Air Quality Assessment Addendum

DP3442QV - Hayes Data Centre Emergency Back-up Generation Facility

Bulls Bridge Industrial Estate, North Hyde Gardens, Hayes, UB3 4DG

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Air Quality Assessment Addendum for Ecological Impacts

March 2023

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DP3442QV - Hayes Data Centre

March 2023

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Executive Summary

Phlorum Limited has been commissioned by HDR to produce an air quality assessment addendum ("Addendum") on behalf of Amazon Data Services UK Limited ("the operator") to support the Environmental Permit application (ref: DP3442QV) to operate the Hayes Data Centre Emergency Back-up Generation Facility.

Phlorum Limited previously (July 2022) provided a full assessment (Ref: 9167K (AQ Permit) v4) of the air quality impacts associated with the development's standby generator (SBG) emissions during testing, maintenance and unplanned emergency use. This assessment concluded that the proposed development is not anticipated to have an overall significant effect on local air quality.

At the request of the Environment Agency (EA), this Addendum presents the results of further air quality assessment, evaluating the likely significant effects of the proposed development's generator operations on the ecological environment. Specifically, this Addendum addresses potential impacts associated with annual mean increases in NO_X, NH_3 and SO_2 concentrations, 24-hour maximum NO_X concentrations, nitrogen deposition and acid deposition at nearby ecological sites.

The results in Section 3 of this report show that the relevant screening criteria are not exceeded at any modelled receptor location for any critical level or critical load of any pollutant. As such, significant impacts on ecological sites as a result of the SBGs operating under normal testing and maintenance, or an unplanned emergency grid failure, are not anticipated.

1. Introduction

1.1 Phlorum Limited has been commissioned by HDR to produce an air quality assessment addendum ("Addendum") on behalf of the legal operator to support the Environmental Permit application (ref: DP3442QV) to operate the Hayes Data Centre Emergency Back-up Generation Facility. The Data Centre is located in Bulls Bridge Industrial Estate, North Hyde Gardens, Hayes, UB3 4DG ("the site"). The National Grid Reference for the centre of the site is TQ 10514 79252.

1.2 This Addendum pertains to one of three data centres to be constructed (see site plan overleaf). At the time of writing the other two data centres are due to be under the control of a separate operator and are likely to be covered under separate environmental permit(s).

1.3 In July 2022, Phlorum Limited produced a full air quality assessment (Ref: 9167K (AQ Permit) v4) to assess impacts associated with the testing, maintenance and unplanned emergency operation of this data centre's SBGs. The assessment concluded that the proposed development is not anticipated to have an overall significant effect on local air quality.

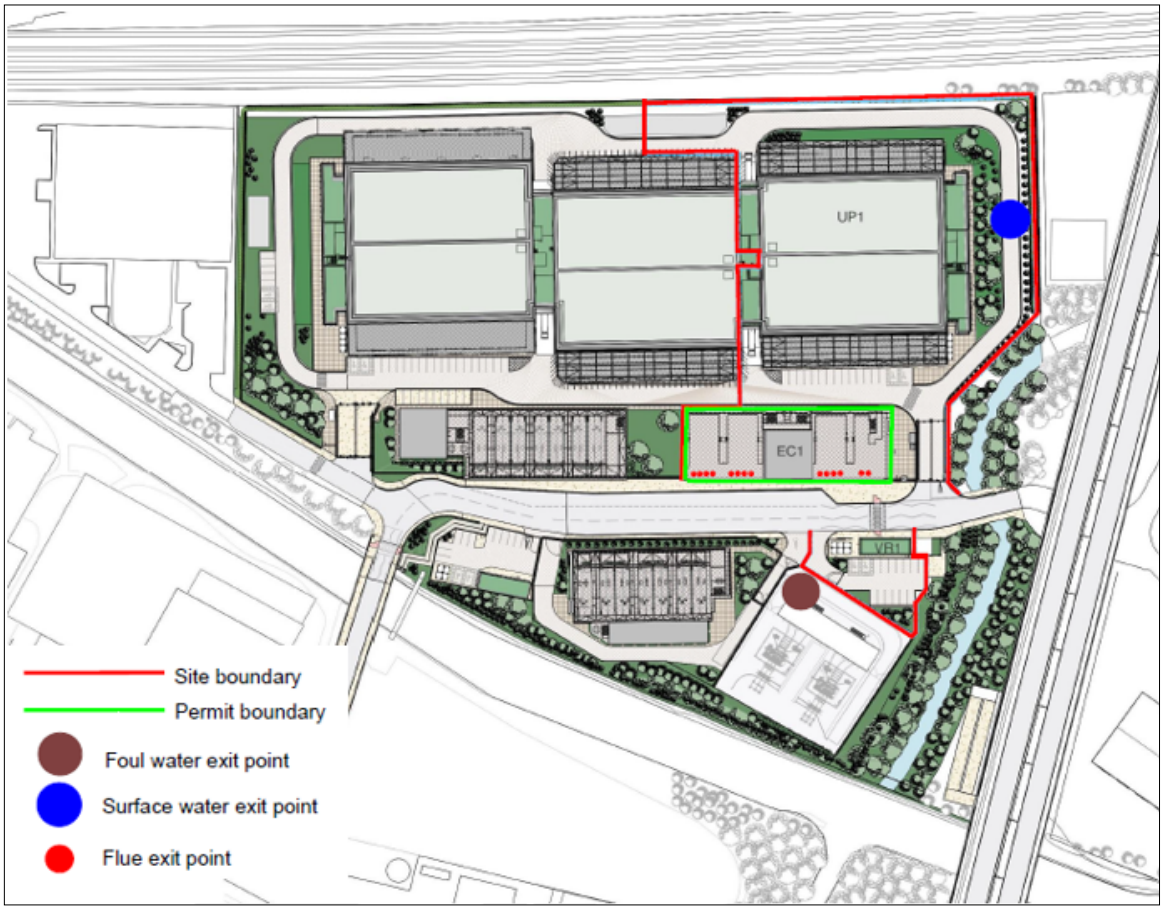
1.4 Following a review of the July 2022 air quality assessment ("the AQA"), the Environment Agency ("EA") requested that additional assessment work be undertaken to establish the following:

- The impact of ammonia (NH_3) emissions on nearby ecological sites from the Selective Catalytic Reduction (SCR) - fitted generators, commonly referred to as '*ammonia slip*'.
- The impact of acid deposition from nitrogen- and sulphur-based pollutants emitted by the SBGs, on nearby ecological sites.

