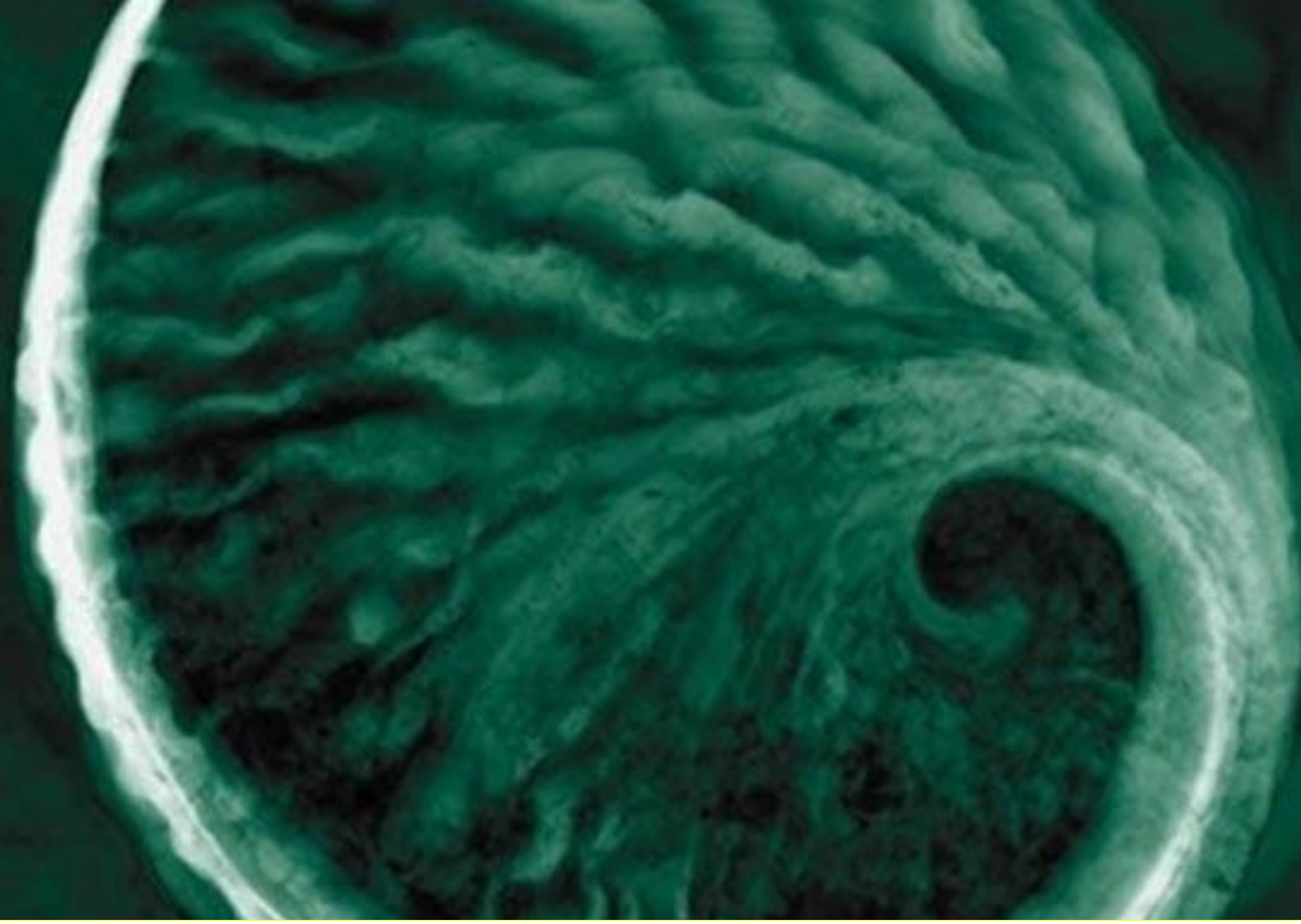

EQUINIX

Slough Campus Permit

Substantial Variation Application: Supporting Information Document

14 October 2020

Project No.: 0420743

The business of sustainability

ERM

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14 October 2020

Slough Campus Permit

Substantial Variation Application: Supporting Information Document

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Acronyms and Abbreviations

Name	Description
BAT	Best Available Technique
BREF	Best Available Techniques Reference document
Breached, breaching, breach	Used here when the predicted ambient concentration of a pollutant at a receptor will not comply with the air quality standard. For example, if the 1-hour mean NO_2 standard is predicted to be exceeded 20 times at a receptor, a breach of the NO_2 1-hour mean is therefore predicted as there would be more than the 18 allowed exceedances of this standard.
Campus	Equinix data centres to remain permitted under Slough Campus Environmental Permit (EPR/LP3303PR) after the partial transfer of LD13x (formerly known as LD10): LD4, LD5, LD6 and LD7
CO	Carbon monoxide
EA	Environment Agency
EMS	Environmental Management System
EP	Environmental Permit
EPR	Environmental Permitting Regulations
Exceeded, exceedance, exceed	Used here when a predicted concentration is above an air quality standard threshold. For example, a 1-hour mean NO_2 predicted environmental contribution of 220 µg/m^3 exceeds the 200 µg/m^3 air quality standard.
kWe	Electrical power in kilowatts
IED	Industrial Emissions Directive
ISO	International Standards Organisation
km	Kilometre
L	Litre
LD11x	Data centre on the Slough Trading Estate operated by Equinix for which a permit application is currently being determined (EPR/CP3409BH)
LD13x	Data centre formerly known as LD10, being transferred into a separate permit from the Campus Permit
m	Meter
MCP	Medium Combustion plant
MCPD	Medium Combustion Plant Directive
MW_e	megawatt electrical
MW_{th}	megawatt thermal
NO_x	Oxides of nitrogen
PM_{10}	Particulate Matter of diameter below or equal to 10 µm
PUE	Power Usage Effectiveness
SO_2	Sulphur dioxide
t	Metric tonne
TGN	Technical Guidance Note
UPS	Uninterruptable Power Supply
WWTP	Waste Water Treatment Plant

APPLICATION CHECKLIST

Requirement	Topic	Location in Report
Form C2 Question 2b and table 1	Changes to existing activities	Section 2
Form C2 Question 3d	Management System	Section 7.1
Form C2 Question 5a	Provide a plan for the Site	Figure 3.2
Form C2 Question 5c	Non-technical summary	Page 2
Form C2 Question 6	Environmental Risk Assessment	Section 15
Form C3 Question 1 and Table 1a	Activities to vary	Section 2
Form C3 Question 2	Emissions to air	Section 5.2
Form C3 Question 2	Emissions to water	Section 5.3
Form C3 Question 2	Emissions to Sewer	Section 5.4
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Form C3 Question 3	Operating Techniques	Section 6
From C3 Question 3b and Table 4	General Requirements	Section 12 and Section 11
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Form C3 Question 4	Monitoring	Section 14
Form C3 Question 4b	Point source emissions	Section 5.2
Form C3 Question 6a	Energy efficiency	Section 10.2
Form C3 Question 6b	Energy usage	Section 10.1
Form C3 Question 6c	Climate change levy	Section 10.4
Form C3 Question 6d	The raw and other materials, other substances and water use	Section 9
Form C3 Question 6e	Avoid producing waste	Section 8

NON-TECHNICAL SUMMARY

Equinix UK Ltd (Equinix) operates five data centres (LD4, LD5, LD6, LD7 and LD10) on the Slough Trading Estate (the Campus), under the current permit number EPR/LP3303PR issued on 26th February 2020. Due to the establishment of an Equinix Joint Venture (JV) company, the LD10 data centre, to be renamed LD13x, is being transferred to a new permit. The partial transfer is covered in a separate supporting document and application. The 'Slough Campus Data Centre Permit' and this variation application now refers to the four remaining data centres LD4, LD5, LD6 and LD7.

The four data centres all comprise warehouse style buildings containing the data storage equipment and ancillary equipment designed to provide power in the event of the external power supply failing. Currently, there are 54 back-up generators across the whole Campus that provide power to the data centre in the event of grid supply failure. Due to growth of the data centres and an increase in power demand, Equinix needs to increase the number of generators by 23 to meet the energy supply needed. The Campus Permit therefore requires to be substantially varied to take into account the increase in emergency power generation capacity and associated diesel fuel storage capacity at LD4, LD5 and LD7.

As per the existing Slough Campus Permit (EPR/LP3303PR) diesel generators are considered to be the best available technique for the purpose of emergency generation for data centres. All of the new generators to be installed have low emissions profile based on 2G-TA-Luft configurations. A review of operating techniques and the potential effects on the environment are included in this application.

The most likely potential impact from the data centres operations, as a result of the increased use of diesel generators, is to air quality. An updated air quality impact assessment has been carried out to assess the potential impact of the operation of additional generators on local air quality. The assessment takes into account the cumulative impact of the Campus (LD4, LD5, LD6 and LD7), the transferred LD13x site and the LD11x data centre for which a permit application is currently being determined (EPR/CP3409BH).

For human health, compliance with short-term PM_{10} and NO_2 standards, as well as long-term NO_2 standards were assessed. The Campus uses ultra-low sulphur diesel. Emission rates for SO_2 for the engines were calculated and were found to be exceptionally small (of the order of 1×10^{-3} g/s) and as a result SO_2 emissions have not been assessed.

The assessment found that the particulate emissions from the engines do not have the potential to breach the air quality standard for PM_{10}, whether in emergency running or in testing mode.

The assessment identified that for the testing regime of the Campus alone and in combination with LD13x and LD11x, there is the potential to breach the hourly nitrogen dioxide standard. The maximum assessed probability of the testing regime breaching the hourly NO_2 standard is 1.7×10^{-17}% for the Campus alone and 1.0×10^{-12}% for the Campus in combination with LD13x and LD11x, i.e. very low. The Environment Agency guidance[1] states that where the probability of exceedance is greater than 5%, further proposals of emissions reduction are required. In both cases, exceedances of the hourly NO_2 standard are considered "highly unlikely" as the probabilities are far less than 1%. Therefore, no further proposals to reduce the risk of exceedance are made.

The testing regime scenarios were not predicted to have the potential to impact adversely the annual mean NO_2 standard for the protection of human health, including at the Air Quality Management Areas in Slough Borough. There are no significant impacts predicted on any protected conservation areas from the testing regime.

Emergency power generation scenarios were assessed with all generators of the Campus alone and in combination LD13x and LD11x running concurrently. In both cases, there is predicted to be the

[1] Environment Agency, 2019, Guidance Specified generators: dispersion modelling assessment, https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment

potential for the hourly NO_2 standard to be exceeded, and with sufficient running hours for a breach to occur.

The model predicts that emergency running of the Campus' generators alone or in combination with LD13x and LD11x has the potential to exceed the 24 hour NO_x standard at Haymill Valley LNR. It also predicts the potential for significant impacts at Burnham Beaches SAC from the emergency running of the Campus' generators in combination with LD13x and LD11x. The predicted process contribution at the SAC is however only marginally over the threshold for insignificance (11% vs a threshold of 10 %).

Furthermore, in practice in the last nine years there has been only one occurrence where some of the data centres (LD6, LD7 and LD10) had to use the back-up generators, this was during a national power outage in mid-2019. As a result the potential for actual significant impacts at Burnham Beaches SAC is considered highly unlikely.

This variation application will not cause the operation to have any further emissions to watercourses, groundwater, sewers or land.

Equinix is an experienced operator of data centres, including back up engines, operating centres across the UK. Equinix will continue to operate its own IS014001 accredited Environmental Management System which will continue to cover the campus data centres.

1. ENVIRONMENTAL PERMIT TO BE VARIED

The following variation application and supporting information for the Campus data centres has been prepared by Environmental Resources Management Limited (ERM) on behalf of Equinix (UK) Limited. The supporting information document is based on the description of the data centres provided by Equinix, publically available environmental data and results of air quality dispersion modelling undertaken by ERM.

This variation application pertains to Environmental Permit (EP): "Equinix (UK) Limited, Equinix Slough Campus Data Centre, Slough Trading Estate, Buckingham Avenue, Slough, SL1 4AX, Permit Number EPR/LP3303PR" (the Permit).

In parallel to this permit variation application, an application has been submitted to the Environment Agency (EA) for the transfer of permitting of one of the data centres (LD10, to be renamed LD13x) to a separate permit. After the transfer, this Campus Permit (EPR/LP3303PR) will cover the following Equinix data centres:

- LD4;
- LD5;
- LD6; and
- LD7.

This Supporting Information Document focuses on the substantial variation of the Campus Permit, i.e. LD4, LD5, LD6 and LD7 only.

2. REASON FOR VARIATION APPLICATION

2.1 Reason for Application

Equinix (UK) Limited operates five data centres (LD4, LD5, LD6, LD7 and LD10) on the Slough Trading Estate (the Campus), under the current permit number EPR/LP3303PR issued on 26th February 2020. Following the establishment of an Equinix Joint Venture (JV) company to operate the LD10 (to be renamed LD13x) data centre, Equinix seeks the transfer of permitting of LD10/LD13x to a new permit, which request is covered in a separate supporting information report provided to the EA.

The four remaining data centres all comprise warehouse style buildings containing data storage equipment and ancillary equipment designed to provide power in the event of the external power supply failing. Currently there are 54 back-up generators across the Campus that provide power to the data centres in the event of grid supply failure, as well as one fire pump. Due to growth of the data centres and an increase in power demand, Equinix proposes to increase the number of generators by 23 to meet the energy supply need in case of power supply failure, as follows:

- LD4: 3 new generators;
- LD5: 8 new generators;
- LD6: No new generators are being added; and
- LD7: 12 new generators.

In order to take into account the additional emergency backup generation capacity of the data centres in Permit EPR/LP3303PR, it is proposed that a substantial variation is made to the Slough Campus Permit. This Supporting Information Document provides information on the changes to be made for this variation to the new Campus Permit.

2.2 Listed Activities

Under this permit variation, the main commercial activity of the data centres does not change and is primarily data storage. The nature of the listed activity (AR1) in the Permit Table S1.1 remains unchanged. However, the overall thermal input capacity will increase due to the additional generators.

Details are given in **Table 2.1**.

Table 2.1 Listed Activities

Listed Activities	Descriptions	Limits
Section 1.1 Part A(1)(a) "Burning any fuel in an appliance with a rated thermal input of 50 or more megawatts"	Combustion of diesel fuel in electrical generators of varying capacities but with an aggregated thermal input >50MW_{th} (total current thermal input c. 255 MW_{th}, total thermal input after variation c. 400 MW_{th})	From receipt of raw materials and generation of electricity to despatch of waste. Electricity produced at the installation cannot be exported to the National Grid.

2.3 Directly Associated Activities

The nature of the directly associated activities (AR2 and AR3) in the Permit Table S1.1 remain unchanged. They are listed in **Table 2.2** below for reference.

