



Thurrock Flexible Generation Plant

Preliminary Environmental Information Report: Appendix 12.1: Assessment of Air Quality Impacts on Ecological Receptors

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Summary

This Appendix assesses the impacts of air quality on ecological receptors. It outlines the methodology, results and conclusions of the assessment.

Qualifications

This chapter has been prepared by Rosemary Challen, a Member of the Institution of Environmental Sciences and Member of the Institute of Air Quality Management (IAQM).

It has been checked by Kathryn Barker, an associate member of the Institute of Air Quality Management and the Institution of Environmental Sciences.

It has been reviewed by Fiona Prismall, a Chartered Environmentalist, Member of the Institution of Environmental Sciences and Member of the Institute of Air Quality Management (IAQM). Fiona is the IAQM committee secretary. Fiona was a member of the working groups that produced the IAQM 2014 'Guidance on the assessment of dust from demolition and construction' and the EPUK&IAQM 2017 'Land-use Planning & Development Control: Planning for Air Quality' guidance.

1. Assessment of Air Quality Impacts on Ecological Receptors

1.1 Introduction

1.1.1 The following European designated nature conservation sites, within 15 km of the Application Site, have been identified:

- Thames Estuary and Marshes Special Protection Area (SPA); and
- North Downs Woodlands Special Area of Conservation (SAC).

1.1.2 The following nationally and locally designated sites, within 15 km of the Application Site, have also been identified:

- Basildon Meadows Site of Special Scientific Interest (SSSI);
- Canvey Wick SSSI;
- Chattenden Woods and Lodge Hill SSSI;
- Cobham Woods SSSI;
- Darenth Wood SSSI;
- Grays Thurrock Chalk Pit SSSI;
- Great Crabbles Wood SSSI;
- Halling to Trottiscliffe Escarpment SSSI;
- Hangmans Wood and Deneholes SSSI;
- Holehaven Creek SSSI;
- Mucking Flats and Marshes SSSI;
- Northward Hill SSSI;
- Pitsea Marsh SSSI;
- Shorne and Ashenbank Woods SSSI;
- South Thames Estuary and Marshes SSSI;
- Thorndon Park SSSI;
- Tower Hill to Cockham Wood SSSI;
- Vange and Fobbing Marshes SSSI;
- West Thurrock Lagoon and Marshes SSSI;
- Broom Hill Local Wildlife Site (LWS);
- West Tilbury Hall LWS;
- Low Street Pit LWS;
- Lytag Brownfield LWS;
- Tilbury Centre LWS;

- Tilbury Marshes LWS; and
- Goshems Farm LWS.

1.1.3 This Appendix considers the impact of the proposed development on nitrogen oxide (NO_x) concentrations, nutrient nitrogen deposition and acid deposition at the nature sites listed above.

1.2 Approach

1.2.1 NO_x concentrations have been predicted using the same model as used in the assessment of impacts on human-health receptors. Modelling has been undertaken for a grid of receptor points, with a grid spacing of 100 m, across each identified nature conservation site. The receptor grid points have been modelled at ground level. The maximum Process Contribution (PC) from the proposed development at each site and for all the meteorological datasets has been identified and is presented in this Appendix.

1.2.2 Modelling has been undertaken for the following engine scenarios:

- 60 x 10.4 MW engines, each engine with its own stack (60 stacks);
- 60 x 10.4 MW engines, aggregated stacks of five engines per stack (12 stacks);
- 33 x 18.4 MW engines, each engine with its own stack (33 stacks); and
- 33 x 18.4 MW engines, aggregated stacks of six groups of five engines per stack and one group of three engines per stack (7 stacks).

1.2.3 Only the results for 60 x 10.4 MW engines, each engine with its own stack (60 stacks) are given in this Appendix. This is the modelled scenario which predicted the greatest impacts.

1.3 Critical Levels/Loads and Significance Criteria

Critical Levels

1.3.1 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, Predicted Environmental Concentrations (PECs) of NO_x have been calculated for comparison with the 30 µg.m⁻³ critical level. Background NO_x concentrations at each designated site have been derived from the UK Air Pollution Information System (APIS) database.