1.5 The EA also requested that all potential ecological impacts be assessed for several Local Wildlife Sites ("LWS") in close proximity to the site.

1.6 This air quality assessment evaluates the air quality impacts of the SBG emissions during routine testing and maintenance, as well as a theoretical 72-hour emergency power outage scenario.

1.7 This Addendum should be read in conjunction with the AQA, which describes the assessment processes in full detail. This Addendum supersedes the results of the ecological assessment work presented within the AQA.


UP1
EC1
VR1
Site boundary
Permit boundary
Foul water exit point
Surface water exit point
Flue exit point

2. Assessment Methodology

Guidance

2.1 For the assessment of emissions from the SBGs, Defra's guidance on assessing air emissions for environmental permitting[1] and the Environment Agency's guidance on assessing impacts on limited hour operations[2] has been followed. The EA's guidance on specified generators[3] and their Data Centre FAQ headline approach guidance[4] to aide permit applications for data centres has also been reviewed.

Assessment Criteria

2.2 There are two categories of pollutants that are typically the subject of assessments for ecological designated sites. These are pollutants that have an effect on vegetation/habitats in (1) a gaseous form, assessed against critical levels, and (2) those which have an impact through deposition, assessed against critical loads.

Critical Levels

2.3 Critical levels represent the maximum concentrations of pollutants in air for the protection of vegetation. These have been adopted by, amongst others, the European Union and the United Nations Economic Commission for Europe (UNECE) and are used as regulatory standards. These critical levels are summarised in Table 2.1.

1 Defra (2016) Air emissions risk assessment for your environmental permit. Available at: https://www.gov.uk/guidance/air-emissions-riskassessment-for-your-environmental-permit
2 Air Quality Modelling & Assessment Unit (AQMAU). (2016). Diesel generator short term NO_2 impact assessment.
3 Environment Agency (2019) Specified generators: dispersion modelling assessment
4 Environment Agency (2018) Data Centre FAQ Headline Approach

Table 2.1: Critical Levels

Pollutant	Averaging Period Critical Level	Averaging Period Critical Level
Oxides of nitrogen (NO_X)	24 Hour maximum mean	75/ 200 $\mu g.m^{-3}$*
	Annual	30 $\mu g.m^{-3}$
Ammonia (NH_3)	Annual	1 $\mu g.m^{-3}$ (for lichens and bryophytes)
	Annual	3 $\mu g.m^{-3}$
Sulphur dioxide (SO_2)	Annual	10 $\mu g.m^{-3}$ (for lichens and bryophytes)
	Annual	20 $\mu g.m^{-3}$

*The critical level is generally considered to be 75$\mu g.m^{-3}$; but this only applies where there are high concentrations of SO_2 and ozone, which is not generally the current situation in the UK.

Critical Loads

2.4 Critical loads represent estimates of exposure to one or more pollutants below which significant effects are not known to occur, according to present knowledge. Whilst critical levels relate to the concentration of pollutants in air, critical loads relate to a quantity of a pollutant being deposited onto a habitat/ ecosystem.

2.5 The Air Pollution Information System (APIS)[5] provides critical loads for nitrogen deposition (leading to eutrophication) and acid deposition (leading to acidification). Critical loads for nitrogen deposition are in units of kilogrammes of nitrogen per hectare per year (kg N/ha/year) and vary with habitat sensitivity. Critical loads for acid deposition are in kilogrammes of acid equivalent per hectare per year (keq H^+/ha/year). Site specific critical loads are discussed below.

Ecological Sites

2.6 Environment Agency guidance sets out that the assessment must consider all Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar sites within 10km of an application site, and all Sites of Special Scientific Interest (SSSI) and local nature sites within 2km. The list of ecological sites considered in this assessment, their critical loads, and critical levels are included in Table 2.2, below.

5 Air Pollution Information System. (2021). Available at www.apis.ac.uk

Table 2.2: Modelled Ecological Sites

Site Name	Distance to Site (km)	Designation	X	Y	Critical Loads		Critical Levels			
					Nitrogen Deposition (Kg/Ha/Yr)	Max N Acid Deposition (Keq/Ha/Yr)	Annual Mean NO_X ($\mu g/m^3$)	Maximum 24-Hr NOx ($\mu g/m^3$)	Annual Mean SO_2 ($\mu g/m^3$)	Annual Mean NH_3 ($\mu g/m^3$)
South West London Waterbodies	7.2	SPA	505363	174127	10	1.72	30	75	10	1
Richmond Park	9.7	SAC	518540	173833	10	1.01	30	75	10	1
Priority Orchard 12	1.1	Priority Orchard	510068	178240	10	2.03	30	75	10	1
Priority Woodland 13	0.2	Priority Woodland	510659	179432	10	2.03	30	75	10	1
Priority Woodland 14	0.1	Priority Woodland	510527	179122	10	2.03	30	75	10	1
Priority Woodland 15	0.4	Priority Woodland	510125	179080	10	2.03	30	75	10	1
Cranford Lane Gravel Workings	1.4	LWS	509509	178226	10	2.05	30	75	10	1
Hartlands Wood and Lower Park Farm	1.2	LWS	510748	178120	10	2.03	30	75	10	1
Crane Corridor	0.4	LWS	510432	178853	10	2.03	30	75	10	1
Lake Farm Country Park	1.4	LWS	509461	180215	10	1.71	30	75	10	1
Airlinks Ponds	1.7	LWS	511663	178031	10	2.03	30	75	10	1
Thorncliffe Rough	2.0	LWS	511772	177665	10	2.03	30	75	10	1
Bollinbrooke Way Sunken Pasture	1.9	LWS	508800	180200	10	1.71	30	75	10	1
St Mary's, Wood End	2.0	LWS	509718	181065	10	2.04	30	75	10	1
Havelock Cemetery	2.0	LWS	512471	179239	10	2.03	30	75	10	1