The capacity of storage of diesel fuel (AR2) will increase as a result of additional fuel storage for the new generators. The detailed capacities of the storage tanks are given in **Section 4.4**.

Table 2.2 Directly Associated Activities

Directly associated activity	Description	Limits
Storage and use of diesel (AR2)	Receipt of diesel into bulk tanks, distribution to day tanks and combustion in generators.	From receipt of materials to use within the facility
Surface water drainage (AR3)	Input to site drainage system until discharge to surface water drain via interceptors.	Input to site drainage system until discharge to surface water drain via interceptors

3. SITE DESCRIPTION

3.1 Site Location

The Campus is located on the Slough Trading Estate, owned and managed by SEGRO plc. The location of the four data centres remains unchanged, but their location is given in **Table 3.1** for completeness.

Table 3.1 Location of the Data Centres

Site	Address	Coordinates (NGR)	Status
LD4	2 Buckingham Avenue, Slough Trading Estate, Slough, SL1 4NB	494777, 181422	Operational
LD5	8 Buckingham Avenue, Slough Trading Estate, Slough, SL1 4RY	495197, 181243	Operational
LD6	52 Buckingham Avenue, Slough Trading Estate, Slough, SL1 4PF	494751, 181453	Operational
LD7	Building 1, Banbury Avenue, Slough Trading Estate, Slough, SL1 4LN	494840, 181566	Building LD7.1: Operational Building 7.2: Under construction

The locations of all the Equinix operated data centres on the Slough Trading Estate are shown in **Figure 3.1**. This includes LD11x for which a permit application is currently being determined (EPR/CP3409BH) and the LD10/LD13x site.

An updated installation boundary for the Campus Permit (EPR/LP3303PR) is provided in **Figure 3.2**.

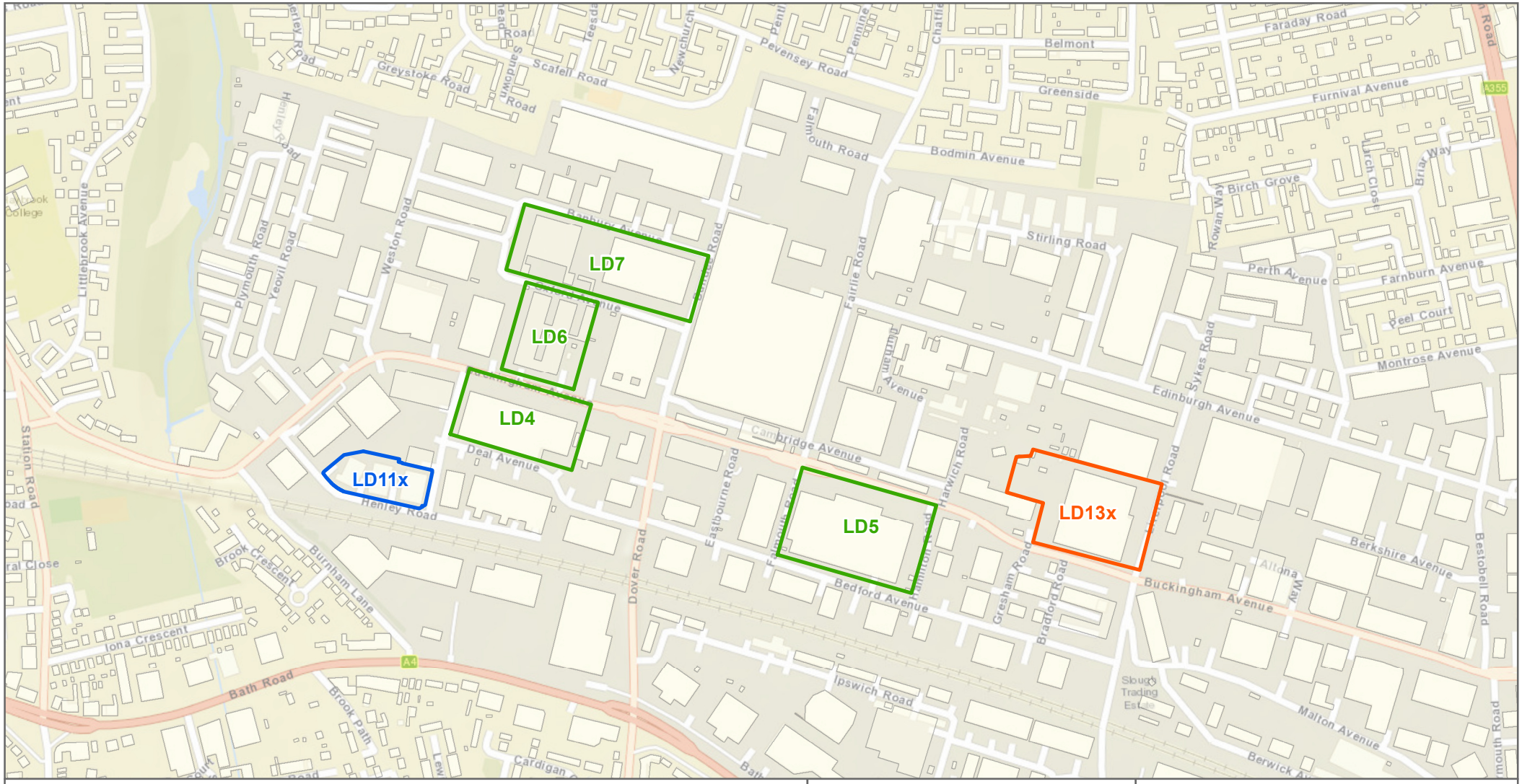


Figure 3.1 Overview of Equinix Operated Data Centres in Slough
Slough Trading Estate, 765 Henley Road
Slough SL1 4JW

SCALE: 1:7,500	VERSION: A01
SIZE: A4	DRAWN: RH
PROJECT: 0420743	CHECKED: HB
DATE: 29/09/2020	APPROVED: HB

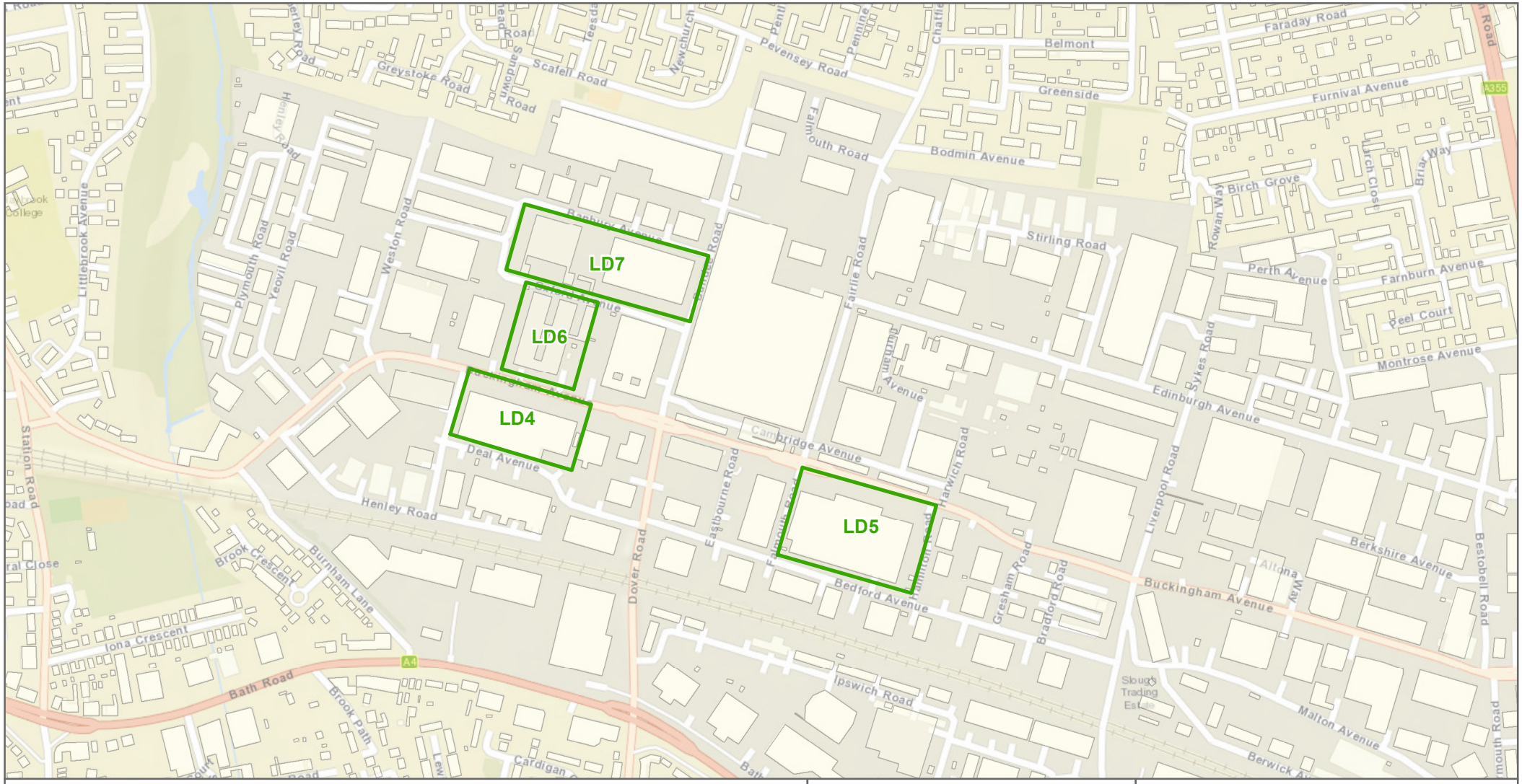
Site layout data provided by Equinix

ERM

EQUINIX

PROJECTION: British National Grid

Path: \\UKLONSV04\Data\Oxford\Projects\0420743 Equinix Slough Permit.GB\Slough campus variation\GIS\MAPS\Figure3.1_OverviewOfEquinixOperatedDataCentresInSlough_A01.mxd



Slough Campus Site Installation Boundary

0 50 100 150 200
Metres

N

Figure 3.2
Updated Installation Boundary
Slough Trading Estate, 765 Henley Road
Slough SL1 4JW

SCALE: 1:7,500	VERSION: A01
SIZE: A4	DRAWN: RH
PROJECT: 0420743	CHECKED: HB
DATE: 29/09/2020	APPROVED: HB

Site layout data provided by Equinix

ERM

EQUINIX

PROJECTION: British National Grid

Path: \\UKLONSV04\Data\Oxford\Projects\0420743 Equinix Slough Permit.GB\Slough campus variation\GIS\MAPS\Figure3.2_UpdatedInstallationBoundary_A01.mxd

3.2 Site Context

The site context of the four remaining sites has not changed as a result of this permit variation as there has not been an alteration to their site boundaries. Detailed information on the site context for LD4, LD5, LD6 and LD7 can be found in the original permit application document dated December 2018.

4. SITE ACTIVITY

4.1 Overall Site Activity

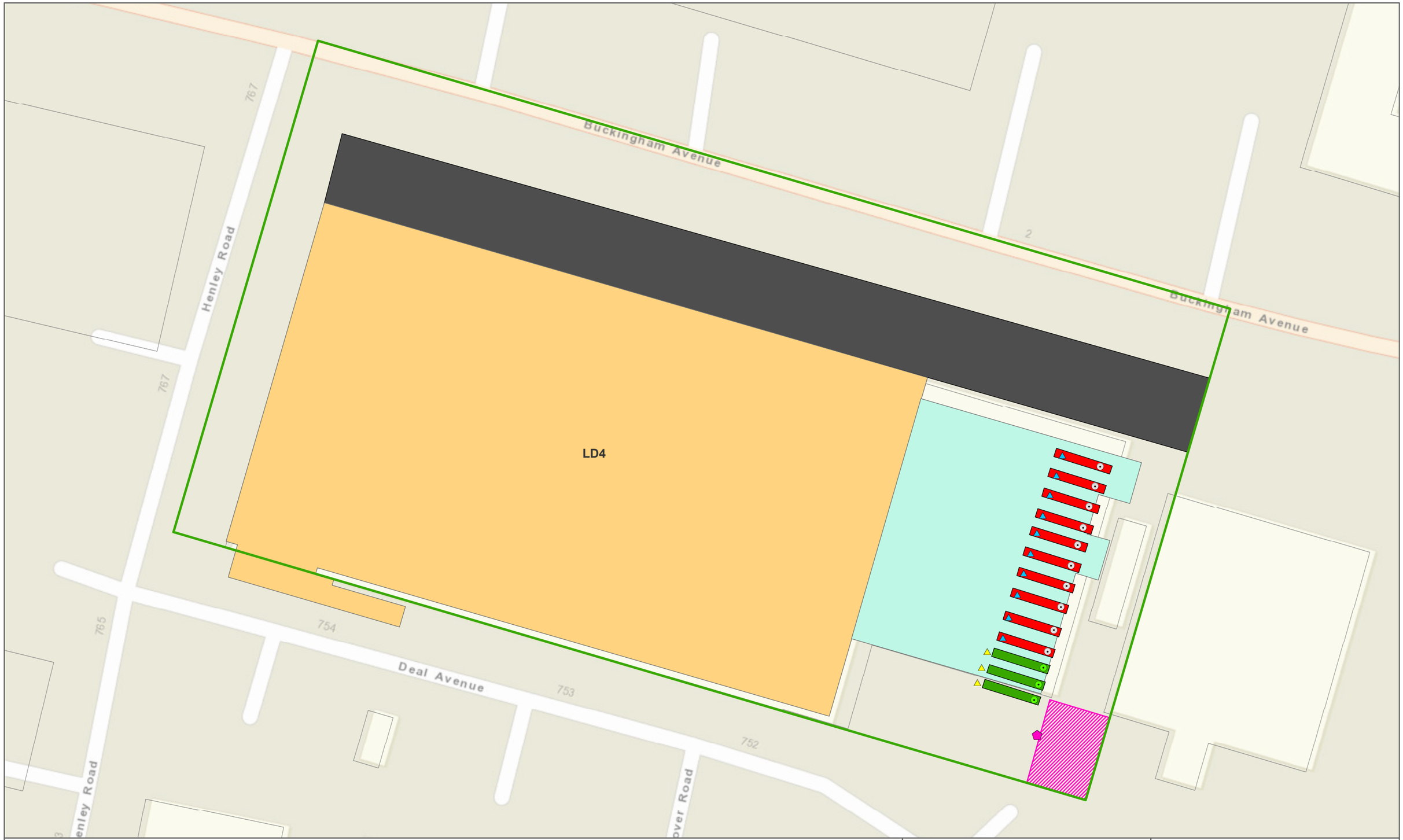
The overall commercial activity for the Campus is data storage in four data centres LD4, LD5, LD6 and LD7. They all comprise warehouse style buildings containing the data storage equipment and ancillary equipment designed to provide power in the event of the external power supply failing. The buildings take up the majority of the site areas.