Critical Loads

1.3.2 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 Nitrogen Deposition

1.3.3 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:

- i. The dry deposition flux ($\mu\text{g}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$) has been calculated by multiplying the ground level NO₂ concentrations ($\mu\text{g}\cdot\text{m}^{-3}$) by the deposition velocity of 0.003 $\text{m}\cdot\text{s}^{-1}$ for forests/tall habitats and 0.0015 $\text{m}\cdot\text{s}^{-1}$ for grassland/short habitats.
- ii. Units of $\mu\text{g}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ have been converted to units of $\text{kg}\cdot\text{ha}^{-1}\cdot\text{year}^{-1}$ by multiplying the dry deposition flux by the standard conversion factor of 96 for NO_x.
- iii. 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 – Acid Deposition

1.3.4 The acid deposition rate, in equivalents $\text{keq}\cdot\text{ha}^{-1}\cdot\text{year}^{-1}$, has been calculated by multiplying the dry deposition flux ($\text{kg}\cdot\text{ha}^{-1}\cdot\text{year}^{-1}$) 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.

1.3.5 Wet deposition in the near field is not significant compared with dry deposition for N (Hertel et al., 2011) and therefore for the purposes of this assessment, wet deposition has not been considered.

1.3.6 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

1.3.7 Maximum PCs and PECs of NO_x and nutrient nitrogen / acid deposition have been compared against the relevant critical level/load for the relevant habitat type/interest feature. Based on current Environment Agency guidelines and the Institute of Air Quality Management (IAQM) Position Statement (IAQM, 2016), the following criteria have been used to determine if the impacts are significant:

For SPAs, SACs and SSSIs:

- If the long-term PC does not exceed 1% of the relevant critical level/load the effect is considered not significant; and
- If the long-term PC exceeds 1% but the resulting PEC is below 100% of the relevant critical level/load, the effect is not considered significant;
- If the short-term PC does not exceed 10% of the relevant critical level/load the effect is considered not significant; and
- If the short-term PC exceeds 10% but the resulting PEC is below 100% of the relevant critical level/load, the effect is not considered significant.

For local nature sites:

- If the short-term PC is less than 100% of the relevant critical level/load the effect is considered not significant; and
- If the long-term PC is less than 100% of the relevant critical level/load the effect is considered not significant.

1.4 Results

1.4.1 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 also been obtained from APIS (APIS, 2018).

1.4.2 The maximum predicted annual-mean NO_x concentrations are compared with the critical level (CL) in Table 1.1. The maximum predicted nutrient nitrogen deposition rates are compared with the critical load (CL) in Table 1.2. The maximum predicted acid deposition rates are compared with the critical load function (CLF) in Table 1.3.

Table 1.1: Predicted Annual-Mean NOx Concentrations at Designated Sites

Designated Site	CL ($\mu\text{g.m}^{-3}$)	AC ($\mu\text{g.m}^{-3}$)	PC ($\mu\text{g.m}^{-3}$)	PEC ($\mu\text{g.m}^{-3}$)	PC/CL (%)	PEC/CL (%)
Thames Estuary and Marshes SPA	30	18.3	2.2	20.5	7	68
North Downs Woodlands SAC		17.4	0.1	17.5	0	58
Basildon Meadows SSSI		22.1	0.4	22.5	1	75
Canvey Wick SSSI		26.4	0.5	26.9	2	90
Chattenden Woods and Lodge Hill SSSI		15.5	0.3	15.8	1	53
Cobham Woods SSSI		19.1	0.2	19.2	1	64
Darenth Wood SSSI		26.5	0.3	26.8	1	89
Grays Thurrock Chalk Pit SSSI		28.0	0.3	28.3	1	94
Great Crabbles Wood SSSI		21.8	0.2	22.0	1	73
Halling to Trottscliffe Escarpment SSSI		16.1	0.2	16.3	1	54
Hangmans Wood and Deneholes SSSI		26.8	0.4	27.2	1	91
Holehaven Creek SSSI		35.9	0.5	36.5	2	122
Mucking Flats and Marshes SSSI		27.3	2.5	29.8	8	99
Northward Hill SSSI		18.9	0.3	19.2	1	64
Pitsea Marsh SSSI		20.1	0.4	20.5	1	68
Shorne and Ashenbank Woods SSSI		21.9	0.2	22.2	1	74
South Thames Estuary and Marshes SSSI		17.1	1.3	18.4	4	61
Thorndon Park SSSI		19.7	0.2	19.9	1	66
Tower Hill to Cockham Wood SSSI		25.8	0.2	25.9	1	86
Vange and Fobbing Marshes SSSI		20.2	0.6	20.9	2	70
West Thurrock Lagoon and Marshes SSSI	26.8	0.5	27.2	2	91	
Broom Hill LWS	-	7.5	-	25	-	
West Tilbury Hall LWS	-	2.5	-	8	-	
Low Street Pit LWS	-	8.1	-	27	-	

Lytag Brownfield LWS	-	8.0	-	27	-
Tilbury Centre LWS	-	3.9	-	13	-
Tilbury Marshes LWS	-	3.3	-	11	-
Goshems Farm LWS	-	4.5	-	15	-

Notes:

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" (IAQM, 2016), the PC as a % of the CL has been rounded to the nearest integer.