2.7 The critical levels and critical loads used for this assessment, as displayed in Table 2.2, have been selected for conservatism. The critical levels are as stringent as they can be, accounting for uncertainties relating to the habitat profiles of the locally designated ecological sites (e.g. whether they contain lichens/ bryophytes). The same approach has been applied for nitrogen deposition critical loads.

2.8 For acid deposition, values were selected based on which identified habitat within each ecological site was considered to be most vulnerable to acid deposition. In all cases, this was categorised within APIS as 'Unmanaged Woodland'.

Baseline

2.9 Baseline air quality conditions in the vicinity of the site were established through the compilation and review of appropriately sourced baseline concentration and deposition estimates.

2.10 For this assessment, it was decided to obtain all baseline information from APIS[5] to enable a streamlined and consistent assessment approach. The baseline concentrations and deposition rates used within this assessment are listed in Table 2.3, below.

Table 2.3: APIS Baseline Pollutant Concentrations and Deposition Rates

Site Name	Nitrogen Deposition (Kg/Ha/Yr)	Acid Deposition (Keq/Ha/Yr)	Annual Mean NO_X ($\mu g/m^3$)	Annual Mean SO_2 ($\mu g/m^3$)	Annual Mean NH_3 ($\mu g/m^3$)
South West London Waterbodies	9.38	0.83	47.69	4.45	1.90
Richmond Park	11.34	0.93	26.74	1.56	2.14
Priority Orchard 12	10.22	0.88	46.44	2.27	2.36
Priority Woodland 13	10.22	0.88	43.09	2.32	2.36
Priority Woodland 14	10.22	0.88	43.09	2.32	2.36
Priority Woodland 15	10.22	0.88	43.09	2.32	2.36
Cranford Lane Gravel Workings	12.46	1.22	44.28	2.40	1.89
Hartlands Wood and Lower Park Farm	10.22	0.88	46.44	2.27	2.36
Crane Corridor	10.22	0.88	46.44	2.27	2.36
Lake Farm Country Park	10.64	0.90	32.32	2.02	2.19
Airlinks Ponds	10.22	0.88	36.40	2.14	2.36
Thorncliffe Rough	10.22	0.88	38.93	2.31	2.36

Site Name	Nitrogen Deposition (Kg/Ha/Yr)	Acid Deposition (Keq/Ha/Yr)	Annual Mean NO_X (µg/m³)	Annual Mean SO_2 (µg/m³)	Annual Mean NH_3 (µg/m³)
Bollinbrooke Way Sunken Pasture	10.64	0.90	32.65	2.17	2.19
St Mary's, Wood End	10.64	0.90	31.02	1.95	2.19
Havelock Cemetery	10.22	0.88	37.91	2.09	2.36

Model Input Data

Meteorological Data and Surface Characteristics

2.11 Dispersion modelling was undertaken using ADMS-5.2 (version: 5.2.2.0), which is produced by Cambridge Environmental Research Consultants (CERC). The handling of meteorological data, surface characteristics, buildings and terrain remain unchanged from the AQA.

Emission Parameters

2.12 The assessment has been carried out assuming that the fuel type for all generators would be diesel. This is likely to represent a worst-case scenario as the generators are capable of operating on Hydrogenated Vegetable Oil (HVO). Emissions from HVO fuelled generators have been shown to be at least 5% lower than from Diesel fuelled generators. than diesel.

2.13 The SBG emission parameters (e.g. volumetric flow rate, exhaust temperature) were derived from the manufacturers' genset data sheet (MTU 20V4000 DS4000) and its associated engine emissions data sheet (20V4000G94LF). The datasheets are included with the July 2022 AQA.

2.14 The flue gas is also to be treated by SCR and the manufacturers have warranted that an emission concentration of 95mg.NO_X.Nm^{-3} (5% O_2) is to be achieved.

2.15 As the SCR system is only effective after temperatures reach 280°C, there is a period after start-up when emissions from the generators would be unabated. It is understood that this period should last less than 20 minutes and that the generator manufacturers are required to specify equipment that can achieve this. We have conservatively assumed that a warm-up time of 20 minutes, from engine start, will occur where NO_X emissions are unabated.

Ammonia Slip

2.16 As was stated within the AQA, ammonia slip is anticipated to be minimal. Exact concentrations are difficult to predict, so highly conservative assumptions have been made:

- NH_3 emission concentrations have been obtained from the upper limit given within the 2017 BAT Conclusions for Large Combustion Plant[6], which is 15 mg NH_3.Nm^{-3} (STP, dry, 15% O_2);
- All emission rates, irrespective of load, were calculated assuming the generators would always operate at 100% load; and
- Ammonia Slip can occur as soon as urea dosing commences (i.e. in this case, after 20 minutes of warm-up time). However, it was assumed that ammonia slip would occur as soon as the SBGs operate.

