations. Essentially, it means 'moles of charge' and is a measure of how acidifying a particular chemical species can be.

To convert the predicted concentration in air of NO_2 , SO_2 , NH_3 , or HNO_3 , the following algorithm is used.

$$DR_i = C_i v_{di} f_i$$

Where:

DR_i = annual deposition of N or S ($\text{kg N ha}^{-1} \text{y}^{-1}$ or $\text{kg S ha}^{-1} \text{y}^{-1}$)

C_i = annual mean concentration of the i th chemical species ($\mu\text{g m}^{-3}$)

v_{di} = deposition velocity of i th species (**Error! Reference source not found.**)

f_i = factor to convert from $\mu\text{g m}^{-2} \text{s}^{-1}$ to $\text{kg ha}^{-1} \text{y}^{-1}$ for the i th species

Table 2.8 provides the relevant conversion factors as extracted from AQTAG06.

Table 2.8 Environment Agency factors for converting modelled deposition rates

Pollutant	Conversion factor ($\mu\text{g m}^{-2} \text{s}^{-1}$ to $\text{kg ha}^{-1} \text{y}^{-1}$ for the i th species)	
	Of	f_i
NO₂	N	96.0
SO₂	S	157.7
HNO₃	N	70.1
NH₃	N	259.7

Source: Environment Agency (2011)

In order to convert deposition of N to acid equivalents, the following relationships can be used:

- $1 \text{ keq ha}^{-1} \text{ y}^{-1} = 14 \text{ kg N ha}^{-1} \text{ y}^{-1}$.

With respect to wet deposition, Environment Agency (2011) states:

"It is considered that wet deposition of SO_2 , NO_2 and NH_3 is not significant within a short range."

Therefore, the assessment only considers dry deposition of nitrifying and acidifying N compounds (sulphur emissions from mains gas are negligible).

2.4 Sensitive receptors

The human receptors considered were chosen based on locations where people may be located and judged in terms of the likely duration of their exposure to pollutants and proximity to the site.

Guidance from the EA⁶ requires impacts at certain local sensitive ecological receptors to be assessed. Parts of a number of Ramsar, Special Protection Areas (SPA), Special Areas of Conservation (SAC) and Sites of Special Scientific Interest (SSSI) have been identified within 5 km of the installation, namely:

- Chichester and Langstone Harbours (Ramsar, SPA);
- Solent Maritime (SAC);
- Portsmouth Harbour (Ramsar, SPA),
- Solent & Isle Of Wight Lagoons (SAC);
- Langstone Harbour (SSSI); and
- Chichester Harbour (SSSI).

Farlington Marshes Local Nature Reserve (LNR) and an area of ancient woodland lie within 2 km. The locations of sensitive ecological receptors identified are presented in **Figure 2.1**.

Following comments from HBC and Natural England, vegetated shingle and coastal saltmarsh features of the Chichester and Langstone Harbour Ramsar/SPA and the Solent Maritime SAC have been considered. Sites found to be part of the Solent Waders and Brent Goose Strategy (SWBGS) have also been considered and added as additional receptors to those included in the model prepared as part of the 2020 assessment. The location of the SWBGS sites are presented in **Figure 2.2**.

Modelled human receptor locations are presented in **Table 2.6** and **Figure 2.3** presents the location of the Ramsar, SPA, SSSI and ancient woodland sites which have been assessed.

Table 2.6 Air dispersion model locations

ID	Type	Y (m)	X (m)	Description
H2	Residential	470273	106054	Mill Lane, Brockhampton
H3	Residential	469945	106161	Lower Road, Brockhampton
H4	Residential	470330	106079	Mill Lane, Brockhampton

ID	Type	Y (m)	X (m)	Description
H5	Residential	470958	106118	Brockhampton Road, Brockhampton,
H6	Residential	471454	105563	Brookmead Way, Langstone
H7	Residential	469309	105643	Havant Road, Bedhampton
H8	Residential	470818	106240	Abrams Way, Brockhampton
H9	Residential	471641	106121	Bosmere Junior School, South Street, Brockhampton
H10	Residential	471577	106179	Bulbeck Road, Brockhampton
H11	Residential	471733	105795	Rectory Road, Langstone
E01	Ecological	469532	106992	Ancient Woodland
E02	Ecological	468990	105431	Chichester and Langstone Harbours Ramsar/SPA, Farlington Marshes LNR
E03	Ecological	470389	105382	Chichester and Langstone Harbours Ramsar/SPA, Solent Maritime SAC
E04	Ecological	471184	105177	Chichester and Langstone Harbours Ramsar/SPA
E05	Ecological	472097	105106	Chichester and Langstone Harbours Ramsar/SPA, Solent Maritime SAC
E06	Ecological	465249	104568	Portsmouth Harbour Ramsar/SPA
E07	Ecological	468508	104709	Perennial vegetation of stony banks feature of Chichester and Langstone Ramsar/SPA
E08	Ecological	469191	105314	Atlantic salt meadows (coastal saltmarsh) feature of Solent Maritime SAC
E09	Ecological	470386	105686	H130 Candidate site
E10	Ecological	470368	105726	H130 Candidate site
E11	Ecological	470611	105632	H130 Candidate site
E12	Ecological	470667	105678	H130 Candidate site
E13	Ecological	470414	105621	H130 Candidate site
E14	Ecological	470432	105565	H130 Candidate site
E15	Ecological	470444	105512	H130 Candidate site
E16	Ecological	470497	105498	H130 Candidate site
E17	Ecological	470542	105536	H130 Candidate site
E18	Ecological	470576	105584	H130 Candidate site
E19	Ecological	470640	105222	H90 Candidate site

ID	Type	Y (m)	X (m)	Description
E20	Ecological	470657	105251	H90 Candidate site
E21	Ecological	470669	105275	H90 Candidate site
E22	Ecological	470697	105127	H29 Candidate site
E23	Ecological	470736	105129	H29 Candidate site
E24	Ecological	470759	105131	H29 Candidate site
E25	Ecological	470376	105641	H07C Candidate site
E26	Ecological	470382	105608	H07C Candidate site
E27	Ecological	470335	105621	H07C Candidate site
E28	Ecological	470389	105564	H07C Candidate site
E29	Ecological	470130	105535	H07B Candidate site
E30	Ecological	470131	105510	H07B Candidate site
E31	Ecological	470134	105427	H07B Candidate site
E32	Ecological	470105	105471	H07B Candidate site
E33	Ecological	470086	105757	H08 Candidate site
E34	Ecological	470132	105736	H08 Candidate site
E35	Ecological	470152	105712	H08 Candidate site
E36	Ecological	470162	105662	H08 Candidate site
E37	Ecological	470161	105620	H08 Candidate site
E38	Ecological	470140	105577	H08 Candidate site
E39	Ecological	469910	105532	H07A Candidate site
E40	Ecological	469838	105609	H07A Candidate site
E41	Ecological	469862	105565	H07A Candidate site
E42	Ecological	470566	105896	H09 Candidate site
E43	Ecological	470558	105937	H09 Candidate site
E44	Ecological	470505	105956	H09 Candidate site
E45	Ecological	470452	105942	H09 Candidate site
E46	Ecological	470922	105148	H28 Candidate site
E47	Ecological	470928	105176	H28 Candidate site
E48	Ecological	470941	105194	H28 Candidate site

