Appendix 4.2
Data Centre Application – Planning Engineering Report

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Planning Engineering Report

Herbata Data Centre Campus

Naas, County Kildare
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1 Introduction

The Herbata Data Centre Campus, located to the West of Naas, represents six independent data center buildings each providing up to 30MW of IT capacity within an overall campus. The campus will be developed on what is currently agricultural land, into a modern energy efficient data center facility. Each building will house eight individual data halls with capacity up to 3.84MW per data hall.

Each building on the site is engineered to be able to fully support itself using on site generation but is also able to use renewable energy sources when available. Each data center building will be further powered by on-site generation with high efficiency gas turbines, cooling to the data halls will be provided using direct air supply and extract with adiabatic top-up. The combination of these two design principles will aid the provision of a low Power Usage Effectiveness (PUE), a metric that is used in the data center industry to compare the efficiency of the mechanical and electrical systems.

In support of the adiabatic cooling, each building will have a minimum of 1-years water storage adjacent with top-up available from on-site ponds, this will result in there being no dependency for cooling on the local Irish water distribution network. Renewable energy sources are to be connected to the site to provide at least 30% of annual operational energy demand in a year, this will be provided as a combination of both on-site renewable sources and off-site renewable sources via Commercial Power Purchase Agreements (CPPAs). In developing the design, consideration of what measures are to be adopted to reduce energy usage have also been at the forefront of the overall design.

The Naas Local Area Plan 2021-2027 has listed these lands for zoning for the purpose of a “Data center” recognizing and excelling with Relevant Legislation and Policies. The proposed data center site is within the County of Kildare, so local policies as well as National and EU policies are fully recognized. The most significant of these are:

Naas Local Area Plan 2021 - 2027 – various policies including:

- General support for the accommodation of data centers as part of National Planning Framework.
- Require data center applications being subject to relevant environmental and planning conditions.
- Require data centers to utilize sustainable renewable sources of energy to enable operations Government Statement on the Role of Data centers in Ireland’s Enterprise Strategy - recognizing the need for digital infrastructure whilst also decarbonizing the supply of energy.
- CRU Direction to the System Operators related to Data center grid connection.
- Eirgrid’s Data centre Connection Offer Process and Policy modified to accommodate direction by CRU process is limited to “auto producers” or generators with dispatchable power.
- Gas Networks Ireland Vision 2050 Statement – strategy to decarbonize Ireland’s gas network fully by 2050.

2 Structural Engineering

The proposed data centre campus buildings each consist of two-storey steel frames, with a mix of composite and non-composite floors supported in turn on primary and secondary steel beams spanning onto steel columns.

The proposal for the typical floor construction consists of a 200mm thick cast in-situ slab on metal deck COMFLOR 51 1.2mm, supported in turn on secondary beams and primary steel beams. The secondary beams are generally UB457x152x82 supported on 1000mm deep primary steel beams, typically UB914x305x201. Both the secondary and the primary beams have been assumed to work compositely with the concrete slab via studs, typically 19mm diameters 125mm high, welded on the top flange. The proposed roof structure consists of a similar structural arrangement to the typical floors, with 150mm thick metal deck concrete floors supported on composite steel beams.

The ground floor slab is proposed as a cast in-situ, ground bearing, 300mm thick reinforced concrete slab suspended between the pile caps and the RC ground beams. The slab has been assumed as fully suspended but will be laid directly on a suitable compacted Type 1 sub-base, to minimize potential settlements.

The lateral stability of each building will be provided by the combined diaphragm action of the composite floors and a series of vertical braced bays. Lateral loadings will be transferred to the braced bays through diaphragm action in the metal deck concrete floor.

The proposed foundations system consists of standalone reinforced concrete pile caps at each column location, supported on a cluster of 2,3 or 4 piles depending on the magnitude of the column loads that will need to be supported. Ground beams have been provided in both orthogonal directions, between the pile caps to minimize potential settlements.

The external plant gantries consist of galvanized steel framed structures. The proposed floor structure consists of heavy-duty grating, 40mm thick, supported in turn on a grillage of secondary and primary beams. The typical primary beams are UB1016x305x222 sections with secondary beams generally UB533x210x122. The structural grid varies between 9.085m x 10.60m and 9.085m x 11.90m. The storey height is 10.00m.

The lateral stability of gantry structure will be provided by vertical braced bays. In plan bracing has been provided to transfer horizontal loading to the vertical braced bays. The gantry structure is independent of the main Data Centre structure.

The foundation system for the external gantries consists of deep reinforced concrete caps supported in turn on bored piles. The pile caps can be clusters of 2, 3 or 4 piles, depending on the magnitude of the column load they need to support. Ground beams are proposed to tie the pile caps in both orthogonal directions.

The ancillary building will comprise the Security House, the Admin Workshop, Water Treatment Building, the District Heating Building, and various yards and compounds that will serve the site. The ancillary building’s structure is typically designed as a steel frame with a light-weight roof. The steel frames will be formed of steel rolled sections arranged in an orthogonal direction with main beams tying perimeter or internal columns.

The roof will consist of a light-weight construction and no heavy loadings are required to be accommodated either at the top or to the soffit. The roof will consist of a metal deck spanning between cold formed purlins.

supported in turn on the primary steel structure. To tie the frames, at roof level and transfer back lateral loadings to the stability system, horizontal tension rods bracings will be provided.

The lateral stability of the ancillary buildings will be achieved through a combination of moment frames and vertically braced bays.

The substructure is designed as a ground bearing solution which consists of an in-situ, 300mm thick concrete slab with continuous perimeter thickenings below the perimeter columns. Locally, pad footings are required under columns where higher loadings need to be accommodated.

The external yards and compounds will consist mainly of a ground bearing, cast in-situ concrete slab laid directly on top of a well compacted sub-base. The perimeter fencing will be tied back to the concrete base.

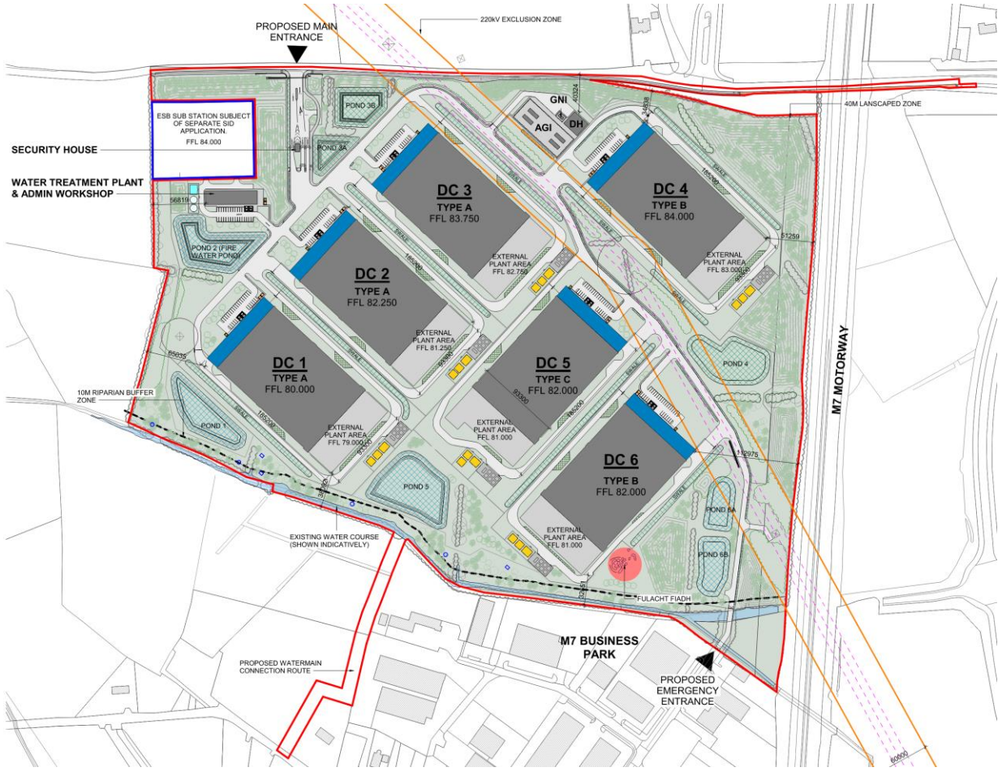
3 Civil Engineering

3.1 Introduction

The proposed development, as shown in the site plan in figure 3-1, will be for a large-scale Data centre Campus. This consists primarily of six data centers referenced as DC01 to DC06 with a similar footprint but with varying finished floor levels to accommodate the existing topography.

The buildings comprise the main Data Hall blocks encompassed between the external plant gantries along with the generator yard and the adjacent office spaces. In addition to the DC's, there will be ancillary buildings / services yards such as the Above Ground Gas Intake yard (AGI), the District Heating building (DH), The Gas Injection yard (NGI), the site security hut, the site administration building and water services building. The proposed development includes upgrade works to a portion of the R409 public road to provide pedestrian and cyclist link access to the site from the millennium park development east of the M7 motorway.

Figure 3-1. Site Plan



3.2 Existing Site

3.2.1 Existing Site Location

The site, as shown in the figure 3-2, is located approximately 3km to the west of Naas town centre in County Kildare in the east of the Republic of Ireland with grid reference SF 85914 79594. The site is accessed on the Northern side by R409 Regional Road via the M7 motorway to the east or through Caragh village to the West. To the south of the site is the existing Naas M7 Business Park and to the north is the existing Osberstown industrial park. Dublin Airport is approximately 30–35 minutes to the east of the site via the M7 motorway. The site is situated adjacent to major infrastructure assets including the M7 Motorway. The site area on which the data centre campus buildings will be located is approximately 37.5 hectares.

The are currently 4 entrances off the R409 onto the site as shown in the figure annotated as 1,2, 3 and 4. Access, 2, 3 and 4 are private entrances which leads to residential dwellings whilst access 2 leads to the existing agricultural buildings. These dwellings are shown on the topographical survey carried out by J&L Surveys.

The existing site is a greenfield site being used as agricultural land. The site in level varies between 85.500m AOD and 77.500m AOD, and slopes from its low point in the south of the site along the Bluebell Stream. The Northeast side of the site that corners the R409 and the M7 motorway, slopes in south easterly direction with levels varying from 85.500m to 80.500m. To the south of the site is the Bluebell Stream which takes all the sites surface water runoff.

Figure 3-2. Site Location

3.2.2 Existing Flood Risk

A Site-Specific Flood Risk Assessment (SSFRA), reference 2232-DOB-XX-XX-RP-C-0002, has been completed for the proposed development site and is included in the planning application documentation.

The subject lands have been analysed for risks from flooding in accordance with the Department of Housing, Local Government & Heritage/ OPW The Planning System and Flood Risk Management Guidelines for Planning Authorities and associated Technical Appendices, published in 2009 from the following components:

- Tidal
- Fluvial
- Pluvial

Design measures have been adopted as part of the proposed development to mitigate risks against flooding from the above components. The proposed development is located wholly within Flood Zone C where the probability of flooding from the Bluebell stream is less than 0.1% (1 in 1000 years). Fluvial flood has been managed by the introduction of nature-based SUDS solutions in accordance with best practice and with Kildare County Council Water Services Department policies and requirements. Table 3-1 is a summary of the Flood Risks from the various components assessed.

Table 3-1. Summary of the Flood Risks

Source	Pathway	Receptor	Likelihood	Consequence	Risk	Mitigation Measure	Residual Risk
Tidal	None	Proposed Development	None	None	Low	None	Negligible
Fluvial	None	Proposed Development	Negligible	None	Low	Building FFLs, plant areas and road levels are more than 2.41m above design flood level for the site	Negligible
Pluvial	Underground Surface Water Networks and overland flood flows	Proposed Development	Negligible	Moderate	Low	Appropriate drainage & SuDS design including 30% Climate Change, overland flood routing	Negligible

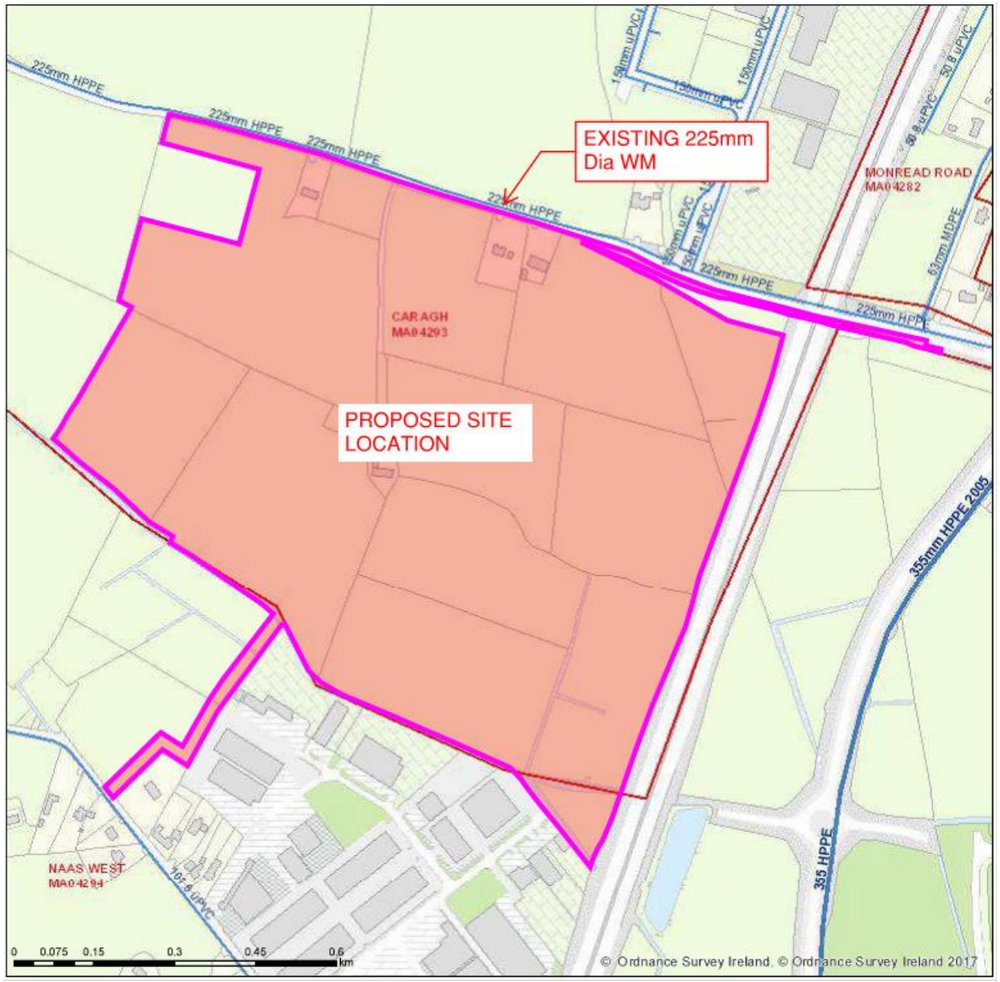
It has been determined that the proposed developments will not result in an increased risk of flooding within or downstream of the site.