2.17 A summary of the emission parameters is included in Table 2.4 below. The X,Y coordinates for each stack are provided in the AQA.

Table 2.4: Model Inputs for Generators

Parameter	Unit	Emissions per generator at 100% load	Emissions per generator at 25% load
Power	kW	3307	827
Stack(s) height	m	23	23
Stack(s) diameter	m	0.7	0.7
Exhaust gas temperature	°C	482	403
Exhaust Volumetric Flow (actual)	$m^3.s^{-1}$	11.9	3.69*
Exhaust Volumetric Flow (dry, 5% O_2)	$Nm^3.s^{-1}$	2.57	0.74
NO_X emission rate (unabated)	g/s	6.063	1.011
NO_X emission rate (SCR abated)	g/s	0.244	0.070
NH_3 Slip emission rate	g/s	0.065	0.065
SO_2 emission rate	g/s	0.0028	0.0007
* Estimated assuming moisture content of 0% in exhaust gas for conservative purposes			

Modelled Scenarios

2.18 The scenarios modelled in this assessment are identical to those modelled within the AQA.

6 EA (2019). UK Interpretation Guidance and Permitting Advice on the Best Available Techniques (BAT) Conclusions for: LARGE COMBUSTION PLANTS (LCPs).

Model Outputs

Modelling of Long Term and Short Term Emissions

2.19 With regard to short-term impacts, consideration has been given to the limited hours of operation through the use of hypergeometric distribution statistics. The short-term impacts are applicable to the 24-hour critical level for NO_X, specifically, where the critical level concentration is not to be exceeded in any day of the year.

2.20 As such, the hypergeometric distribution has been used to ascertain the likelihood of 1 or more days of exceedance in a calendar year coinciding with the actual maximum discrete number of days when the generators are operating. For the purposes of this assessment, a probability threshold of 2% (due to Monte Carlo simulations, this equates to a 5% probability) has been considered as an indicator of 'unlikely exceedance', when generators could run over consecutive days. The percentiles used account for the number of discrete exceedance opportunities, and are as follows: 100% for Testing Scenario 1; 98.90% for Testing Scenario 2; and 99.18% for the Grid Failure scenario.

2.21 To calculate the long-term process contribution, the modelled output, which is based on the model running for every hour in the year, was scaled down to account for the actual number of SBGs operating at one time and the hours of operation in the commissioning year.

Deposition Velocities

2.22 Deposition velocities were obtained from AQTAG06[7] and velocities for forested areas were assumed for all ecological sites, for conservative purposes. The velocities used are provided below:

- NO_X = 0.003 $m.s^{-1}$
- SO_2 = 0.024 $m.s^{-1}$
- NH_3 = 0.030 $m.s^{-1}$

2.23 Nitrogen and acid deposition fluxes were also obtained from the AQTAG06[7] document.

Significance of Impacts

2.24 The significance of impacts from the proposed energy centre is determined in terms of criteria set out in Defra's 'Air emissions risk assessment for your environmental permit'[1]. The significance of impacts is considered both in terms of the:

7 Habitats Directive (2014). AQTAG06 Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air.

- **Process Contribution (PC):** the impact of direct, additional emissions associated with the new processes only, and
- **Predicted Environmental Concentration (PEC):** the impact associated with combined PC and existing background pollutant concentrations.

2.25 The determination of significance is the same within this Addendum as was used within the AQA.

Model Uncertainty

2.26 There are a number of inherent uncertainties associated with the modelling process, including:

- Model uncertainty – due to model formulations;
- Data uncertainty – due to inaccuracies in input data, including emissions estimates, background estimates and meteorology; and uncertainty.

2.27 The choices of the practitioner throughout the air quality assessment process are also essential to the management of uncertainty, including the decision to bias the predicted impact towards a worst-case estimate or a central estimate. This assessment has used inputs tending towards 'worst-case', where appropriate, to provide a conservative and robust approach.

2.28 Table 2.4 below summarises the approach to minimising the uncertainty in the conclusions drawn.

Table 2.4: Summary of Conservative Methods used in Assessment

Source of uncertainty	Approach	Comments
Meteorological data	Heathrow Airport is located 3.5km southwest of the application site and, therefore, conditions will be similar but not exactly the same. As such, the model has been run with 5 years of meteorological data to account for potential differences in meteorology between the two sites. The maximum concentration from 5 years' worth of data, at each receptor or gird point was used in analysis.	This is the recommended approach for Environmental Permitting.
Surface roughness + Minimum Monin Obukhov length	Sensitivity testing exploring the impact of surface roughness ranging between 1.5m or 1.0m and MO between 30m and 100m was undertaken. 1.5m SR and 100m MO was chosen due to most conservative outputs.	Environmental Permitting guidance recommends carrying out sensitivity tests to explore the impact of varying uncertain parameters.

'Ammonia Slip' Emission Assumptions	Due to uncertainties surrounding the NH_3 emission concentrations, assumptions as listed in paragraph 2.16 have been applied.	This is a worst-case approach, especially considering that none of the generators are categorised as 'large combustion plant'.
Use of stringent critical levels and loads	Due to uncertainties surrounding the habitats within LWSs in particular, worst-case critical levels and loads have generally been applied.	It is unlikely that, for example, all modelled ecological sites will contain lichens/ bryophytes, so this is a highly conservative approach.

3. Assessment of Impacts

3.1 The proposed development's predicted impact on air quality at ecological sites during routing testing and maintenance of the generators, as well as during prolonged 72-hour emergency operation, is presented below.

Annual Mean Air Quality Impacts

3.2 For the assessment of annual mean impacts, the outputs of Testing Scenario 1 and Testing Scenario 2 are combined, to reflect the combined impact of all testing and maintenance on local air quality. Grid failure impacts are assessed separately.