ID	Type	Y (m)	X (m)	Description
E49	Ecological	470967	105196	H28 Candidate site

Figure 2.2 locations of sensitive ecological receptors

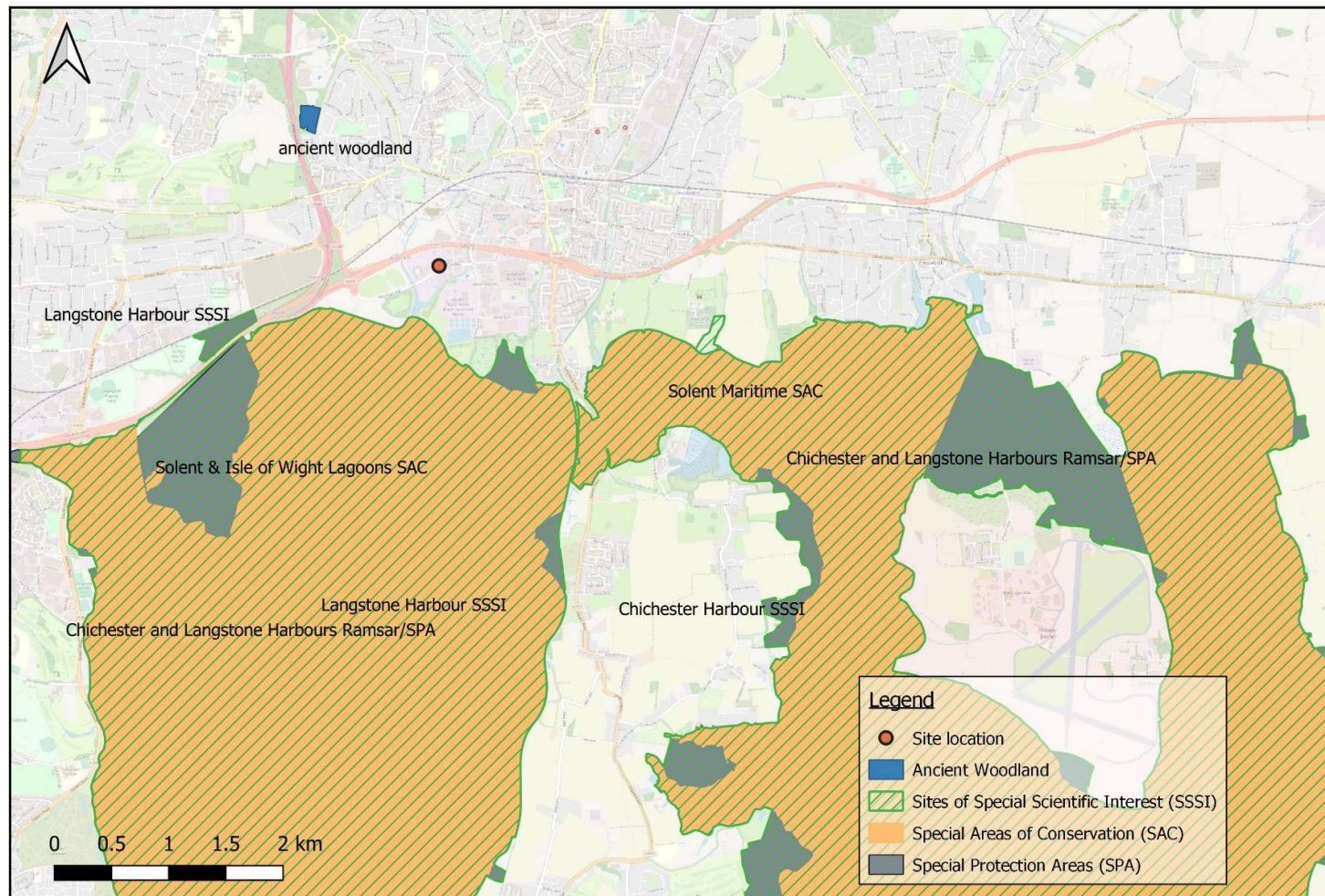


Figure 2.2 Location of SWBGS candidate sites considered

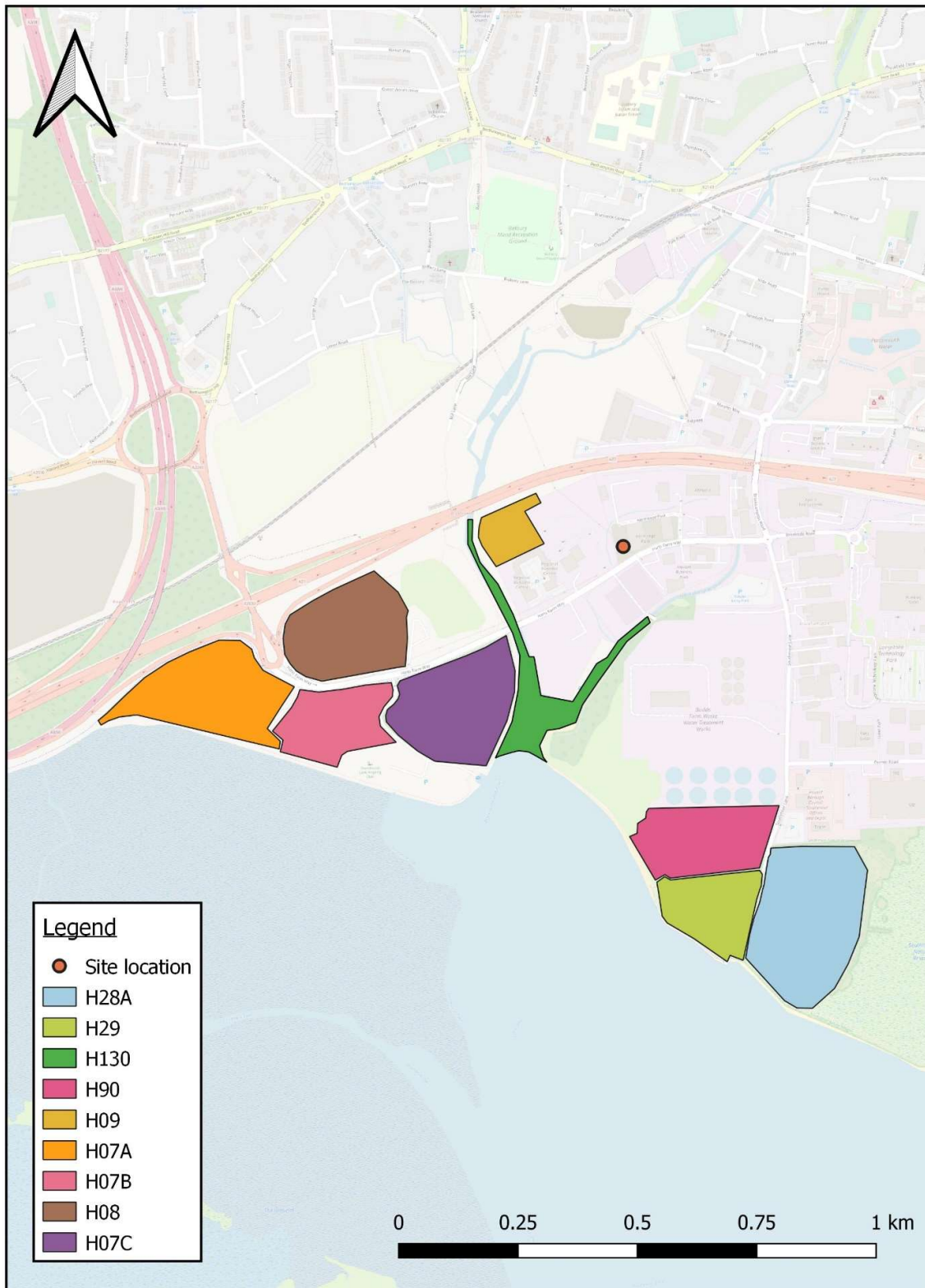


Figure 2.3 Location of sensitive human receptors



3. Assessment criteria

3.1 Air quality assessment levels

There are a large number of sources of standards against which air quality should be assessed, and these often use different terms for the assessment levels, including limit value, air quality standard (AQS), air quality objective (AQO), environmental assessment level (EAL), critical level (CLE), critical load (CL) and target. For simplicity, this document follows IAQM/EPUK (2015)⁷ in using the term “air quality assessment level (AQAL)”, or simply assessment level, to refer to any of these, unless it is useful to be more specific (e.g. to indicate the legal status of the AQAL).

Table 3.1 sets out those AQALs that are relevant to this assessment.

Table 3.1 Air quality assessment levels

Pollutant	Receptors affected	AQS/AQO/EAL	Averaging Period	Value
NO₂	Human	AQS	Annual mean	40 µg m ⁻³
		AQS	1-hour mean, not to be exceeded more than 18 times a year (equivalent to 99.79th percentile)	200 µg m ⁻³
		EAL	1-hour mean	30,000 µg m ⁻³
NO_x	Ecological	AQS	Annual mean	30 µg m ⁻³
		Target	Daily mean	75 µg m ⁻³
		WHO assessment level	Daily mean	200 µg m ⁻³ *
Nitrogen deposition	Ecological	Critical load	Annual mean	Site-specific
Acid deposition	Ecological	Critical load	Annual mean	Site-specific

* Where O₃ and SO₂ are not present above their critical levels.

Guidance from Defra in LAQM.TG16⁸ establishes that exceedances of the human health based AQALs should only be assessed at outdoor locations where members of the general public are regularly present over the averaging time of the objective.

Table 3.2 provides examples of those locations that may be relevant for different averaging periods, as extracted from LAQM.TG16⁸.

