

Appendix 5.4: Assessment of Ecological Impacts

The following European designated nature conservation sites, within 10 km of the Application Site, have been identified:

- The Swale Special Protection Area (SPA);
- The Swale Ramsar;
- Medway Estuary and Marshes SPA;
- Medway Estuary and Marshes Ramsar;
- Thames Estuary and Marshes SPA;
- Thames Estuary and Marshes Ramsar;
- Queensdown Warren Special Area of Conservation (SAC); and
- Outer Thames Estuary SPA.

The following nationally designated sites, within 2 km of the Application Site, have also been identified:

- The Swale SSSI;
- Milton Creek LWS; and
- Elmley NNR.

For information, the Medway Estuary and Marshes SSSI is 2.9 km from the Application Site (i.e. more than 2 km away) and has been excluded from the assessment. The Swale Marine Conservation Zone (MCZ) has also been excluded as there is no requirement to assess air quality impacts at waterbodies/MCZs.

Approach

NO_x concentrations have been predicted using the same model as used in the assessment of impacts at human-health receptors. Modelling has been undertaken for a grid of receptor points, with a grid spacing of 200 m, across each identified nature conservation site. The receptor grid points have been modelled at ground level. The maximum PC for K4 at each site and for all the meteorological datasets has been identified and is presented in this Appendix.

Modelling has also been undertaken to determine the total PC with K2, K3 and K4 operating concurrently. The PC for K2, K3 and K4 has been added to the ambient concentration to determine a total cumulative PEC.

Critical Levels

Critical levels are maximum atmospheric concentrations of pollutants for the protection of vegetation and ecosystems and are specified within relevant European air quality directives and corresponding UK air quality regulations. PCs and, if appropriate, PECs of NO_x have been calculated for comparison with the 30

$\mu\text{g.m}^{-3}$ critical level. Background NO_x concentrations at each designated site have been derived from the UK Air Pollution Information System (APIS) database [1].

Critical Loads

Critical loads refer to the quantity of pollutant deposited, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. Nutrient nitrogen deposition and acid deposition are considered in this Appendix.

Critical Loads – Nutrient N Deposition

Percentage contributions to nutrient nitrogen deposition have been derived from the modelled NO_x concentrations. Deposition rates have been calculated using empirical methods recommended by the Environment Agency, as follows:

1. The dry deposition flux ($\mu\text{g.m}^{-2}.\text{s}^{-1}$) has been calculated by multiplying the ground level NO_2 concentrations ($\mu\text{g.m}^{-3}$) by the deposition velocity of 0.003 m.s^{-1} for forests/tall habitats and 0.0015 m.s^{-1} for grassland/short habitats.
2. Units of $\mu\text{g.m}^{-2}.\text{s}^{-1}$ have been converted to units of $\text{kg.ha}^{-1}.\text{year}^{-1}$ by multiplying the dry deposition flux by the standard conversion factor of 96 for NO_x .
3. Predicted contributions to nitrogen deposition have been calculated and compared with the relevant critical load range for the habitat types associated with the designated site. These have been derived from the APIS database.

Critical Loads – Acidification

The acid deposition rate, in equivalents $\text{keq.ha}^{-1}.\text{year}^{-1}$, has been calculated by multiplying the dry deposition flux ($\text{kg.ha}^{-1}.\text{year}^{-1}$) by a conversion factor of 0.071428 for N. This takes into account the degree to which a chemical species is acidifying, calculated as the proportion of N within the molecule.

Wet deposition in the near field is not significant compared with dry deposition for N [2] and therefore for the purposes of this assessment, wet deposition has not been considered.

Predicted contributions to acid deposition have been calculated and compared with the minimum critical load function for the habitat types associated with the designated site as derived from the APIS database.

Significance Criteria

Maximum PC and PEC of NO_x and N/acid deposition have been compared against the relevant EQS for the relevant habitat type/interest feature. The Environment Agency guidelines [3] state that:

"To screen out a PC for any substance so that you don't need to do any further assessment of it, the PC must meet both of the following criteria:

-the short-term PC is less than 10% of the short-term environmental standard

-the long-term PC is less than 1% of the long-term environmental standard

If you meet both of these criteria you don't need to do any further assessment of the substance.