3.3 Water Supply

3.3.1 Existing Water Supply

The Uisce Éireann (UE) record drawings indicate the presence of a 225mm diameter HPPE watermain to the north of the site along the R409 as illustrated in Figure 3-3. The location of the watermain was verified following a Ground Penetrating Radar (GPR) survey of the existing site and adjacent roads which was commissioned by the Applicant.

Figure 3-3. Site Location



3.3.2 Pressure Testing

The Applicant commissioned SES Water Management to conduct Fire Flow Simulation Testing on the nearest existing hydrants to the site. The hydrant was pressure logged for a period of 7 days which determined that the existing flow rate is approximately 26 l/ sec. The Pressure Testing Report is included in Appendix F of this report.

Figure 3-4. Pressure Testing

Figure 3-5. Hydrant Locations and Test Results

FH No.	Surface	Cover / Frame	Pit	Type	Depth	Marker / Plate	Canary Yellow	Spindle	Operating	Comments
1	Grass	Poor	Good	LUG	290	Yes	No	Good		No Plinth
2	Grass	Poor	Good	LUG	370	Yes	No	Missing		No Plinth
3	Grass	Poor	Good	LRT	520	Yes	No	Good		No Plinth

3.4 Foul Drainage

3.4.1 Existing Foul Drainage

There is no existing public foul drainage system serving or near the site. The existing private dwellings located on the site the site is currently served by private septic tanks/wastewater treatment systems which appear to discharge to ground. The nearest public foul drainage network is located approximately 275m to the south of the site and runs along the L2030, Newhall Road. Uisce Éireann mapping indicates that there is an existing 300mm public drainage infrastructure to the south of the site which conveys flows along the L2030 Newhall Rd. Flows are conveyed to the existing Newhall Wastewater Pumping Station which is located to the west of the proposed site as seen in Figure 3-7. Flows from the Newhall Wastewater Pumping station are pumped via rising main to the Osberstown Wastewater Treatment Plant to the north of the site.

Figure 3-6. Existing Foul Drainage Network in L2030

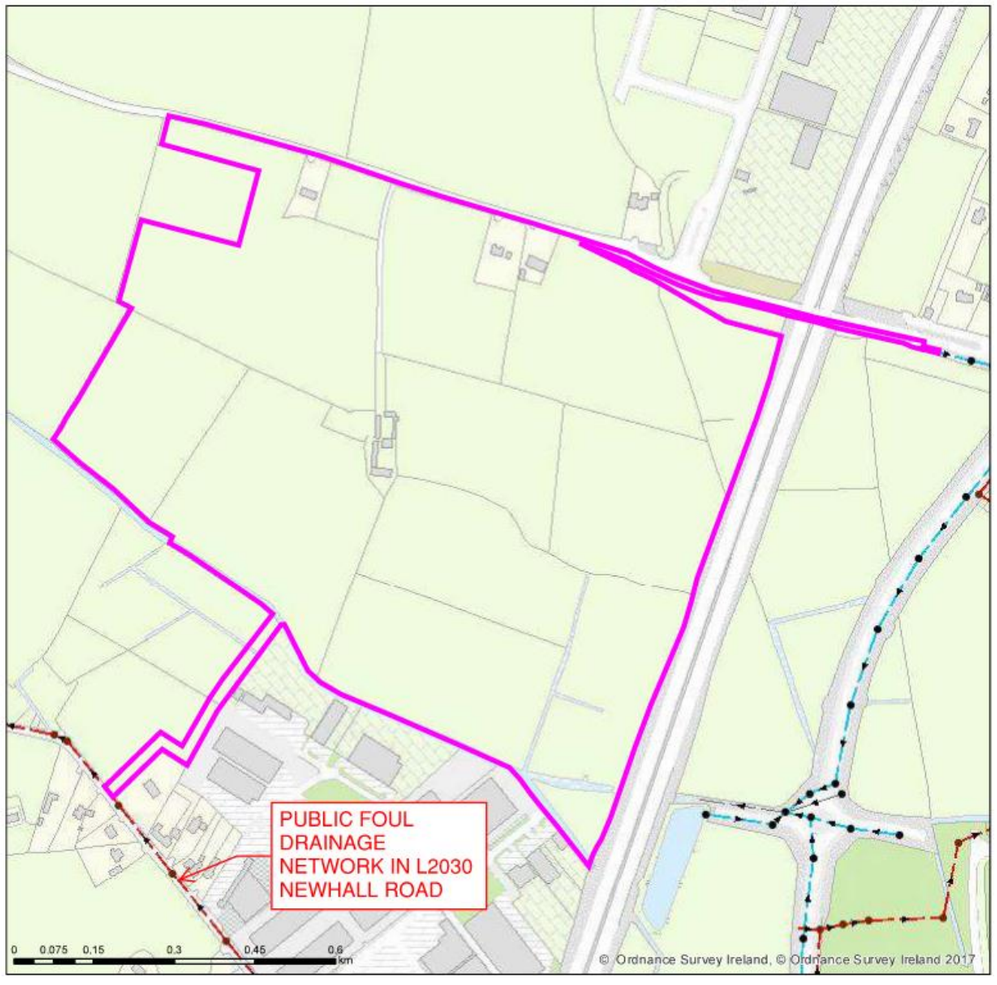
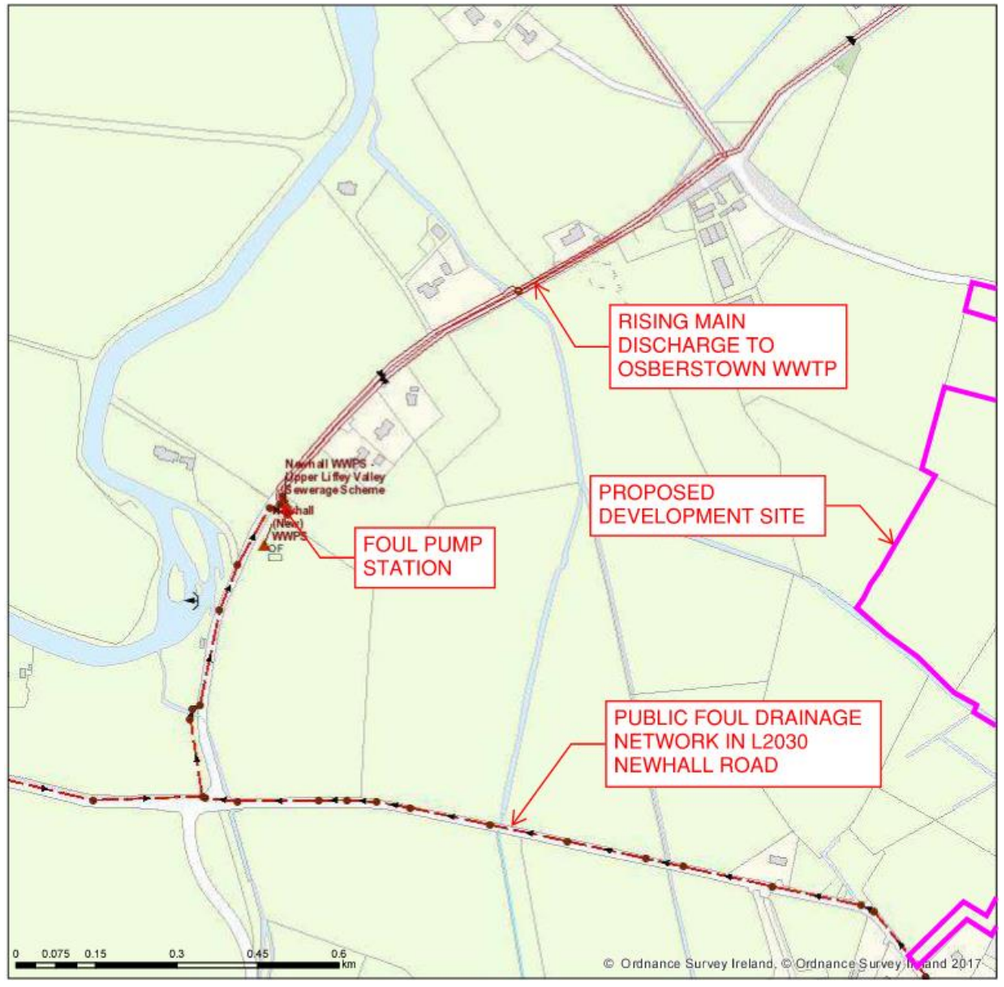


Figure 3-7. Existing Foul Drainage Network in L2030 / Pump Station

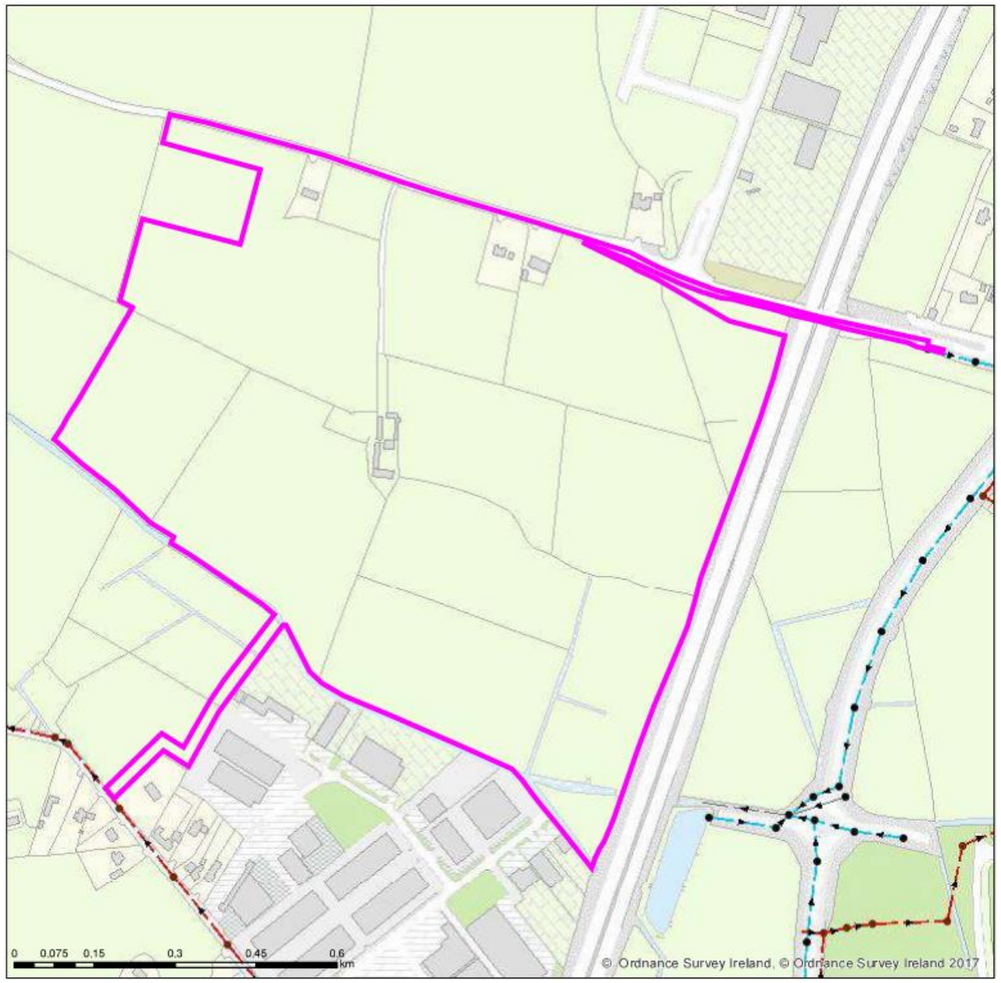


3.5 Surface Water

3.5.1 Existing Site Surface Water Conditions

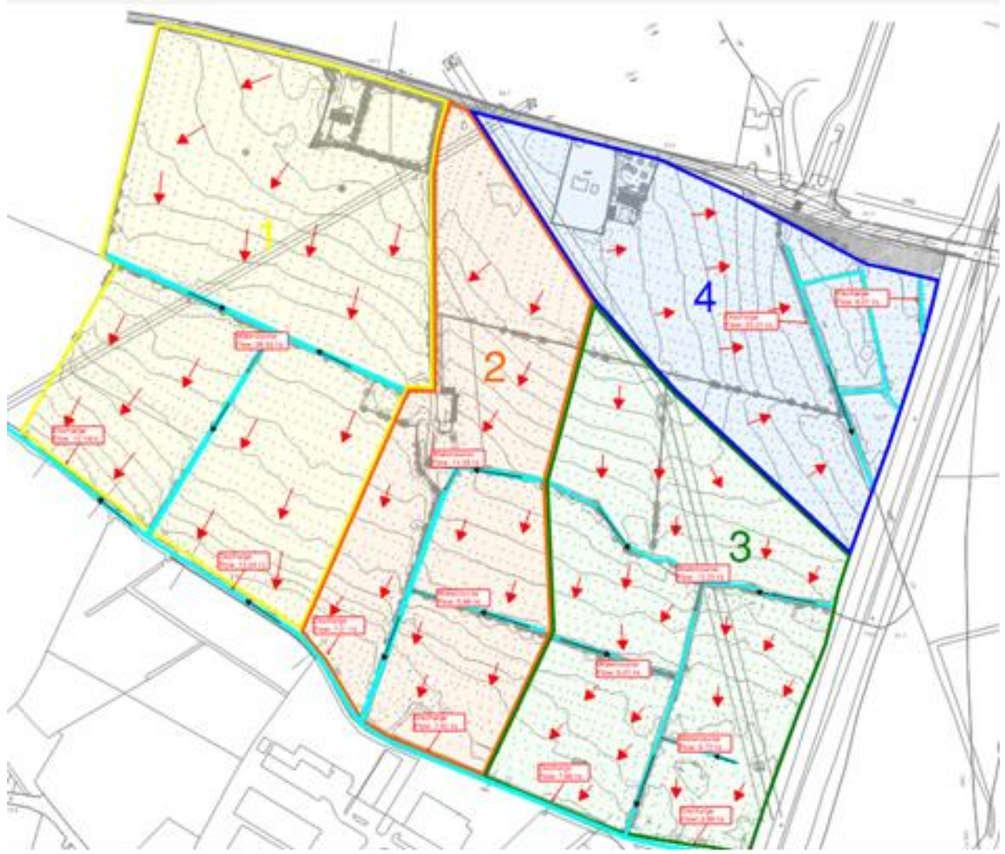
The existing site is not served by any public or formal surface water drainage system, as is illustrated in Figure 3-8 below which is an extract from the available Kildare County Council / Irish Water public drainage mapping.