⁷ EPUK & IAQM, 2017. *Land-Use Planning and Development Control: Planning for Air Quality*. [Online]. Available from: <https://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf>

⁸ Defra, 2021. *Local Air Quality Management: Technical Guidance (TG16)*. [Online]. Available from: <https://laqm.defra.gov.uk/documents/LAQM-TG16-April-21-v1.pdf>

Table 3.2 Examples of locations where Air Quality Objectives apply

Averaging period	Objectives should apply	Objectives should not apply
Annual mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.
24-hour mean, and 8-hour mean	All locations where the annual mean objectives would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.
1-hour mean	All locations where the annual mean and: 24 and 8-hour mean objectives would apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably be expected to spend one hour or more. Any outdoor locations at which the public may be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-min mean	All locations where members of the public might reasonably be expected to spend a period of 15 minutes or longer.	-

For NO₂, it is the annual mean objective that is the more stringent AQAL. Monitoring results show that the 1-hour mean NO₂ AQAL is unlikely to be exceeded if the annual mean objective is not exceeded. For PM₁₀, the 24-hour mean objective is more stringent than the annual mean.

The likelihood of exceedance of the NO₂ and PM₁₀ short-term AQALs can be assessed with reference to the predicted annual means and the relationships recommended by the Local Air Quality Management Technical Guidance (LAQM.TG(16))⁸ The 1-hour mean NO₂ objective is unlikely to be exceeded if the annual mean is less than 60 µgm⁻³. An estimate of potential exceedances of the 24-hour mean PM₁₀ objective is given by:

$$\text{Number of 24 hour mean exceedences} = -18.5 + 0.00145 \times \text{annual mean}^3 + \frac{206}{\text{annual mean}}$$

Based on the above relationship, the 24-hour mean objective for PM₁₀ is likely to be met if the predicted annual-mean PM₁₀ concentration is 31.8 µgm⁻³ or less.

Table 3.2 presents the critical loads for the identified ecological receptors. E06 and E08 are not assessed for acid deposition because they are not considered sensitive. Littoral Sediment is the feature that is part of the site E06 represents that is reported as not sensitive towards acid deposition within the APIS data search. E08 is reported as not sensitive towards acid deposition since this receptor looks at the Atlantic Coastal Meadows feature of the Solvent Maritime SAC specifically, and APIS reports that this feature is not sensitive towards acid deposition.

Receptor points E09 – E18 relate to the SWBGS candidate site H130 and have therefore not been assessed for nitrogen and acid deposition because it is not considered sensitive due to the site being representative of a coastal system. Chartered Institute of Ecology and Environmental Management (CIEEM) advice on marine systems states that they are nitrogen limited, however removal of atmospheric nitrogen inputs may have a negligible effect⁹. More information on the sensitivity of this site to nitrogen deposition is provided in **Table 5.5**.

Table 3.2 Critical Loads

Site	Acid deposition Critical Load Function (Keq/ha/yr)			Nitrogen deposition Critical Load (kgN/ha/yr)
	CLmaxS	CLminN	CLmaxN	
E01	1.838	0.357	2.195	10
E02	0.24	0.321	0.561	10
E03	0.87	0.223	1.123	20
E04	0.87	0.223	1.123	20
E05	0.87	0.223	1.123	20
E06	N/A	N/A	N/A	20
E07	0.356	0.672	1.323	10
E08	N/A	N/A	N/A	20
E19	4	1.071	5.071	20
E20	4	1.071	5.071	20
E21	4	1.071	5.071	20
E22	1.846	0.357	2.203	10
E23	1.846	0.357	2.203	10
E24	1.846	0.357	2.203	10

⁹ CIEEM, 2021. *Advisory Note: Ecological Assessment of Air Quality Impacts*. [Online]. Available from: [Advisory Note: Ecological Assessment of Air Quality Impacts | CIEEM](#) [Accessed 28th March 2022].

E25	1.846	0.357	2.203	10
E26	1.846	0.357	2.203	10
E27	1.846	0.357	2.203	10
E28	1.846	0.357	2.203	10
E29	1.846	0.357	2.203	10
E30	1.846	0.357	2.203	10
E31	1.846	0.357	2.203	10
E32	1.846	0.357	2.203	10
E33	1.846	0.357	2.203	10
E34	1.846	0.357	2.203	10
E35	4	1.071	5.071	20
E36	4	1.071	5.071	20
E37	4	1.071	5.071	20
E38	1.846	0.357	2.203	10
E39	1.834	0.357	2.191	10
E40	1.834	0.357	2.191	10
E41	1.834	0.357	2.191	10
E42	1.846	0.357	2.203	10
E43	1.846	0.357	2.203	10
E44	1.846	0.357	2.203	10
E45	1.846	0.357	2.203	10
E46	1.846	0.357	2.203	10
E47	1.846	0.357	2.203	10
E48	1.846	0.357	2.203	10
E49	1.846	0.357	2.203	10

3.2 Significance criteria

The IAQM and EPUK⁷ outline impact descriptors which have formed the basis of the description of impacts associated with the Proposed Installation, and therefore the conclusion of significance of these impacts. The impact descriptors are detailed below in **Table 3.3**. The criteria reported within

the Environment Agency's risk assessment guidance (Environment Agency 2016¹⁰) are the principle drivers for assessing ecological impacts. Further detail relating to these screening criteria is reported underneath **Table 3.3**.

Table 3.3 Impact descriptors for individual receptors

Absolute concentration with Proposed Development, relative to assessment level	% change in Concentration Relative to Assessment Level				
	0%	1%	2–5%	6–10%	> 10%
75% or less	Negligible	Negligible	Negligible	Slight	Moderate
76–94%	Negligible	Negligible	Slight	Moderate	Moderate
95–102%	Negligible	Slight	Moderate	Moderate	Substantial
103–109%	Negligible	Moderate	Moderate	Substantial	Substantial
110% or more	Negligible	Moderate	Substantial	Substantial	Substantial

Table notes: When defining the concentration as a percentage of the AQAL, the 'without scheme' concentration is used where there is a decrease in pollutant concentration, and the 'with scheme;' concentration for an increase. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL. It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it¹⁴.

The Environment Agency's risk assessment guidance (Environment Agency 2016¹⁰) criteria has been used in this AQA to define when the impacts of emissions on ecological receptors can be screened-out of the assessment. For European Sites (SAC and SPA) and RAMSAR sites and nationally designated sites (SSSI and NNR), the guidance advises that to screen-out the need for further assessment, the Process Contribution (PC) for any substance emitted from an industrial source must meet both of the following criteria at the assessment location:

- short-term PC is less than 10% of the short-term environmental standard; and
- long-term PC is less than 1% of the long-term environmental standard.

For non-statutory sites, including local wildlife sites and ancient woodlands, the EA uses less stringent criteria in its permitting decisions. Environment Agency policy for its permitting process is that if either the short-term or long-term PC is less than 100% of the Critical Level or Critical Load, they do not require further assessment.

¹⁰ Environment Agency (EA), 2016. *Air emissions risk assessment for your environmental permit*. [Online]. Available from: <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screening-for-protected-conservation-areas>

The APIS website identifies the Critical Level of NO_x as 75µg m⁻³ (daily mean) and 30µg m⁻³ (annual mean). These levels are set for all receptor types as *“values are not habitat specific, as in Critical Loads, but have been set to cover broad vegetation types”* (APIS, 2020¹¹). These are the relevant long-term and short-term environmental standards for NO_x, however a higher (200 µg m⁻³) daily mean is an appropriate standard in circumstances where SO₂ and Ozone levels are predicted to be well below their respective Critical Levels and has been applied in this appraisal (Wood 2020¹).

¹¹ APIS, 2020. http://www.apis.ac.uk/critical-loads-and-critical-levels-guide-data-provided-apis#_Toc279788054. Accessed: 25th March 2022.

4. Baseline air quality

The Proposed Installation lies within the administrative area of Havant Borough Council (HBC). HBC's latest publicly available Annual Status Report (ASR) was published in 2019. During 2018, there were no Air Quality Management Area's (AQMA) declared by HBC.

4.1 Baseline

During 2018, HBC did not undertake automatic monitoring of NO₂. The council undertook non-automatic (passive) monitoring of NO₂ at 37 locations during 2018. The monitoring site's operated by HBC are not located in the vicinity of the sensitive human receptors identified for this AQA. This AQA has therefore utilised the background concentrations of pollutants provided by Defra to describe the baseline air quality of the Proposed Installation.

Defra Background maps

In the absence of the Proposed Installation, it is expected there would be a gradual decrease in current baseline concentrations as a result of expected improvements in air quality. Defra estimates background pollutant concentrations on a 1 km² grid for the UK for seven of the main pollutants, including NO_x, NO₂, PM₁₀ and PM_{2.5}. Background concentrations of NO_x, NO₂, PM₁₀ and PM_{2.5} are reported in **Table 4.1** for future years. These background concentrations are reported for the centre of the Site. The background concentrations show a general downward trend in pollutant concentrations for future years.