As per the Environment Agency guidelines, the PEC does not need to be calculated for local nature sites.

Table 1.2: Predicted Nutrient Nitrogen Deposition at Designated Sites

Designated Site	Interest Feature	CL ($\text{kgN.ha}^{-1}.\text{yr}^{-1}$)	AC ($\text{kgN.ha}^{-1}.\text{yr}^{-1}$)	PC ($\text{kgN.ha}^{-1}.\text{yr}^{-1}$)	PEC ($\text{kgN.ha}^{-1}.\text{yr}^{-1}$)	PC/CL (%)	PEC/CL (%)
Thames Estuary and Marshes SPA	Charadrius hiaticula (Europe/Northern Africa - wintering) - Ringed plover (A137)	8	11.7	0.2	11.9	3	149
	Circus cyaneus - Hen harrier (A082)	15	11.7	0.2	11.9	1	79
	Recurvirostra avosetta (Western Europe/Western Mediterranean - breeding) - Pied avocet (A132)	20	11.7	0.2	11.9	1	60
	Pluvialis squatarola (Eastern Atlantic - wintering) - Grey plover (A141)	20	11.7	0.2	11.9	1	60
	Calidris canutus (North-eastern Canada/Greenland/Iceland/North-western Europe) - Red knot (A143)	20	11.7	0.2	11.9	1	60
	Calidris alpina alpina (Northern Siberia/Europe/Western Africa) - Dunlin (A149)	20	11.7	0.2	11.9	1	60

Designated Site	Interest Feature	CL (kgN.ha ⁻¹ .yr ⁻¹)	AC (kgN.ha ⁻¹ .yr ⁻¹)	PC (kgN.ha ⁻¹ .yr ⁻¹)	PEC (kgN.ha ⁻¹ .yr ⁻¹)	PC/CL (%)	PEC/ CL (%)
	Limosa limosa islandica (Iceland - breeding) - Black-tailed godwit (A156)	20	11.7	0.2	11.9	1	60
	Tringa totanus (Eastern Atlantic - wintering) - Common redshank (A162)	20	11.7	0.2	11.9	1	60
North Downs Woodlands SAC	Taxus baccata woods of the British Isles (H91J0)	5	24.43	<0.05	24.5	1	489
	Asperulo-Fagetum beech forests (H9130)	10	24.43	<0.05	24.5	0	245
	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) (H6210)	15	14.62	<0.05	14.6	0	98
Basildon Meadows SSSI	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)	20	23.31	<0.05	23.3	0	117
Chattenden Woods and Lodge Hill SSSI	Broad-leaved, mixed and yew woodland (Quercus robur - Pteridium aquilinum - Rubus fruticosus woodland)	15	22.61	0.1	22.7	0	151
	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)	20	13.47	<0.05	13.5	0	67
Cobham Woods SSSI	Broad-leaved, mixed and yew woodland (Fraxinus excelsior - Acer campestre - Mercurialis perennis woodland)	15	25.07	<0.05	25.1	0	167
	Broad-leaved, mixed and yew woodland (Quercus robur - Pteridium aquilinum - Rubus fruticosus woodland)	15	25.07	<0.05	25.1	0	167