Figure 3-8. Irish Water mapping



Currently surface water from rainfall flows across the land and is collected in several ditches which traverse the site and discharge into the Bluebell Stream (also known as the Yeomanstown watercourse) which runs in a northwest direction along the southern boundary of the site. Figure 3-9 below indicates the extent of the existing field boundaries and existing ditches. For the purposes of the surface water management design, we have identified below the existing discharges and the natural sub-catchments on the site. Catchment 4, noted in Figure 3-9 below, discharges to open watercourses which traverse the M7 motorway and flows southward and discharge to the Bluebell stream to the east of the motorway. An existing 900mm pipe traverses the motorway and conveys flows from east to west below the M7 Motorway, and this existing pipe will be maintained as part of the overall surface water strategy for the site.

Figure 3-9. Existing Overland flow paths and Catchment areas.



3.6 Existing Ground Conditions - Site Investigation

A suite of ground investigations, as shown in Appendix B Part 1, has been carried out on site by IGSL Ltd which includes the following.

- Cable Percussive Boreholes
- Trial Pits
- BRE365 Soakaway Tests
- Dynamic Probes
- Plate Bearing Tests
- Ground Water monitoring
- Geotechnical Laboratory Testing

Figure 3-10. Site Investigation Boreholes

In summary the results of the ground investigations yielded the following findings:

- The underlying strata consists of predominately silty/sandy gravelly CLAYS.
- Ground water monitoring was conducted by IGSL during the site investigation, over a 6-month period. Water strikes (seepage, slow and moderate inflows) were intercepted during shallow trial pit excavations, with groundwater also struck during borehole construction at BH01, BH02, BH04 and BH12. A well, installed in BH13 later reported water. Except for TP30 and BH12 in the northeast, shallow groundwater was found towards the south of the site, near the stream boundary. The groundwater entries were reported as seepages in trial pits, frequently in gravel horizons at the base of trial pits at approximately 3.0m depth. Refer to section 5.3 of the IGSL report in Appendix B Part 1.
- BRE635 soakaway testing yielded variable results across the site with poor infiltration rates to the south of the site and poor to moderate infiltration in some of the northern portions of the site with rates of approximately $5x10^{-6}$ m/s being determined (see Figure 3-11 below).
- Disposal of surface water run-off to ground via infiltration will vary across the site with infiltration not practical across the central and southern portion of the site for significant surface water disposal. Surface water infiltration may be feasible along the northern boundary, adjacent to the R409 road.

Figure 3-11. Site Investigation Calculations

Soakaway Design f -value from field tests (F2C) IGSL

Contract: Halverstown — Contract No. 24330
Test No. SA06 (Cycle 1)
Client DOBA
Date: 10/10/2022

Summary of ground conditions

from	to	Description	Ground water
0.00	0.40	TOPSOIL: Soft brown sandy CLAY with rootlets. Sand is fine to	
0.30	1.20	Firm brown sandy gravelly CLAY. Sand is fine to coarse. Grave	Dry
1.20	2.00	Grey brown gravelly silty SAND with a low cobble content. Sand	

Notes: Samples: AA181953, AA181954

Field Data

Depth to Water (m)	Elapsed Time (min)
1.12	0.00
1.13	1.00
1.14	2.00
1.14	3.00
1.15	4.00
1.15	5.00
1.16	6.00
1.16	7.00
1.17	8.00
1.17	10.00
1.17	12.00
1.18	14.00
1.18	16.00
1.18	18.00
1.19	20.00
1.19	25.00
1.19	30.00
1.20	35.00
1.20	40.00
1.21	50.00
1.22	60.00

Field Test

Depth of Pit (D) = 2.00 m
Width of Pit (B) = 0.45 m
Length of Pit (L) = 1.60 m

Initial depth to Water = 1.12 m
Final depth to water = 1.22 m
Elapsed time (mins)= 60.00

Top of permeable soil = m
Base of permeable soil = m

Base area= 0.72 m2
*Av. side area of permeable stratum over test pe 3.403 m2
Total Exposed area = 4.123 m2

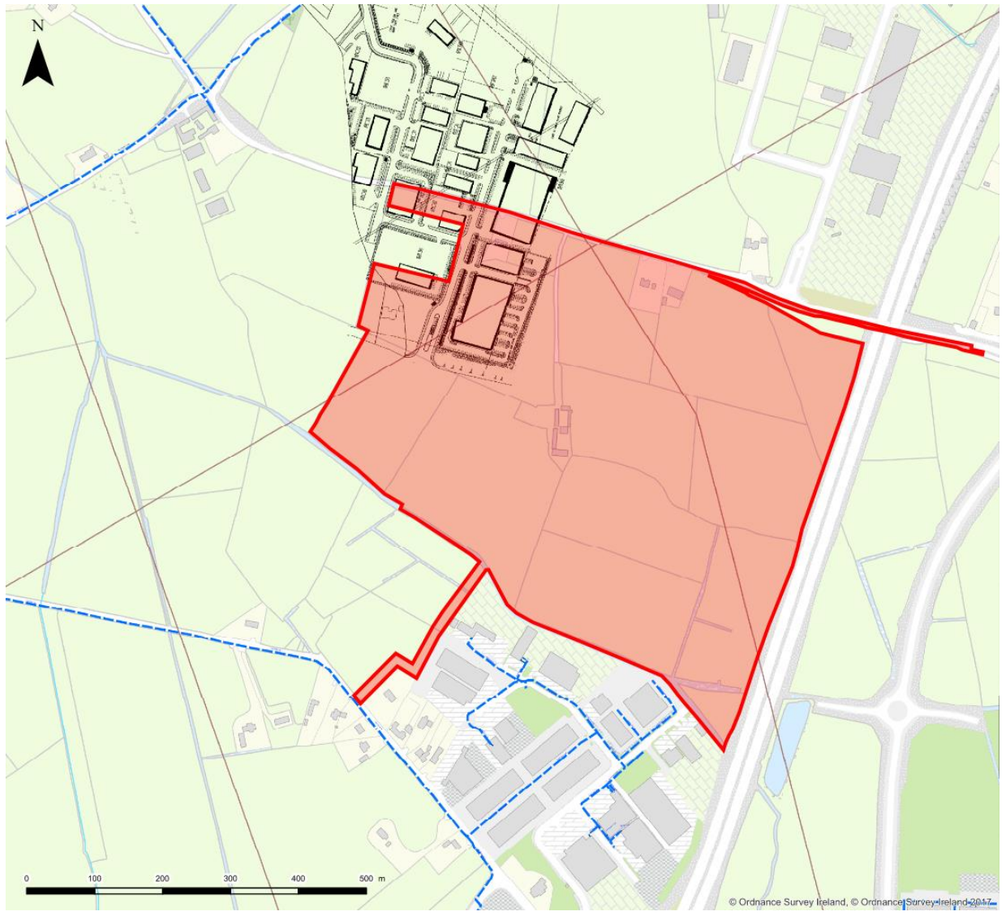
Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.00029 m/min or 4.851E-06 m/sec

3.6.1 Gas

There is currently no high-pressure gas main close to the site, only low pressure as shown in Figure 3-12 below. The design of the Herbata data centre campus is based on the use of gas turbines, as such, a high-pressure gas supply will be needed for the gas turbines. In discussion with Gas Networks Ireland (GNI), the client is in the process of negotiating to bringing in a new high-pressure gas main from an existing high pressure main AGI at Glebe West to the South-East of Naas. It is currently proposed that the new gas main will run alongside an existing low pressure main and then on to the Herbata site via the R409 road, a total distance of circa 10.5 km.

Figure 3-12. Existing LP Gas network around proposed site (in blue)



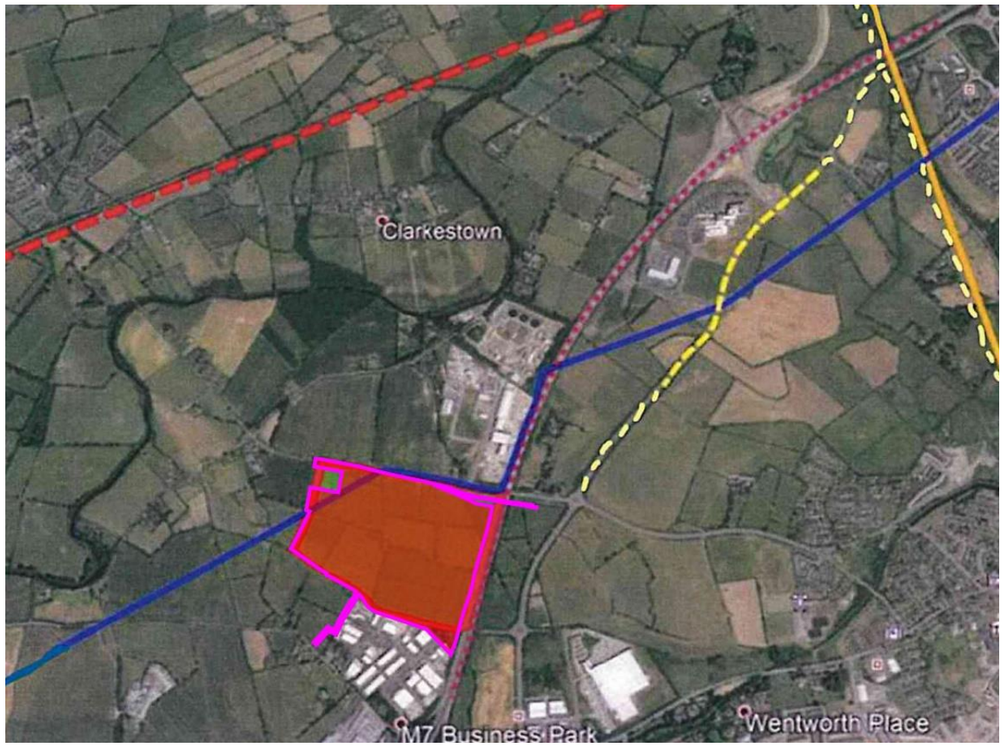
3.6.2 Fibre Connectivity

There are various options available to the data centre occupiers, which will develop over time. Fibre providers that are available in the vicinity are shown in Figure 3-13 below and include the following shown in the Table 3.2 below:

Table 3-2. Summary of Fibre Providers

Fibre Provider	Potential Fibre Services	Options / Notes
ESB-T (part of ESB Group)	Fibre is currently routed on the 110kV line crossing site so could be undergrounded and provided as a service from the new Grid substation.	ESB-T also have a Point of Presence (POP) in Monread in Sallins which could be used and then ducted to the Herbata site.
BT Ireland	Currently services are located on the railway line to the North of the Herbata site. Services can be provided from the POP in Naas to the site via new ducting.	
Eircom (Eir)	A POP is available in Naas, so new ducts will need to be laid to service the Herbata site.	Currently there is no Metropolitan Area Network (MAN) in Naas, so backbone upgrades will be required by Eir to provide high speed data services.
euNetworks (formerly Inland Fibre)	Services from euNetworks are currently available in Millennium Park and could be extended to the Herbata site.	
Aurora	High speed data services are available on parts of the Gas Networks Ireland High Pressure gas main infrastructure. With the new gas main being brought to site, discussions are ongoing about provide Aurora fibre along the new installation.	

Figure 3-13. Fibre Network



Key:

ESB-T (Blue continuous)

BT (Light red dash)

EIR (Orange continuous)

euNetworks (Yellow dash)

M7 Ducting (Dark red dash)

3.6.3 Power

Currently there are 2 overhead powerlines on site. On the west of the site, there is an existing 110kV overhead powerline which crosses the site in a north easterly direction. This overhead powerline as a single tower on site at the following co-ordinate: northing 686128.8208m, easting 719763.4211m. There are a further 2 towers for this overhead powerline, one located to the southwest of the onsite tower in the adjacent farmers field and one to the northeast of the onsite tower, across the R409 also located in a farmer's field.