Table 4.1 Annual mean pollutant background concentrations (µg m⁻³)

Pollutant	2022	2023	2024
NO _x	26.7	25.9	24.9
NO ₂	18.6	18.1	17.5
PM ₁₀	14.1	13.9	13.8
PM _{2.5}	9.6	9.5	9.4

Background annual mean concentrations of pollutant at centre of grid square 470500,105500. 2018 base year (µg m⁻³)

Ecological receptors

In regard to baseline ambient concentrations and deposition levels, over the identified ecological receptors, data were extracted from the APIS) APIS¹².website and the Defra background maps. The pollutants of concern were NO_x, NH₃, SO₂ and their contribution to nitrogen and acid deposition. The data applied are presented in **Table 4.2**.

¹² APIS, 2022. <http://www.apis.ac.uk/search-location>. Accessed: 25th March 2022.

Table 4.2 Background data for ecological receptors

ID	Background NO _x (µg m ⁻³)	Nitrogen deposition (kgN/ha/yr)	Acidification load (keq/ha/yr)	
			N	S
E01	26.7	22.96	1.64	0.31
E02	21.9	13.86	0.99	0.27
E03	25.0	13.70	1.00	0.30
E04	21.9	13.70	1.00	0.30
E05	21.9	13.70	1.00	0.30
E06	25.7	12.90	0.90	0.30
E07	31.4	11.57	0.83	0.16
E08	21.9	11.57	0.00	0.00
E09	22.2	13.58	0.97	0.18
E10	22.2	13.58	0.97	0.18
E11	25.7	13.58	0.97	0.18
E12	25.0	13.58	0.97	0.18
E13	26.2	13.58	0.97	0.18
E14	26.7	13.58	0.97	0.18
E15	25.7	13.58	0.97	0.18
E16	18.6	13.58	0.97	0.18
E17	33.7	13.58	0.97	0.18
E18	25.1	13.58	0.97	0.18
E19	31.4	13.58	0.97	0.18
E20	26.7	13.58	0.97	0.18
E21	26.7	13.58	0.97	0.18
E22	26.7	22.96	1.64	0.21
E23	26.7	22.96	1.64	0.21
E24	26.7	22.96	1.64	0.21
E25	26.7	22.96	1.64	0.21
E26	26.7	22.96	1.64	0.21
E27	26.7	22.96	1.64	0.21

ID	Background NO _x (µg m ⁻³)	Nitrogen deposition (kgN/ha/yr)	Acidification load (keq/ha/yr)	
			N	S
E28	26.7	22.96	1.64	0.21
E29	26.7	22.96	1.64	0.21
E30	26.7	22.96	1.64	0.21
E31	26.7	22.96	1.64	0.21
E32	26.7	22.96	1.64	0.21
E33	26.7	22.96	1.64	0.21
E34	26.7	22.96	1.64	0.21
E35	26.7	13.58	0.97	0.18
E36	26.7	13.58	0.97	0.18
E37	26.7	13.58	0.97	0.18
E38	26.7	22.96	1.64	0.21
E39	26.7	24.36	1.74	0.22
E40	26.7	24.36	1.74	0.22
E41	26.7	24.36	1.74	0.22
E42	26.7	22.96	1.64	0.21
E43	26.7	22.96	1.64	0.21
E44	26.7	22.96	1.64	0.21
E45	26.7	22.96	1.64	0.21
E46	26.7	22.96	1.64	0.21
E47	26.7	22.96	1.64	0.21
E48	26.7	22.96	1.64	0.21
E49	26.7	22.96	1.64	0.21

5. Assessment of impacts

5.1 Human health effects

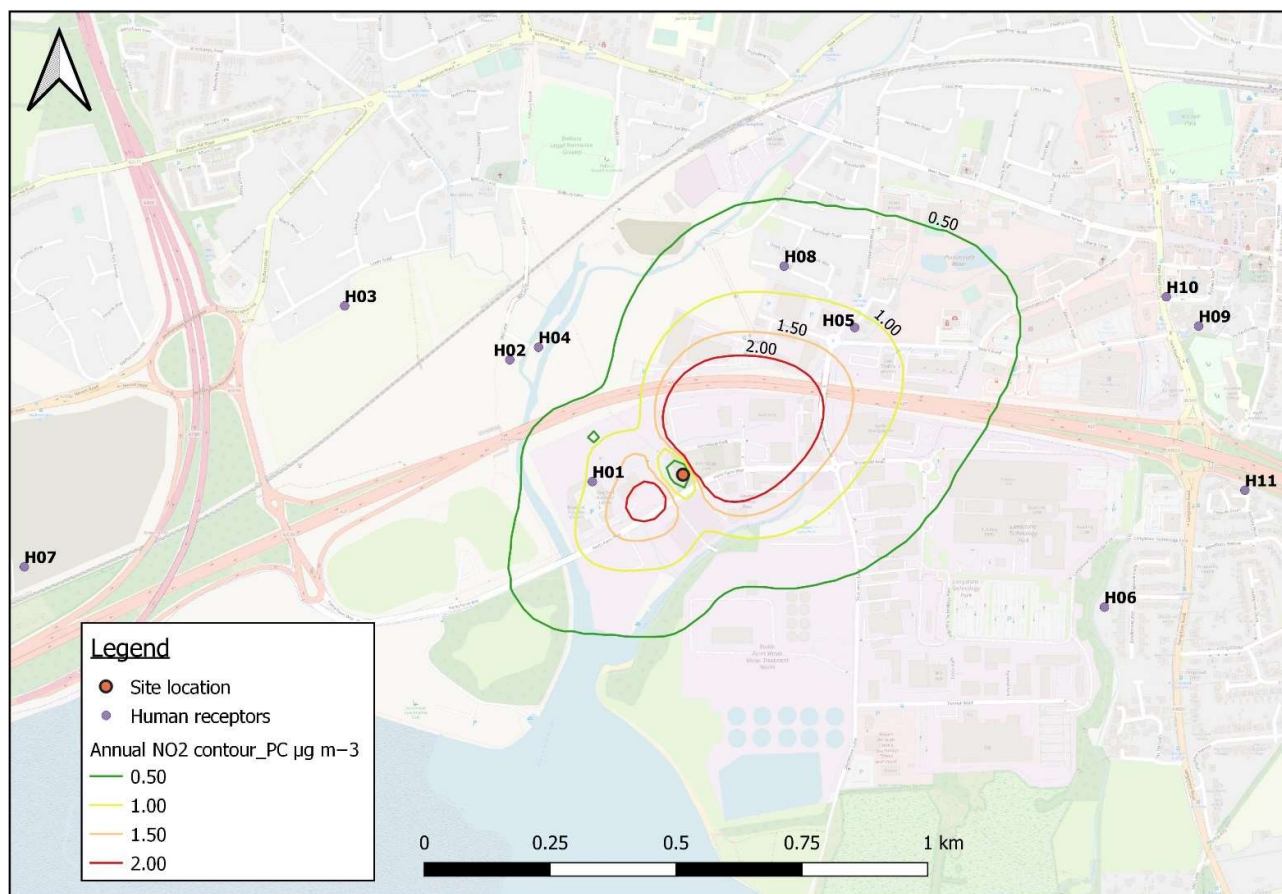
Annual mean nitrogen dioxide (NO₂)

Predicted concentrations of annual mean NO₂ are given in **Table 5.1**. The contour plot of the annual mean NO₂ PC is given in **Figure 5.1**. These concentrations tables assume the installation operates for up to a notional 1,500 hours a year.

Table 5.1 Annual mean NO₂ impacts

Receptor	AQAL (µg m ⁻³)	PC (µg m ⁻³)	PEC (µg m ⁻³)	PC (% of AQAL)	PEC (% of AQAL)
H01	40	1.17	22.04	2.9%	55.1%
H02	40	0.27	16.61	0.7%	41.5%
H03	40	0.11	18.06	0.3%	45.2%
H04	40	0.30	16.84	0.8%	42.1%
H05	40	1.13	17.48	2.8%	43.7%
H06	40	0.26	18.52	0.6%	46.3%
H07	40	0.07	21.86	0.2%	54.7%
H08	40	0.79	17.22	2.0%	43.0%
H09	40	0.24	16.33	0.6%	40.8%
H10	40	0.27	16.37	0.7%	40.9%
H11	40	0.22	18.47	0.5%	46.2%

The long-term human receptor experiencing the highest PEC is H01 approximately 180 m to west of the site. Assuming the installation operates for a maximum of 1500 hours per year, concentrations at all receptors are within the AQAL. When operating at 1500 hours per year, impacts from the PC predicted at receptor H01 are reported to be 2.9% of the long-term AQALs, and impacts from the PEC are reported to be 55.1% of the long-term AQAL. According to the IAQM & EPUK impact descriptors reported in **Table 3.3**, this impact is negligible and therefore not significant.