3.3 Tables 3.1, 3.2 and 3.3, below, show the modelled impacts on annual mean NO_x, NH_3 and SO_2 concentrations, respectively.

Table 3.1: Annual mean NO_x impacts from routine testing and a prolonged grid failure.

Modelled Receptor	Annual Mean NO_X ($\mu g.m^{-3}$)				Potentially Significant
	NO_X	%CL	PEC	%CL	
Testing Scenarios 1 and 2					
South West London Waterbodies SPA	0.000	0.00%	47.690	159%	No
Richmond Park SAC	0.000	0.00%	26.740	89%	No
Priority Orchard 12	0.005	0.02%	46.445	155%	No
Priority Woodland 13	0.084	0.28%	43.174	144%	No
Priority Woodland 14	0.046	0.15%	43.136	144%	No
Priority Woodland 15	0.016	0.05%	43.106	144%	No
Cranford Lane Gravel Workings LWS	0.004	0.01%	44.284	148%	No
Hartlands Wood and Lower Park Farm LWS	0.003	0.01%	46.443	155%	No
Crane Corridor LWS	0.018	0.06%	46.458	155%	No
Lake Farm Country Park LWS	0.002	0.01%	32.322	108%	No
Airlinks Ponds LWS	0.002	0.01%	36.402	121%	No
Thorncliffe Rough LWS	0.002	0.01%	38.932	130%	No
Bollinbrooke Way Sunken Pasture LWS	0.001	0.00%	32.651	109%	No
St Mary's, Wood End LWS	0.001	0.00%	31.021	103%	No
Havelock Cemetery LWS	0.004	0.01%	37.914	126%	No
Grid Failure					
South West London Waterbodies SPA	0.001	0.00%	47.691	159%	No
Richmond Park SAC	0.000	0.00%	26.740	89%	No

Modelled Receptor	Annual Mean NO_X ($\mu g.m^{-3}$)				Potentially
Priority Orchard 12	0.006	0.02%	46.446	155%	No
Priority Woodland 13	0.105	0.35%	43.195	144%	No
Priority Woodland 14	0.043	0.14%	43.133	144%	No
Priority Woodland 15	0.019	0.06%	43.109	144%	No
Cranford Lane Gravel Workings LWS	0.005	0.02%	44.285	148%	No
Hartlands Wood and Lower Park Farm LWS	0.003	0.01%	46.443	155%	No
Crane Corridor LWS	0.020	0.07%	46.460	155%	No
Lake Farm Country Park LWS	0.003	0.01%	32.323	108%	No
Airlinks Ponds LWS	0.003	0.01%	36.403	121%	No
Thorncliffe Rough LWS	0.002	0.01%	38.932	130%	No
Bollinbrooke Way Sunken Pasture LWS	0.001	0.00%	32.651	109%	No
St Mary's, Wood End LWS	0.002	0.01%	31.022	103%	No
Havelock Cemetery LWS	0.005	0.02%	37.915	126%	No

Note: Any discrepancies are due to rounding.

3.4 As shown in Table 3.1, annual mean NO_X concentrations are modelled to be above the critical level at each ecological site, except Richmond Park. However, none of these exceedances are caused by the development, with the largest concentration increase from process contributions being 0.105 $\mu g.m^{-3}$ (grid failure scenario), which is just 0.35% of the 30 $\mu g.m^{-3}$ critical level.

3.5 As all increases (process contributions) are less than 1% of the critical level at internationally designated sites, and less than 100% of the critical level at locally designated sites, the EA's screening criteria[3] have not been exceeded and all impacts in relation to annual mean NO_X can be considered insignificant.

Table 3.2: Annual mean NH_3 impacts from routine testing and a prolonged grid failure.

Modelled Receptor	Annual Mean NH_3 ($\mu g.m^{-3}$)				Potentially Significant
	NO_X	%CL	PEC	%CL	
Testing Scenarios 1 and 2					
South West London Waterbodies SPA	0.000	0.00%	1.900	190%	No
Richmond Park SAC	0.000	0.00%	2.140	214%	No
Priority Orchard 12	0.000	0.04%	2.360	236%	No
Priority Woodland 13	0.007	0.67%	2.367	237%	No
Priority Woodland 14	0.004	0.39%	2.364	236%	No
Priority Woodland 15	0.001	0.13%	2.361	236%	No
Cranford Lane Gravel Workings LWS	0.000	0.03%	1.890	189%	No
Hartlands Wood and Lower Park Farm LWS	0.000	0.02%	2.360	236%	No

Modelled Receptor	Annual Mean NH_3 ($\mu g.m^{-3}$)				Potentially
Crane Corridor LWS	0.001	0.14%	2.361	236%	No
Lake Farm Country Park LWS	0.000	0.01%	2.190	219%	No
Airlinks Ponds LWS	0.000	0.02%	2.360	236%	No
Thorncliffe Rough LWS	0.000	0.01%	2.360	236%	No
Bollinbrooke Way Sunken Pasture LWS	0.000	0.01%	2.190	219%	No
St Mary's, Wood End LWS	0.000	0.01%	2.190	219%	No
Havelock Cemetery LWS	0.000	0.03%	2.360	236%	No
Grid Failure					
South West London Waterbodies SPA	0.000	0.01%	1.900	190%	No
Richmond Park SAC	0.000	0.01%	2.140	214%	No
Priority Orchard 12	0.001	0.13%	2.361	236%	No
Priority Woodland 13	0.021	2.10%	2.381	238%	No
Priority Woodland 14	0.009	0.87%	2.369	237%	No
Priority Woodland 15	0.004	0.38%	2.364	236%	No
Cranford Lane Gravel Workings LWS	0.001	0.09%	1.891	189%	No
Hartlands Wood and Lower Park Farm LWS	0.001	0.06%	2.361	236%	No
Crane Corridor LWS	0.004	0.39%	2.364	236%	No
Lake Farm Country Park LWS	0.001	0.05%	2.191	219%	No
Airlinks Ponds LWS	0.001	0.06%	2.361	236%	No
Thorncliffe Rough LWS	0.000	0.04%	2.360	236%	No
Bollinbrooke Way Sunken Pasture LWS	0.000	0.03%	2.190	219%	No
St Mary's, Wood End LWS	0.000	0.04%	2.190	219%	No
Havelock Cemetery LWS	0.001	0.10%	2.361	236%	No

Note: Any discrepancies are due to rounding.