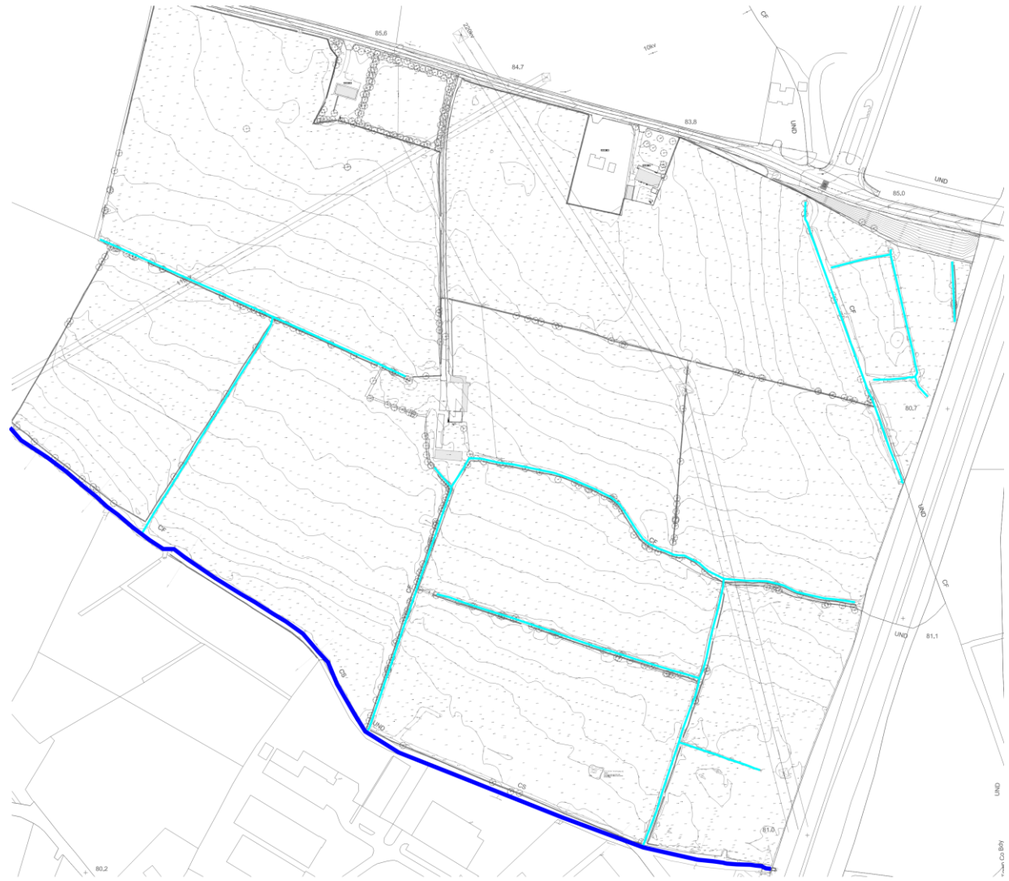
In addition to the existing 110kV overhead powerline, there is an existing 220kV overhead powerline to the east of the site. This more substantial overhead powerline crosses the site in a south easterly direction. This overhead powerline has 2 towers on site at the following co-ordinate: Northing 686552.7548m, Easting 686552.7548 and Northing 686635.9805m, Easting 686635.9805m. There are a further 2 towers for this overhead powerline, one located to the northwest of the onsite towers, across the R409, in the adjacent farmers field and one to the southeast of the onsite tower, across the M7 motorway also located in a farmer's field.

In addition to the major overhead powerlines, there are domestic 10kV overhead powerlines which provide power to dwelling 1 and the agricultural buildings. It's currently unknown where the power for dwelling 2 and dwelling 3 is provided from. The 110kV, the 220kV overhead powerlines, as well as the 10kV, are owned and operated by EirGrid.

3.6.4 Open Water Bodies

As stated in the wastewater section, there is an array of shallow ditches across the site as shown in Cyan in figure 3-14 with the Bluebell Stream shown to the south in blue. These ditches are believed to be dry and only collect runoff from overland flow across the field. The ditches connect to the Bluebell Stream in 3 locations as shown. The northeast of the site has a series of ditches which are believed to collect water from the site as well as the R409 embankment.

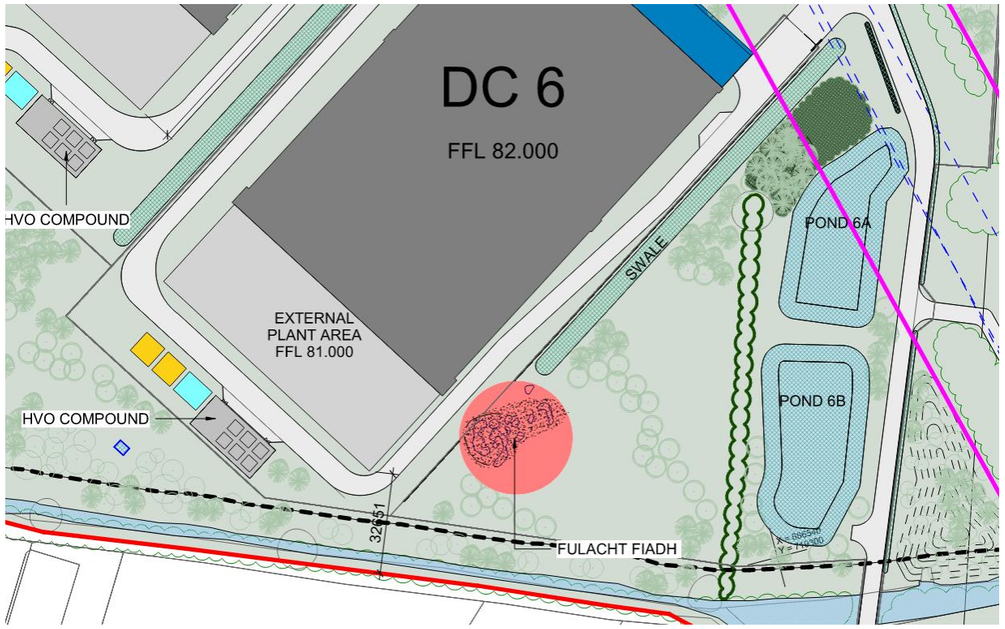
Figure 3-14. Ditches and Bluebell Stream



3.6.5 Historical Importance

There is an area on site which is of historical interest, Fulacht fiadh, as shown in figure 3-15. The was recently surveyed with the accurate locations shown in the figure below. Further detail is provided in the Environmental Impact Assessment Report.

Figure 3-15. Fulacht fiadh



3.7 Proposed Site

3.7.1 Levels and Topography

Due to the existing topography of the proposed site, it was necessary to review the proposed finished floor level (FFL) relative to the following criteria:

- Cut and fill volumes where a balance scenario is required.
- Landscape requirements to maintain as much of the existing topography, trees, and hedgerows as possible.
- Architectural requirements
- Planning requirements

Access to pedestrian entrances and door thresholds should be designed in accordance with the local design guidance documentation.

Where retaining walls are required, consultation and approval from the Client Security Team will be required. Retaining wall construction subject to vehicle loading and designed in accordance with the local design guidance documentation. Retaining walls located within external areas which are not subjected to heavy loading may need to be incorporated into the Landscape Architect proposals.

Landscape architectural mounds are proposed on the periphery of the site but will be designed to be self-supporting. For further details on this, please refer to landscape architect proposals.

Please refer to the cut and fill report enclosed reference number 10360452-HDR-XX-00-RP-C-090001 for a detailed review of the cut and fill analysis.

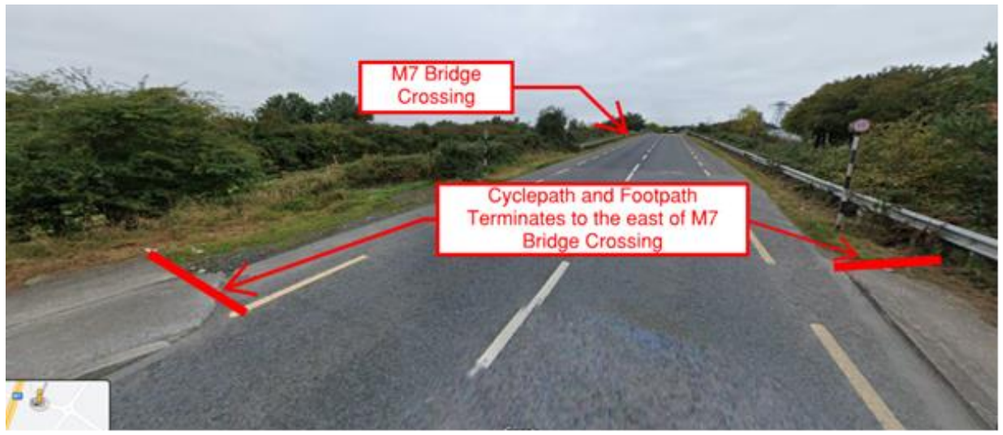
3.8 External Roads and Access

3.8.1 Existing Road Infrastructure

The existing site is bound to the north by a public road (R409). This road provides access to residents along the R409 as well as providing access to the Osberstown Business Park. The site is adjacent to the M7 Motorway along the eastern boundary. The site is also bound to the south by the M7 Business Park which is accessed via a roundabout on the L2030.

There are currently no existing vulnerable road user (VRU) facilities along the R409 adjacent to the proposed site. The R409 road connects to Millennium Park at the Caragh Road roundabout to the east of the proposed site. Furthermore, the provision of VRU facilities is constrained by the existing geometric configuration of the existing M7 motorway overbridge. A cycle path and footpath have been provided from the Caragh Road roundabout and terminate approximately 85m east of the M7 bridge crossing (see Figure 3-16 below).

Figure 3-16. Existing Cycle Path and Footpaths terminating to the east of the M7 bridge crossing.



3.8.2 Local Authority Pre-Planning Consultations

Formal pre-planning meetings have been conducted with Kildare County Council Road Planning section on relation to key roads issues raised preplanning. A traffic and transport assessment has been prepared by Systra and is included as a separate report as part of this application. Key correspondence and communication with KCC Roads Planning is included in Appendix G of this report.

3.8.3 Proposed R409 VRU Works

KCC's requested the extension of the existing pedestrian and cyclist infrastructure along the south side of the R409 from the east of the M7 bridge crossing. Full details of the proposed works are included on drawings 2232-DOB-ZZ-ZZ-DR-C-1600. These proposals with KCC Roads planning section who have indicated their agreement with the works. KCC have also engaged with KCC NDRO office on the proposed works and comments from both KCC and the NDRO office have been taken on board. Details of correspondence with KCC Road Planning department is provided in Appendix G. Key aspects of the proposed improved VRU works along the R409 are as follows:

- Transition of the existing cycle path and footpath to a single 2.0m wide 'off-road' shared surface, which maintains existing carriageway widths on the bridge structure in accordance with TII Transition zone detail (CC-SCD-05106).
- The 2.0m shared surface crossing the bridge structure shall transition to a separated 1.8m off road cycle path and 2.0m footpath on the west side of the bridge once clear of the existing traffic barrier restrictions. This arrangement shall continue along the R409 for the extent of the proposed development boundary.
- The proposed arrangement shall be constructed to allow for a 3.0m wide bus stop carriageway where the proposed cycle track shall transition to a 1.8m 'on-road' arrangement for the extent of the bus stop as indicated below.
- A proposed shared surface shall be proposed at the main site entrance to facilitate all VRU's travelling to and from the site.
- The road will be provided with public lighting and full details of this are included in this application. Refer to Sabre lighting design and drawings in Appendix I for full details.
- New roadside drainage will be provided along the southern section of the road where new kerbs are to be installed as part of the proposed improvement works. This drainage has been discussed and agreed pre-planning with KCC Water Services Department and the Area Engineer. Refer to drawing 2232-DOB-ZZ-ZZ-DR-C-0220 for full details.

3.8.4 Site Access - Sightlines

An analysis of the sightline visibility splays at the exit of the proposed development has been conducted. The analysis considered a visibility splay of 90m for a 60kph road in accordance with the requirements of Transport Infrastructure Ireland's Geometric Design of Junctions document (DN-GEO-03060). While the posted speed limit of this section of the R409 is 60kph, sight lines have been provided based on an 85kph design speed on the road as this is more representative of the 95th percentile design speed for this section of the R409.

The design of the site access has been arranged so that there is a clear visibility distance of a minimum of 160m for vehicles accessing the R409 from the proposed development. The analysis also indicates that a clear visibility distance of 160m in each direction is achieved from the site exit. Refer to drawing 10360452-HDR-XX-XX-DR-C-112250 for the sightline analysis.

Figure 3-17. Extract from TII – Geometric Design of Junctions document – Visibility distances.

Design Speed of major road(km/h)	'y' Distance(m)
42	50
50	70
60	90
70	120
85	160
100	215
120	295

3.8.5 Internal Road Layout

The internal road layout on the site is indicated on Drawing 10360452-HDR-XX-XX-DR-C-112250.The internal roads within the development are to remain private and will be maintained by the data centre management company. The internal road network is comprised of a 7.5m wide main campus road with 5.5m one-way roads provided around each data centre Building. A full Autotrack analysis has been undertaken for the site access road and the internal roads and is included on drawings 10360452-HDR-XX-XX-DR-C-112320. Road arrangements have been provided at the security entrance so that there is no queuing of vehicles onto the R409 and so that any rejected traffic (including HGV's) can safely turn and exist the site without blocking or causing a road safety issue on the R409.

3.8.6 Parking

Car parking for the data centre campus has been assessed and included as part of the Traffic Assessment scoping document prepared by Systra and pre-planning with KCC Roads Planning department. Given the bespoke data centre land use of the proposed development, there are no appropriate car parking guidelines provided within the current Kildare County Development Plan (2023- 2029). Of the total floor area of each proposed data centre building, 4,800sqm of this will be assigned as office / admin space. If the six data centre buildings and the additional administration / management building's GFAs are considered, this would equate to 29,100sqm of total office / admin GFA across the campus.

Car parking standards for an 'Office Park' land use set out within the current Kildare County Development Plan state a maximum parking limit of 1 space per 50sqm (where the GFA exceeds 1,500sqm). Applying this standard to the assigned use of office and admin space across the campus would equate to a maximum car parking level of 582 car parking spaces.

Car parking therefore has been assessed based on the actual staffing levels anticipated for each data centre. Staffing and visitor numbers are indicated in Figure 3-18 below and this data was included within the TA scoping document agreed with KCC and used for traffic volume generation on the site. The figures are total staff numbers and visitors based on 24hr operation of the Data centers and do not factor in shift pattern working or the distribution of visitors over the working day.