Figure 5.1 Annual mean NO₂ PC contour

Hourly mean nitrogen dioxide (NO₂)

Predicted concentrations of 99.79th percentile 1-hour mean NO₂ are given in are given in **Table 5.2**. The below table assumes that the engines operate 1,500 hours per year.

Of the receptor locations where the EA's criteria¹⁰ is exceeded (PC > 10% of AQAL), there is only one receptor location where the PEC also exceeds the AQAL. This is predicted at receptor H01. H01 is approximately 180 m to west of the site. The short term PECs predicted here assume that the neighbouring facility operated every single hour of the year when in reality it is allowed to operate for 500 hours per year. Since the installation will operate for far fewer hours than modelled, the likelihood that it will be running during those hours of the year that produce the highest concentrations is very low. Therefore the PECs are overly conservative and not representative of actual concentrations.

The PEC exceedances are driven by the neighbouring facility as demonstrated by probability calculation, following the EA guidance, undertaken to ascertain the likelihood of the hourly NO₂ objective being exceeded. The probability calculation, following the EA's guidance¹⁰, shows that if the installation operates for 5840 hours per year, the probability of an exceedance of the AQAL is 0, equivalent to none in 20 years occurrence. EA guidance¹⁰ suggests that if the likelihood of an exceedance is less than a 1 in 20 year occurrence, the impact is likely to be acceptable for

permitting. Therefore, if the hours of operation are fewer than 5,840 hours per year, this will meet the conditions for permitting. Therefore, the assessment concludes that impacts on short-term NO₂ concentrations are no significant.

Table 5.2 99.79 percentile 1-hour mean NO₂ impacts

Receptor	AQAL ($\mu\text{g m}^{-3}$)	PC ($\mu\text{g m}^{-3}$)	PEC ($\mu\text{g m}^{-3}$)	PC (% of AQAL)	PEC (% of AQAL)
H01	200	56.94	367.65	28.5%	183.8%
H02	200	20.72	145.84	10.4%	72.9%
H03	200	9.60	74.19	4.8%	37.1%
H04	200	22.85	149.94	11.4%	75.0%
H05	200	20.31	74.58	10.2%	37.3%
H06	200	11.65	71.76	5.8%	35.9%
H07	200	7.32	69.83	3.7%	34.9%
H08	200	18.76	72.24	9.4%	36.1%
H09	200	8.63	57.24	4.3%	28.6%
H10	200	8.35	58.34	4.2%	29.2%
H11	200	9.33	65.37	4.7%	32.7%

5.2 Ecological impacts

Daily mean nitrogen oxide (NO_x)

Predicted daily mean NO_x concentrations at sensitive ecological receptors are presented in **Table 5.3**. These concentrations assume the installation operates for up to a notional 1,500 hours a year. Where there are multiple receptor points for one designated site or SWBGS site, the receptor point with the highest predicted PC concentration is reported.

Table 5.3 Daily mean NO_x impacts

Receptor ID	Description	AQAL ($\mu\text{g m}^{-3}$)	PC ($\mu\text{g m}^{-3}$)	PEC ($\mu\text{g m}^{-3}$)	PC (% of AQAL)	PEC (% of AQAL)
E01	Ancient Woodland	200	0.04	25.07	0.1%	83.6%
E02	Chichester and Langstone Harbours Ramsar/SPA, Farlington Marshes LNR	200	0.71	52.99	0.4%	26.5%
E03	Chichester and Langstone Harbours Ramsar/SPA, Solent Maritime SAC	200	1.05	56.92	0.5%	28.5%

Receptor ID	Description	AQAL ($\mu\text{g m}^{-3}$)	PC ($\mu\text{g m}^{-3}$)	PEC ($\mu\text{g m}^{-3}$)	PC (% of AQAL)	PEC (% of AQAL)
E04	Chichester and Langstone Harbours Ramsar/SPA	200	3.65	65.23	1.8%	32.6%
E05	Chichester and Langstone Harbours Ramsar/SPA, Solent Maritime SAC	200	2.26	57.93	1.1%	29.0%
E06	Portsmouth Harbour Ramsar/SPA	200	1.29	42.02	0.6%	21.0%
E07	Perennial vegetation of stony banks feature of Solent Maritime SAC	200	0.21	68.35	0.1%	34.2%
E08	Atlantic salt meadows (coastal saltmarsh) feature of Solent Maritime SAC	200	0.57	52.22	0.3%	26.1%
E12	H90 Classification primary support area	200	1.26	68.01	0.6%	34.0%
E22	H29 Candidate site	200	15.45	86.03	7.7%	43.0%
E25	H07C Candidate site	200	2.57	61.55	1.3%	30.8%
E29	H07B Candidate site	200	9.40	81.93	4.7%	41.0%
E36	H08 Candidate site	200	4.30	68.55	2.1%	34.3%
E39	H07A Candidate site	200	6.77	75.40	3.4%	37.7%
E42	H09 Candidate site	200	3.52	75.04	1.8%	37.5%
E49	H28 Candidate site	200	33.32	139.49	16.7%	69.7%

All sensitive receptors representative of sites which have statutory designation (E01- E08) satisfy the short-term criteria provided by the EA¹⁰ (PC < 10% of AQAL), therefore the impacts predicted at these receptors are screened out as insignificant.

There is one exceedance of the EA¹⁰'s short-term criteria (PC < 10% of AQAL) and this is predicted at receptor E49. E49 is representative of the H28 SWBGS candidate site. As discussed in **Table 5.5**, the SWBGS sites have not received formal designation, but for this AQA the SWBGS sites are being assessed against the criteria for both statutory and local designation. If one were to assess E49 (H28 SWBGS site) against the criteria for statutory designation, this impact equates to a moderate impact of significance (**Table 3.3**). Considering E49 in the context of a local designation, the impact predicted at this receptor is less than 100% and is therefore insignificant.

Annual mean nitrogen oxide (NO_x)

Predicted concentrations of annual mean NO_x are given in are given in **Table 5.4** Error! Reference source not found.. These concentrations assume the installation operates for up to a notional 1,500 hours a year. Where there are multiple receptor points for one designated site or SWBGS site, the receptor point with the highest predicted PC concentration is reported.

Table 5.4 Annual mean NO_x impacts

Receptor ID	Description	AQAL ($\mu\text{g m}^{-3}$)	PC ($\mu\text{g m}^{-3}$)	PEC ($\mu\text{g m}^{-3}$)	PC (% of AQAL)	PEC (% of AQAL)
E01	Ancient Woodland	30	0.04	25.07	0.1%	83.6%
E02	Chichester and Langstone Harbours Ramsar/SPA, Farlington Marshes LNR	30	0.08	26.34	0.3%	87.8%
E03	Chichester and Langstone Harbours Ramsar/SPA, Solent Maritime SAC	30	0.47	27.48	1.6%	91.6%
E04	Chichester and Langstone Harbours Ramsar/SPA	30	0.20	26.08	0.7%	86.9%
E05	Chichester and Langstone Harbours Ramsar/SPA, Solent Maritime SAC	30	0.13	18.79	0.4%	62.6%
E06	Portsmouth Harbour Ramsar/SPA	30	0.02	33.76	0.1%	112.5%
E07	Perennial vegetation of stony banks feature of Solent Maritime SAC	30	0.06	25.24	0.2%	84.1%
E08	Atlantic salt meadows (coastal saltmarsh) feature of Solent Maritime SAC	30	0.11	31.58	0.4%	105.3%
E12	H130 Candidate site	30	1.55	29.06	5.2%	96.9%
E21	H90 Classification primary support area	30	0.31	27.22	1.0%	90.7%
E22	H29 Candidate site	30	0.22	27.08	0.7%	90.3%
E25	H07C Candidate site	30	1.30	28.89	4.3%	96.3%
E29	H07B Candidate site	30	0.52	27.72	1.7%	92.4%
E37	H08 Candidate site	30	0.59	27.99	2.0%	93.3%
E39	H07A Candidate site	30	0.31	32.01	1.0%	106.7%
E43	H09 Candidate site	30	2.47	36.77	8.2%	122.6%
E48	H28 Candidate site	30	0.21	27.08	0.7%	90.3%

The annual mean NO_x PC from the proposed installation exceeds the 1% screening criteria at receptor E03 (Chichester and Langstone Harbours Ramsar and SPA, Langston Harbour SSSI and Solent Maritime SAC). The PEC at E03 is predicted below the AQAL. Receptor E03 is at the northern edge of Chichester and Langstone Harbours Ramsar and SPA, Langston Harbour SSSI and Solent Maritime SAC and the point from all four designations that is closest to the proposed installation. The PC is likely to remain below the 1% criterion throughout the majority of the area covered by these biodiversity sites, including as modelled at E02 and E05.