As the sites are solely permitted for their combustion activities (diesel emergency backup generators and fire pump), this application focuses solely on those activities. The activities related to the operation of the data centre itself (electronic equipment, cooling, etc.) are not included.

Currently there are 54 back-up generators across LD4, LD5, LD6 and LD7 to provide power to the data centres in the event of grid supply failure. There is also a small diesel fire pump at LD5. Due to the growth of the data centres and an increase in power demand in case of power supply failure, Equinix needs to install 23 additional generators across the different sites to meet the energy supply need.

Each data centre has the means of back-up power supply consisting of battery Uninterruptable Power Supplies (UPS) capable of maintaining data centre operations for several minutes before using the on-site generators for electrical power supply.

Updated site layout drawings for each of the four data centre, including locations of generators and fuel storage, are shown in **Figure 4.1, Figure 4.2, Figure 4.3** and **Figure 4.4**.



- LD4 Site Installation Boundary
- Data Centre
- Proposed New Generators (Outside - in Containers)
- Operational Generators (Outside - in Containers)
- Bulk Fuel Storage
- Car Park
- Gantry
- Operational Day Tanks
- Proposed New Day Tanks
- Operational Stacks
- Proposed New Stacks
- Filling Point

0 10 20
Metres

N

Figure 4.1
Site Layout - LD4
Slough Trading Estate, 765 Henley Road
Slough SL1 4JW

SCALE: See Scale Bar	VERSION: A02
SIZE: A3	DRAWN: RH
PROJECT: 0420743	CHECKED: HB
DATE: 07/10/2020	APPROVED: HB

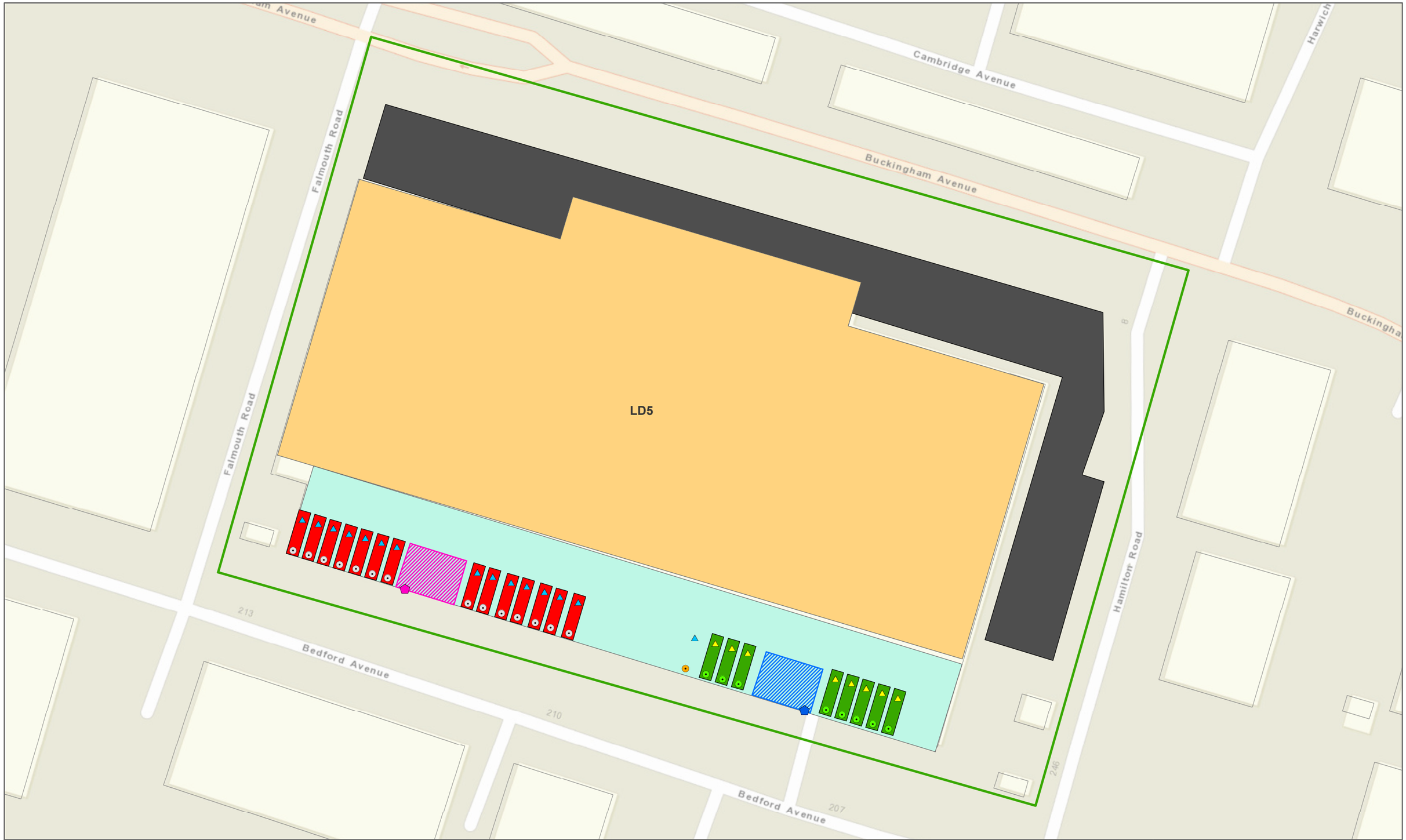
Site layout data provided by Equinix

ERM

EQUINIX

PROJECTION: British National Grid

Path: \\UKLONSV04\Data\Oxford\Projects\0420743 Equinix Slough Permit.GB\Slough campus variation\GIS\MAPS\LD4\Figure4.1_SiteLayout_LD4_A02.mxd



- LD5 Site Installation Boundary
- Data Centre
- Proposed New Generators (Outside - Small Room)
- Operational Generators (Outside - Small Room)
- Operational Bulk Fuel Storage
- Proposed New Bulk Fuel Storage
- Car Park
- Gantry
- Operational Day Tanks
- Proposed New Day Tanks
- Operational Stacks
- Proposed New Stacks
- Diesel Fire Pump Stack
- Operational Filling Point
- Proposed New Filling Point

0 10 20
Metres

N

Figure 4.2
Site Layout - LD5
Slough Trading Estate, 765 Henley Road
Slough SL1 4JW

SCALE: See Scale Bar	VERSION: A05
SIZE: A3	DRAWN: RH
PROJECT: 0420743	CHECKED: HB
DATE: 07/10/2020	APPROVED: HB

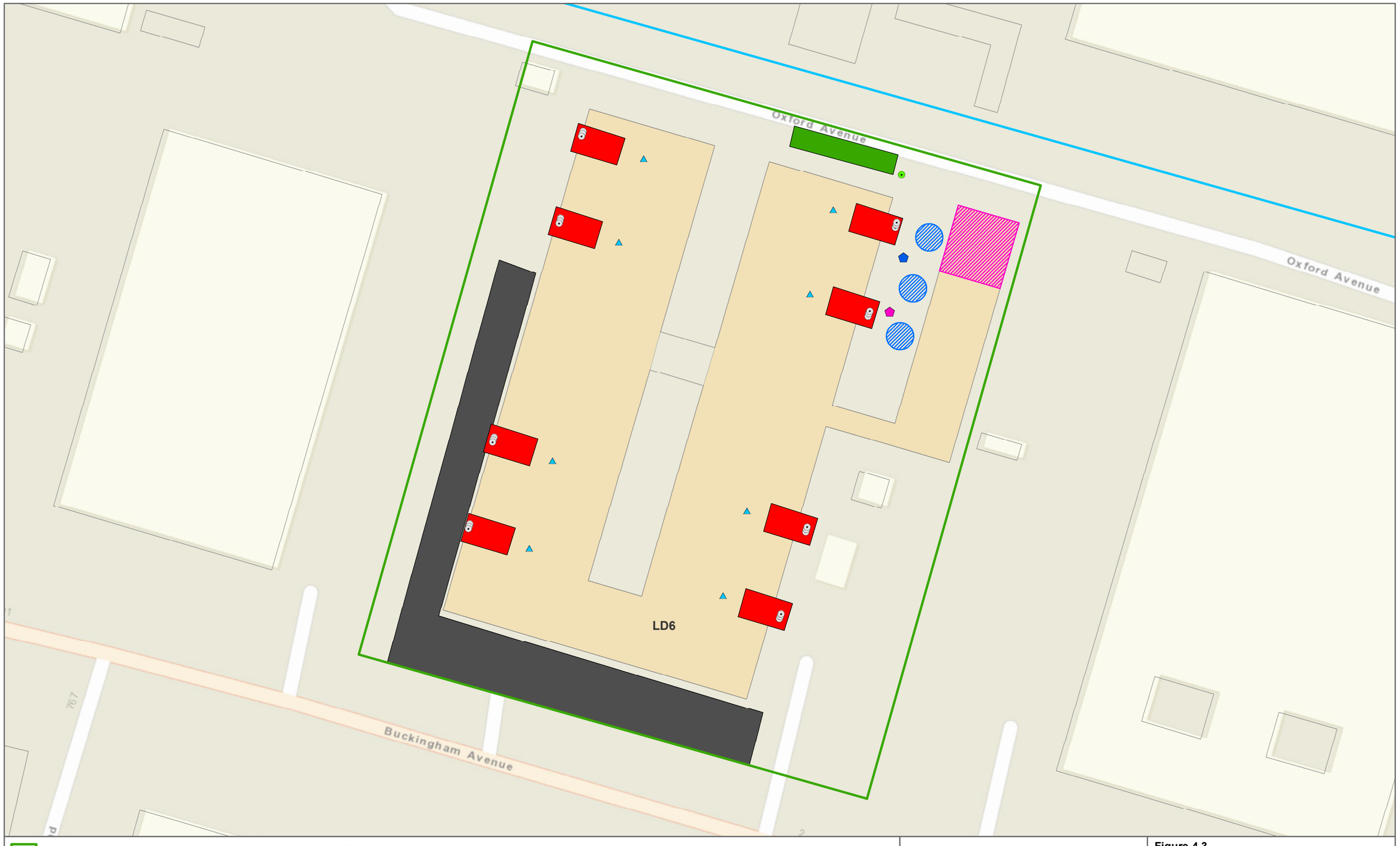
Site layout data provided by Equinix

ERM

EQUINIX

PROJECTION: British National Grid

Path: \\UKLONSV04\Data\Oxford\Projects\0420743 Equinix Slough Permit.GB\Slough campus variation\GIS\MAPS\LD5\Figure4.2_SiteLayout_LD5_A05.mxd



- LD6 Site Installation Boundary
- LD7 Site Installation Boundary
- Data Centre
- Proposed New Generators (LD7 only)
- Operational Generators
- Operational Bulk Fuel Storage
- Proposed New Bulk Fuel Storage (LD7 only)
- Car Park
- Day Tanks
- Operational Stacks
- Proposed New Stacks (LD7 only)
- Operational Filling Point
- Proposed New Filling Point

0 10 20
Metres

N

Figure 4.3
Site Layout - LD6
Slough Trading Estate, 765 Henley Road
Slough SL1 4JW

SCALE: See Scale Bar	VERSION: A03
SIZE: A3	DRAWN: RH
PROJECT: 0420743	CHECKED: HB
DATE: 06/10/2020	APPROVED: HB

Site layout data provided by Equinix

ERM

EQUINIX

PROJECTION: British National Grid

Path: \\UKLONSV04\Data\Oxford\Projects\0420743 Equinix Slough Permit.GB\Slough campus variation\GIS\MAPS\LD6\Figure4.3_SiteLayout_LD6_A03.mxd

LD6 Site Installation Boundary
LD7 Site Installation Boundary
Data Centre
Proposed New Generators
Operational Generators
Operational Bulk Fuel Storage
Proposed New Bulk Fuel Storage
Operational Day Tanks
Proposed New Day Tanks
Operational Stacks
Proposed New Stacks
Operational Filling Point
Proposed New Filling Point

PROJECTION: British National Grid

0 10 20
Metres

N

Figure 4.4
Site Layout - LD7
Slough Trading Estate, 765 Henley Road
Slough SL1 4JW

SCALE: See Scale Bar	VERSION: A06
SIZE: A3	DRAWN: JS
PROJECT: 0420743	CHECKED: HB
DATE: 06/10/2020	APPROVED: HB

Site layout data provided by Equinix

ERM

EQUINIX

Path: \\UKLONSV04\Data\Oxford\Projects\0420743 Equinix Slough Permit.GB\Slough campus variation\GIS\MAPS\LD7\SS\Figure4.4_SiteLayout_LD7_A06.mxd

4.2 Backup Generators

Due to an increase in power demand, additional generators need to be installed at LD4, LD5 and LD7 to provide emergency power in the event of a grid supply failure.

The new generators will be for backup generation purposes only, i.e. for electrical generation in the event of a failure of the national grid electrical supply. The data centres each have two separate substation feeds in order that power supply has a good level of redundancy. The data centres are protected from short-term brown-outs or black-outs by uninterruptable power supplies (UPS). These buffer small fluctuations in electrical supply. If the UPS detects power failure or extended reduced power, the generators within the data centres affected will start automatically to begin generating sufficient electricity to match the load required by the data centre. The UPS can supply power for a maximum of six minutes but ordinarily the generators would start well before this time elapses.

No periods of off-grid operation have been recorded since the original permit application except for a national power outage mid-2019 during which generators at LD6 and LD7 ran for a short period of time (few hours). Generator starts have otherwise been for maintenance and testing purposes, which is an integral part of Equinix's service commitment to clients.

The type, number and capacity of the new generators to be installed per data centre is shown in **Table 4.1**. As the generator manufacturers do not always provide thermal input data, an assumption of 35% efficiency has been applied to the electrical output power rating of each generator set. A power factor of 0.8 has already been applied to the generator power rating to adjust for the losses between the generator and alternator.

Table 4.1 New Generators to be Installed on the Campus

Site	Engine	Number of Generators	Individual Generator Output Rating (MVA)	Individual Generator Output (MW_e)[a]	Individual Generator Input (MW_{th})[b]	Total Input (MW_{th})
LD4	CAT 3516B	3	2.25	1.8	5.14	15.42
LD5	SDMO X2500C	8	2.50	2.0	5.71	45.68
LD7	Cummins C3000 D5e (LD7.1)	2	3.00	2.4	6.86	13.72
	Cummins C3500 D5e (LD7.1)	1	3.50	2.8	8.00	8.00
	Cummins C3000 D5e (LD7.2, one of them to be installed on LD6 land)	9	3.00	2.4	6.86	61.74
Total		**23**	**-**	**-**	**-**	**144.56**

[a] *Assuming power factor of 0.8 to convert from MVA*
[b] *Using the amps methodology located in* ***Appendix A.***

4.3 Testing Regime

The generators are tested regularly to demonstrate they are capable of fulfilling the backup supply requirements. The updated testing regime for the Campus is presented in **Table 4.2**.