Figure 3-18. Staff Numbers agreed in Systra TA Scoping Document

CATEGORY OF STAFF	STAFF PER DATA CENTRE BUILDING	TOTAL FACILITY STAFF	TOTAL DAY TIME OCCUPANCY
Tenant Security	4	24	10
Cleaners	2	20	8
M&E Engineers	10	60	24
Engineering Support	6	30	12
Technical Support	4	24	10
Administration Staff	2	12	12
Landlord Management	N/A	20	8
Landlord Engineering Support	N/A	25	10
Landlord Security	N/A	10	4
Total Staff	**28**	**225**	**98**
Anticipated Customers / visitors	25	125 - 175	50 - 70

Table 3-3. Car Parking Spaces

	KCC Development Plan Standards	Total Staff	Total Visitors	Staff per shift (2No. 12 hr. shifts)	Visitors/hr.	Proposed No of spaces
Per data centre	96	28	25	14	5	30
Site security / Management	34 (10 Landlord, 24 Tenant)	55	0	22	0	30

Based on the above table, it is proposed that sitewide parking spaces are provided at each of the six data centre buildings, with an additional 30 car parking spaces located at the administration / management building. This would equate to a total of 210 car parking spaces across the proposed development, which is well within the maximum parking level if the 'Office Park' standards within the current Kildare County Development Plan were applied to the office / administration portion of the development.

3.8.7 Cycle Parking

Cycle parking for the data centre campus has been discussed and agreed with KCC Roads Planning department (refer to correspondence dated 26th April 2023 include in Appendix G. Data centres have extremely low staff number proportional to the floor area of the buildings and it is accepted that the application of Development Plan Parking Standards of one space per 100m^2 of gross floor area is not appropriate give the low staffing levels. During consultations with KCC Roads Planning department it was agreed to provide a reduced total of 52 bicycle parking spaces on the site (8 no. per Data Centre Building and 4 no. at the administration building). Following this consultation, it was decided that additional spaces would be provided on the site to further promote the use of sustainable transport, increasing the total bicycle parking spaces to be provided on the site to 104 as follows:

16 No. per Data centre building - this provides cycle parking for 57% of the total number of permanent staff on site at each data centre.

8 No. for Administration building.

Transport Assessment

Systra have been engaged to undertake a Transport Assessment (TA) of the proposed development and their full report is included in the planning information submitted with this application. A scoping document was submitted and agreed with KCC Roads Planning department prior to preparing the TA and there has been extensive pre-planning technical engagement with the Roads Panning Department. The TA describes and evaluates the baseline transport environment, forecasts multi-modal travel demand from the proposed development, and assesses the potential impact of this demand on the surrounding network. The TA also details the proposed access arrangements to the development for all travel modes and identifies necessary mitigation measures required to support the development and limit adverse impacts on the surrounding network. The TA has been undertaken in line with the guidelines set out in Transport Infrastructure Ireland's (TII's) 'Traffic and Transport Assessment Guidelines.

A Traffic Impact Assessment (TIA) is submitted to KCC as an addendum to the Transport Assessment. This TIA provides details of a Vissim model, prepared by SYSTRA, to assess the impact of the development proposals on the local road network. The extent of the Vissim model and the junctions assessed was agreed in the Scoping document prepared and submitted to KCC and includes Junction 9a and 10 on the M7 motorway (requested by KCC following their consultation with TII / Kildare County Council National Roads Office.

The TA concludes that:

- The proposed development is well placed to take advantage of the surrounding transport network.
- Due to the bespoke land use on the site for data centre use, the TA has adopted a robust 'first principles' approach to trip generation, based upon operation of the data centre.
- The volume of traffic generated by the development has no significant impact on the assessed junctions, including Junctions 9a and 10 on the M7 motorway.
- Dedicated pedestrian and cycle infrastructure improvement works are provided along the R409 and are included as part of the application. This will encourage sustainable transport trips where possible.
- The proposed pedestrian and cycle infrastructure on the R409 will be accompanied the provision of a bus stop adjacent to the proposed development, approximately 100m east of the vehicular access junction, to improve provision for the site to be served by public local transport.
- the area in which the proposed development is located is designated for 'data centre' land use within the Naas Local Area Plan 2021-2027 and the TA has determined that the proposed development aligns with sustainable transport best practices and the wider policy set out by the Naas Local Area Plan 2021 – 2027.

3.8.8 Mobility Management Plan

SYSTRA Ltd have prepared a Mobility Management Plan (MMP) to accompany this Planning Application and this MMP report should be read in conjunction with the accompanying Transport & Traffic Assessment (TTA). The MMP is the principal mitigation measure proposed by the TTA to address the anticipated transport impacts of the development.

The MMP has been prepared to promote sustainable travel choices and reduce reliance on private car, associated with staff and visitor trips to the Proposed Development and has been written in accordance with policy requirements, by seeking to ensure promotion of sustainable transport to and from the Site. A package of measures has been noted to ensure that targets can be met. The measure includes the appointment of a Mobility Manager, a staff induction containing sustainable travel information, marketing and promotion of travel event, provision of personalised travel planning and monitoring / surveys.

As the MMP is a continuous and evolving document it requires monitoring, review, and revision to ensure that it remains relevant. Baseline monitoring surveys are recommended to be undertaken within 6 months of occupation, with this MMP being updated as a result.

In conclusion, the MMP accompanying this application provides a mechanism for influencing the travel behavior of workers and visitors to the Site, with a focus on encouraging sustainable travel modes, in particular walking and cycling.

Refer to Appendix L for the Mobility Management Plan.

3.8.9 Road Safety Audit

A road safety audit has been conducted on the proposed R409 works to the public road by Bruton Consulting Engineering. The Road Safety Auditors' recommendations have been considered and all recommendations have been accepted and have been adapted into the design of the road improvement works to the R409. Refer to Appendix J for Road Safety Audit and Designers response.

3.9 Internal Roads and Access

3.9.1 General

All internal roads, part from the entrance road, which are deemed as ‘campus’ access road is 7.5m wide from kerb to kerb and deemed as duel directional traffic flow. The roads around the data centres have a reduced with of 5.5m wide kerb to kerb and deemed a single directional flow in a clockwise direction around the building.

There will be pedestrian footpaths provided to each of the data centres as well as all other ancillary buildings. Due to the low volumes and frequency of traffic, cyclists will be expected to use the roads around the site for access to the data centres and other ancillary buildings.

A dedicated gates maintenance access has also been provided for Eirgrid for access to the existing 220kV tower located to the southeast corner of the site.

3.9.2 Main Site Entrance

The development will comprise of a single main entrance access via the existing R409 located to the northwest of the site. This access will be designed to accommodate the maneuvering of all relevant permanent and maintenance vehicles including cranes. The main entrance will comprise of sliding gate to designate the site boundary. This gate sliding gate will remain open 24hrs a day all year round and will only close in an emergency.

The R409 is currently designated as an 80km/h road which means that the sightlines for the main access was 160m. The sightlines, as shown on drawing number 10360452-HDR-XX-XX-DR-C-112250, does impact some of the vegetation along the R409, within the site boundary, but these would need to be removed regardless to make allowances for the proposed footpath and cycle lane located on the southern side of the R409.

A second gate, as shown on drawing number 10360452-HDR-XX-XX-DR-C-112250, which will form the secure boundary of the site, is located further into the site where the security compound will be located. This gate will be the primary gate which will need to comprise of secure fencing as well as Hostile Vehicle Mitigation (HVM) folding gates for security purposes. The entrance will comprise of 2 entry locations and 1 exit with a minimum lane width of 4m. The first entrance, on the far right as you enter the sight, will be for staff. This entrance will comprise of a single entrance gate with security pass access.

The second gate, located directly to the right of the security compound, will be for all non-staff vehicles and heavy goods and delivery vehicles entering the site. The non-staff vehicle entrance will be designed with a double entrance vehicle lock (tiger lock) for inspection. This total length between the gates should be no less than 20m.

The exit, located to the left of the security compound, will be for all vehicles and comprise of a single gate and a lane width of 4m. This lane will have an exit gate. Should entry at the non-staff vehicle entrance be refused, a rejection lane, as shown on drawing number 10360452-HDR-XX-XX-DR-C-112320, has been designed to accommodate up to HGV’s.

A pedestrian and cycle lane shared surface are also proposed from the R409 into the site up to the secure boundary. A turnstile will be provided for the pedestrians and a single gate will be provided for cyclists. Prior to access being permitted, pedestrians and cyclists would need to cross over to the security booth for entrance to be permitted.

3.9.3 Emergency Entrance

A second, for emergency use only, entrance / exit has been created to the southeast corner of the site as shown on drawing number 10360452-HDR-XX-XX-DR-C-112250. The emergency access will link up to an existing road via the M7 business park to the south of the development. This connection will be over the existing Bluebell Stream which is covered in Section 3.11.12 of this report.

This entrance will be provided with a security gate which will be permanently closed unless there is an emergency. A turning head has been provided for security to be able to patrol this part of the site.

This access has been designed to accommodate the manoeuvring of all relevant permanent and maintenance vehicles including cranes.

3.9.4 Temporary Construction Entrance

A temporary construction entrance will be created to the north of the site and approximately 120m west of the Osbertown industrial park entrance as shown on drawing number 10360452-HDR-XX-XX-DR-C-112250. This entrance will be used for the construction of Phases 1 and 2 of the proposed development. The access has been designed to accommodate vehicles up to and including larger cranes with sightlines drawn at 160m due to the R409 stated as an 80km/h road.

Once the temporary construction access is no longer required, the landscaping strategy will be completed in this area to continue the screening that is proposed for the development.

3.9.5 Sitewide Car Parking

Each data centre will be provided with dedicated parking as shown on drawing number 10360452-HDR-XX-XX-DR-C-112250. There will be 30 carparking spaces in total of which 2 will be disabled spaces and 9 electric vehicles (EV) charging points. The disabled and EV parking spaces will be located closest to the main entrance of the data centre.

In addition to the data centre parking, the admin building, and workshop will have 30 carparking spaces in total of which 2 will be disabled spaces and 9 electric vehicle (EV) charging points. Provision will be made to ensure future upgrade of all parking spaces to EV.

To the rear of the Admin and Workshop, a road and layout down space has been provided for vehicles and deliveries.

This road will also be the means to enter the GIS Substation which will form part of a separate SID application. The substation entrances have been tracked for delivery vehicles and a crane for plant replacement. Access to the GIS Substation will be available 24hours per day 365 days a year.

3.9.6 Pedestrian Routes and Access

Pedestrian access will be provided adjacent to all campus roads from the main site entrance to the Admin Building and Workshop as well as all Data centre Buildings and Ancillary facilities such as the GIS Substation, the AGI, and District Heating Building.

The data centre building will be provided with footpath access to the parameter of the building as well as its associated ancillary facilities such as the Fuel Filling Compound and Sprinkler Pump Room and associated storage.

3.9.7 Cycling Routes, Access, and Storage

Once cyclists are within the secure compound, they will be encouraged to use the roads for access to the various buildings on site. Cycle storage will be provided at each of the data centre buildings as well as the admin building. For cycle storage numbers and locations, please refer to the RKD master site plan drawing.

3.9.8 AGI and District Heating Access

The AGI and District heating facilities has been provided with a separate entrance, layout down space and a sufficient space for vehicle maneuvering to turn around as shown on drawing number 10360452-HDR-XX-XX-DR-C-112250. This access will be security controlled with entry limited to maintenance staff and utilities providers only.

3.9.9 Fuel Delivery

Fuel delivery will be required to the rear of each of the data centers as shown on drawing number 10360452-HDR-XX-XX-DR-C-112250. The vehicle will be revering into the layby which has been designed long enough for the whole vehicle to park off the road. The appropriate pollution prevention measure will be implemented at this location.

3.9.10 Refuse Collection

Refuse collection will be required to the side of the each of the data centers, just in front of the loading dock, as shown on drawing number 10360452-HDR-XX-XX-DR-C-112250. The vehicle will be driving forward to this space which has been designed long enough for the whole vehicle to park off the road. The refuse bins will then be wheeled out from the refuse bin store at the loading dock to be emptied.

3.9.11 Loading Dock

The loading dock has been designed with 2 dock levelers which can accommodate 2 HGVs simultaneously as shown on drawing number 10360452-HDR-XX-XX-DR-C-112320. Unlike the general clockwise movement of vehicles around the data centers, the HGVs will be entering the data centre road in an anticlockwise direction and reversing into the loading dock. Once completed, the HGV will then exit the loading dock in a clockwise direction.

This area of movement will be designated with signage and road marking to ensure safe movement of vehicles.

3.9.12 Plant Replacement

Plant replacement access for cranes will be required to all the data centre buildings as well as all ancillary buildings. Therefore, all the roads across the site, including the emergency access, have been tracked with the appropriate crane to service the building.

3.9.13 Highway Loadings and Pavement Design

Highway Vehicular loading design will be in accordance with local design guidance documentation. Overall pavement construction to be a minimum 450mm thick for frost protection. All material within 450mm of the road surface, where the mean annual frost index (MAFI) of the site is ≥50 must be non-frost susceptible in the long-term

Road and external finishes to be accordance with the surface water strategy and Landscape proposals. It is proposed that all external roads to be designed as Asphalt roads, all parking areas designed as permeable block paving and all services yards etc. will be design as concrete surfacing. Selected surface materials to be in accordance with the latest Irish Standards and to withstand HGV loading where used within vehicular areas.

3.10 Proposed Utilities

3.10.1 Electrical HV Power

As part of SID application, it is proposed that the existing 110kV overground power supply is undergrounded from the pylon located towards the southwestern site boundary to the existing tower on the opposite side of the R409 as shown on drawing number 10360452-HDR-XX-XX-DR-C-082220.