Designated Site	Interest Feature	CL (kgN.ha ⁻¹ .yr ⁻¹)	AC (kgN.ha ⁻¹ .yr ⁻¹)	PC (kgN.ha ⁻¹ .yr ⁻¹)	PEC (kgN.ha ⁻¹ .yr ⁻¹)	PC/CL (%)	PEC/ CL (%)
Darenth Wood SSSI	Broad-leaved, mixed and yew woodland (Fraxinus excelsior - Acer campestre - Mercurialis perennis woodland)	15	26.32	0.1	26.4	0	176
	Broad-leaved, mixed and yew woodland (Quercus robur - Pteridium aquilinum - Rubus fruticosus woodland)	15	26.32	0.1	26.4	0	176
Great Crabbles Wood SSSI	Broad-leaved, mixed and yew woodland (Fraxinus excelsior - Acer campestre - Mercurialis perennis woodland)	15	24.37	<0.05	24.4	0	163
	Broad-leaved, mixed and yew woodland (Quercus robur - Pteridium aquilinum - Rubus fruticosus woodland)	15	24.37	<0.05	24.4	0	163
Halling to Trottscliffe Escarpment SSSI	Broad-leaved, mixed and yew woodland (Taxus baccata woodland)	5	24.03	<0.05	24.1	1	481
	Broad-leaved, mixed and yew woodland (Fagus sylvatica - Mercurialis perennis woodland)	10	24.03	<0.05	24.1	0	241
	Broad-leaved, mixed and yew woodland (Fraxinus excelsior - Acer campestre - Mercurialis perennis woodland)	15	24.03	<0.05	24.1	0	160
	Broad-leaved, mixed and yew woodland (Quercus robur - Pteridium aquilinum - Rubus fruticosus woodland)	15	24.03	<0.05	24.1	0	160
	Calcareous grassland (Bromus erectus lowland calcareous grassland)	15	14.52	<0.05	14.5	0	97

Designated Site	Interest Feature	CL (kgN.ha ⁻¹ .yr ⁻¹)	AC (kgN.ha ⁻¹ .yr ⁻¹)	PC (kgN.ha ⁻¹ .yr ⁻¹)	PEC (kgN.ha ⁻¹ .yr ⁻¹)	PC/CL (%)	PEC/ CL (%)
	Calcareous grassland (Festuca ovina - Avenula pratensis lowland calcareous grassland)	15	14.52	<0.05	14.5	0	97
Mucking Flats and Marshes SSSI	Calidris alpina alpina - Dunlin	20	13.57	0.3	13.8	1	69
	Charadrius hiaticula - Ringed Plover	20	13.57	0.3	13.8	1	69
	Limosa limosa islandica - Black-Tailed Godwit	20	13.57	0.3	13.8	1	69
	Pluvialis squatarola - Grey Plover	20	13.57	0.3	13.8	1	69
	Tadorna tadorna - Shelduck	20	13.57	0.3	13.8	1	69
	Tringa totanus - Redshank	20	13.57	0.3	13.8	1	69
Pitsea Marsh SSSI	Fen, marsh and swamp (Phragmites australis swamp and reed-beds)	15	27.16	<0.05	27.2	0	181
Shorne and Ashenbank Woods SSSI	Broad-leaved, mixed and yew woodland (Fraxinus excelsior - Acer campestre - Mercurialis perennis woodland)	15	23.5	<0.05	23.5	0	157
	Broad-leaved, mixed and yew woodland (Quercus robur - Pteridium aquilinum - Rubus fruticosus woodland)	15	23.5	<0.05	23.5	0	157
South Thames Estuary and Marshes SSSI	Littoral sediment (Annual Salicornia Saltmarsh)	20	11.81	0.1	11.9	1	60
	Littoral sediment (Atriplex portulacoides saltmarsh)	20	11.81	0.1	11.9	1	60
	Littoral sediment (Inula crithmoides stands)	20	11.81	0.1	11.9	1	60

Designated Site	Interest Feature	CL (kgN.ha ⁻¹ .yr ⁻¹)	AC (kgN.ha ⁻¹ .yr ⁻¹)	PC (kgN.ha ⁻¹ .yr ⁻¹)	PEC (kgN.ha ⁻¹ .yr ⁻¹)	PC/CL (%)	PEC/ CL (%)
	Littoral sediment (Puccinellia maritima saltmarsh, Puccinellia maritima dominant sub-community)	20	11.81	0.1	11.9	1	60
	Littoral sediment (Rayed Aster tripolium on saltmarsh)	20	11.81	0.1	11.9	1	60
	Littoral sediment (Sarcocornia perennis)	20	11.81	0.1	11.9	1	60
	Littoral sediment (Spartina Anglica Saltmarsh)	20	11.81	0.1	11.9	1	60
	Littoral sediment (Suaeda Maritima Saltmarsh)	20	11.81	0.1	11.9	1	60
	Littoral sediment (Transitional low marsh vegetation with Puccinellia maritima, annual Salicornia species and Suaeda maritima.)	20	11.81	0.1	11.9	1	60
	Circus cyaneus - Hen Harrier	15	11.81	0.1	11.9	1	80
	Anas acuta - Pintail	20	11.81	0.1	11.9	1	60
	Anas crecca - Teal	20	11.81	0.1	11.9	1	60
	Anas querquedula - Garganey	20	11.81	0.1	11.9	1	60
	Anser albifrons albifrons - White-Fronted Goose	20	11.81	0.1	11.9	1	60
	Calidris alpina alpina - Dunlin	20	11.81	0.1	11.9	1	60
	Calidris canutus - Knot	20	11.81	0.1	11.9	1	60
	Charadrius hiaticula - Ringed Plover	20	11.81	0.1	11.9	1	60
	Limosa limosa islandica - Black-Tailed Godwit	20	11.81	0.1	11.9	1	60