Scheduling of the test runs takes into account the potential for effect on local air quality and as a result the black building and full load tests are conducted on a weekend when a lower background burden on the local air quality is expected.

Further details on the assessment of air quality impacts from the testing regime can be found in **Section 12**.

Table 4.2 Updated Testing Regime

Type of test / Frequency	Indicative Duration	Scheduling	Load
Start up test - fortnightly	5 minutes	• Weekdays, not to coincide with tests at any other data centre on Campus or other Equinix operated site on the Slough Trading Estate • Grouped either as an entire site, or by groups or generators for larger sites	No load
Black building test - quarterly three times a year	1 hour	• Weekends, not to coincide with tests at any other data centre on the Campus or other Equinix operated site on the Slough Trading Estate • All generators on an individual site at once • This test is only undertaken three times a year – the fourth time is replaced by the Annual full load test	60% maximum
Full load test - annually –	1 hour	• Weekend, not to coincide with tests at any other data centre on the Campus or other Equinix operated site on the Slough Trading Estate • One engine after the other, at 100% load • One data centre at a time	Load bank for full potential of individual generator capacity

4.4 Fuel Storage

There is currently a diesel fuel day tank in the immediate vicinity of each generator set with bulk fuel tank supply tanks located in a separate area of each data centre.

Additional fuel storage tanks (day and bulk) need to be installed at LD4, LD5 and LD7 to support the new generators. The proposed additional fuel storage tanks are listed in **Table 4.3**.

Table 4.3 Additional Fuel Storage Tanks Capacities

Site	Additional Day Tanks (litre (L))	Additional Bulk Tanks (litre (L))
LD4	3 x 5,063 L	None
LD5	8 x 4,000 L	2 x 68,000 L
LD6	None	None
LD7 (Building 7.1)	1 x 1,500 L and 2 x 1,900 L	None
LD7 (Building 7.2)	9 x 1,900 L	3 x 63,000 L (located on LD6 land)

Bulk fuel tanks are fully bunded to 110% of their volume and are double skinned. The majority are under cover and not subject to rainfall. Those that are outside have a means of removing rainwater from the bund that does not penetrate the bund wall. As per current procedure, any oil and oily water will be removed using a vacuum pump, and recycled or disposed using an appropriate waste disposal company if deemed appropriate.

The day tanks are all double skinned. The majority are located within the generators enclosures (containers) except for the three new day tanks at LD4. Those three tanks should not be subject to rainfall as they are under a gantry.

The diesel filling procedure is defined and set out in **Appendix B.** It remains the same as the current procedure.

Equinix has an emergency response procedure in place in the event of a release of oil or diesel, and processes for the planning for such eventualities and to audit the response in case such an event occurs. These are provided in **Appendix C.**

4.5 Fire Pump

There is currently a small diesel fire pump at LD5 (circa 0.3 MW_{th} capacity), already included in the Permit. No additional diesel fuelled fire pumps are to be installed here.

5. EMISSIONS

5.1 Introduction

No change to the type of activities undertaken at the data centres is anticipated, therefore, the principal emissions from the Campus will remain the emissions to air from the maintenance testing of the emergency back-up generators. Actual emergency running of the generators is expected to be very infrequent.

There are no new material emissions to surface water, sewer, groundwater and land created from the additional generators.

5.2 Emissions to Air

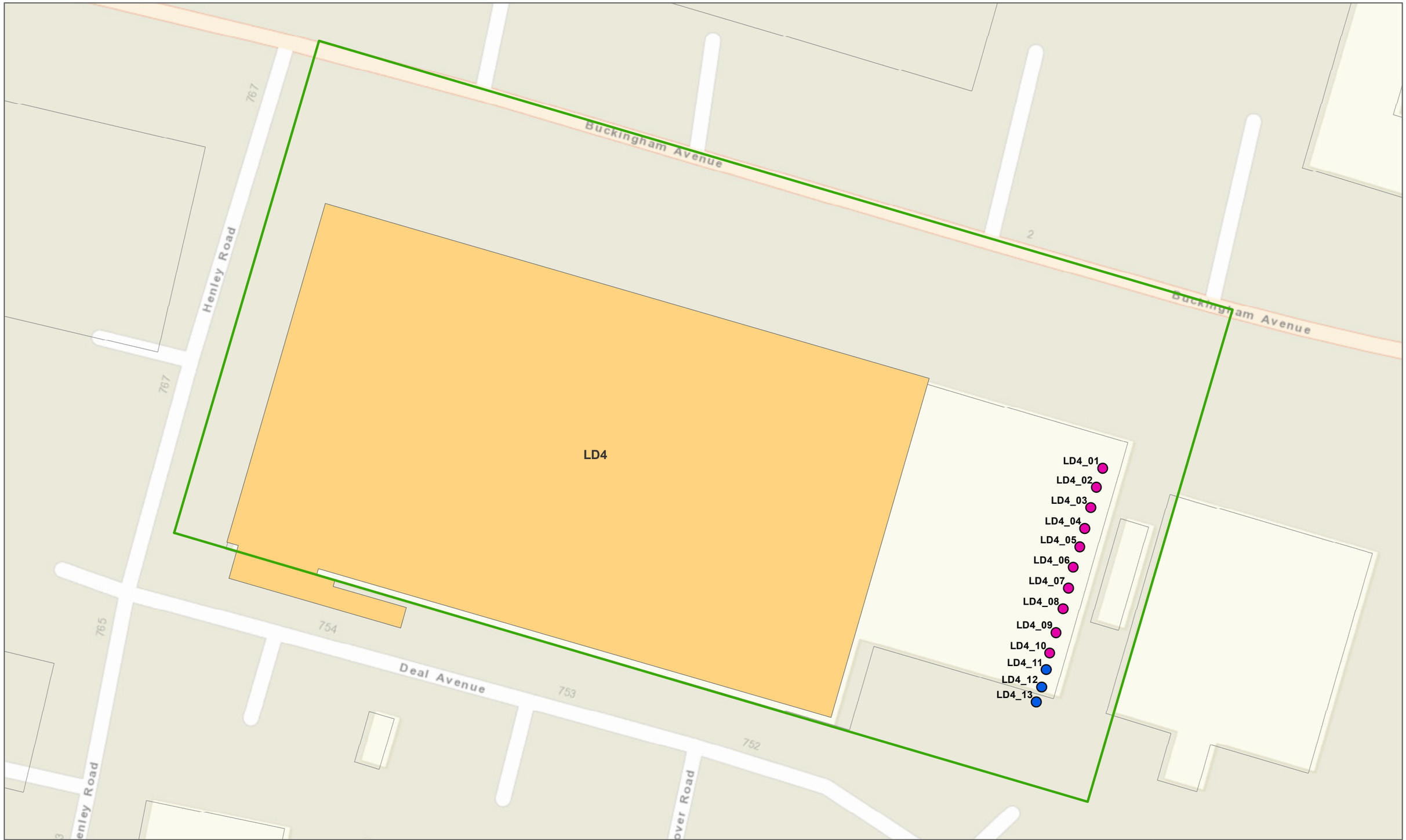
5.2.1 Point Source Emissions to Air

The only notable point source emissions to air from the data centres are from the generators and the diesel fuelled fire pump at LD5. Characteristics for the new generators to be installed are listed in **Table 5.1** and the location of each emission point at each site are shown in **Figure 5.1, Figure 5.2, Figure 5.3** and **Figure 5.4.**

Air dispersion modelling has been undertaken by ERM for those sources. More details can be found in **Section 12** and the air quality impact assessment report in **Appendix D**.

Table 5.1 Slough Campus Point Source Emissions to Air

Data Centre	Emission Point ID	Emission Source	Use	Parameter	Limits
LD4	LD4_01 to LD4_10: Generators already included in Permit EPR/LP3303PR				
	LD4_11 to LD4_13	3 x CAT3516B	Emergency back-up generation	NO_x, SO_2, CO, Particulates	No limits set. Backup generation only.
LD5	LD5_01 to LD5_15: Generators and fire pump already included in Permit EPR/LP3303PR				
	LD5_16 to LD5_23	8 x SDMO X2500C	Emergency back-up generation	NO_x, SO_2, CO, Particulates	No limits set. Backup generation only.
LD6	LD6_01 to LD6_24: Generators already included in Permit EPR/LP3303PR				
LD7	LD7_01 to LD7_06: Generators already included in Permit EPR/LP3303PR				
	LD7.1: LD7_07 and LD7_08	2 x Cummins C3000 D5e	Emergency back-up generation	NO_x, SO_2, CO, Particulates	No limits set. Backup generation only
	LD7.1: LD7_09	Cummins C3500 D5e	Emergency back-up generation	NO_x, SO_2, CO, Particulates	No limits set. Backup generation only.
	LD7.2: LD7_10 to LD7_18 (LD7_18 installed on LD6 land)	9 x Cummins C3000 D5e	Emergency back-up generation	NO_x, SO_2, CO, Particulates	No limits set. Backup generation only



Existing Emission Points to Air
Proposed New Emission Points to Air
LD4 Site Installation Boundary
Data Centre

0 10 20
Metres

N

Figure 5.1
Emission Points - LD4
Slough Trading Estate, 765 Henley Road
Slough SL1 4JW

SCALE: See Scale Bar	VERSION: A01
SIZE: A3	DRAWN: RH
PROJECT: 0420743	CHECKED: HF
DATE:29/09/2020	APPROVED: HF

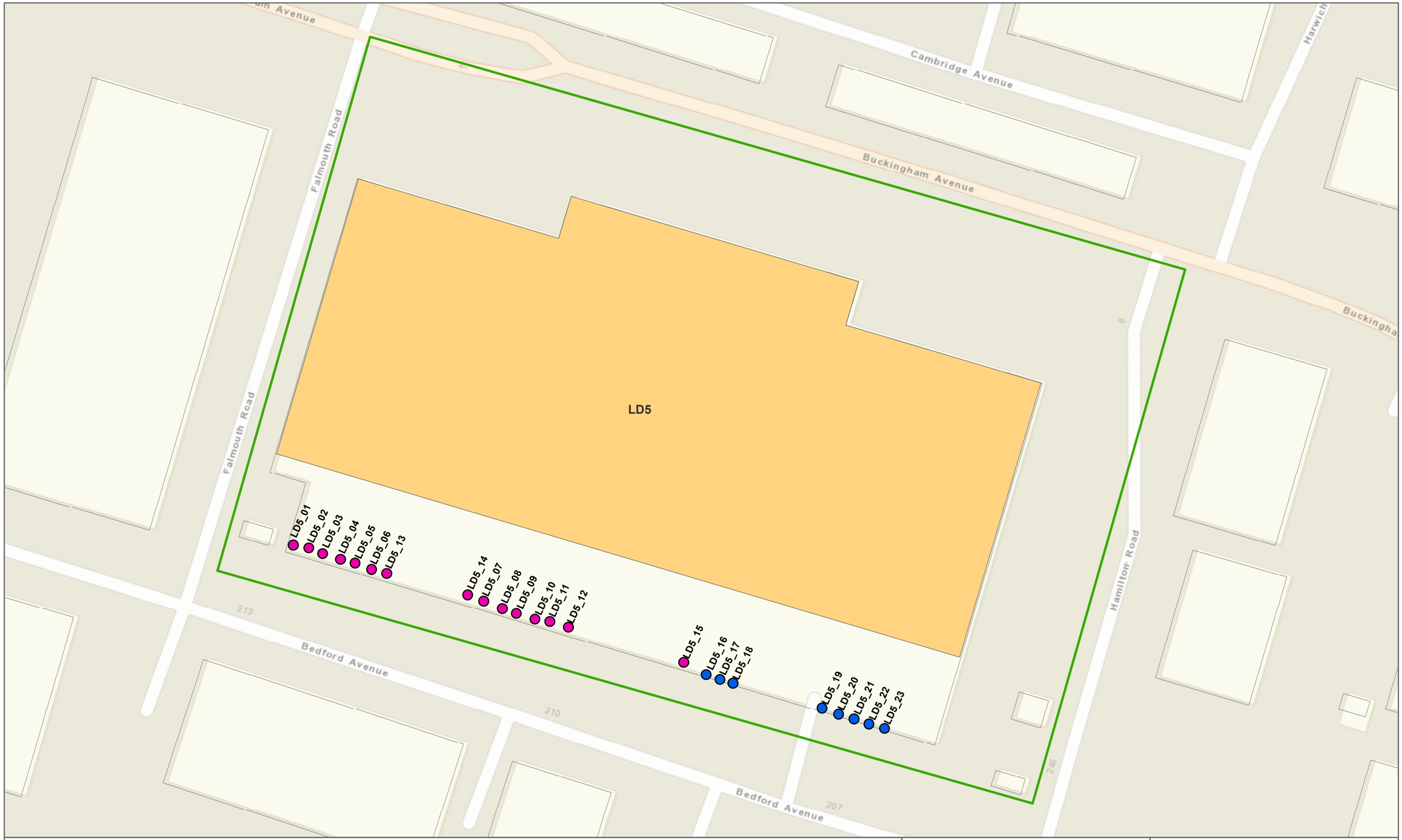
Site layout data provided by Equinix

ERM

EQUINIX

PROJECTION: British National Grid

Path: \\UKLONSV04\Data\Oxford\Projects\0420743 Equinix Slough Permit.GB\Slough campus variation\GIS\MAPS\LD4\Figure5.1_EmissionPointsToAir_LD4_A01.mxd



Existing Emission Points to Air
Proposed New Emission Points to Air
LD5 Site Installation Boundary
Data Centre

0 10 20
Metres

N

Figure 5.2
Emission Points - LD5
Slough Trading Estate, 765 Henley Road
Slough SL1 4JW

SCALE: See Scale Bar	VERSION: A01
SIZE: A3	DRAWN: RH
PROJECT: 0420743	CHECKED: HF
DATE: 29/09/2020	APPROVED: HF

Site layout data provided by Equinix

ERM

EQUINIX

PROJECTION: British National Grid

Path: \\UKLONSV04\Data\Oxford\Projects\0420743 Equinix Slough Permit.GB\Slough campus variation\GIS\MAPS\LD5\Figure5.2_EmissionPointsToAir_LD5_A01.mxd

Existing Emission Points to Air
LD6 Site Installation Boundary
LD7 Site Installation Boundary
Data Centre

PROJECTION: British National Grid

0 10 20
Metres

N

Figure 5.3
Emission Points - LD6
Slough Trading Estate, 765 Henley Road
Slough SL1 4JW

SCALE: See Scale Bar	VERSION: A01
SIZE: A3	DRAWN: RH
PROJECT: 0420743	CHECKED: HF
DATE: 06/10/2020	APPROVED: HF

Site layout data provided by Equinix

ERM

EQUINIX

Path: \\UKLONSV04\Data\Oxford\Projects\0420743 Equinix Slough Permit.GB\Slough campus variation\GIS\MAPS\LD6\Figure5.3_EmissionPointsToAir_LD6_A01.mxd

LD7.1

LD7.2

LD7_09
LD7_03
LD7_04
LD7_01
LD7_02
LD7_05
LD7_06
LD7_07
LD7_08

LD7_12
LD7_13
LD7_14
LD7_10
LD7_11
LD7_17
LD7_15
LD7_16

Oxford Avenue

LD7_18

- Existing Emission Points to Air
- Proposed New Emission Points to Air
- LD6 Site Installation Boundary
- LD7 Site Installation Boundary
- Data Centre

PROJECTION: British National Grid

0 10 20
Metres

N

Figure 5.4
Emission Points - LD7
Slough Trading Estate, 765 Henley Road
Slough SL1 4JW

SCALE: See Scale Bar	VERSION: A01
SIZE: A3	DRAWN: RH
PROJECT: 0420743	CHECKED: HF
DATE: 07/10/2020	APPROVED: HF

Site layout data provided by Equinix

ERM

EQUINIX

Path: \\UKLONSV04\Data\Oxford\Projects\0420743 Equinix Slough Permit.GB\Slough campus variation\GIS\MAPS\LD7\Figure5.4_EmissionPointsToAir_ForPermit_A01.mxd

5.2.2 Fugitive Emissions to Air

There is a potential for localised fugitive emissions to air of hydrocarbon vapour from the bulk diesel fuel storage tanks breathers.