It is proposed that the underground using new 110kV cables in underground ducts will be installed as contestable works, with the new line/cable (L/C) towers installed by Eirgrid or ESB (as Eirgrid's installer) along with the final connections, commissioning and bringing into service. Both L/C towers are to be located on the Herbata site and so there would be no requirement easement across the R409, but wayleaves would be granted to Eirgrid for the new cable installation. The cabled circuit would then loop in and out of the new 110kV grid substation allowing downstream circuits to be connected to the data centre campus. Please refer to a report included within the SID application titled "110kV Grid Substation and Transmission Line Report".

As part of the separate SID planning application, a new Eirgrid grid substation will be built to allow connectivity with the data centers for export to the grid and to allow import from off-site renewable energy sources sourced through CPPAs. Please refer to Section 5 for further details on this.

3.10.2 Electrical MV Power

Excess power will be generated by the Gas turbines which will feed back into the propose Eirgrid substation. For this, each data centre building will have a dual feed, medium voltage (MV) supply, as shown on drawing number 10360452-HDR-XX-XX-DR-C-082220, feeding into a sitewide MV supply which will then connect into the substation.

3.10.3 Fibre

Is it proposed to have 4 site entry locations:

- At the main entrance
- Via a farmer's field to the south of the site
- Via the eastern boundary of the site along the M7 motorway.
- Via Eirgrid 110kv lines

Each of the entry points will have 12No ducts.

The fibre layout is as shown on drawing number 10360452-HDR-XX-XX-DR-C-082220.

3.10.4 Water Supply

PROPOSED WATER SUPPLY STRATEGY

Due to the nature of the development, there are several waters demands required for the operation of the facility. The following sections describe proposed water supply strategy:

- Potable Water Supply
- Processing Water supply
- Firefighting Water Supply

3.10.5 Potable Water Supply

A new dedicated water supply is proposed to be taken from the existing 225mm diameter public water supply located along the R409 to serve the potable water supply demands of the site. The estimated average hour water demand and peak hour water demand generated by the proposed development are 0.26l/s and 1.30l/s respectively as calculated below in accordance with Uisce Éireann Code of Practice for Water.

Total Staff on Site over one day = 400 (as included in the original pre-connection enquiry as an upper maximum for robustness of design. Final staff figure is less.)

Water Demand (Office / Industry) = 45 l/person/day (UE Code of Practice for Water)

Total Demand = 18,000 l/day

Average Hour Water Demand = 18,000 l/day / 24x60x60 = 0.26 l/s

Peak Hour Water Demand = 0.26 l/s x 5 = 1.30 l/s

PROCESS WATER

It is understood from pre-planning consultations held with Uisce Éireann that processing water supply from the public water supply system is not permitted. It is proposed to provide water for the industrial processes via rainwater harvesting from the data hall building roofs. Run-off will be collected in a dedicated drainage network, treated in the onsite water treatment works and stored in underground tanks located below the car park to each data hall. Surplus run-off will overflow from this network into the Surface water drainage network. The tanks have been sized to provide full annual storage of 481.5m^3 storage per data centre building.

A back-up supply for process demand will be provided by retaining a permanent volume of water in the proposed attenuation ponds on the site that can be used for process water top up. This system will have associated pumping facilities that can supplement the feed to the on-site water treatment facility and be used as a top-up supply to the data centre storage tanks.

The Industrial Process demand for water has been calculated as follows:

Annual water requirement for process water = 481,501 litres (481.5m^3) per data centre building

The supply of rainwater via rainwater harvesting has been calculated as follows:

Area of Roof serving harvesting network = 4,000m^2 (approximately 3x Admin portion of data hall) per data centre

Standard Average Annual Rainfall (SAAR) = 848mm/annum

Total Volume of runoff = 3,392m^3

Applicable factor for runoff from roof areas = 0.9

Total volume supplying storage tanks = 3,052.8m^3

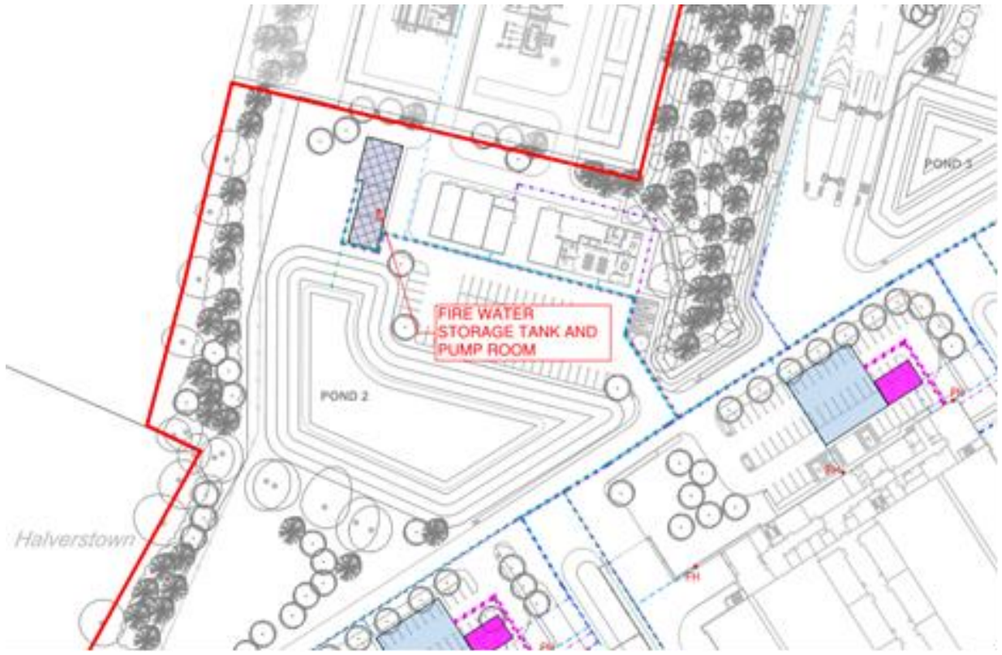
The available supply of water via rainwater harvesting therefore greatly outweighs the demand over the course of a year and any surplus rainwater will be directed to the site surface water swales and network serving each building.

FIREFIGHTING WATER

The recommended firefighting water demand purposes for the proposed site is 100l/sec per data hall. (4 hydrants operating simultaneously at a flow rate of 25l/sec).

Uisce Éireann have noted that they cannot guarantee a fire-fighting flow of water during summer months and have recommended that the full quantity of water supply for fire-fighting purposes be stored on site. This volume will be provided in a static water storage tank which will be pressure boosted to an internal fire-fighting watermain with 8 No. Fire hydrants located in accordance with Building Regulation requirements around each Data Hall building.

Figure 3-19. Extract from Watermain Layout indicating location of Fire-fighting Storage Tank



The required volume to be stored in the tank is calculated as follows:

25 l/s x 3600 secs x 4 hydrants = 360 m^3 between 2 tanks.

Additionally, pond number 2 has been identified as being suitable for providing additional supply of water for fire-fighting purposes that can be accessed directly by the fire tenders in the event of a fire (volume of pond is 600m^3).

3.10.6 Proposed Water Supply Layout

The watermain layout and connections, valves, hydrants, meters are designed in accordance with Irish Water's Code of Practice for Water Infrastructure IW-CDS-5020-03 (Revision 2 – July 2020) / Standard Details and the Department of the Environment's Building Regulations "Technical Guidance Document Part B Fire Safety". Twenty-four-hour storage will be provided, as specified by the M&E Engineer, to cater for shutdowns in the system. Sluice valves will be provided at appropriate locations to facilitate isolation and purging of the system. A potable water storage tank has been allowed for each data hall with a booster pump set to achieve adequate pressure throughout the data hall. Each toilet area will have a water shut off valve linked to the lighting PIR to shut off the water when the area is not in use. The cold-water feed to urinal cisterns will be fitted with a PIR flush controller to comply with the Water Regulations. The flush controller will be a main powered unit with a flush fitting ceiling mounted sensor.

Rainwater from the blue roof system above the admin block as well as an area twice this amount from the main roof shall be collected into the internal rainwater harvesting day tank and external underground rainwater harvesting tank. A separate rainwater harvesting day tank and booster pump set has been allowed for each data hall to serve the WC's and urinals.

The external underground rainwater harvesting tank shall be used as a secondary backup domestic supply to the internal rainwater harvesting day tank should this be depleted. It will also be used as a primary mechanical supply to the pre-treatment central process plant.

It is anticipated that ~100% of the water requirements for the pre-treatment central process plant shall be met and ~70% of the requirements for WC and urinal flushing shall be met.

The low level cut out switch for the domestic supply fed via the external underground rainwater harvesting tank shall be set at an appropriate level to ensure a guaranteed supply to the mechanical pre-treatment central process plant.

CONSULTATIONS WITH UISCE ÉIREANN

Uisce Éireann (UE) were consulted in relation to the proposed development and a pre-connection enquiry was submitted to UE and UE responded with a Confirmation of Feasibility (CoF) (Appendix E) noting that a new water connection is feasible but limited to potable water demand of 1.3 litres/second. UE noted that the public water supply shall not be used for process water.

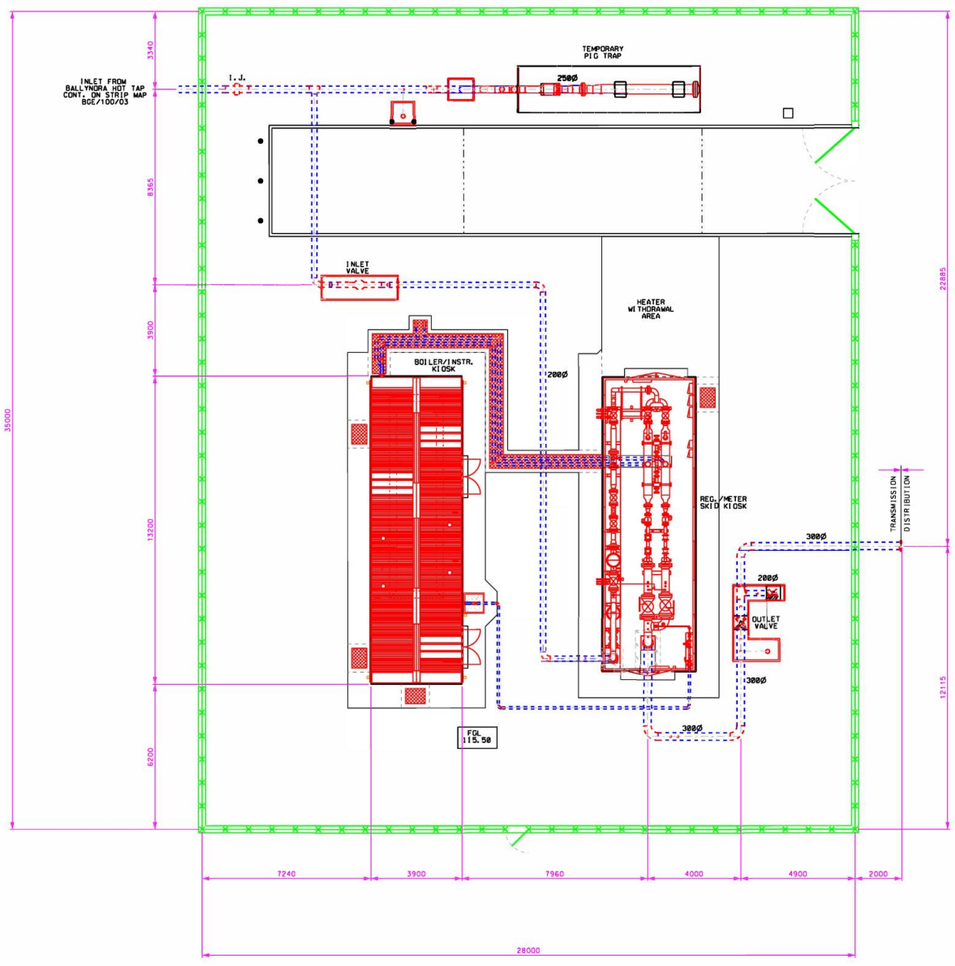
Figure 3-20. Extract from Watermain Layout indicating arrangement at typical data hall.

3.10.7 Gas Supply

Further to section 3.6.1, a single or dual high pressure (50Bar) gas pipe is expected to be made available by Gas Networks Ireland (GNI) at the site boundary on the R409. This will then feed into two Above Ground Installation (AGI) gas infrastructure compounds to reduce the pressure to 24 Bar. From the AGI, a dual feed, one on each side of the internal campus road, will be the campus supply from which a dual feed will be distributed to each building with the intake at the gantry.

Please refer to the below figure for a typical GNI (previously Bord Gais) AGI compound layout.

Figure 3-21. Typical Bord Gais AGI Compound



The AGI compound area has been sized on a dual incoming supply. Adjacent to the AGI area is another compound set aside for GNI to provide a bio-methane injection point into the gas network; details for this injection point equipment are in development with GNI. The gas layout is as shown on the drawing number 10360452-HDR-XX-XX-DR-C-082220.

3.10.8 District Heating System

It is proposed to use the waste heat from the exhaust stacks from two of the gas turbines in the Data Centre 5 building. This heat will be medium to high grade quality due to the high temperature that the turbines operate at, this heat will then be conveyed to an onsite district heating building via pipework installed underground. From this location it is proposed that a district heating network operator could then provide pumps and heat exchangers to service heat demand that is required offsite, assumed to be in and around the Naas district.

Please refer to Section 4 for further details. The district heating layout is as shown on drawing number 10360452-HDR-XX-XX-DR-C-082220.

3.10.9 Fuel

In addition to the gas as the primary fuel supply to the turbines, it is proposed to provide a fuel compound to the rear of each data centre as a backup fuel supply as shown on drawing number 10360452-HDR-XX-XX-DR-C-082190.

Each fuel compound will have a desiccated fuel filling layby which has been designed to accommodate a fuel filling vehicle. From the compound, the full will be pumped to the generators.