Designated Site	Interest Feature	CL (kgN.ha ⁻¹ .yr ⁻¹)	AC (kgN.ha ⁻¹ .yr ⁻¹)	PC (kgN.ha ⁻¹ .yr ⁻¹)	PEC (kgN.ha ⁻¹ .yr ⁻¹)	PC/CL (%)	PEC/ CL (%)
	Numenius arquata - Curlew	20	11.81	0.1	11.9	1	60
	Pluvialis squatarola - Grey Plover	20	11.81	0.1	11.9	1	60
	Recurvirostra avosetta - Avocet	20	11.81	0.1	11.9	1	60
	Tadorna tadorna - Shelduck	20	11.81	0.1	11.9	1	60
	Tringa nebularia - Greenshank	20	11.81	0.1	11.9	1	60
	Tringa totanus - Redshank	20	11.81	0.1	11.9	1	60
Thorndon Park SSSI	Broad-leaved, mixed and yew woodland (Quercus robur - Pteridium aquilinum - Rubus fruticosus woodland)	15	27.47	<0.05	27.5	0	183
Tower Hill to Cockham Wood SSSI	Broad-leaved, mixed and yew woodland (Fraxinus excelsior - Acer campestre - Mercurialis perennis woodland)	15	22.14	<0.05	22.2	0	148
West Thurrock Lagoon and Marshes SSSI	Calidris alpina alpina - Dunlin	20	13.58	<0.05	13.6	0	68
	Tringa totanus - Redshank	20	13.58	<0.05	13.6	0	68
Broom Hill LWS	Acid grassland	10	-	0.8	-	8	-
West Tilbury Hall LWS	Acid grassland	10	-	0.3	-	3	-
Low Street Pit LWS	Acid grassland	10	-	0.8	-	8	-
Lyttag Brownfield LWS	Acid grassland	10	-	0.8	-	8	-
Tilbury Centre LWS	Acid grassland	10	-	0.4	-	4	-
Tilbury Marshes LWS	Coastal & floodplain grazing marsh	20	-	0.3	-	2	-
	Coastal saltmarsh	20	-	0.3	-	2	-

Designated Site	Interest Feature	CL (kgN.ha ⁻¹ .yr ⁻¹)	AC (kgN.ha ⁻¹ .yr ⁻¹)	PC (kgN.ha ⁻¹ .yr ⁻¹)	PEC (kgN.ha ⁻¹ .yr ⁻¹)	PC/CL (%)	PEC/ CL (%)
Goshems Farm LWS	Coastal & floodplain grazing marsh	20	-	0.5	-	2	-

Notes: Results are not shown for sites/interest features which are not sensitive to nutrient nitrogen deposition, or for which no data are provided on APIS.
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.
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" (IAQM, 2016), the PC as a % of the CL has been rounded to the nearest integer.
As per the Environment Agency guidelines, the PEC does not need to be calculated for local nature sites.

Table 1.3: Predicted Acid Deposition at Designated Sites

Designated Site	Interest Feature	CLF CLminN (keq.ha ⁻¹ .yr ⁻¹)	AC (keq.ha ⁻¹ .yr ⁻¹)	PC (keq.ha ⁻¹ .yr ⁻¹)	PEC (keq.ha ⁻¹ .yr ⁻¹)	PC/CLF (%)	PEC/ CLF (%)
Thames Estuary and Marshes SPA	Charadrius hiaticula (Europe/Northern Africa - wintering) - Ringed plover (A137)	0.223	0.84	<0.05	0.9	7	384
North Downs Woodlands SAC	Taxus baccata woods of the British Isles (H91J0)	0.142	1.74	<0.05	1.7	1	1227
	Asperulo-Fagetum beech forests (H9130)	0.142	1.74	<0.05	1.7	1	1227
	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) (H6210)	0.856	1.04	<0.05	1.0	0	122
Basildon Meadows SSSI	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)	0.438	1.67	<0.05	1.7	1	382
Chattenden Woods and Lodge Hill SSSI	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)	0.223	0.96	<0.05	1.0	1	431