5.3 Emissions to Water

No changes to emissions to water are proposed in this variation application.

5.4 Emissions to Sewer

No changes to emissions to sewer are proposed in this variation application.

5.5 Emissions to Land and Groundwater

5.5.1 Point Source Emissions to Land and Groundwater

No changes to emissions to land and groundwater are proposed in this variation application.

5.5.2 Fugitive Emissions to Land and Groundwater

The key potential for any fugitive emissions to land and groundwater would be in the event of a leak or spill from the on-site above ground fuel tanks which have increased in capacity due to the additional generators.

Equinix has an emergency response procedure in place in the event of a release of oil or diesel, and processes for the planning for such eventualities and to audit the response in case such an event occurs. These are provided in **Appendix C.**

6. OPERATING TECHNIQUES

6.1 Applicable Technical Standards

In order to demonstrate that the site is operating Best Available Techniques (BAT) for the relevant permitted activities carried out at the site, a review of the European Commission's relevant BAT Reference Documents (BREFs) has been carried out. In addition the relevant sector Technical Guidance Notes (TGN) and industry guidance has also been reviewed. The documents reviewed are:

- Data Centre FAQ Headline Approach, 2018 presented in **Table 6.1**;
- Best Available Techniques (BAT) Reference Document for Large Combustion plants, 2017 presented in **Table 6.3**;

It is noted that the Campus does not contain any Large Combustion Plants (LCP) under the meaning of Chapter III of the Industrial Emissions Directive (2010/75/EU). The LCP BREF has therefore been reviewed for general measures appropriate to data centres.

The individual generators meet the definition of Medium Combustion Plant (MCP) under the meaning of the Medium Combustion Plant Directive (2015/2193/EU) (MCPD), being in the 1-50 MW_{th} size range (generally around 3-6 MW_{th}). The Medium Combustion Plant Directive states: "*(19) In order to take account of certain specific circumstances where the application of emission limit values would lead to disproportionately high costs compared to the environmental benefits, Member States should be able to exempt medium combustion plants used in cases of emergency and operated during limited time periods from compliance with the emission limit values set out in this Directive.*"

The generators are not 'specified generators' under Schedule 25B of the Environmental Permitting (England and Wales) Regulations 2016 (as amended), as emergency generators only used to provide power at a site during an emergency are excluded.

The Data Centre FAQ document does not yet represent formal Environment Agency sector guidance but has been used as a reference in its present form as the most relevant emerging set of requirements for data centres.

6.2 Other Technical Guidance Considered

Other documents reviewed include the Government's Medium Combustion Plant Directive and Specified Generator Regulations page (https://www.gov.uk/guidance/medium-combustion-plant-and-specified-generators-environmental-permits). **Table 6.2** summarises the applicable MCP guidance**.** At the Campus data centres, the generators provide back-up generation only and are not tested for more than 50 hours a year meaning they are exempt from Schedule 25B i.e. they are not specified generators.

6.3 Operating Techniques Review Tables

Each of the documents considered above are presented in tabular form on the following pages. Best Available Techniques that are not considered applicable are greyed out.

Table 6.1 Data Centre FAQ Headline Approach, 2018

<table>
<tr><th></th><th>EA Summary Requirement</th><th>Equinix Response</th></tr>
<tr><td>1</td><td>We accept that oil fired diesel generators are presently the default technology for standby generators in data centres. However the permit application still requires a BAT discussion detailing the choice of engine, the particular configuration and plant sizing meeting the standby arrangement (e.g. 2n).</td><td>
The Slough Campus data centres work with the following different arrangements, where n is the number of generators necessary to meet the load requirement of the data centre:

LD4: n+1
LD5: 2 x (n+2)
LD6: n+2
LD7:

L7.1: n+2
L7.1: n+2

The 54 current and 23 new engines reflect local and global investment and acquisition decisions by Equinix and have been selected to provide power and capacity, reliability and serviceability for emergency generation. The new engines will meet the 2G TA-Luft emissions standard as per requirement of item 12 of this FAQ.
For completeness, the table below provides more information on the viability of different power generation options.
<table>
<tr><th>Criteria</th><th>Diesel engines generators</th><th>Natural gas generators</th><th>Hydrogen fuel cell</th><th>Battery banks</th><th>Renewable energy (wind or solar)</th></tr>
<tr><td>Provides sufficient power quickly following power outage</td><td>Yes – response time is low</td><td>Yes – response time is low</td><td>Yes – but unknown reliability</td><td>Yes – response time is the fastest</td><td>No – insufficient space on site for required capacity and would be subject to meteorological conditions</td></tr>
<tr><td>Provide continuous power</td><td>Yes – easy to continue filling diesel tanks if required</td><td>Yes – if sufficient gas storage on site or sufficient capacity on national gas</td><td>Yes – as long as hydrogen storage on site</td><td>No – can only provide power during the short battery life</td><td></td></tr>
</table>
</td></tr>
</table>

	EA Summary Requirement	Equinix Response
		<table><tr><td></td><td></td><td>pipeline connection</td><td></td><td></td><td></td></tr><tr><td>**Operational constraints**</td><td>Diesel generators are already installed. Diesel is stored in bunded tanks. Fuel is regularly polished.</td><td>New generators would be required to be installed in addition to large volume of emergency gas supply or connection to a sufficiently large capacity natural gas supply. Large volume storage of natural gas presents an explosion hazard that would need to be managed appropriately.</td><td>New generators would be required to be installed in addition to large volume of emergency gas supply. Large volume storage of hydrogen gas presents an explosion hazard that would need to be managed appropriately.</td><td></td><td></td></tr><tr><td colspan="6">**Summary**: Diesel generators are proven as a suitable and reliable means of providing extended emergency power in the event of a power failure. No other option (other than substantial redevelopment of site) are capable of providing this capability. All new generators being installed meet 2G TA-Luft standard.</td></tr></table>
2	Standby engine capacities are added together in MW_{th} input at the quoted standby rating, being usually 110% of the continuous rating (if >=50MW_{th} the site then needs an EA 1.1A Combustion Activity EPR permit)	The installed overall capacity on the Campus is well in excess of 50 MW_{th}.
3	If precise MW_{th} figures are unavailable and spec sheets or face-plates are unclear, the calculation for MW_{th} derived from MVA output is based on: power factor 0.8 and an assumed poor conversion efficiency of 0.35 for	See **Table 4.1**. This methodology has been followed, the MW_e outputs quoted are assumed to include power factor correction from MVA. MW_{th} figures are not generally available from generator manufacturers.

	EA Summary Requirement	Equinix Response
	MW_{th} to MW_e e.g. 3MVA = (3*0.8)/0.35 = 6.86MW_{th}.	
4	The sum of generator plant capacities is based only on MW_{th} inputs of all plant regardless of the standby configuration. MW_e output constraints such as realistic customer load or other practical output limiting factors do not constitute a limit to the MW_{th} input as defined in the EA's guide RGN02.	As noted above, the installed capacity is well over 50MW_{th}, irrespective of calculations methods.
5	Proximity of data centres with a company campus, adjacent, neighbouring or close by buildings in urban locations (e.g. within a common trading estate but only separated by a road width or notional distance) may constitute a single site for determining the boundary	This is directly applicable to Slough Campus and was confirmed in the existing Slough Campus Permit (EPR/LP3303PR), and will apply to this Slough Campus Permit Variation As described above, LD10 is proposed to be being transferred out of the single Campus Permit to reflect the change in ownership by a joint venture.
6	Permits will include a maximum 500 hour 'emergency/standby operational limit' for any or all the plant producing on-site power under the limits of the combustion activity; and thereby emission limit values ELVs to air (and thus engine emissions monitoring) are not required within the permit.	Emergency operation is highly unusual and is not expected to exceed 500 hours. No periods of off-grid operation were recorded since the original permit application except for a national power outage mid-2019 during which generators at LD6 and LD7 ran for a short period of time (few hours). See **Section 4.2** for details of measures in place to protect against the need for emergency operation of the generators.
7	Emergency hours operation includes those unplanned hours required to come off grid to make emergency repair of electrical infrastructure associated but occurring only within the data centre itself.	This is likely to occur very rarely. The Slough Campus data centres have two substation feeds so there is a good level of redundancy in power supply. No periods of off-grid operation were recorded since the original permit application except for a national power outage mid-2019 during which generators at LD6 and LD7 ran for a short period of time (few hours). See **Section 4.2** for details of measures in place to protect against the need for emergency operation of the generators.

	EA Summary Requirement	Equinix Response
8	Each individual generator with its own discharge stack, can be maintained, tested and used in a planned way for up to 500 hours per calendar year each without ELVs (and hence no monitoring) under IED/MCPD. Though clearly the EA expects planned testing and generator operations to be organised to minimise occasions and durations (subject to client requirements). Ideally a target should seek to keep individual generator testing to below 50 hours/annum each.	Individual generator run times are expected to be well under 50 hours per year. During fortnightly testing each is fired for approximately 5 minutes, and operate for only around an hour during quarterly and annual tests. Each generator is expected to be tested for about five hours each per year a detailed in **Table 4.2.** The generators do not need to meet the definition of a specified generator under MCPD.
9	In summary 7, & 8 means the whole or part site can only operate as emergency plant up to 500 hours as an absolute limit for grid backup issues; but that individual plant (at any load) with its own stack (or a stack with multiple plant) with justification can be operated for up to 500 hours (ideally <50) each as part of its nonemergency role under maintenance and testing.	Noted. See **Section 4.3** and **Table 4.2** for details of the maintenance testing regime and durations.
10	For the purposes of determining operating hours, data centre diesel generators are regarded as having a minimal start-up or shut-down times. Operational hours start on the first fuel ignition.	This has been assumed in the air quality assessment found in **Appendix D**
11	Data Centre permits (unless they apply and justify it in a permit application) will expressly have a limit on the activity to exclude voluntary 'elective power operation' such as demand side	The Slough Campus generators will not be used for voluntary elective power operations for on-site use, STOR or FCDM.

	EA Summary Requirement	Equinix Response
	response (i.e. on-site use) or grid operating reserve (STOR) (i.e. off-site export of electricity) and Frequency Control by Demand Management (FCDM) for grid support. This is primarily to differentiate data centres from 'diesel arrays or MCPD specified generators' that voluntarily operate within the balancing market, and importantly a clear way to demonstrate minimisation of emissions to air as 'Emergency plant'.	
12	The default engine specification as a minimum for new plant to minimise the impacts of emissions to air (NO_x) is 2g TA-Luft (or equivalent standard). A detailed cost benefit analysis (CBA) is otherwise needed justifying worse emission such as 4g TA-Luft plant or for example a justification under FCDM.	See 1 for the different loads arrangements per data centres. The 54 current and 23 new engines reflect local and global investment and acquisition decisions by Equinix and have been selected to provide power and capacity, reliability and serviceability for the function they are required for, namely emergency generation. The new engines will meet the 2G TA-Luft emissions standard. The air quality impact assessment (**Appendix D**) identified that the assessed probability of the testing regime breaching the hourly NO_2 standard is 1.7 x 10^{-17}% for the Campus alone (including the new generators) and 1.0 x 10^{-12}% when in combination with LD13x and LD11x, i.e. very low. The Environment Agency guidance for modelling generators states that where the probability of exceedance is greater than 5%, further proposals of emissions reduction are required. In both cases, exceedances of the hourly NO_2 standard are considered "highly unlikely" as the probabilities are far less than 1%. Therefore, no further proposals to reduce the risk of exceedance are made.
13	CBA for improved exhaust emissions, dispersion and mitigations from the plant is expected for the maintenance/testing and the emergency standby roles. We would be looking for improvements particularly if Local Air Quality (LAQ) modelling (under H1) indicates anything other than an insignificant contribution to short term local air quality for the 'planned' maintenance emissions of the plant.	EA guidance on dispersion modelling assessment (2019) can be found on https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment An air dispersion model was prepared by ERM to assess the impact of the Campus' air emissions. The Campus has been assessed separately and in-combination with LD11x and LD13x to assess the effect of all the Equinix sites on the Slough Trading Estate. A detailed report is presented in **Appendix D.** For human health, compliance with short-term PM_{10} and NO_2 standards, as well as long-term NO_2 standards were assessed. The Campus uses ultra-low sulphur diesel. Emission rates for SO_2 for the engines were calculated and were found to be exceptionally small (of the order of 1 x 10^{-3} g/s) and as a result SO_2 emissions have not been assessed. The assessment found that the particulate emissions from the engines do not have the potential to breach the air quality standard for PM_{10}, whether in emergency running or in testing mode.