3.6 As shown in Table 3.2, annual mean NH_3 concentrations are modelled to be above the critical level at each ecological site. However, none of these exceedances are caused by the development, with the largest concentration increase from process contributions being 0.021 $\mu g.m^{-3}$ (grid failure scenario), which is just 2.1% of the 1 $\mu g.m^{-3}$ critical level (assuming the habitat includes lichens/ bryophytes).

Table 3.3: Annual mean SO_2 impacts from routine testing and a prolonged grid failure.

Modelled Receptor	Annual Mean SO_2 ($\mu g.m^{-3}$)				Potentially Significant
	NO_X	%CL	PEC	%CL	
Testing Scenarios 1 and 2					
South West London Waterbodies SPA	0.0000	0.000%	4.4500	45%	No
Richmond Park SAC	0.0000	0.000%	1.5600	16%	No
Priority Orchard 12	0.0000	0.000%	2.2700	23%	No
Priority Woodland 13	0.0001	0.001%	2.3201	23%	No
Priority Woodland 14	0.0001	0.001%	2.3201	23%	No
Priority Woodland 15	0.0000	0.000%	2.3200	23%	No
Cranford Lane Gravel Workings LWS	0.0000	0.000%	2.4000	24%	No
Hartlands Wood and Lower Park Farm LWS	0.0000	0.000%	2.2700	23%	No
Crane Corridor LWS	0.0000	0.000%	2.2700	23%	No
Lake Farm Country Park LWS	0.0000	0.000%	2.0200	20%	No
Airlinks Ponds LWS	0.0000	0.000%	2.1400	21%	No
Thorncliffe Rough LWS	0.0000	0.000%	2.3100	23%	No
Bollinbrooke Way Sunken Pasture LWS	0.0000	0.000%	2.1700	22%	No
St Mary's, Wood End LWS	0.0000	0.000%	1.9500	20%	No
Havelock Cemetery LWS	0.0000	0.000%	2.0900	21%	No
Grid Failure					
South West London Waterbodies SPA	0.0000	0.000%	4.4500	45%	No
Richmond Park SAC	0.0000	0.000%	1.5600	16%	No
Priority Orchard 12	0.0001	0.001%	2.2701	23%	No
Priority Woodland 13	0.0009	0.009%	2.3209	23%	No
Priority Woodland 14	0.0004	0.004%	2.3204	23%	No
Priority Woodland 15	0.0002	0.002%	2.3202	23%	No
Cranford Lane Gravel Workings LWS	0.0000	0.000%	2.4000	24%	No
Hartlands Wood and Lower Park Farm LWS	0.0000	0.000%	2.2700	23%	No
Crane Corridor LWS	0.0002	0.002%	2.2702	23%	No
Lake Farm Country Park LWS	0.0000	0.000%	2.0200	20%	No

Modelled Receptor	Annual Mean SO_2 (µg.m^{-3})				Potentially
Airlinks Ponds LWS	0.0000	0.000%	2.1400	21%	No
Thorncliffe Rough LWS	0.0000	0.000%	2.3100	23%	No
Bollinbrooke Way Sunken Pasture LWS	0.0000	0.000%	2.1700	22%	No
St Mary's, Wood End LWS	0.0000	0.000%	1.9500	20%	No
Havelock Cemetery LWS	0.0000	0.000%	2.0900	21%	No

Note: Any discrepancies are due to rounding.

3.7 As shown in Table 3.3, annual mean SO_2 concentrations are modelled to be well below the critical level for each ecological site, even when assuming the habitat includes lichens/ bryophytes. The largest concentration increase from process contributions is 0.0009 µg.m^{-3} (grid failure scenario), which is just 0.009% of the 10 µg.m^{-3} critical level.

3.8 As all increases are less than 1% of the critical level at internationally designated sites, and less than 100% of the critical level at locally designated sites, the EA's screening criteria[3] have not been exceeded and all impacts in relation to annual mean SO_2 can be considered insignificant.

Short-Term Air Quality Impacts

3.9 For short term impacts, the results for Testing Scenarios 1 and 2 are presented separately, as the different types of generator testing would not occur within the same hour. Short-term impacts associated with an emergency grid failure are also presented separately.

3.10 Short-term impacts for NO_X are provided in Table 3.4, below, assessed against the maximum daily critical level of 75 µg.m^{-3}.

Table 3.4: 24-hour maximum NO_x impacts from routine testing and a prolonged grid failure.