If you don't meet them you need to carry out a second stage of screening to determine the impact of the PEC."

It continues by stating that:

"If your long-term PC is greater than 1% and your PEC is less than 70% of the long-term environmental standard, the emissions are insignificant – you don't need to assess them any further."

Where *potentially* significant impacts have been identified, the impacts have been passed to the project's ecologist to allow the significance of the likely effect to be determined.

Results

The ambient NO_x concentrations and existing deposition rates have been obtained from APIS. The highest deposition rates have been obtained taking into account the various habitats across the sites. The lowest critical loads for nitrogen deposition and the nitrogen component for acid deposition have been also obtained from APIS [4].

The maximum predicted annual-mean NO_x concentrations are compared with the critical level in Table C1. The maximum predicted nutrient N deposition rates are compared with the critical load in Table C2. The maximum predicted acid deposition rates are compared with the critical load function in Table C3.

For the Outer Thames Estuary SPA, APIS describes the habitat as *inshore sublittoral sediment*, which provides wintering for the red-throated diver. APIS states that this habitat is not sensitive to increases in NO_x concentrations, nitrogen deposition or acid deposition. As such, this site has not been considered further in the assessment.

Table C1 Predicted Annual-Mean NOx Concentrations at Designated Sites

Designated Site	CL ($\mu\text{g.m}^{-3}$)	PC ($\mu\text{g.m}^{-3}$)	PC/CL (%)
The Swale SPA/Ramsar/SSSI/Elmley NNR/Milton Creek LWS	30	0.7 (0.8)	2 (3)
Medway Estuary and Marshes SPA/Ramsar		0.1 (0.1)	0 (0)
Thames Estuary and Marshes SPA/Ramsar		0.1 (0.1)	0 (0)
Queendown Warren SAC		<0.05 (<0.05)	0 (0)

Notes:

The Swale SPA, Medway Estuary and Marshes SPA and Thames Estuary and Marshes SPA all cover the same geographical areas as the corresponding Ramsar and SSSI designations. Therefore, the values set out in Table C1 represent the NOx concentrations at all of these sites. Elmley NNR is within The Swale SPA/Ramsar/SSSI. APIS does not provide data for NNRs so the ambient concentrations and critical levels/loads have been assumed to be the same as The Swale SPA. Milton Creek LWS is an extension of the Swale SPA and the project's ecologist has advised that the same habitats, ambient concentrations and critical levels/loads apply. The Milton Creek LWS is mostly upwind of the Proposed Development; the nearest part of the LWS downwind of the site is to the east and covers a similar geographic area as the Swale SPA/Ramsar/SSSI. Milton Creek is a LWS and so the impact would only be significant if the PC exceeds 100% of the CL. Therefore considering the LWS to be the same as the Swale SPA/RAMSAR/SSSI is a conservative approach.

PCs shown are for stack location 1. PCs for stack location 2 are shown in brackets.

Consistent with the Institute of Air Quality Management's Position Statement "Use of a Criterion for the Determination of an Insignificant Effect of Air Quality Impacts on Sensitive Habitats" [5], the PC as a % of the CL has been rounded to the nearest integer.

Table C2 Predicted Nutrient N Deposition at Designated Sites

Designated Site	Interest Feature	CL ($\text{kgN.ha}^{-1}.\text{yr}^{-1}$)	PC ($\text{kgN.ha}^{-1}.\text{yr}^{-1}$)	PC/CL (%)
The Swale SPA/Elmley NNR/Milton Creek LWS	Breeding Lapwing	20	0.1	1
	Ringed plover	20	0.1	1
	Eurasian reed warbler	15	0.1	1
	Eurasian curlew	20	0.1	1
	Reed bunting	15	0.1	1
	Dark-bellied brent goose	20	0.1	1
	Common shelduck	20	0.1	1
	Eurasian teal	20	0.1	1
	Mallard	Not available	0.1	-
	Common moorhen	Not available	0.1	-
	Gadwall	Not available	0.1	-
Grey plover	20	0.1	1	