	EA Summary Requirement	Equinix Response
		The assessment identified that for the testing regime of the Campus alone and in combination with LD13x and LD11x, there is the potential to breach the hourly nitrogen dioxide standard. The maximum assessed probability of the testing regime breaching the hourly NO_2 standard is 1.7 x 10^{-17}% for the Campus alone and 1.0 x 10^{-12}% for the Campus in combination with LD13x and LD11x, i.e. very low. The Environment Agency guidance states that where the probability of exceedance is greater than 5%, further proposals of emissions reduction are required. In both cases, exceedances of the hourly NO_2 standard are considered "highly unlikely" as the probabilities are far less than 1%. Therefore, no further proposals to reduce the risk of exceedance are made. The testing regime scenarios were not predicted to have the potential to impact adversely the annual mean NO_2 standard for the protection of human health, including at the Air Quality Management Areas in Slough Borough. There are no significant impacts predicted on any protected conservation areas from the testing regime. Emergency power generation scenarios were assessed with all generators of the Campus alone and in combination LD13x and LD11x running concurrently. In both cases, there is predicted to be the potential for the hourly NO_2 standard to be exceeded, and with sufficient running hours for a breach to occur. The model predicts that emergency running of the Campus' generators alone or in combination with LD13x and LD11x has the potential to exceed the 24 hour NO_x standard at Haymill Valley LNR. It also predicts the potential for significant impacts at Burnham Beaches SAC from the emergency running of the Campus' generators in combination with LD13x and LD11x. The predicted process contribution at the SAC is however only marginally over the threshold for insignificance (11% vs a threshold of 10 %). Furthermore, in practice in the last nine years there has been only one occurrence where some of the data centres (LD6, LD7 and LD10) had to use the back-up generators, this was during a national power outage in mid-2019. As a result the potential for actual significant impacts at Burnham Beaches SAC is considered highly unlikely.
14	Retrofit abatement techniques for existing installations for engine emissions such as selective non-catalytic or catalytic reduction (SNCR or SCR) would not normally be expected for standby plant to mitigate the emissions for standby/emergency operation. BAT might include improved flue gas dispersion (e.g. stack modifications, increased height) or improved low NO_x engine management controls or possibly fuel choice.	Stacks have typically been designed at the maximum height permissible in this part of the Slough Trading Estate simplified planning zone (SPZ). This height varies across the sites. The new engines were chosen to comply with TA-Luft 2G emissions and reflect local and global investment and acquisition decisions by Equinix based on power and capacity, reliability and serviceability for the function of emergency generation. The 56 existing engines are a mix of 3G and 4G standard emissions and were consented to at the time the existing Slough Campus Permit (EPR/LP3303PR) was applied for. The original Permit application included cost-benefit analysis to investigate possible improvements to the dispersion of the generators' emissions. The air quality impact assessment (**Appendix D**) identified that the assessed probability of the testing regime breaching the hourly NO_2 standard is 1.7 x 10^{-17}% for the Campus alone (including the new generators) and 1.0 x 10^{-12}% when in combination with LD13x and LD11x, i.e. very low. The Environment Agency guidance for modelling generators states that where the probability of exceedance is greater than 5%, further proposals of emissions reduction are required. In both cases,

	EA Summary Requirement	Equinix Response
		exceedances of the hourly NO_2 standard are considered "highly unlikely" as the probabilities are far less than 1%. Therefore, no further proposals to reduce the risk of exceedance are made.
15	Operations and management procedures should reflect the outcomes of the air quality modelling by minimising the duration of testing, phasing engines into subgroups, avoiding whole site tests and planning off-grid maintenance days and most importantly times/days to avoid adding to "at risk" high ambient pollutant background levels.	The black building and full load tests are planned for weekends when the NO_x contribution from the local road network on the Slough Trading Estate and the road network in general is expected to be lower than weekdays. See **Section 4.3** and **Table 4.2**. Whole site load back tests are restricted to one hour per data centre, and whole site "black building" tests to one per quarter per data centre (three per year, the fourth 'quarter' is the annual test). These tests represent part of Equinix's commercial offering to guarantee maximum uptime to clients.
16	When AQ modelling the emissions from the engines, the certified technical standard provided by the manufacturer should be used (i.e. likely worst case emissions). However any 'fit for purpose' monitoring of the actual emissions from installed plant will be considered as evidence of the likely real impacts as part of the permitting decision process.	Reported 'worst case' emissions have been used for modelling.
17	The groundwater monitoring of fuel storage tanks and distribution pipework using GW boreholes is risk based for the site condition report (SCR) and IED 5yearly monitoring. Should GW monitoring be required for underground tanks and/or the SCR, the boreholes should be positioned for whole site surveillance (for the SCR) rather than as a very local control immediately around the buried fuel oil tanks (i.e. not be just an addition to double skinned tanks	Equinix do not operate or plan to operate underground storage tanks for fuel oil. Where new bulk and day fuel tanks have been added the preventative measures are being used as per the existing permit application (EPR/LP3303PR). Due to the nature of operations and the preventative measures in place, Equinix does not propose to undertake intrusive groundwater or soil quality assessment.

	EA Summary Requirement	Equinix Response
	already protected by leak detection and hence ignoring distribution pipework etc.).	
18	10-yearly soil sampling under IED is normally not needed but still needs some justification.	As specified in the existing Slough Campus Permit (EPR/LP3303PR) soil sampling took place at LD5, LD6 and LD7 before each data centre was developed. Due to the nature of operations and the preventative measures in place, with limited potential for fugitive emissions to ground, Equinix does not propose to undertake intrusive groundwater or soil quality assessment.
19	The permit application must assess and provide evidence of actual reliability data for the local electricity grid distribution (including data centre internal electrical design) for the EA to judge the realistic likelihood of the plant needing to operate for prolonged periods in an emergency mode (especially if emissions model so as to exceed short term air quality standards).	The Campus site is not expected to operate for a prolonged period in emergency mode. The extent of back-up power generation capacity and fuel storage reflects the Equinix business model of providing customers with a very high assurance of continuity, not an expectation of loss of grid supply in practice. The Slough Campus data centres has two substation feeds so there is a good level of redundancy in power supply. No periods of off-grid operation were recorded since the original permit application except for a national power outage mid-2019 during which generators at LD6 and LD7 ran for a short period of time (few hours). See **Section 4.2** for details of measures in place to protect against the need for emergency operation of the generators.
20	Optimising grid reliability within the site as part of general BAT to minimise emergency operating hours is required – evaluation is needed within the permit application on the Tier reliability standard under ISO27001 and Uptime.	Equinix does not subscribe to Uptime Institute Tier Levels per se but the Equinix equivalent tier level rating is Tier 3 for each data centre. Each site is certified to ISO27001:2013.
21	Reporting of standby engine operational run hours and discussion of any electrical outages (planned or grid failures regardless of duration) required annually.	Equinix notes that this is the expectation for annual reporting to the EA, as per its current Campus Permit and proposes to continue on that basis.
22	Assuming AQ modelling, based on operating scenarios, indicates a local air quality risk then notification to the EA of unplanned (and pre-notification of planned)	Equinix proposes to continue to operate to current Permit EPR/LP3303PR notification requirements.

	EA Summary Requirement	Equinix Response
	continuous grid outage exceeding 18 hours LAQM (or the otherwise assessed short term interval from modelling) is likely required under a permit schedule 5 notification.	
23	The notification requirement stated in the permit should also indicate the actual number of generators that need to be operating above which the local air quality is at risk e.g. 'notification of continuous emergency operation exceeding 18 hours with 5 or more engines operating together is required' (i.e. model shows 4 or less engines unlikely to breach LAQ)	Equinix proposes to continue to operate to its current Permit EPR/LP3303PR notification requirements.
24	Assuming AQ modelling, based on emergency outage operating scenarios, indicates a very significant risk to local air quality and identified receptors, the EA will ask the operator to have a written action plan to manage the issue for prolonged emergency running of the plant (including sensitive receptors list and mitigations, assessments and impacts evaluation against modelled risk conditions i.e. occurrence at periods of most concern in the year, possibly ambient air monitoring surveillance at very sensitive receptors). An AQ outage action plan is also likely required for sites which might operate in conjunction with other neighbouring large sites during an outage i.e. data centre hubs.	An Air Quality Management Plan (AQMP) is under preparation and is being produced in conjunction with the Local Authority, Slough Borough Council, as per Improvement Condition 3 of the existing Slough Campus Permit (EPR/LP3303PR). The changes being proposed in this variation will be factored into the development of this plan. The AQMP outlines the response measures to be taken in the event of a grid failure. The AQMP will include the following considerations: ■ The response should be tailored to reflect the predicted potential impact indicated by the air dispersion modelling at individual receptors ■ Specific timescales for response measures; ■ How local conditions during a grid failure might influence the response required, for example meteorological conditions or time of day; ■ Contingency for how the response will be carried out in the event scenario i.e. loss of power; and ■ Timescales for continued review of the management plan. Once produced the AQMP will be submitted to the EA for approval.

	EA Summary Requirement	Equinix Response
25	Due to the emphasis of the permit on electrical (and cooling) systems it is noted that the EA considers the F-Gas regulations as falling under the remit of the EPR permit (for notifications and management) where F-gases (or potentially any polluting potential substance) are used directly under the combustion aspects of the permitted activity (e.g. switchgear). It is important to notify the EA of any significant releases. Other uses of F-gases e.g. for server room cooling are not strictly under the EA permit but are regulated by the EA generally so it may still be prudent to make the EA aware of your F-gas releases.	The emergency electrical generation systems do not have gas cooling. Cooling gases are used exclusively for sever room cooling.
26	The permit application should detail the likely quantities of waste engine oil generated annually – EWC 13 02 waste oils following servicing for example. Although unlikely to be huge, the Pollution inventory has a reporting threshold of 1 tonne for non-hazardous waste but technically no lower thresholds for hazardous waste oil.	For existing data centres waste oil is removed by subcontractors AWC who perform servicing and maintenance of the generators at Slough. The zero threshold is noted and these data are being collected from the sub-contractor as part of the annual EA reporting process. In 2017, for the existing Slough Campus data centres only millilitre quantities of oil were removed for testing and no bulk replacement took place. Given the lack of routine operation which would cause degradation of the lubricating oil, this situation is expected to be typical of most years. For existing data centres an external company is brought in on site annually to test the stored diesel fuel. They test a variety of parameters, including clarity, adenosine triphosphate, water content and particle count. If required the fuel is then cleaned on site by the same company (fuel polishing). Samples are taken after the polishing to ensure that the quality of the cleaned fuel is acceptable.
27	The permit application is for the combustion plant and associated environmental concerns and not for the Data Centre itself. The applicant should be aware that the permitting process and application is accessible to the public so should have regard to 'Commercial in Confidence' and	Noted.

	EA Summary Requirement	Equinix Response
	Critical National Infrastructure. In the first instance discuss particular concerns directly with the EA and/or exclude such priority information from the application but indicate that such is 'available on request'.	

Table 6.2 Medium Combustion Plant and Specified Generator Regulations Guidance, updated 25 September 2019

Key Definitions and Scope		Comments
Excluded Generators	Excluded Generators are generators that are exempt from Schedule 2 5B of the Permitting Regulations. Excluded generators are not included when determining capacity of the permitted specified generator site. Excluded generators are those that meet the following condition – ■ Are part of an IED installation under Chapter II or III. BAT applies to these installations so air quality is protected. It should be noted that a generator which is a Part B (1.1 or 5.1) or permitted Waste Facility (Small Waste Incineration Plant, SWIP) is not excluded. ■ Have a defined nuclear safety role under a nuclear site licence issued by the Office for Nuclear Regulation. ■ Emergency 'backup generators' (see definition below) that are not tested for more than 50 hours a year. ■ Data centres that use an on-site emergency backup generator when the transmission frequency is unstable are excluded. ■ Are operated offshore ■ Generators installed on a gas storage or unloading platform (as defined in Regulation 2 of the Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013.	The Campus generators are to serve the data centres as emergency 'backup generators' that are not tested for more than 50 hours a year.
Backup Generator	Means a generator that is operated for the sole purpose of providing power at a site during an onsite emergency from the 1 January 2019. Balancing Services, and Demand Side Response operations, whether procured or not, such as Triad Avoidance or Fast Frequency Response are not on site emergencies and a generator that provides these services is not excluded.	The generators are emergency 'backup generators' that are not tested for more than 50 hours a year.
Emergency Operation	There is no restriction on the total operating hours in the event of an onsite emergency. However operators should make best endeavours to reduce the period and frequency of emergencies. Similarly there is no restriction on the hours of operation by 'black start' backup generators.	No periods of off-grid operation were recorded since the original permit application except for a national power outage mid-2019 during which generators at LD6 and LD7 ran for a short period of time (few hours).

Key Definitions and Scope		Comments
Testing Backup Generators	Operators must not carry out more than 50 hours testing a year for each backup generator. Operators must get agreement in writing from your regulator if you want to increase this limit. The regulator can exclude commissioning time within the written agreement. For each backup generator, operators must record the number of hours you test during the year. This is to demonstrate that you meet the exclusion criteria. If the limit of 50 hours testing a year is exceeded without written agreement the regulator will take appropriate enforcement action.	The testing regime is described in **Section 4.3**. The generators are tested for less than 50 hours per year. Equinix will continue to record, for each generator/data-centre as applicable: ■ Number of test/maintenance running hours per year; ■ Number of emergency generation events and running hours – per year; and ■ Quantity and type of backup generation fuel used over the period.

Table 6.3 Best Available Techniques (BAT) Refeence Docnument for Large Combustion Plants, 2017

Section	Subsection	BAT#	BAT Text	Requirements	Comment
General BAT Conclusions	Environmental Management System EMS	BAT1	In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates the features presented in the BREF.	See BREF for detailed requirements	An ISO140001 accredited environmental management system (EMS) is in operation for the Slough Campus data centres (**Appendix E**)
	Monitoring	BAT2	BAT is to determine the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the gasification, IGCC and/or combustion units by carrying out a performance test at full load (1), according to EN standards, after the commissioning of the unit and after each modification that could significantly affect the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the unit. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	(1) In the case of CHP units, if for technical reasons the performance test cannot be carried out with the unit operated at full load for the heat supply, the test can be supplemented or substituted by a calculation using full load parameters	As the 54 current and 23 new generators are considered individually to be medium combustion plant and for the purpose of emergency generation, they are only required to comply with the MCPD requirements for monitoring instead of LCP BREF.
	Monitoring process parameters for emissions to air and water	BAT3		■ Fuel gas - Flow - Oxygen content, temperature and pressure - Water vapour content ■ Waste water from flue-gas treatment	Normal operating condition for the data centres is grid supply electricity. As Other than Normal Operating Conditions (OTNOC) conditions occur n an emergency situation, there is no opportunity to schedule monitoring of emergency operations. To monitor during testing regimes would extend the running period of engines, thus worsening any air quality impact they may have.