Of the SWBGS candidate sites, there are exceedances of the EA's criteria¹⁰ for statutory designated sites (PC < 1% of AQAL) predicted at receptors E12, E25, E29, E37 and E43. The PECs at receptor points E12, E25, E29 and E37 are above 70% of the AQAL but there are no exceedances predicted. When assessing against local designation criteria, the PC predicted at E12, E25, E29 and E37 are below the AQAL, therefore the impacts are screened out as insignificant (PC < 100% of AQAL).

When operating at 1500 hours per year, impacts from the PC at E43 are reported to be 8.2% of the long-term AQAL, and impacts from the PEC are reported to be 122.6% of the long-term AQAL. Therefore, impacts cannot be screened out as insignificant when assessed against the criteria for statutory designated sites. However the PC at E43 can be screened out as insignificant when assessing against the EA's criteria¹⁰ for locally designated sites (PC < 100% of AQAL).

Figure 5.3 presents a contour of NO_x PC with 1500 hours operation, showing the 0.3 µg m⁻³ contour corresponding to the 1% criterion. This exceedance is overlaid on the boundary of Chichester and Langstone Harbours Ramsar and SPA, Solent Maritime SAC and Langstone Harbour SSSI and the SWBGS candidate sites H09 (receptor E09) and H130 (receptor E10). The overlap represents the region where the impacts cannot be screened out as insignificant. **Table 5.5** summaries these biodiversity sites.

As reported in **Table 5.5** the SWBGS sites are being considered in this assessment under the context of their importance to the surrounding SPA. For this reason, the area of the SWBGS sites has been added to the area of the Chichester and Langstone Harbours Ramsar and SPA area, to allow for a holistic and complete consideration of impacts on the Chichester and Langstone Harbours Ramsar and SPA.

The area of these designated sites over which the PC is predicted to exceed the 1% assessment criterion is approximately 9 hectares, representing a very small proportion of these designated sites: ~0.2% (SPA and Ramsar, including area of the H09, H130, H07B, H07C and H08 SWBGS sites), ~0.2% (SAC) and ~0.4% (SSSI). Based on the MAGIC website and aerial imagery, the habitats within this area are substantially intertidal mud and intertidal mixed sediments, with small isolated fragments of saltmarsh. These habitats are supporting features of the SPA and Ramsar Site, providing foraging habitats for the associated bird species/assemblages. These habitats are also one of the qualifying features of the SAC and a reason for the notification of the SSSI. The area of these habitats over which the exceedance is predicted to occur is a tiny proportion of the available mudflat habitat within the SPA/Ramsar/SAC/SSSI and a smaller proportion of the mudflat habitat within the wider Chichester and Langstone Harbour and Portsmouth Harbour area.

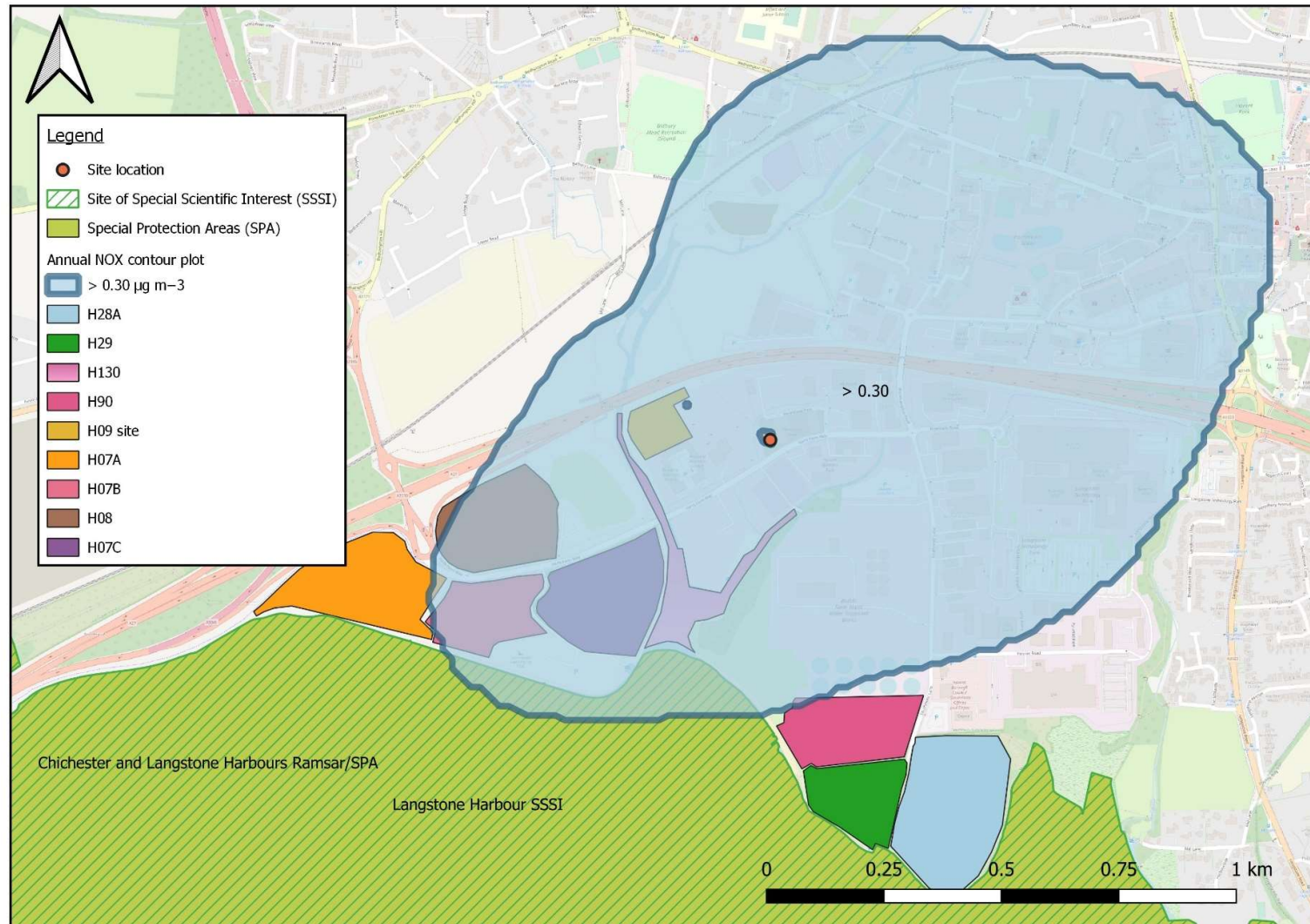
Figure 5.3 Annual mean NO_x PC contour

Table 5.5 Biodiversity sites within the Zone of Influence

Designation (area)	Reasons for designation (summary)
Chichester and Langstone Harbour SPA (5810.65ha)	Qualifying features include <i>waterbird assemblages</i> along with 18 bird species (bar-tailed godwit, common tern, curlew, dark-bellied brent goose, dunlin, grey plover, little tern, pintail, red-breasted merganser, redshank, ringed plover, sanderling, sandwich tern, shelduck, shoveler, teal, turnstone and wigeon), all of which apart from common tern, little tern and sandwich tern are non-breeding¹³. Conservation objectives for the site are to maintain or restore: extent and distribution of habitats of the qualifying features; structure and function of the habitats of the qualifying features; supporting processes on which the habitats of the qualifying features rely; populations of each of the qualifying features; and distribution of qualifying features. Natural England (2020¹⁴) provides information on site targets for each qualifying feature. All 19 qualifying features are given the target attribute of '<i>supporting habitat: air quality</i>' with the target to '<i>maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values</i>'. This has been included to maintain the vegetation structure and composition of the habitats that support the qualifying species.
Chichester and Langstone Harbour Ramsar (5749ha)	Two large estuarine basins which include extensive intertidal mudflats, saltmarsh, sand and shingle spits and sand dunes supporting beds of <i>Zostera</i> and <i>Enteromorpha</i>, with a more varied community at higher levels. Peak counts of wintering water birds regularly exceed 20,000, including internationally important numbers. Assemblages of international importance with peak counts in winter of 76480 waterfowl (5 year peak mean 1998/99-2002/2003) and also species/populations occurring at levels of international importance (black-tailed godwit, common redshank, dark-bellied brent goose, common shelduck, grey plover and dunlin¹⁵). Conservation objectives for the site include maintaining the internationally important wetlands characteristic of the Atlantic biogeographical region in favourable condition, as well as maintaining the status of the wetland in regularly supporting 20,000 waterfowl. Intertidal mudflats and sandflats are habitats particularly relevant to these objectives¹⁶. Air quality is not specifically listed as a threat, although contamination is noted, including nutrient enrichment: <i>nutrient enrichment can adversely affect the feeding habitats of wintering waterfowl and assemblage populations and because of this, the high levels of nutrients in Langstone Harbour and the extensive use of its intertidal areas and shallow coastal waters for feeding give cause for concern</i>. Airborne NOx could potentially be considered one such source of nutrient enrichment which may have the potential to affect the feeding habitats of wintering waterfowl through alteration to botanical composition or structure or through effects of airborne NOx on prey species of the bird species listed.
Solent Maritime SAC (11243.12)	Habitats that are a primary reason for site selection: • Estuaries • Spartina swards (<i>Spartinion maritimae</i>) • Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)

¹³ Natural England (2019). European Site Conservation Objectives for Chichester and Langstone Harbours Special Protection Area Site Code: UK9011011. Version 3 – 21st February 2019.