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Designated Site	Interest Feature	CL (kgN.ha ⁻¹ .yr ⁻¹)	PC (kgN.ha ⁻¹ .yr ⁻¹)	PC/CL (%)
	Dunlin	20	0.1	1
	Common coot	Not available	0.1	-
	Common redshank	20	0.1	1
	Eurasian oystercatcher	20	0.1	1
Medway Estuary and Marshes SPA	Common tern	8	0.01	0
	Red-throated diver	Not sensitive	0.01	-
	Eurasian curlew	20	0.01	0
	Common greenshank	20	0.01	0
	Little tern	10	0.01	0
	Hen harrier	15	0.01	0
	Merlin	20	0.01	0
	Ringed plover	20	0.01	0
	Short-eared owl	Not available	0.01	-
	Great crested grebe	20	0.01	0
	Great cormorant	Not available	0.01	-
	Dark-bellied brent goose	20	0.01	0
	Eurasian teal	20	0.01	0
	Mallard	20	0.01	0
	Northern shoveler	Not available	0.01	-
	Common shelduck	20	0.01	0
	Eurasian wigeon	20	0.01	0
	Northern pintail	20	0.01	0
	Common pochard	20	0.01	0
	Eurasian oystercatcher	20	0.01	0
	Pied avocet	20	0.01	0
	Grey plover	20	0.01	0
	Red knot	20	0.01	0
	Dunlin	20	0.01	0
Black-tailed godwit	20	0.01	0	
Common redshank	20	0.01	0	

Designated Site	Interest Feature	CL (kgN.ha ⁻¹ .yr ⁻¹)	PC (kgN.ha ⁻¹ .yr ⁻¹)	PC/CL (%)
	Ruddy turnstone	20	0.01	0
	Tundra swan	Not sensitive	0.01	-
	Common kingfisher	Not available	0.01	-
Thames Estuary and Marshes SPA	Ringed plover	10	0.01	0
	Hen harrier	10	0.01	0
	Pied avocet	20	0.01	0
	Grey plover	20	0.01	0
	Red knot	20	0.01	0
	Dunlin	20	0.01	0
	Black-tailed godwit	20	0.01	0
	Common redshank	20	0.01	0
Queendown Warren SAC	Semi-natural dry grasslands and scrubland facies on calcareous substrates	15	<0.005	0
The Swale Ramsar/SSSI	Intertidal habitats (coastal saltmarsh)	20	0.1	1
	Saltmarsh (coastal saltmarsh)	20	0.1	1
	Shingle & sea cliff (dunes, shingle & machair)	10	0.1	1
	Arable (horticultural & arable)	Not sensitive	-	-
	Standing water (standing open water)	No CL	-	-
	Waste land, industrial (no corresponding APIS habitat)	Not sensitive	-	-
Medway Estuary and Marshes Ramsar	Intertidal habitats (coastal saltmarsh)	20	0.01	0
	Saltmarsh (coastal saltmarsh)	20	0.01	0
	Shingle & sea cliff (dunes, shingle & machair)	10	0.01	0
	Wet grassland (grazing marsh)	20	0.01	0
	Dry grassland (grazing marsh)	10	0.01	0
	Bogs, marshes, fens (fen, marsh & swamp)	15	0.01	0
	Standing water (standing open water)	No CL	-	-
	Intertidal habitats (coastal saltmarsh)	20	0.01	0
Thames Estuary and Marshes Ramsar	Intertidal habitats (coastal saltmarsh)	20	0.01	0
	Saltmarsh (coastal saltmarsh)	20	0.01	0
	Shingle & sea cliff (dunes, shingle & machair)	10	0.01	0

Designated Site	Interest Feature	CL (kgN.ha ⁻¹ .yr ⁻¹)	PC (kgN.ha ⁻¹ .yr ⁻¹)	PC/CL (%)
	Wet grassland (grazing marsh)	20	0.01	0
	Dry grassland (grazing marsh)	20	0.01	0
	Bogs, marshes, fens (fen, marsh & swamp)	15	-	-
	Standing water (standing open water)	No CL	0.1	1

Note: Critical loads (CLs) for nutrient nitrogen deposition are provided as a range. In this case, the lower limit of the CL range has been used in the assessment. PCs are identical for stack location 1 and 2 and are therefore not shown separately.