Modelled Receptor	Maximum 24-Hour NO_X (µg.m^{-3})		Potentially Significant
	NO_X	%CL	
Testing Scenario 1			
South West London Waterbodies SPA	0.2	0.2%	No
Richmond Park SAC	0.1	0.1%	No
Priority Orchard 12	1.9	2.6%	No
Priority Woodland 13	15.8	21.1%	No
Priority Woodland 14	23.2	30.9%	No
Priority Woodland 15	6.6	8.8%	No
Cranford Lane Gravel Workings LWS	1.3	1.8%	No
Hartlands Wood and Lower Park Farm LWS	1.4	1.8%	No
Crane Corridor LWS	7.3	9.7%	No
Lake Farm Country Park LWS	1.2	1.6%	No
Airlinks Ponds LWS	0.9	1.2%	No
Thorncliffe Rough LWS	0.7	1.0%	No
Bollinbrooke Way Sunken Pasture LWS	0.7	1.0%	No

Modelled Receptor	Maximum 24-Hour NO_X ($\mu g.m^{-3}$)		Potentially
St Mary's, Wood End LWS	0.9	1.2%	No
Havelock Cemetery LWS	0.9	1.3%	No
Testing Scenario 2			
South West London Waterbodies SPA	0.2	0.3%	No
Richmond Park SAC	0.1	0.1%	No
Priority Orchard 12	2.2	3.0%	No
Priority Woodland 13	16.9	22.6%	No
Priority Woodland 14	22.2	29.6%	No
Priority Woodland 15	8.7	11.5%	No
Cranford Lane Gravel Workings LWS	1.5	2.0%	No
Hartlands Wood and Lower Park Farm LWS	1.6	2.1%	No
Crane Corridor LWS	8.5	11.3%	No
Lake Farm Country Park LWS	1.3	1.7%	No
Airlinks Ponds LWS	1.0	1.4%	No
Thorncliffe Rough LWS	0.8	1.1%	No
Bollinbrooke Way Sunken Pasture LWS	0.7	1.0%	No
St Mary's, Wood End LWS	0.6	0.9%	No
Havelock Cemetery LWS	1.0	1.3%	No
Grid Failure			
South West London Waterbodies SPA	0.6	0.8%	No
Richmond Park SAC	0.3	0.5%	No
Priority Orchard 12	6.4	8.5%	No
Priority Woodland 13	50.3	67.1%	No
Priority Woodland 14	56.3	75.1%	No
Priority Woodland 15	25.2	33.7%	No
Cranford Lane Gravel Workings LWS	4.5	6.1%	No
Hartlands Wood and Lower Park Farm LWS	4.9	6.5%	No
Crane Corridor LWS	25.6	34.1%	No
Lake Farm Country Park LWS	4.1	5.5%	No
Airlinks Ponds LWS	3.4	4.5%	No
Thorncliffe Rough LWS	2.7	3.6%	No
Bollinbrooke Way Sunken Pasture LWS	2.5	3.4%	No
St Mary's, Wood End LWS	2.1	2.8%	No
Havelock Cemetery LWS	3.0	4.0%	No

Note: Any discrepancies are due to rounding.

3.11 As shown in Table 3.4, maximum 24-hour NO_x concentrations are modelled to be below the critical level at each ecological site, even when using the more stringent assessment criteria. The maximum predicted daily concentration increase from process contributions is 56.3 $\mu g.m^{-3}$ (grid failure scenario), which is 75.1% of the 75 $\mu g.m^{-3}$ critical level.

3.12 As all increases are less than 10% of the critical level at internationally designated sites, and less than 100% of the critical level at locally designated sites, the EA's screening criteria[3] have not been exceeded and all impacts in relation to daily maximum NO_x can be considered insignificant.

Deposition

3.13 For the assessment of nitrogen and acid deposition impacts, the outputs of Testing Scenario 1 and Testing Scenario 2 are combined, to reflect the combined impact of all testing and maintenance on local air quality. Grid failure impacts are assessed separately.

3.14 Tables 3.5 and 3.6, below, show modelled impacts on nitrogen and acid deposition, respectively. Nitrogen deposition considers the cumulative contributions of NO_X and NH_3, and acid deposition considers both of these pollutants and SO_2.

Table 3.5: Nitrogen deposition impacts from routine testing and a prolonged grid failure.

Modelled Receptor	Nitrogen deposition (Kg N/ha/yr)				Potentially Significant
	N Deposition PC	%CL	N Deposition PEC	%CL	
Testing Scenarios 1 and 2					
South West London Waterbodies SPA	0.000	0.00%	9.380	94%	No
Richmond Park SAC	0.000	0.00%	11.340	113%	No
Priority Orchard 12	0.005	0.05%	10.225	102%	No
Priority Woodland 13	0.077	0.77%	10.297	103%	No
Priority Woodland 14	0.043	0.43%	10.263	103%	No
Priority Woodland 15	0.015	0.15%	10.235	102%	No
Cranford Lane Gravel Workings LWS	0.003	0.03%	12.463	125%	No
Hartlands Wood and Lower Park Farm LWS	0.002	0.02%	10.222	102%	No
Crane Corridor LWS	0.016	0.16%	10.236	102%	No
Lake Farm Country Park LWS	0.002	0.02%	10.642	106%	No
Airlinks Ponds LWS	0.002	0.02%	10.222	102%	No
Thorncliffe Rough LWS	0.001	0.01%	10.221	102%	No
Bollinbrooke Way Sunken Pasture LWS	0.001	0.01%	10.641	106%	No
St Mary's, Wood End LWS	0.001	0.01%	10.641	106%	No
Havelock Cemetery LWS	0.003	0.03%	10.223	102%	No
Grid Failure					
South West London Waterbodies SPA	0.001	0.01%	9.381	94%	No
Richmond Park SAC	0.001	0.01%	11.341	113%	No
Priority Orchard 12	0.012	0.12%	10.232	102%	No
Priority Woodland 13	0.194	1.94%	10.414	104%	No
Priority Woodland 14	0.080	0.80%	10.300	103%	No
Priority Woodland 15	0.036	0.36%	10.256	103%	No

Modelled Receptor	Nitrogen deposition (Kg N/ha/yr)				Potentially
Cranford Lane Gravel Workings LWS	0.009	0.09%	12.469	125%	No
Hartlands Wood and Lower Park Farm LWS	0.006	0.06%	10.226	102%	No
Crane Corridor LWS	0.036	0.36%	10.256	103%	No
Lake Farm Country Park LWS	0.005	0.05%	10.645	106%	No
Airlinks Ponds LWS	0.006	0.06%	10.226	102%	No
Thorncliffe Rough LWS	0.004	0.04%	10.224	102%	No
Bollinbrooke Way Sunken Pasture LWS	0.002	0.02%	10.642	106%	No
St Mary's, Wood End LWS	0.004	0.04%	10.644	106%	No
Havelock Cemetery LWS	0.009	0.09%	10.229	102%	No

Note: Any discrepancies are due to rounding.