¹⁴ Natural England (2020). Designated Sites View:

<https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK9011011&SiteName=&SiteNameDisplay=Chichester+and+Langstone+Harbours+SPA&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=18>. Accessed 21st May 2020.

¹⁵ Information Sheet on Ramsar Wetlands (RIS). Ramsar Information Sheet: UK11013.

¹⁶ English Nature (2001). English Nature's advice for the Solent European marine site given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994.

Designation (area)	Reasons for designation (summary)
	Qualifying features (habitats), not a primary reason for site selection: • Sandbanks which are slightly covered by sea water all the time • Mudflats and sandflats not covered by seawater at low tide • Coastal lagoons (Priority feature) • Annual vegetation of drift lines • Perennial vegetation of stony banks • Salicornia and other annuals colonizing mud and sand • Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ("white dunes") Qualifying feature (species), not a primary reason for site selection: Desmoulin's whorl snail (<i>Vertigo moulinsiana</i>) Air borne pollutants are not listed as one of the most important impacts on this site. The Conservation Objectives are maintain or restore: extent and distribution of qualifying natural habitats and habitats of qualifying species; structure and function (including typical species) of qualifying natural habitats; structure and function of the habitats of qualifying species; supporting processes on which qualifying natural habitats and the habitats of qualifying species rely; populations of qualifying species; and distribution of qualifying species.
Langstone Harbour SSSI (2,069.4 ha)	Extensive mudflats; saltmarsh and cord-grass marsh. Internationally important, supporting high densities of intertidal invertebrates and large populations of migrant and overwintering waders and wildfowl, dependent on them and on extensive eelgrass (<i>Zostera angustifolia</i> and <i>Z. noltii</i>) beds. An important intertidal summer and autumn assembly ground for waders during the moult and as a post-moult wintering ground. Includes Farlington Marshes - grassland and marsh on reclaimed tidal silt protected by a sea wall; and a similar smaller area at Southmoor in the north-east of the harbour. Brackish, marsh, fresh marsh, lagoon with reed beds, <i>Agrostis stolonifera</i> grassland and scrub. Vital high water wader roost and feeding ground for Brent geese.
SWBGS sites	Brent Goose and Wader bird populations are species of international importance, however despite this, brent goose feeding sites and wader rooster sites around the Solent fall outside of statutory nature conservation site boundaries¹⁷. To comply with European legislation protecting migratory coastal bird populations, the sites identified as part of the SWBGS must be protected. The strategy reports that it must be recognised that the feeding and roosting sites supporting the Solent's designated wader and brent geese populations are important for the integrity of the internationally important sites. The sites fall outside of the statutory nature conservation sites, although they are considered important habitat for supporting the wintering bird populations Error! Bookmark not defined. For this reason, the SWBGS sites considered in this assessment have been assessed against the criteria for local designations and statutory designations. <u>Candidate site H130</u> Review of the site through Magic reveals that this site falls into the category of Coastal Mudflats. CIEEM advice on marine systems states that they are nitrogen limited, however removal of atmospheric nitrogen inputs may have a negligible effect⁹. This is since the scale of nitrogen inputs from marine and riverine sources is expected to be much larger than atmospheric nitrogen inputs. APIS reports that "Overall, N deposition [from the atmosphere] is likely to be of low importance for these systems as inputs are probably significantly below the large nutrient loadings from river and tidal inputs"

¹⁷ Solent Waders and Brent Goose Steering Group, 2020. *Solent Waders and Brent Goose Strategy*. [Online]. Available from: [solent-waders-brent-geese-strategy-2020.pdf \(wordpress.com\)](https://www.solent-waders-brent-geese-strategy-2020.pdf). [Accessed 28th March 2022].

Designation (area)	Reasons for designation (summary)
	<u>Candidate site's H09, H07A, H07B, H07C, H28, H29 and H90</u> Review of these sites through Magic reveals that there are areas which include broadleaved woodland, which is a habitat of principal importance.

Acid deposition

The impacts of acid deposition at all ecological receptors have been assessed and the results are presented below in **Table 5.6**. Where there are multiple receptor points for one designated site or SWBGS site, the receptor point with the highest predicted PC concentration is reported. The acid deposition PC is predicted to be below the EAs screening criteria (PC <1% of CL) at all ecological receptors except E43. E43 is relates to the H09 SWBGS candidate site. H09 can be considered a local nature site, therefore following the EAs screening criteria for local nature sites, this impact can be screened out as insignificant. Impacts from acid deposition for all remaining ecological receptors are predicted to be insignificant.

Table 5.6 Acid deposition

Receptor	CL MaxS (kg N ha ⁻¹ y ⁻¹)	CL MinN (kg N ha ⁻¹ y ⁻¹)	CLMaxN (kg N ha ⁻¹ y ⁻¹)	PC (kg N ha ⁻¹ y ⁻¹)	PC (% of CL)
E01	1.838	0.357	2.195	0.0006	0.0
E02	0.24	0.321	0.561	0.0006	0.1
E03	0.87	0.223	1.123	0.0034	0.3
E04	0.87	0.223	1.123	0.0015	0.1
E05	0.87	0.223	1.123	0.0009	0.1
E07	0.356	0.672	1.323	0.0004	0.0
E19	4	1.071	5.071	0.0020	0.0
E22	1.846	0.357	2.203	0.0031	0.1
E25	1.846	0.357	2.203	0.0187	0.9
E38	1.846	0.357	2.203	0.0079	0.4
E39	1.834	0.357	2.191	0.0045	0.2

Receptor	CL MaxS (kg N ha ⁻¹ y ⁻¹)	CL MinN (kg N ha ⁻¹ y ⁻¹)	CLMaxN (kg N ha ⁻¹ y ⁻¹)	PC (kg N ha ⁻¹ y ⁻¹)	PC (% of CL)
E43	1.846	0.357	2.203	0.0356	1.6

Nitrogen deposition

Predicted nitrogen deposition values are given in **Table 5.7**, these values relate to the Proposed Installation operating at a maximum of 1,500 hours. Where there are multiple receptor points for one designated site or SWBGS site, the receptor point with the highest predicted PC concentration is reported in **Table 5.7**.

Receptor points relating to the H130 SWBGS candidate site have not been assessed for nitrogen deposition because this site not considered sensitive. This is due to confirmation from an ecologist that additional nitrogen deposition would be of low importance for this site. More information regarding the sensitivity of this site to nitrogen deposition is provided in Error! Reference source not found..

Predicted nitrogen deposition values are below the respective site CL at all receptor locations. The PC concentrations reported at receptor points E25 and E38 are above the EA screening criteria (i.e. PC < 1% AQAL). E25 relates to the H07C SWBGS site and the PC is predicted to reach 2.6% of the AQAL. E38 relates to the H08 SWBGS candidate site, the PC emission at this site is predicted to be 1.1% of the critical load of the site. If E25 and E38 had formal statutory designation, then the impacts could not be screened as insignificant using the EA criteria. However, these sites are not formally designated but a part of the SWBGS, and impacts can be assessed according to the guidance set out by the EA¹⁰ for local nature sites. Following this guidance, the impacts predicted at E25 and E38 can be screened out as insignificant.