Section	Subsection	BAT#	BAT Text	Requirements	Comment
					Not required to monitor as MCP. See BAT2 above, i.e. is required to comply with MCPD requirements only. No waste water to monitor.
	Monitoring of emissions to air	BAT4	BAT is to monitor emissions to air with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	■ NH_3 ■ NO_2 ■ N_2O ■ CO ■ SO_2 ■ SO_3 ■ Gaseous chlorides ■ HF ■ Dust ■ Metals and metalloids ■ Hg ■ TVOC ■ Formaldehyde ■ CH_4 ■ PCDD/F	As the 54 current and 23 new generators are considered individually to be medium combustion plant and for the purpose of emergency generation, they are only required to comply with the MCPD requirements for monitoring instead of LCP BREF.
	Monitoring emissions to water from flue-gas treatment	BAT5			No flue-gas gas treatment
	General environmental	BAT6	In order to improve the general environmental performance of combustion plants and to reduce	Techniques	Equinix has an extensive preventative maintenance regime which includes maintenance and good design of the

Section	Subsection	BAT#	BAT Text	Requirements	Comment
	and combustion performance		emissions to air of CO and unburnt substances, BAT is to ensure optimised combustion and to use an appropriate combination of the techniques given below.	■ Fuel blending and mixing ■ Maintenance of the combustion system ■ Advanced control system ■ Good design of the combustion equipment ■ Fuel choice	combustion equipment to reliably fulfil the function of an emergency back-up generator. Refer to **Table 6.1** response to items 7, 15 and 26.
	General environmental and combustion performance	BAT7	In order to reduce emissions of ammonia to air from the use of selective catalytic reduction (SCR) and/or selective non-catalytic reduction (SNCR) for the abatement of NO_x emissions, BAT is to optimise the design and/or operation of SCR and/or SNCR (e.g. optimised reagent to NO_x ratio, homogeneous reagent distribution and optimum size of the reagent drops).		No use of selective catalytic or non-catalytic reductions
		BAT8	In order to prevent or reduce emissions to air during normal operating conditions, BAT is to ensure, by appropriate design, operation and maintenance, that the emission abatement systems are used at optimal capacity and availability.	(No requirements specified)	Reduction of impacts for the data centres includes the scheduling of testing regimes on weekends i.e. not during periods of poor air quality associated with weekday traffic. Emissions are minimised by using 2G TA-Luft engines, see **Table 6.1** response 12.
		BAT9	In order to improve the general environmental performance of combustion and/or gasification plants and to reduce emissions to air, BAT is to include the following elements in the quality assurance/quality control programmes for all the fuels used, as part of the environmental management system (see BAT 1):	i. Initial full characterisation of the fuel used including at least the parameters listed below and in accordance with EN standards. ISO, national or other international standards may be used provided they ensure the provision of data of an equivalent scientific quality;	Fuel supply is ultra-low-sulphur diesel from commercial supply. Usage is extremely low due to normal operational for the data centres being powered by grid supply. As a result the fuel selected is optimal for the use intended, i.e. emergency supply.

Section	Subsection	BAT#	BAT Text	Requirements	Comment
				ii. Regular testing of the fuel quality to check that it is consistent with the initial characterisation and according to the plant design specifications. The frequency of testing and the parameters chosen from the table below are based on the variability of the fuel and an assessment of the relevance of pollutant releases (e.g. concentration in fuel, flue-gas treatment employed); iii. Subsequent adjustment of the plant settings as and when needed and practicable (e.g. integration of the fuel characterisation and control in the advanced control system (see description in Section 10.8.1)).	
		BAT10	In order to reduce emissions to air and/or to water during other than normal operating conditions (OTNOC), BAT is to set up and implement a management plan as part of the environmental management system (see BAT 1), commensurate with the relevance of potential pollutant releases, that includes the following elements:	■ Appropriate design of the systems considered relevant in causing OTNOC that may have an impact on emissions to air, water and/or soil (e.g. low-load design concepts for reducing the minimum start-up and shutdown loads for stable generation in gas turbines) ■ Set-up and implementation of a specific preventive maintenance plan for these relevant systems; ■ Review and recording of emissions caused by OTNOC and associated	Normal operating condition for the data centres is grid supply of electricity. Tests within the testing regime which have the potential to significantly affect local air quality (black building test and load bank test) are scheduled on weekends, i.e. not during periods of typically poor air quality associated with weekday traffic. In the event of emergency generation being required, the number of running hours will be recorded and reported to the EA.

Section	Subsection	BAT#	BAT Text	Requirements	Comment
				circumstances and implementation of corrective actions if necessary; ■ Periodic assessment of the overall emissions during OTNOC (e.g. frequency of events, duration, emissions quantification/estimation) and implementation of corrective actions if necessary	
		BAT11	BAT is to appropriately monitor emissions to air and/or to water during OTNOC	The monitoring can be carried out by direct measurement of emissions or by monitoring of surrogate parameters if this proves to be of equal or better scientific quality than the direct measurement of emissions. Emissions during start-up and shutdown (SU/SD) may be assessed based on a detailed emission measurement carried out for a typical SU/SD procedure at least once every year, and using the results of this measurement to estimate the emissions for each and every SU/SD throughout the year.	Normal operating conditions for the data centres is grid supply of electricity. As Other than Normal Operating Conditions (OTNOC) conditions occur in an emergency situation, there is no opportunity to schedule monitoring of emergency operations. Monitoring of the testing regime is as per BAT2 above, i.e. is required to comply with MCPD requirements only.
	Energy Efficiency	BAT12	In order to increase the energy efficiency of combustion, gasification and/or IGCC units operated ≥ 1 500 h/yr, BAT is to use an appropriate combination of the techniques given below	*Techniques* ■ Combustion optimisation ■ Optimisation of the working medium conditions ■ Optimisation of the steam cycle ■ Minimisation of energy consumption ■ Preheating of combustion air ■ Fuel preheating ■ Advanced control system	Not applicable. The engine/generator sets provide backup generation only and do not run for >1500 hr/yr.

Section	Subsection	BAT#	BAT Text	Requirements	Comment
				■ Feed-water preheating using recovered heat ■ Heat recovery by cogeneration (CHP) ■ CHP readiness ■ Flue-gas condenser ■ Heat accumulation ■ Wet stack ■ Cooling tower discharge ■ Fuel pre-drying ■ Minimisation of heat losses ■ Advanced materials ■ Stream turbine upgrades ■ Supercritical and ultra-supercritical steam conditions	
	Water usage and emissions to water	BAT13-15			No routine water usage and no emissions to water
	Waste Management	BAT16	In order to reduce the quantity of waste sent for disposal from the combustion and/or gasification process and abatement techniques, BAT is to organise operations so as to maximise, in order of priority and taking into account life-cycle thinking: (a) waste prevention, e.g. maximise the proportion of residues which arise as by-products;	Techniques: ■ Generation of gypsum as a by product ■ Recycling or recovery of residues in the construction sector ■ Energy recovery by using waste in the fuel mix ■ Preparation of spent catalyst for reuse	Waste produced by the permitted activity is managed by subcontractors. If left over a long period of time the fuel in the tanks degrades and becomes less pure. Once a year a subcontractor comes to site and accesses each bulk tank analysing the quality of the fuel. Depending on the results, they will undertake fuel polishing improving its quality, taking any waste diesel off-site with them Mineral lube oil is also brought and taken off site by the subcontractor changing the oil.

Section	Subsection	BAT#	BAT Text	Requirements	Comment
			(b) waste preparation for reuse, e.g. according to the specific requested quality criteria; (c) waste recycling; (d) other waste recovery (e.g. energy recovery)		
	Noise Emissions Flaring	BAT17	In order to reduce noise emissions, BAT is to use one or a combination of the techniques given below.	Techniques ■ Operational measures ■ Low-noise equipment ■ Noise attenuation ■ Noise-control equipment ■ Appropriate location of equipment and buildings	Extended running will only occur in an emergency situation. Many of the generators are located within a building and those that are external are housed within acoustic enclosures. The proximate receptors are commercial and industrial premises. See details in **Section 11**.
BAT conclusions for the combustion of solid fuels	BAT conclusions for the combustion of coal and/or lignite	BAT18-23			Not applicable
	BAT Conclusions for the combustion of solid biomass and/or peat	BAT24-27			
BAT conclusions for the combustion of liquid fuels	HFO- and/or gas-oil-fired boilers	BAT28-30			Not applicable
	HFO- and/or gas-oil-fired engines	BAT31	In order to increase the energy efficiency of HFO and/or gas oil combustion in reciprocating engines, BAT is to use an appropriate	*Techniques* ■ Combined cycle	The purpose of the diesel generators is for emergency supply only. There is no opportunity for combined cycle operation.

Section	Subsection	BAT#	BAT Text	Requirements	Comment
	Energy efficiency		combination of the techniques given in BAT 12 and below.		
	HFO- and/or gas-oil-fired engines NO_x, CO and volatile organic compound emissions to air	BAT32	In order to prevent or reduce NO_x emissions to air from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below.	*Techniques* ■ Low-NO_x combustion concept in diesel engines ■ Exhaust-gas recirculation (EGR) ■ Water/steam addition ■ Selective catalytic reduction (SCR)	The Slough Campus data centres work with the following different arrangements, where n is the number of generators necessary to meet the load requirement of the data centre ■ LD4: n+1 ■ LD5: 2 x (n+2) ■ LD6: n+2 ■ LD7: - L7.1: n+2 - L7.1: n+2 The 54 current and 23 new engines reflect local and global investment and acquisition decisions by Equinix and have been selected to provide power and capacity, reliability and serviceability for emergency generation. The new engines will meet the 2G TA-Luft emissions standard as per requirement of item 12 of the FAQ (**Table 6.1**). The air quality impact assessment (**Appendix D**) identified that the assessed probability of the testing regime breaching the hourly NO_2 standard is 1.7 x 10^{-17}% for the Campus alone (including the new generators) and 1.0 x 10^{-12}% when in combination with LD13x and LD11x, i.e. very low. The Environment Agency guidance for modelling generators states that where the probability of exceedance is greater than 5%, further proposals of emissions reduction are required. In both cases, exceedances of the

Section	Subsection	BAT#	BAT Text	Requirements	Comment
					hourly NO_2 standard are considered "highly unlikely" as the probabilities are far less than 1%. Therefore, no further proposals to reduce the risk of exceedance are made.
		BAT33	In order to prevent or reduce emissions of CO and volatile organic compounds to air from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or both of the techniques given below.	*Techniques* ■ Combustion optimisation ■ Oxidation catalysts	The purpose of the diesel generators is for emergency supply only. Combustion is optimised for this purpose. As the engines are considered individually to be medium combustion plant and for the purposes of emergency generation, they are not required to comply with emission limits in the MCPD.
	HFO- and/or gas-oil-fired engines SO_x, HCl and HF emissions to air	BAT34	In order to prevent or reduce SOX, HCl and HF emissions to air from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below.	Techniques ■ Fuel choice ■ Duct sorbent injection (DSI) ■ Wet flue-gas desulphurisation (wet FGD)	Ultra-low-sulphur fuels as a primary source. Ultra-low-sulphur diesel is specified for purchase. Actual annual purchase is very low. As the engines are considered individually to be medium combustion plant and for the purpose of emergency generation, they are not required to comply with emission limits in the MCPD.
	HFO- and/or gas-oil-fired engines Dust and particulate bound metal emissions to air	BAT35	In order to prevent or reduce dust and particulate-bound metal emissions from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below.	Techniques ■ Fuel choice ■ Electrostatic precipitator (ESP) ■ Bag filter	As the engines are considered individually to be medium combustion plant and for the purposes of emergency generation, they are not required to comply with emission limits in the MCPD.
	Gas-oil-fired gas turbines	BAT36-40			Not applicable
10.4 BAT conclusions for the combustion of gaseous fuel		BAT40-54			Not applicable

Section	Subsection	BAT#	BAT Text	Requirements	Comment
10.5 BAT conclusions for multi-fuel-fired plants		BAT55-59			Not applicable
10.6 BAT conclusions for the co-incineration of waste		BAT60-75			Not applicable

7. ENVIRONMENTAL MANAGEMENT SYSTEM

7.1 ISO 14001

Equinix operates an ISO 14001 accredited environmental management system (EMS) for their Slough Campus data centres. The EMS will include the additional 23 generators. The current ISO 14001 certificate is presented in **Appendix E.**

7.2 Summary of Equinix Environmental Management System

The following is a summary of the contents of the original Equinix EMS for the Equinix Campus Data Centre. No changes to the EMS are required for the permit variation.

Contents:

1. Purpose
2. Scope of Document
3. Management Systems Elements
    - 3.1. Health Safety and Environment Policy
    - 3.2. Health Safety and Environment Organisation and Roles and Responsibilities
    - 3.3. Health Safety and Environmental Communications
    - 3.4. Compliance with Legislation
    - 3.5. Scope of the Health Safety and Environment Management System
    - 3.6. Health Safety and Environment Objectives
    - 3.7. Health Safety and Environment Training
    - 3.8. Employee Health Safety and Environment Competence
    - 3.9. Monitoring
    - 3.10. Record Management
    - 3.11. Visitors
4. Health and Safety Section
5. Occupational Health
6. Environmental Management Section
    - 6.1. Significant Environmental Aspects
    - 6.2. Environmental Incident Reporting
    - 6.3. Environmental Spill Response Process
    - 6.4. Environmental Emergency Preparedness
    - 6.5. Water Quality and Legionella Management
    - 6.6. Waste (incl. licences and permits, waste documentation and List of wastes codes)
    - 6.7. Hazardous Waste (incl. fluorescent light tubes, lead batters, printer cartridges and toner, WEEE, chemicals and hazardous materials
    - 6.8. Site Environmental Issues
    - 6.9. Energy Management

8. WASTE MANAGEMENT

8.1 Waste Generation

Minimal additional waste is expected to be generated as a result of the permit variation as waste generated from the permitted activities is waste lubricating oil and diesel fuel waste.

Currently, waste oil is removed by subcontractors AWC who perform servicing and maintenance of the generators at Slough. In 2017, for the existing Slough Campus data centres only millilitre quantities of oil were removed for testing and no bulk replacement took place. Given the lack of routine operation which would cause degradation of the lubricating oil, this situation is expected to be typical of most years even with the additional generators. The waste oil is not stored on site and its appropriate disposal is undertaken by AWC.

An external company is brought in on site annually to test the stored diesel fuel. They test a variety of parameters, including clarity, adenosine triphosphate, water content and particle count. If required the fuel is then cleaned on site by the same company (fuel polishing). Samples are taken after the polishing to ensure that the quality of the cleaned fuel is acceptable. The waste diesel fuel is not stored on site and its appropriate disposal is undertaken by the external company.

8.2 Waste Minimisation

Waste minimisation measures are already in place, as per the original Slough Campus Permit application (December 2018) and will continue to apply to the varied activities.

8.3 Waste Storage

The management of waste storage is as previously applied for and determined as per the extant Slough campus permit (EPR/LP3303PR).

9. RAW MATERIALS

The data centres use the raw materials detailed in **Table 9.1**. Typical consumption values are given, as all raw material usage is intermittent. There is no change to the consumption of water, mineral lube oil and biocides as part of this permit variation.