Consistent with the Institute of Air Quality Management's Position Statement "Use of a Criterion for the Determination of an Insignificant Effect of Air Quality Impacts on Sensitive Habitats" [5], the PC as a % of the CL has been rounded to the nearest integer.

Table C3 Predicted Acid Deposition at Designated Sites

Designated Site	Interest Feature	CLF C _{max} N (keq.ha ⁻¹ .yr ⁻¹)	PC (keq.ha ⁻¹ .yr ⁻¹)	PC/CLF (%)
The Swale SPA/Milton Creek LWS	Breeding Lapwing	4.856	0.01	1
	Eurasian curlew	4.856	0.01	1
	Common redshank	4.856	0.01	1
Medway Estuary and Marshes SPA	Common tern	4.856	0.001	0
	Eurasian curlew	4.856	0.001	0
	Little tern	4.856	0.001	0
Thames Estuary and Marshes SPA	Ringed plover	4.856	0.001	0
Queendown Warren SAC	Semi-natural dry grasslands and scrubland facies on calcareous substrates.	4.856	<0.0005	0
The Swale Ramsar/SSSI	Intertidal habitats (coastal saltmarsh)	Not sensitive	-	-
	Saltmarsh (coastal saltmarsh)	Not sensitive	-	-
	Shingle & sea cliff (dunes, shingle & machair)#	Not sensitive	-	-
	Arable (horticultural & arable)	Not sensitive	-	-

	Standing water (standing open water)	No CL	-	-
	Waste land, industrial (no corresponding APIS habitat)	Not sensitive	-	-
Medway Estuary and Marshes Ramsar	Intertidal habitats (coastal saltmarsh)	Not sensitive	-	-
	Saltmarsh (coastal saltmarsh)	Not sensitive	-	-
	Shingle & sea cliff (dunes, shingle & machair)	Not sensitive	-	-
	Wet grassland (grazing marsh)	Not sensitive	-	-
	Dry grassland (grazing marsh)	Not sensitive	-	-
	Bogs, marshes, fens (fen, marsh & swamp)	Not sensitive	-	-
	Standing water (standing open water)	No CL	-	-
Thames Estuary and Marshes Ramsar	Intertidal habitats (coastal saltmarsh)	Not sensitive	-	-
	Saltmarsh (coastal saltmarsh)	Not sensitive	-	-
	Shingle & sea cliff (dunes, shingle & machair)	Not sensitive	-	-
	Wet grassland (grazing marsh)	Not sensitive	-	-
	Dry grassland (grazing marsh)	Not sensitive	-	-
	Bogs, marshes, fens (fen, marsh & swamp)	Not sensitive	-	-
	Standing water (standing open water)	No CL	-	-

Notes:

* Habitat in parenthesis is the corresponding APIS broad habitat for which critical loads are available

dune/shingle/marsh systems in this location are calcareous and therefore well buffered

CLF = Critical Load Function. PCs are identical for stack location 1 and 2.

Consistent with the Institute of Air Quality Management's Position Statement "Use of a Criterion for the Determination of an Insignificant Effect of Air Quality Impacts on Sensitive Habitats" [5], the PC as a % of the CL has been rounded to the nearest integer.

The maximum NO_x PC is below 1% of the critical level for all designated sites except the Swale SPA/SSSI/Ramsar and the effects can be screened out as insignificant. For The Swale SPA/SSSI/Ramsar, when the PC for K2 and K3 of 1.2 µg.m⁻³ is added to the K4 PC of 0.7 µg.m⁻³ and the ambient concentration of 12.3 µg.m⁻³, the PEC is 14.2 µg.m⁻³ which is only 47% of the critical level. On that basis the effects at The Swale can also be screened out as insignificant.

The maximum N deposition PC is below 1% of the critical load for all designated sites and the effects can be screened out as insignificant.

The maximum acid deposition PC is below 1% of the critical load for all designated sites and the effects can be screened out as insignificant.

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- 1 Air Pollution Information Systems, www.apis.ac.uk
 - 2 Approaches to modelling local nitrogen deposition and concentrations in the context of Natura 2000 - Topic 4
 - 3 Air emissions risk assessment for your environmental permit
 - 4 Data downloaded from APIS December 2017
 - 5 http://www.iaqm.co.uk/text/position_statements/aq_impacts_sensitive_habitats.pdf