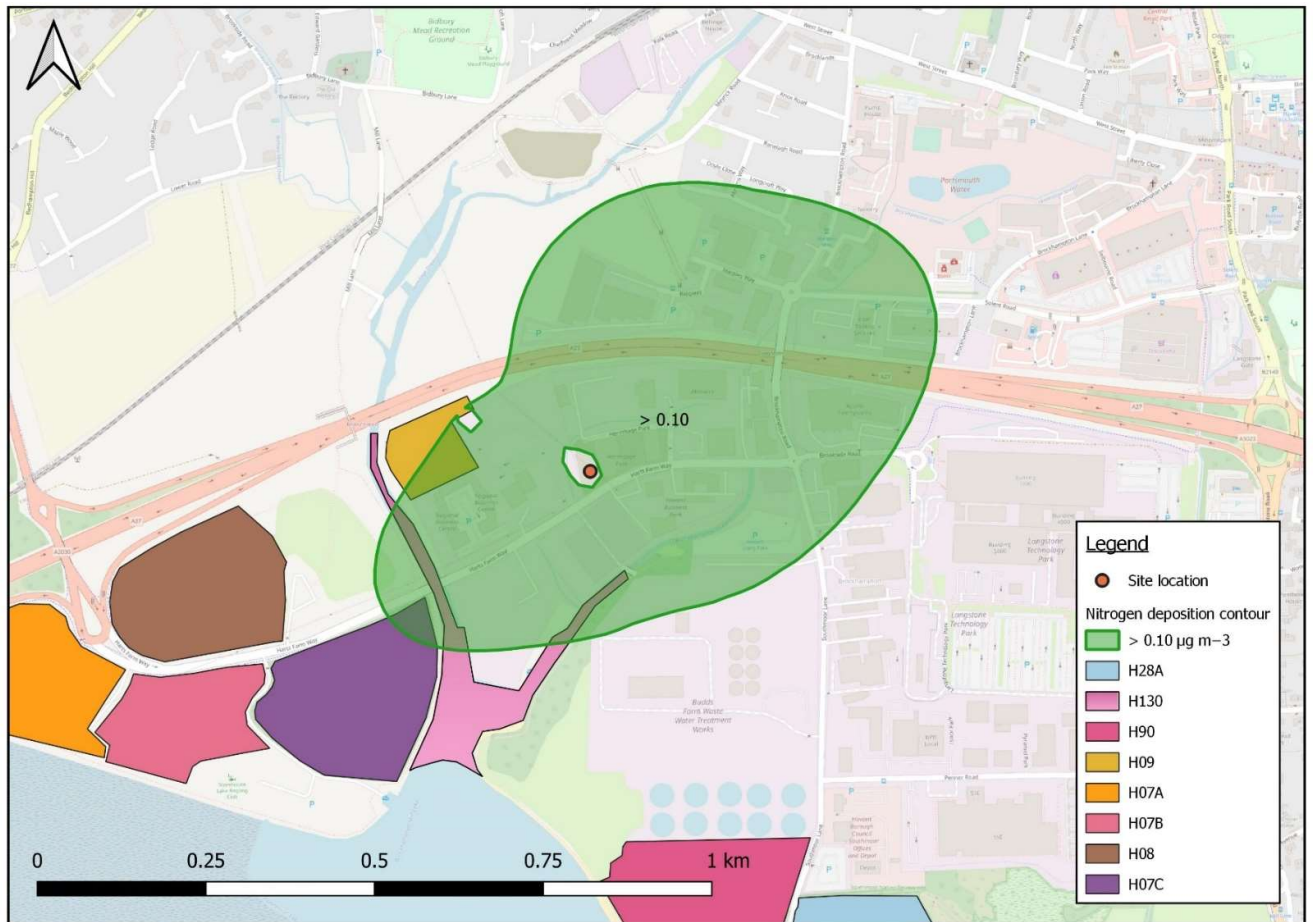
Figure 4.6 presents the 0.1 µg m⁻³ deposition PC contour, corresponding to the 1% of the critical load assuming the plant operates for 1500 hours, overlaid on the SWDGS candidate sites. The ecological receptors modelled report two different minimum CLs. The lower CL of 10 kg N ha⁻¹ y⁻¹ has been used for the contour presented in **Figure 4.6**. It should be noted that this is a minimum CL and if the maximum CL was considered, the area of exceedance would be halved. This is since for those sites which report a minimum CL of 10 kg N ha⁻¹ y⁻¹, the upper CL reported for these sites is 20 kg N ha⁻¹ y⁻¹.

The contour overlaps with two SWBGS sites which have been assessed as sensitive towards nitrogen deposition impacts. These sites are H07C and H09. The area of the H09 SWBGS candidate site which the nitrogen deposition level is above 1% of the CL is 0.5 ha, representing 43% of the area of the site. This site is representative of a car park, with small areas of the perimeter containing grassland. It is again worth noting that the SWBGS sites such as H09 are not formally designated. The maximum PC predicted at H09 is below 100% of the CL, this satisfies the EAs criteria for an impact at a local nature site to be screened out as insignificant. The area of the H07C SWBGS candidate site which the nitrogen deposition level is above 1% of the CL is 0.3 ha, representing 5.5% of the area of the site and impacts can be screened out as insignificant.

Table 5.7 Nitrogen deposition

Receptor	Minimum Critical Load (kg N ha ⁻¹ y ⁻¹)	PC (kg N ha ⁻¹ y ⁻¹)	PEC (kg N ha ⁻¹ y ⁻¹)	PC (% of critical Load)	PEC (% of critical load)
E01	10	0.01	22.97	0.1%	229.7%
E02	10	0.01	13.88	0.1%	138.8%
E03	20	0.05	13.78	0.2%	68.9%
E04	20	0.02	13.73	0.1%	68.7%
E05	20	0.01	13.72	0.1%	68.6%
E06	20	0.00	12.90	0.0%	64.5%
E07	10	0.01	11.58	0.1%	115.8%
E08	20	0.01	11.59	0.1%	58.0%
E19	20	0.03	13.81	0.1%	69.1%
E22	10	0.04	23.03	0.4%	230.3%
E25	10	0.26	23.39	2.6%	233.9%
E29	10	0.10	23.16	1.0%	231.6%
E38	10	0.11	23.18	1.1%	231.8%
E39	10	0.06	24.49	0.6%	244.9%
E43	10	0.50	24.98	5.0%	249.8%
E46	10	0.04	23.02	0.4%	230.2%

Figure 5.2 Nitrogen deposition contour plot



6. Conclusions

Human health impacts

Human health impacts arising from the NO₂ annual and hourly mean have been assessed. Human health impacts from predicted annual mean NO₂ emissions are negligible, there is one exceedance of the EAs criteria (PC > 10% of AQAL), however this impact has been screened out as insignificant through following the impact descriptors reported by the IAQM & EPUK (**Table 3.3**). There is a potential impact predicted from the hourly NO₂ mean at H01. A probability calculation has been carried out to reveal that if the Proposed Installation were to operate for 5,840 hours per year, the likelihood of an exceedance of the AQAL occurring is 0. This is equivalent to a none in 20 year and therefore impacts are negligible.

Ecological impacts

The impacts from daily mean NO_x emissions are negligible at all ecological receptor points relating to sites with statutory designation. The daily mean NO_x impact at H28 cannot be screened out as insignificant if assessed against criteria for statutory designation, but as discussed in **Table 5.5** this site has not obtained formal designation and can therefore be considered as a local nature site. Assessing against the EAs criteria for local sites concludes this impact as insignificant.

The annual mean NO_x PC from the proposed installation, operated at 1,500 hours per year, is predicted to exceed the 1% assessment criteria at five of the SWBGS sites assessed (receptors E12, E25, E29, E37 and E43), and at the closest point on Chichester and Langstone Harbours Ramsar and SPA, Langston Harbour SSSI and Solent Maritime SAC. Although intertidal mudflat habitats are supporting features of the SPA and Ramsar Site and the SWBGS sites, one of the qualifying features of the SAC and a reason for the notification of the SSSI, a small increase in NO_x is predicted to affect a small proportion of the area covered by these biodiversity sites: ~0.2% (SPA and Ramsar and SWBGS sites), ~0.2% (SAC) and ~0.4% (SSSI), and a small proportion of the available mudflat habitat within these sites and surrounding areas. Therefore, no likely significant effects on these biodiversity sites are predicted, also recognising that mudflats are subject to frequent tidal inundation and are likely to be more resilient to the influence of small changes in aerial NO_x emissions compared to other habitat types to which the same Critical Level (30 µg m⁻³) applies.

Impacts from acid deposition are predicted to be insignificant at all receptor locations except for E43. E43 relates to SWBGS candidate site H09 which does not hold statutory designation (**Table 5.5**). The impact from acid deposition at E43 is insignificant when assessing as a local nature site. The PC at receptor locations E25 and E38 are predicted to exceed 1% of the CL. Receptor locations E25 and E38 relate to the H07C and H08 SWBGS candidate sites respectively. The area of which each site occupies has been identified to include some broadleaved woodland. This is a habitat of principal importance and therefore sensitive to nitrogen deposition. The background nitrogen deposition reported at each site at 22.96 kg N ha⁻¹ yr⁻¹ already exceeds the 10 kg N ha⁻¹ yr⁻¹ critical level. This can be owed to the position of the site's being immediately adjacent to the A27. Therefore, the additional deposition reported at these site's is not likely to be significant since the critical load is exceeded without this addition from the Proposed Installation. Additionally,

impacts at these sites have been screened out as insignificant when assessed against the EA's criteria¹⁰ for local nature sites.

wood.