3.11 Surface Water

3.11.1 Consultation With Kildare County Council Water Services Department

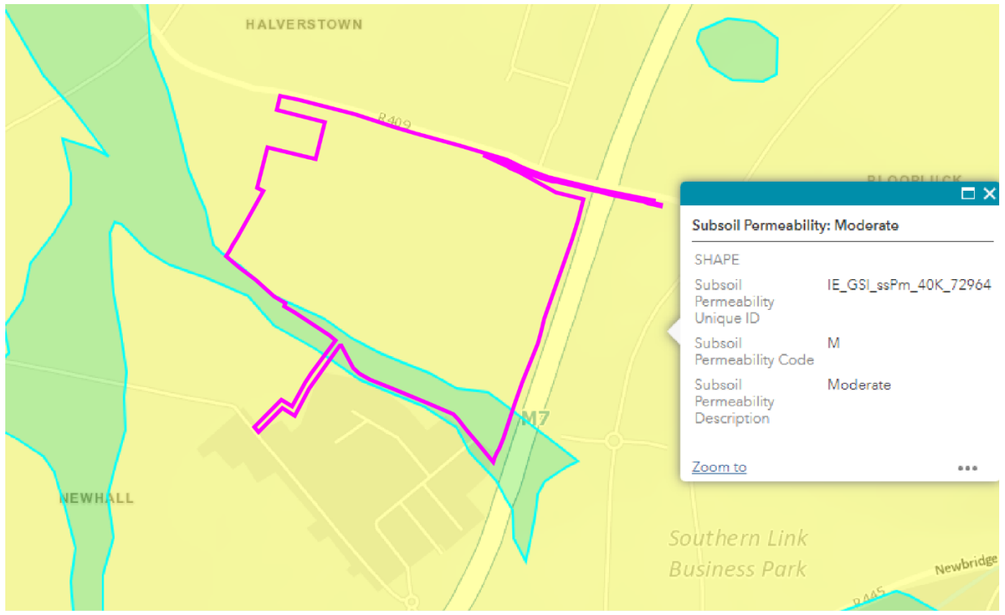
Appendix C shows the Pre-Planning meeting notes held on 11 April 2023 with Kildare County Council Water Services and Planning Departments and the landscape architects. At this meeting, the principles of a coordinated surface water drainage strategy where nature-based surface water solutions are prioritised were discussed and agreed. Further details on the Surface Water strategy adapted for the site are outlined below.

3.11.2 Estimation of Greenfield Runoff Rate

SOIL CLASSIFICATION

As part of the Site Investigation conducted and discussed in section 0 of this report above, the site comprises of predominantly silty/ sandy gravelly clays with poor infiltration rates to the south of the site and poor to moderate infiltration in some of the northern portions of the site with rates of approximately $5x10^{-6}$ m/s being determined. Figure 3-22 below is an extract from the GSI website which indicates that the subsoil infiltration capacity for the site is 'MODERATE.' Which bis reflected in the IGSL site investigation conducted.

Figure 3-22. Extract from GSI Website indicating subsoil infiltration capability.



An extract from the TII publication DN-DNG-03064 (Drainage of Runoff from Natural Catchments), as shown in Figure 3-23. This outlines the criteria for each soil type given their runoff potential. Therefore, with the Runoff potential being determined as moderate, a soil Type 3 for the Greenfield Runoff rate is deemed appropriate.

Figure 3-23. Extract from TII Publication DN-DNG-03064.

General soil description	Runoff potential	Soil class
Well drained sandy, loamy or earthy peat soils Less permeable loamy soils over clayey soils on plateaux adjacent to very permeable soils in valleys	Very low	S_1
Very permeable soils (e.g. gravel, sand) with shallow groundwater Permeable soils over rocks Moderately permeable soils some with slowly permeable subsoils	Low	S_2
Very fine sands, silts and sedimentary clays Permeable soils (e.g. gravel, sand) with shallow groundwater in low lying areas Mixed areas of permeable and impermeable soils in similar proportions	Moderate	S_3
Clayey or loamy soils	High	S4
Soils of the wet uplands: Bare rocks or cliffs Shallow, permeable rocky soils on steep slopes Peats with impermeable layers at shallow depth	Very high	S_5

In accordance with the IH24 method, the greenfield runoff for existing undeveloped sites measuring less than 50Ha can adopting the following formula and the total permissible outflow has been calculated in Table 3-4 below.

Qbar Rural(m^3/s) =0.00108x(Area)0.89(SAAR)1.17(SOIL)2.17

Table 3-4. Estimation of Greenfield Runoff Rate (Qbar)

Standard Average Annual Rainfall	848	mm
Soil Index	0.47	
Total Site Area	37.5	Hectares (ha)
Total Analysed Area	30.07	Hectares (ha)
Permissible Outflow per hectare, QBAR	6.0	l/s/ha
Total Permissible Outflow	180.42	l/s

3.11.3 Proposed Surface Water Strategy

The proposed Surface Water Drainage Strategy is based on applying GDSDS and SuDS best practice to provide an effective drainage design that maximises sustainability and promotes Nature-based solutions for the management of surface water run-off from the post development site.

Due to the variable high quantities of attenuation requites and the BRE 365 soakaway testing results across the site (as outlined in section 3.6 above) the opportunities for the inclusion of significant infiltration-based surface water management are limited and it is not considered a suitable solution for the site in general, although advantage will be taken of infiltration where possible, particularly along the R409 to the north of the site.

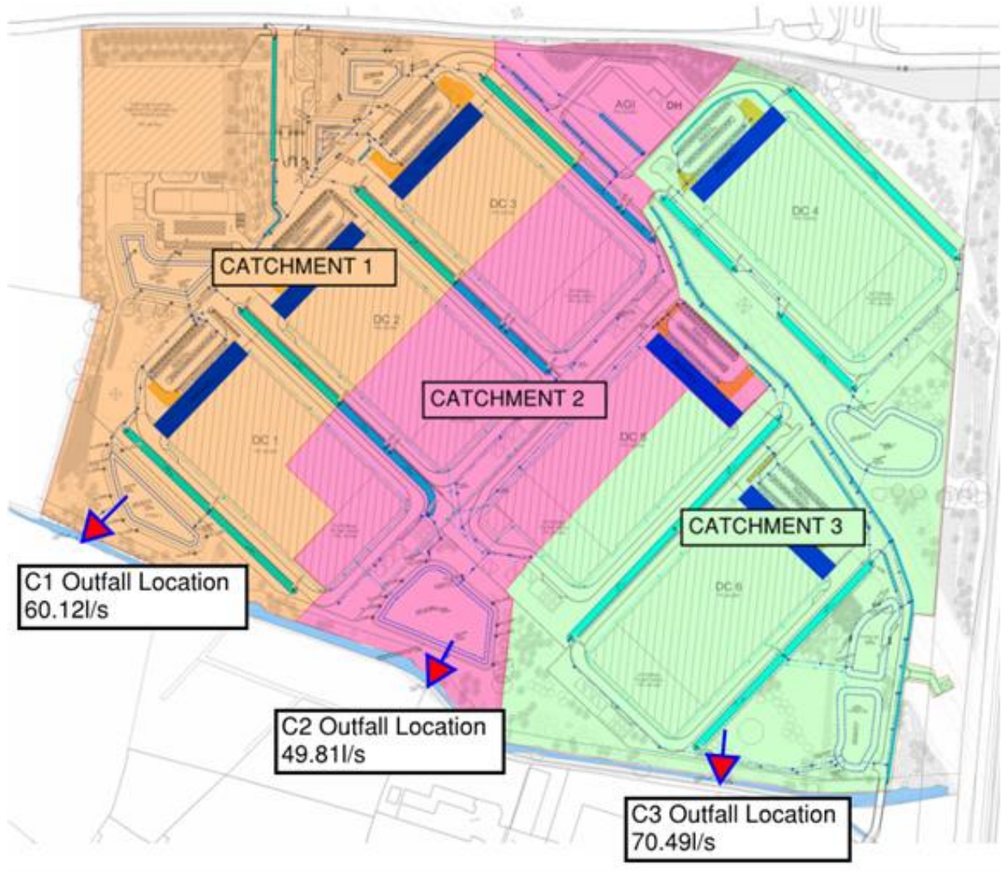
It is proposed to discharge collected SW runoff from the site to the existing Bluebell Stream at Qbar rates. Attenuation of SW runoff shall be provided in a wide variety of nature-based SUDS and surface water network features including Swales, Bioretention areas, Bioretention Ponds, Blue/Green Roofs, Permeable Paving, Filter Drains, Rainwater Harvesting, using flow control devices.

To reflect the pre-development conditions the proposed development has been divided into three catchments, which will have separate discharge points into the Bluebell Stream so that run-off from the site is distributed along the length of the site boundary with the stream, broadly in line with the existing greenfield conditions. Each catchment will discharge to the stream at an apportioned percentage of the overall discharge rate calculated in Table 3-4 above.

Figure 3-24. Catchment Discharge Rates

	Soil Type	Alloawable discharge l/s/ha	Analysed Area	Discharge Rate	Discharge %
Catchment 1	3	6.0	10.020	60.12	33
Catchment 2	3	6.0	8.301	49.81	28
Catchment 3	3	6.0	11.748	70.49	39

Figure 3-25. Proposed drainage catchments & discharge locations



3.11.4 Proposed SuDS Strategy

PROPOSED SUDS HIERARCHY

The SuDS hierarchy outlined in Figure 3-26 below has been considered for this development in accordance with the requirements of KCC Water Services Department, with priority given to nature-based solutions.

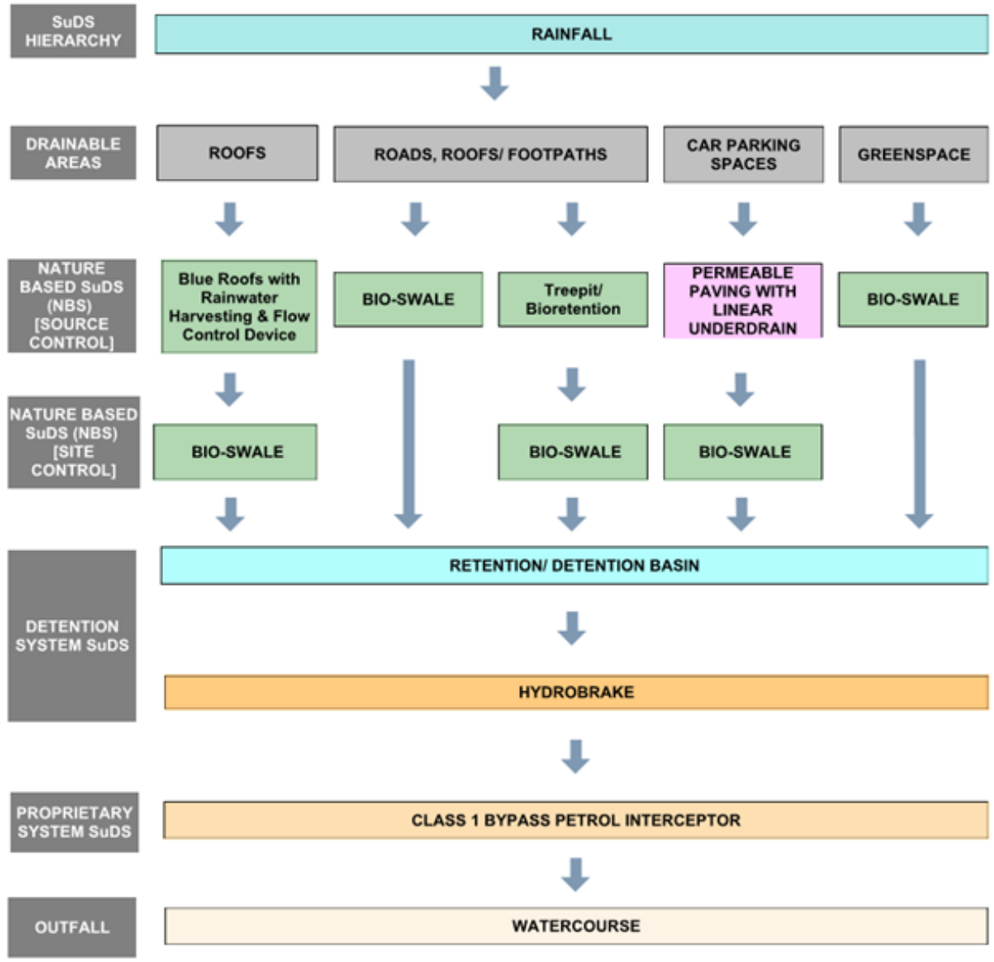
Figure 3-26. SUDS Hierarchy of Features proposed for the development.

	Sustainable Urban Drainage System	Regional Control	Source Control	Site Control	Other	Proposed for the Scheme (Y/N)	Rationale for the provision or otherwise of proposed SuDS measures
#	**Nature Based SuDS (NBS)**						
1	**Constructed Wetlands**					N	
2	Retention Pond	•				Y	Retention ponds are proposed as regional control NBS SuDS measures for this project.
3	Bioretention Areas		•			Y	Bioretention areas are proposed as source control NBS SuDS measures for this project.
4	Bioswales		•	•		Y	Bioswales areas are proposed as source control and site control NBS SuDS measures for this project.
5	**Rain Gardens**		•			N	
6	Blue-Green Roofs		•			Y	Blue-Green Roofs are proposed on the flat roofs of all administartion blocks of each building buildings as source control NBS SuDS measures for this project.
7	**Green Walls**					N	
8	**Tree Pits**					N	
	Infiltration System SuDS						
9	**Unlined tree pits-trenches**					N	
10	Unlined permeable paving		•			Y	Further to Ground Investigation works carried out on site, Infiltration of the sub-soils is very poor and therefore infiltartion system SuDS can not be relied on. Infiltration will not be considered as part of the Surface Water design. However, any infiltration experienced shall only benefit the proposed system.
11	**Infiltration trenches**					N	
	Filtration System SuDS						
12	Filter Drains		•			Y	Filter Drains are proposed as source control SuDS measures for this project.
13	**Filter Strips**					N	
14	**Lined Permeable Paving**					N	
	Detention Systems SuDS						
15	Detention Basin			•		Y	Retention ponds are proposed as regional control NBS SuDS measures for this project.
16	**Lined Underground Attenuation Tank**					N	
17	**Over-sized pipes**					N	
	Proprietary Treatment Systems						
18	Petrol/ oil separators				•	Y	Petrol/ oil interceptors are proposed to be placed prior to the dischrage of surface water to the existing watercourse.
19	Rainwater Harvesting		•			Y	Rainwater Harvesting is proposed as a source control measure on each of the proposed buildings.