Designated Site	Interest Feature	CLF CLminN (keq.ha ⁻¹ .yr ⁻¹)	AC (keq.ha ⁻¹ .yr ⁻¹)	PC (keq.ha ⁻¹ .yr ⁻¹)	PEC (keq.ha ⁻¹ .yr ⁻¹)	PC/CLF (%)	PEC/ CLF (%)
South Thames Estuary and Marshes SSSI	Anas querquedula - Garganey	0.856*	0.84	<0.05	0.8	1	99
	Numenius arquata - Curlew	0.856*	0.84	<0.05	0.8	1	99
Thorndon Park SSSI	Broad-leaved, mixed and yew woodland (Quercus robur - Pteridium aquilinum - Rubus fruticosus woodland)	0.142	1.96	0.0	2.0	2	1382
Broom Hill LWS	Acid grassland	0.438	-	0.1	-	12	-
West Tilbury Hall LWS	Acid grassland	0.48	-	<0.05	-	4	-
Low Street Pit LWS	Acid grassland	0.223	-	0.1	-	26	-
Lyttag Brownfield LWS	Acid grassland	0.48	-	0.1	-	12	-
Tilbury Centre LWS	Acid grassland	0.48	-	<0.05	-	6	-

Notes: Results are not shown for sites/interest features which are not sensitive to acid deposition, or for which no data are provided on APIS.

CLF = Critical Load Function.

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" (IAQM, 2016), the PC as a % of the CL has been rounded to the nearest integer.

As per the Environment Agency guidelines, the PEC does not need to be calculated for local nature sites.

*As advised by the proposed development's ecologist, a CLF CLminN of 0.856 keq.ha⁻¹.yr⁻¹ has been used on the basis that the SSSI is entirely on the south bank of the Thames and is either grazing marsh or saltmarsh sitting over London Clay.

1.4.3 The maximum NO_x PC does not exceed 1% of the critical level at the following designated sites:

- North Downs Woodlands SAC
- Basildon Meadows SSSI
- Chattenden Woods and Lodge Hill SSSI
- Cobham Woods
- Darenth Wood SSSI
- Grays Thurrock Chalk Pit SSSI
- Great Crabbles Wood SSSI

- Halling to Trottiscliffe Escarpment SSSI
- Hangmans Wood and Deneholes SSSI
- Northward Hill SSSI
- Pitsea Marsh SSSI
- Shorne and Ashenbank Woods SSSI
- Thorndon Park SSSI
- Tower Hill to Cockham Wood SSSI

1.4.4 The NO_x effects can therefore be screened out as insignificant at these sites.

1.4.5 The maximum NO_x PCs are below 100% of the crucial level at all local wildlife sites and the NO_x effects can therefore be screened out as insignificant at these sites.

1.4.6 The maximum NO_x PC exceeds 1% of the critical level at the following sites:

- Thames Estuary and Marshes SPA
- Canvey Wick SSSI
- Holehaven Creek SSSI
- Mucking Flats and Marshes SSSI
- South Thames Estuary and Marshes SSSI
- Vange and Fobbing Marshes SSSI
- West Thurrock Lagoon and Marshes SSSI

The PECs are below the critical level at all sites, except Holehaven Creek SSSI, and the effects can be screened out as insignificant. At Holehaven Creek SSSI, the NO_x effects cannot be screened out as insignificant based on the results of detailed modelling.

1.4.7 The proposed development's ecologist has advised the following:

Holehaven Creek SSSI comprises the intertidal mudflats and saltmarsh habitats separating mainland Essex from Canvey Island. In this location the maximum PC NOx is predicted to be 2% of the critical level. The PEC is predicted to be 122% of the critical level at 35.94 µg.m⁻³. The effect of NOx on flora at these concentrations is confined to those driven by changes in N availability and corresponding changes to growth rate, rather than any direct toxic effects (WHO, 2000); direct toxicity has only been reported at concentrations >100 µg.m⁻³. Given that the nitrogen regime of the salt marsh habitats within the SSSI will be driven primarily by the influence of the marine environment in which they occur and, as such, are not considered sensitive to atmospheric nitrogen input to any great extent (as demonstrated by a high critical load of 20-30 kgN.ha⁻¹.yr⁻¹), it is considered highly unlikely that the exceedance of the critical level in this location would have a significant effect on the SSSI.