3.15 As shown in Table 3.5, nitrogen deposition is modelled to be above the critical load for each ecological site, except the South London Waterbodies SPA. However, none of these exceedances are caused by the development, with the largest deposition increase from process contributions being 0.194 kg $N.Ha^{-1}.Yr^{-1}$ (grid failure scenario), which is just 1.94% of the 10 kg $N.Ha^{-1}.Yr^{-1}$ critical load.

3.16 As all increases are less than 1% of the critical load at internationally designated sites, and less than 100% of the critical load at locally designated sites, the EA's screening criteria[3] have not been exceeded and all impacts in relation to nitrogen deposition can be considered insignificant.

Table 3.6: Acid deposition impacts from routine testing and a prolonged grid failure.

Modelled Receptor	Nitrogen deposition (Keq H^+/ha/yr)				Potentially Significant
	Acid Deposition PC	%CL	Acid Deposition PEC	%CL	
Testing Scenarios 1 and 2					
South West London Waterbodies SPA	0.0000	0.00%	0.8300	48%	No
Richmond Park SAC	0.0000	0.00%	0.9300	92%	No
Priority Orchard 12	0.0003	0.02%	0.8803	43%	No
Priority Woodland 13	0.0055	0.27%	0.8855	44%	No
Priority Woodland 14	0.0031	0.15%	0.8831	44%	No
Priority Woodland 15	0.0011	0.05%	0.8811	43%	No
Cranford Lane Gravel Workings LWS	0.0002	0.01%	1.2202	59%	No
Hartlands Wood and Lower Park Farm LWS	0.0002	0.01%	0.8802	43%	No
Crane Corridor LWS	0.0012	0.06%	0.8812	43%	No

Modelled Receptor	Nitrogen deposition (Keq H^+/ha/yr)				Potentially
Lake Farm Country Park LWS	0.0001	0.01%	0.9001	53%	No
Airlinks Ponds LWS	0.0001	0.01%	0.8801	43%	No
Thorncliffe Rough LWS	0.0001	0.00%	0.8801	43%	No
Bollinbrooke Way Sunken Pasture LWS	0.0001	0.00%	0.9001	53%	No
St Mary's, Wood End LWS	0.0001	0.00%	0.9001	44%	No
Havelock Cemetery LWS	0.0002	0.01%	0.8802	43%	No
Grid Failure					
South West London Waterbodies SPA	0.0001	0.00%	0.8301	48%	No
Richmond Park SAC	0.0000	0.00%	0.9300	92%	No
Priority Orchard 12	0.0009	0.04%	0.8809	43%	No
Priority Woodland 13	0.0140	0.69%	0.8940	44%	No
Priority Woodland 14	0.0058	0.29%	0.8858	44%	No
Priority Woodland 15	0.0026	0.13%	0.8826	43%	No
Cranford Lane Gravel Workings LWS	0.0006	0.03%	1.2206	59%	No
Hartlands Wood and Lower Park Farm LWS	0.0004	0.02%	0.8804	43%	No
Crane Corridor LWS	0.0026	0.13%	0.8826	44%	No
Lake Farm Country Park LWS	0.0004	0.02%	0.9004	53%	No
Airlinks Ponds LWS	0.0004	0.02%	0.8804	43%	No
Thorncliffe Rough LWS	0.0003	0.01%	0.8803	43%	No
Bollinbrooke Way Sunken Pasture LWS	0.0002	0.01%	0.9002	53%	No
St Mary's, Wood End LWS	0.0003	0.01%	0.9003	44%	No
Havelock Cemetery LWS	0.0007	0.03%	0.8807	43%	No

Note: Any discrepancies are due to rounding.

3.17 As shown in Table 3.6, acid deposition is modelled to be below the critical load at each ecological site, with the largest deposition increase from process contributions being 0.014 Keq $H^+.Ha^{-1}.Yr^{-1}$ (grid failure scenario), at Priority Woodland 13, which is just 0.69% of the 2.0295 Keq $H^+.Ha^{-1}.Yr^{-1}$ critical load for that habitat.

3.18 As all increases are less than 1% of the critical load at internationally designated sites, and less than 100% of the critical load at locally designated sites, the EA's screening criteria[3] have not been exceeded and all impacts in relation to acid deposition can be considered insignificant.

4. Conclusions

4.1 Phlorum Limited has been commissioned by HDR to produce an air quality assessment addendum to support the permit application to operate a data centre at Bulls Bridge Industrial Estate, Hayes, UB3 4QQ.

4.2 A dispersion modelling assessment of the 14 SBGs was undertaken at the request of the Environment Agency, to assess air quality impacts on nearby ecological sites. Concentrations of NO_x, NH_3 and SO_2 were predicted at selected ecological receptors using a detailed dispersion model and compared with the relevant long and short-term critical levels. Nitrogen and acid deposition were also predicted and compared against relevant critical loads.

4.3 The results in Section 3 of this report show that the relevant screening criteria are not exceeded at any modelled receptor location for any critical level or critical load of any pollutant. As such, significant impacts on ecological sites as a result of the SBGs operating under normal testing and maintenance, or an unplanned emergency grid failure, are not anticipated.

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