Table 9.1 Raw Materials Usage

Substance	Approximate Annual Consumption	Typical Storage Capacity	Use	Risk
Water	No change as a result of this permit variation			
Diesel	No routine consumption. Delivered as needed.	Each new generator has its own day tank. New day tanks are to be added as part of this variation as detailed in **Section 4.4**. LD5 and LD7 both require additional bulk storage with enough capacity for the site to run in island mode for 36 hours as detailed in **Section 4.4**.	Generator and fire pump fuel	Flammable liquid and vapour, Toxic to aquatic life with long lasting effects
Mineral lube oil	No routine consumption- this will continue to occur periodically according to service requirements.	Minimal. Subcontractor brings and removes mineral oil. Less than 1,000 L per site	To lubricate generators	None
Biocides	No change as a result of this permit variation. Only required for data centre cooling activities so not covered by the Environment Agency Permit.			

10. ENERGY

10.1 Energy Usage

The data centres on the Campus are supplied by the national grid during normal operation. The Permitted activity, the emergency power generation from the diesel generators, consumes diesel to produce electricity. The quantity of diesel required depends on the running time each year.

10.2 Energy efficiency

As per the information already submitted for the EPR/LP3303PR application, Equinix uses the power usage effectiveness (PUE) metric to measure the energy efficiency of a data centre's infrastructure under normal operating conditions.

$$PUE = \frac{total\ energy\ entering\ the\ data\ centre}{energy\ used\ by\ IT\ equipment\ inside\ data\ centre}$$

Each of the data centres has a target PUE set against a 2015 baseline to accomplish an 8-10% improvement in energy efficiency against that baseline.

10.3 Energy Management System

Equinix operates an ISO 50001 accredited energy management system for their Slough Campus data centres, at the latest review date of 5 June 2020. The 23 generators are to be included in the management system. The current ISO 50001 certificate is presented in **Appendix E.**

10.4 Climate Change Agreement

There is no change to the Climate Change Agreement (CCA) as a result of the changes to be made to this permit under this variation application.

Equinix (UK) Ltd.'s CCA is included in **Appendix F**.

11. NOISE

As per the existing Slough Campus Permit (EPR/LP3303PR) noise emissions from permitted activities will occur during the generator testing or emergency operation. The generators will be tested for no longer than an hour, only during day time, as detailed in the testing regime shown in **Table 4.2**.

11.1 LD4

There are currently ten generators at the LD4 data centre. Three additional generators are to be installed on site to accommodate an increase in power demand. The existing and new generators are all located on the eastern side of the site. They are all housed in individual acoustic enclosures, outside of the main building in a gantry. The stack walls are also all lined with acoustic insulation and are enclosed. There have not been any noise complaints received by Equinix to date for LD4.

During the determination of the current Campus Permit EPR/LP3303PR, the attenuation measures, screening from surrounding buildings and distance of sensitive receptors were considered sufficient to not require a detailed noise impact assessment. As the new generators are located next to the currently installed generators with the same noise attenuation measures, no detailed noise impact assessment has been undertaken for the additional generators.

11.2 LD5

There are currently 14 generators and one fire pump at the LD5 data centre. Eight additional generators are to be installed on site to accommodate an increase in power demand. The existing and new generators are all located on the southern side of the building. They are all housed in individual acoustic rooms, outside the main building. The stack walls are also all lined with acoustic insulation and are enclosed. There have not been any noise complaints received by Equinix to date for LD5 for the additional generators.

During the determination of the current Campus Permit EPR/LP3303PR, the attenuation measures, screening from surrounding buildings and distance of sensitive receptors were considered sufficient to not require a detailed noise impact assessment. As the new generators are located next to the currently installed generators with the same noise attenuation measures, no detailed noise impact assessment has been undertaken for the additional generators.

11.3 LD7

There are currently six generators at the LD7 data centre, all located in the LD7.1 building. Three additional generators are to be installed at building LD7.1 and nine at building LD7.2 to accommodate an increase in power demand. One of the LD7.1 generator lies within the boundary of LD6 further south. The existing and new generators are all located on the southern side of the site. They are all housed in individual acoustic enclosures, outside of the main building in gantries or close to buildings. The stack walls are also all lined with acoustic insulation. There have not been any noise complaints received by Equinix to date for LD7.

During the determination of the current Campus Permit EPR/LP3303PR, the attenuation measures, screening from surrounding buildings and distance of sensitive receptors were considered sufficient to not require a detailed noise impact assessment. As the new generators are located next to the currently installed generators with the same noise attenuation measures, no detailed noise impact assessment has been undertaken for the additional generators.

12. DETAILED MODELLING

The generators, which are all powered by diesel engines, will be tested periodically during the year, as part of the Equinix standard engine testing regime. In case of a failure of the national electricity grid, the generators would also be operated in order to supply power to the Site.

As Equinix operates other data centres than LD4, LD5, LD6 and LD7 on the Slough Trading Estate, there is a potential for in-combination effects on receptors. The impacts from the Campus emissions have therefore been considered separately and in-combination with the other sites, namely LD11x and LD10 (to be renamed LD13x). The detailed air quality impact assessment is presented in **Appendix D**.

For human health, compliance with short-term PM_{10} and NO_2 standards, as well as long-term NO_2 standards were assessed. The Campus uses ultra-low sulphur diesel. Emission rates for SO_2 for the engines were calculated and were found to be exceptionally small (of the order of 1×10^{-3} g/s) and as a result SO_2 emissions have not been assessed.

The assessment found that the particulate emissions from the engines do not have the potential to breach the air quality standard for PM_{10}, whether in emergency running or in testing mode.

12.1 Air Quality – Testing Regime

The assessment identified that for the testing regime of the Campus alone and in combination with LD13x and LD11x, there is the potential to breach the hourly nitrogen dioxide standard. The maximum assessed probability of the testing regime breaching the hourly NO_2 standard is 1.7×10^{-17}% for the Campus alone and 1.0×10^{-12}% for the Campus in combination with LD13x and LD11x, i.e. very low. The Environment Agency guidance[2] states that where the probability of exceedance is greater than 5%, further proposals of emissions reduction are required. In both cases, exceedances of the hourly NO_2 standard are considered "highly unlikely" as the probabilities are far less than 1%. Therefore, no further proposals to reduce the risk of exceedance are made.

The testing regime scenarios were not predicted to have the potential to impact adversely the annual mean NO_2 standard for the protection of human health, including at the Air Quality Management Areas in Slough Borough. There are no significant impacts predicted on any protected conservation areas from the testing regime

12.2 Air Quality – Emergency Power Generation

Emergency power generation scenarios were assessed with all generators of the Campus alone and in combination LD13x and LD11x running concurrently. In both cases, there is predicted to be the potential for the hourly NO_2 standard to be exceeded, and with sufficient running hours for a breach to occur.

The model predicts that emergency running of the Campus' generators alone or in combination with LD13x and LD11x has the potential to exceed the 24 hour NO_x standard at Haymill Valley LNR. It also predicts the potential for significant impacts at Burnham Beaches SAC from the emergency running of the Campus' generators in combination with LD13x and LD11x. The predicted process contribution at the SAC is however only marginally over the threshold for insignificance (11% vs a threshold of 10 %).

Furthermore, in practice in the last nine years there has been only one occurrence where some of the data centres (LD6, LD7 and LD10) had to use the back-up generators, this was during a national power outage in mid-2019. As a result the potential for actual significant impacts at Burnham Beaches SAC is considered highly unlikely.

[2] Environment Agency, 2019, Guidance Specified generators: dispersion modelling assessment, https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment

12.3 Air Quality Management Plan

An Air Quality Management Plan (AQMP) is under preparation and is being produced in conjunction with the Local Authority, Slough Borough Council, as per Improvement Condition 3 of the existing Slough Campus Permit (EPR/LP3303PR). The changes being proposed in this variation will be factored into the development of this plan. The AQMP outlines the response measures to be taken in the event of a grid failure. The AQMP will include the following considerations:

- The response should be tailored to reflect the predicted potential impact indicated by the air dispersion modelling at individual receptors
- Specific timescales for response measures;
- How local conditions during a grid failure might influence the response required, for example meteorological conditions or time of day;
- Contingency for how the response will be carried out in the event scenario i.e. loss of power; and
- Timescales for continued review of the management plan.

Once produced the AQMP will be submitted to the EA for approval.

13. SITE CONDITION REPORT

The Site Condition Reports (SCR) have been updated for this application to include the additional fuel storage at each data centre associated with the additional generators.

The site condition of each data centre has not been changed due to this application as there has been no change to site boundaries and no ground pollution incidents have been reported. No additional baseline data/site investigation has been undertaken for this application.

The updated SCRs are included in **Appendix G.**

14. MONITORING

14.1 Emissions to Air

No change is proposed as a result of this permit variation in the way Equinix reports to the Environment Agency the following metrics in relation to the backup generation activity at each of the Campus data centres:

- Number of test/maintenance running hours per year;
- Number of emergency generation events and running hours – per year; and
- Quantity and type of backup generation fuel used over the period.

No periodic monitoring of emissions is proposed due to emergency only nature of the generation.

15. ENVIRONMENTAL RISK ASSESSMENT

15.1 Identify and Consider Risks from the Site

The environmental risk assessment of the original Campus Permit application has been updated for this variation. This has included identification of sources, pathways and receptors and is presented in **Table 15.1**.

Separately, the EA's H1 tool has been updated as a screening exercise. The database file is supplied with this application via OneDrive as "H1TOOL_2.78.30.09.20.mdb". Detailed modelling of emissions to air is described in **Section 12** of this document.

15.2 Climate Change Risk Assessment

A climate change risk assessment has been completed for this variation application as this was not a requirement from the EA when the original permit was submitted. This is supplied in **Appendix H**.

Table 15.1 Environmental Risk Assessment

Hazard	Operational scenario	Receptor	Pathway	Risk management techniques	Probability of exposure	Consequence	Overall risk
Emission to air *(NO_x, CO, SO_2, particulates)*	Testing	See detailed air quality modelling, **Section 12**	Dispersion through the air	Testing regime scheduled for minimum practicable impact – see detailed air quality modelling in **Appendix D.**	High	High	High
	Emergency operation	See detailed air quality modelling, **Section 12**	Dispersion through the air	Sites have uninterruptable power supply (UPS) units designed for up to 6 minutes autonomy. During a utility failure it is expected that generators will start and take load within 1 minute of the failure occurring. Brownouts mitigated by dual supply and UPS.	Low	High	Medium
	In case of fire	See detailed air quality modelling, **Section 12**	Dispersion through the air	Each generator container or room has a fire alarm panel (flame detection) interfaced to the site wide fire alarm system. A fusible link interfaced with fire alarm system and drop valves on both the fuel transfer and feed line to the generator are also provided to terminate the flow of fuel to the engine. When the fusible link melts, it isolates the fuel feed to the engine which shuts the generator down in the event of the fire which triggers the fire alarm. The generator containers are designed to withstand the fire.	Low	Low	Low
Emission to water	No known scenarios – water courses are at least 400 m from the data centres						
Emission to sewer *(Bulk fuel)*	Accidental	WWTP	Combined sewer following a direct spill onto hard	Bulk storage tanks are situated within a bund(s) that are 110% storage capacity of the largest tank. Each day	Low	Medium. WWTP may need to	Low

Hazard	Operational scenario	Receptor	Pathway	Risk management techniques	Probability of exposure	Consequence	Overall risk
			standing and entry to the drainage system following catastrophic failure of tank / pipework, overfill or bund failure and/or failure of and site site hard surfacing.	tank is double-skinned. Any water that accumulates in external bunds is to be tested prior to discharge into rainwater drains. Any oil and oily water will be removed using a vacuum pump, and recycled or disposed using an appropriate waste disposal company. The areas in which the bulk and day tanks are located are subject to a daily site housekeeping walk around to look for issues. The diesel filling procedure is defined and set out in **Appendix B.** It includes using drain covers, spill kits and dip trays to mitigate this hazard. The generators are stored in shipping containers over hardstanding or in concrete rooms. The Site surfaces consist of hardstanding in generally good condition both inside and outside of the building. Equinix has emergency response procedures in place in the event of a release of oil or diesel, processes for the planning for such eventualities and checklists to audit the response in case such an event occurs. These are provided in **Appendix C**.		quarantine the affected flow	
Emission to sewer	In case of fire	WWTP	Combined sewer	The generator containers are designed to withstand the fire within	Low	Low	Low

Hazard	Operational scenario	Receptor	Pathway	Risk management techniques	Probability of exposure	Consequence	Overall risk
(*firefighting water*)				and do not use water as a means of fire suppression. In the event the fire services are required to use water in the generator container area, firefighting water would be collected by the surface water drains, The surface water drains of the sites connects to the Slough Trading Estate sewer system.			
Emission to land *(Bulk fuel)*	Accidental	Land within or adjacent to the installation boundary	Direct spill onto land through catastrophic failure of tank / pipework, or overfill, bund failure and/or failure of site hard surfacing	See response for Emissions to Sewer (bulk fuel)	Medium	Low . Site clean-up and possible remediation required	Medium – low
Emission to groundwater *(Bulk fuel)*	Accidental	LD4, 5 and 6 lie within the total catchment (Zone 3) of a groundwater source. LD7 lies on the outer edge of the outer zone (Zone 2) of a groundwater source.	Infiltration through land surface following direct spill as above	See response for Emission to Sewer (bulk fuel)	Low	Medium. Site clean-up and possible remediation required	Medium-low
Odour	No known scenarios for significant emissions reaching offsite receptors						

Hazard	Operational scenario	Receptor	Pathway	Risk managementtechniques	Probability of exposure	Consequence	Overall risk
Noise and vibration	Generator testing /emergency operation	Local businesses /residential receptors	Airborne	Testing regime scheduled for daytime hours. Emergency running likelihood is very low and unlikely to be of extended duration (see emissions to air)	Very low	Low – nearest residences are c. 200 m. Nearest businesses are c. 100 m	Low
Litter / pests	Normal operation	Neighbouring industrial and commercial units	Windblown	Housekeeping is given a high priority as company policy. Waste generating activities occur within the data centre building and are not external Waste generated by the data centres is not putrescible	Very low	Low	Very low
Visible emissions *(Black smoke on start up)*	Generator testing /emergency operation	Neighbouring industrial and commercial units	Airborne / visual	Minimisation of planned testing Low likelihood of emergency running (see emissions to air)	Low	Low – short duration visible emission	Low
Surface water flooding from a weather event	All operational scenarios	Site operations restricted	Direct effects	Surface water drainage to combined sewer. Site operations are principally internal	Low – not in a fluvial flood plain	Low – operational impact	Low

APPENDIX A AMPS TECHNICAL COMMITTEE METHODOLOGY

APPENDIX B DIESEL FILLING PROCEDURE

APPENDIX C EMERGENCY RESPONSE PROCEDURE

APPENDIX D AIR QUALITY IMPACT ASSESSMENT REPORT

APPENDIX E ISO 14001 AND 50001 CERTIFICATE

APPENDIX F CLIMATE CHANGE AGREEMENT

APPENDIX G SITE CONDITION REPORTS

APPENDIX H CLIMATE CHANGE RISK ASSESSMENT

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