- 1.4.8 At all European and nationally designated sites, with the exception of Thames Estuary and Marshes SPA, the maximum nutrient nitrogen deposition PC does not exceed 1% of the critical load and the effects can therefore be screened out as insignificant. For Thames Estuary and Marshes SPA, the maximum PC is greater than 1% of the CL and the PEC exceeds the CL, and the effects are therefore considered to be potentially significant based on the results of detailed modelling.
- 1.4.9 The maximum nutrient nitrogen deposition PCs are below 100% of the crucial level at all local wildlife sites and the effects can therefore be screened out as insignificant at these sites.
- 1.4.10 The maximum acid deposition PC does not exceed 1% of the critical load function at all European and nationally designated sites, with the exception of Thames Estuary and Marshes SPA and Thorndon Park SSSI, and the effects can therefore be screened out as insignificant. For Thames Estuary and Marshes SPA and Thorndon Park SSSI, the PCs are greater than 1% of the CLF and the PECs exceed the CLF. The effects are therefore considered to be potentially significant based on the results of detailed modelling.
- 1.4.11 The maximum acid deposition PCs are below 100% of the crucial level at all local wildlife sites and the effects can therefore be screened out as insignificant at these sites.
- 1.4.12 The project's ecologist has advised the following with respect to nutrient nitrogen and acid deposition effects on the Thames Estuary and Marshes SPA:

For the majority of interest features of the SPA, the PCs and/or PECs for all pollutant types were <1%/<EQS. The one exception was nutrient nitrogen deposition and acid deposition for Ringed Plover where the maximum PC >1% and the PEC exceeded the relevant CL/CLF. The CL/CLF used in the assessment is taken from the Site-Relevant Critical Load tool on APIS and is for acidic coastal stable dune grassland. This habitat type does not occur within the Thames Estuary and Marshes SPA; indeed the main associations of this species within the SPA are the grazing marsh and inter-tidal mudflats, in particular at Mucking Flats near east Tilbury and further east at Allhallows-on-Sea (Frost et al., 2016). Such habitats are not susceptible to either acid or nutrient nitrogen deposition on the basis that they are both high nutrient systems (as demonstrated by a high critical load of 20-30 kgN.ha⁻¹.yr⁻¹) and brackish (or salt water) and therefore more alkaline. On this basis, it is considered that the data on APIS is not directly relevant to the population of Ringed Plover using the SPA where a higher critical load/CLF would be more appropriate, given the habitat associations of this species in this geographic location. Therefore, there is no potential for a likely significant effect on Ringed Plover using the Thames Estuary and Marshes SPA as a result of emissions to air from the proposed facility.

- 1.4.13 The proposed development's ecologist notes the following with respect to nutrient nitrogen and acid deposition effects on the Thorndon Park SSSI:

For the majority of interest features of the SSSI, the PCs and/or PECs for all pollutant types were <1%/<EQS. The exception was with respect to acid deposition on the woodland interest features where the max PC acid deposition was 2% of the minimum acid CLF and the PEC was 1,382% of the PEC. While Thorndon Park SSSI is located on the Claygate and Bagshot Beds and gravels and the soils present are therefore likely to be somewhat acidic, the closest SSSI unit to the proposed development (Unit 12) is in Favourable condition with a diverse flora and invertebrate assemblage. Although some of the other units are in Unfavourable condition, current condition reports for the site state this is due to the lack of appropriate management resulting in the dominance of invasive species such as sycamore and concomitant lack of open-grown shrubs and herbaceous vegetation; units that are subject to appropriate management have achieved Favourable status (such as Unit 12) despite the very high exceedance of the relevant EQS. It is therefore considered highly unlikely that a 0.15% increase in acid deposition in this location would result in any significant effect on the SSSI.

- 1.4.14 Based on the results of detailed modelling and advice from the proposed development's ecologist, no significant air quality effects on designated habitat sites are expected to arise due to the proposed development.

Cumulative Effects

- 1.4.15 Chapter 12 outlines the projects which have been considered in the cumulative effects at human-health receptors. For ecological receptors, the cumulative effects have been considered qualitatively.
- 1.4.16 For sites and interest features where the PEC is less than 70% of the CL, the cumulative effects have been considered to be not significant. This is on the basis that there is considerable headroom between the PEC and the CL and it is unlikely that the cumulative PEC will exceed the CL.
- 1.4.17 For NO_x, there are four designated sites where the PC exceeds 1% of the CL and the PEC is greater than 70% of the CL:
- Holehaven Creek SSSI
 - Canvey Wick SSSI;
 - Mucking Flats and Marshes SSSI; and
 - West Thurrock Lagoon and Marshes SSSI.
- 1.4.18 The proposed development's ecologist has advised the following:
- The effect of NO_x on flora at these concentrations is confined to those driven by changes in N availability and corresponding changes to growth rate, rather than any direct toxic effects (WHO, 2000); direct toxicity has only been reported at concentrations >100 µg.m⁻³. Given that the nitrogen regime of the salt marsh habitats within the SSSIs will be driven primarily by the influence of the marine environment in which they occur and, as such, are not considered sensitive to atmospheric nitrogen input to any great extent (as demonstrated by a high critical load of 20-30 kgN.ha⁻¹.yr⁻¹), it is considered highly unlikely that the exceedance of the critical level in these locations would have a significant effect on the SSSIs.*
- 1.4.19 For nutrient nitrogen deposition and acid deposition, there are two interest features where the PC exceeds 1% of the CL and the PEC exceeds 70% of the CL:
- Thames Estuary and Marshes SPA - Charadrius hiaticula (Europe/Northern Africa - wintering) - Ringed plover (A137); and
 - Thorndon Park SSSI - Broad-leaved, mixed and yew woodland (Quercus robur - Pteridium aquilinum - Rubus fruticosus woodland)
- 1.4.20 The project's ecologist has advised the following with respect to nutrient nitrogen and acid deposition effects on the Thames Estuary and Marshes SPA:

For the majority of interest features of the SPA, the PCs and/or PECs for all pollutant types were <1%/<EQS. The one exception was nutrient nitrogen deposition and acid deposition for Ringed Plover where the maximum PC >1% and the PEC exceeded the relevant CL/CLF. The CL/CLF used in the assessment is taken from the Site-Relevant Critical Load tool on APIS and is for acidic coastal stable dune grassland. This habitat type does not occur within the Thames Estuary and Marshes SPA; indeed the main associations of this species within the SPA are the grazing marsh and inter-tidal mudflats, in particular at Mucking Flats near east Tilbury and further east at Allhallows-on-Sea (Frost et al., 2016). Such habitats are not susceptible to either acid or nutrient nitrogen deposition on the basis that they are both high nutrient systems (as demonstrated by a high critical load of 20-30 kgN.ha⁻¹.yr⁻¹) and brackish (or salt water) and therefore more alkaline. On this basis, it is considered that the data on APIS is not directly relevant to the population of Ringed Plover using the SPA where a higher critical load/CLF would be more appropriate, given the habitat associations of this species in this geographic location. Therefore, there is no potential for a likely significant effect on Ringed Plover using the Thames Estuary and Marshes SPA as a result of emissions to air from the proposed facility.

- 1.4.21 The project's ecologist notes the following with respect to nutrient nitrogen and acid deposition effects on the Thorndon Park SSSI:

For the majority of interest features of the SSSI, the PCs and/or PECs for all pollutant types were <1%/<EQS. The exception was with respect to acid deposition on the woodland interest features where the max PC acid deposition was 2% of the minimum acid CLF and the PEC was 1,382% of the [CLF]. While Thorndon Park SSSI is located on the Claygate and Bagshot Beds and gravels and the soils present are therefore likely to be somewhat acidic, the closest SSSI unit to the proposed development (Unit 12) is in Favourable condition with a diverse flora and invertebrate assemblage. Although some of the other units are in Unfavourable condition, current condition reports for the site state this is due to the lack of appropriate management resulting in the dominance of invasive species such as sycamore and concomitant lack of open-grown shrubs and herbaceous vegetation; units that are subject to appropriate management have achieved Favourable status (such as Unit 12) despite the very high exceedance of the relevant EQS. It is therefore considered highly unlikely that a 0.15% increase in acid deposition in this location would result in any significant effect on the SSSI.

- 1.4.22 Based on the results of detailed modelling and advice from the proposed development's ecologist, no significant cumulative air quality effects on designated habitat sites are expected to arise.

2. References

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