PROPOSED TREATMENT STRATEGY

The minimum two stage treatment strategy per sub-catchment proposed for the development and associated SuDS hierarchy is illustrated in Figure 3-27 below.

Figure 3-27. Proposed Treatment Train



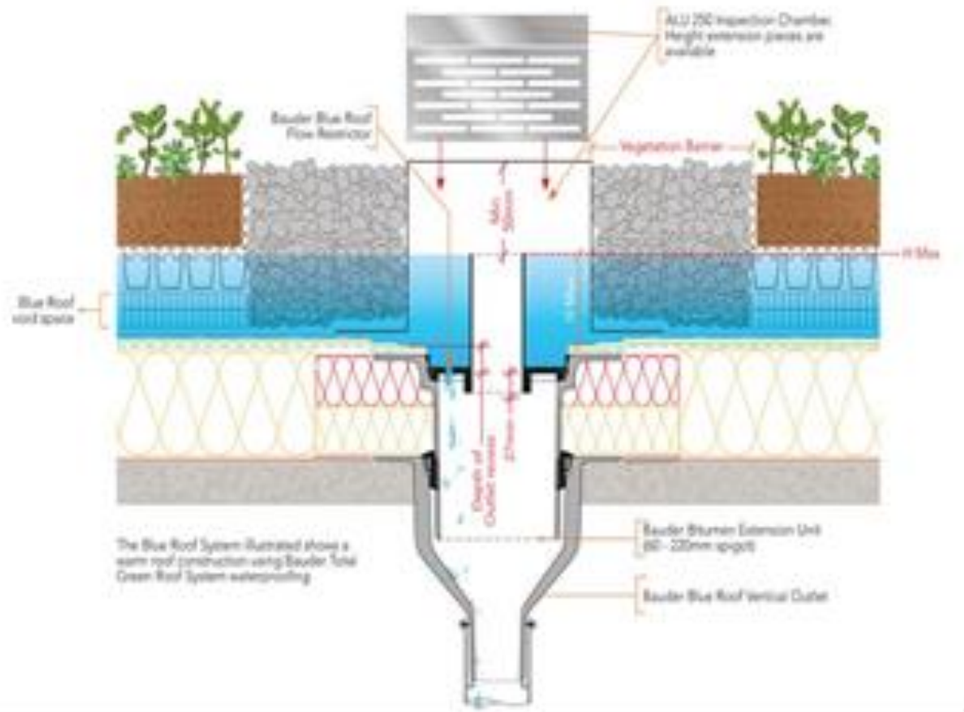
3.11.5 Proposed SuDS Elements

BLUE/ GREEN ROOFS

It is proposed that the administration block of each data centre and ancillary buildings of the proposed development should have Blue Roofs. These will provide interception of rainfall, filtration through the medium, storage within the voids facilitating evapotranspiration and storing of surface water run-off with a restriction placed on the outfall limiting discharge from each roof to 2.0 l/s. The blue roofs on the administration blocks will also receive runoff from an area of the data hall roofs twice that of the administration block so that they are treating a larger volume of runoff than that which falls on it directly. The Blue Roofs will:

- intercept and absorb the first 10mm of rainfall thus reducing the volume of run-off into the receiving surface water piped system. Rainfall run-off which is not absorbed by the roof shall filtrate through the substrate and geotextile filter fabric below.
- delay the time of entry between the rainfall event and discharge into the surface water piped network system thereby assisting in reducing peak discharge rates.
- have low substrate depths, are lightweight and low cost to maintain.
- will be covered in an extensive green roof sedum blanket cover with hardy, slow growing, drought resistance, minimal maintenance plants and vegetation. The planting usually matures slowly, with the long-term biodiverse benefits being the sought-after results. The sedum roof there will provide interception and primary treatment storage at source.

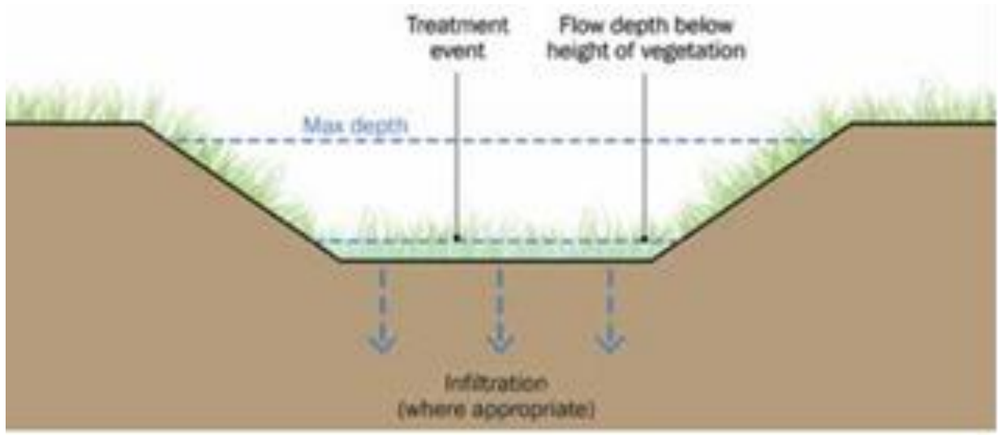
Figure 3-28. Typical Blue Roof Detail (source: CIRIA SUDS Manual)



SWALES/BIOSWALES

Bioswales will be provided as a primary nature-based Suds feature across the site. Rainwater from the data centre perimeter roads will be directed to the swales through the road cross falls utilising dropped kerbs and traverse a grass filter strip before discharging directly to the swales Rainwater pipes from the data centre roofs will discharge directly to the swales and a range of biodiverse planting will be provided to treat, convey, and attenuate the surface water run-off while enhancing the natural landscape and providing aesthetic and biodiversity benefits. Check dams will be provided along their length to temporarily retain surface water, reduce flow velocity, increase pollutant retention and infiltration. Appropriate planting will provide opportunity for sedimentation and further flow velocity reduction, promote evaporation when climatic conditions allow, and allow both filtration and infiltration through the subsoils and the root zone of the planting. Except for the southern portion of the site, moderate infiltration is likely to occur within the swale construction, but this has not been factored into the attenuation calculations.

Figure 3-29.Typical Swale / Bioswale (source: CIRIA SUDS Manual)



BIORETENTION PONDS & RETENTION PONDS

The site utilises both bioretention pond and wetland ponds as part of the nature-based Suds strategy and to provide attenuation for the surface water run-off from roof and paved areas. The ponds are on-line features where water level can rise and fall through vortex flow control to provide storage and attenuation of flows to match Qbar greenfield run-off rates. Water levels have been designed to provide a minimum of 500mm freeboard to adjoining ground and road levels and a minimum of 1m freeboard to finish floor levels of all buildings on the site.

The detention basin will be vegetated and planted as part of a biodiverse landscaping solution which has been coordinated with the engineering solution with the project landscape consultant (refer to Brady Shipman Martin landscape drawings and report for full details of proposed planting and landscape treatment).

Detention basins will prevent run off from the site for small rainfall events by absorption and infiltration through the base and contribute to interception storage. Vegetated basins will assist with removal of sediment and any pollutants, nutrients, or oxygen demanding materials as well as providing interception storage for most small rainfall events. The base of the bioretention basins will be gently sloping (not greater than 1:100) and liners may be provided in areas on high natural or seasonal water tables, along with a layer of engineered soil to mitigate against groundwater seepage. The planting of the detention basins will provide a variety of structurally diverse plants which will promote and support habitats and for insects, invertebrates and birds and we will provide micro pools and wetland zones within the basin to further enhance biodiversity.

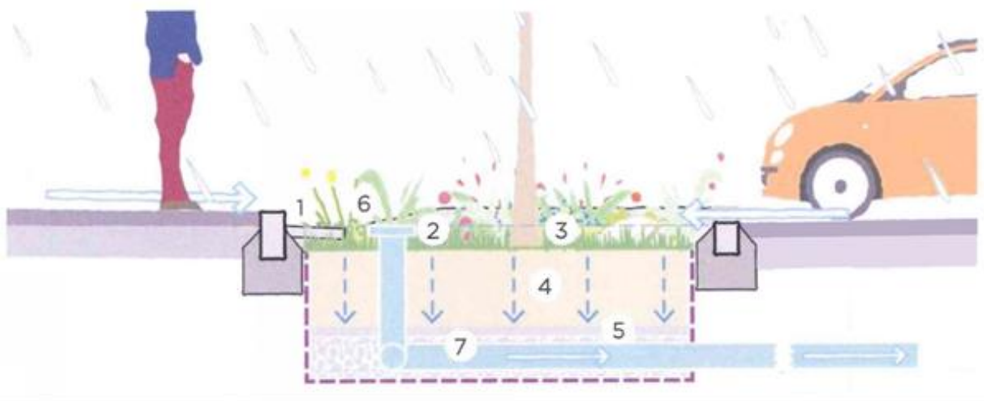
Adjacent to Bluebell Stream towards the south of the site, ponds with wetland edges are provided to both attenuate and treat surface water and provide an element of aquatic vegetation which will enhance the existing vegetation along the Bluebell stream. The ponds are located at the bottom of the catchments where there has been significant surface water treatment in the upstream network through swales, permeable paving and infiltration/ filtration measures incorporated around the data centre buildings. Dense wetland vegetation around the perimeter will promote the adhesion of contaminants, aerobic decomposition and will help to manage sediments and prevent resuspension.

BIORETENTION TREE PITS

A bioretention tree pits employ engineered topsoil and are used to manage polluted urban rainfall runoff in street locations and car parks. These structures shall include the following as indicated in Figure 3-30.

- Dropped kerb to receive overland surface water run-off from the adjacent impermeable car parking bays supplemented by a silt collection apron,
- Engineered levels above the soil profile to allow water collection and silting before infiltration through the engineered soil,
- Mulch of organic matter located at the surface to protect the infiltration capacity of the soil.
- 450-600mm of free-draining soil with 20-30% organic matter which cleans, stores, and conveys runoff to the lower drainage layer,
- Transition layer of sand which protects the under-drained drainage layer,
- Surface overflow for heavy rain or in the event of a blockage,
- Perforated land drain to allow full drain down.

Figure 3-30. Bioretention Tree Pit Raingarden

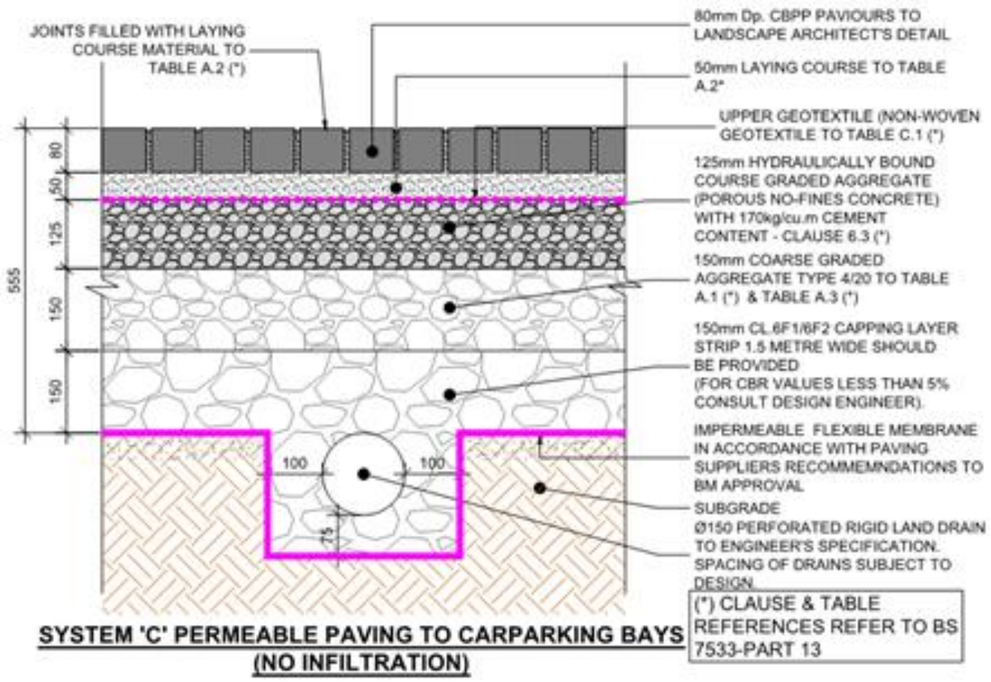


Bioretention tree pits are located around the parking areas at each data centre and will receive runoff from the local road networks and pathways.

POROUS & PERMEABLE PAVING

Porous and permeable paving, refer to Figure 3-31, shall be provided to all car parking surfaces throughout the development. Permeable paving systems will reduce peak discharges into the drainage system and treat run-off by providing a 70-90% removal efficiency rate for hydrocarbons and 60-95% removal of suspended solids thereby improving the quality of water discharging. The base of the porous paving build-up shall also benefit from infiltration to ground. The porous paving shall be underlain by linear filter drains which shall provide a second treatment to the run-off preventing ingress of fine materials from the paved areas prior to discharge into the surface water drainage system.

Figure 3-31. Typical Porous Paving Detail



PROPRIETARY SURFACE WATER TREATMENT SYSTEM

Proposed Class 1 bypass petrol interceptors shall be incorporated into the drainage system to intercept run-off and improve the quality of surface water discharging into the receiving system in compliance with best drainage practice and SuDS requirements. The interceptors shall serve to provide interception of run-off and deliver removal efficiency rates of up to 80% for suspended solids and hydrocarbons. The interceptors are proposed for use within the basement surface water drainage system.

3.11.6 Proposed SuDS Features & Associated Management/ Maintenance

The following section of the report addresses the maintenance requirements for the proposed SuDS features to be used on the Herbata site in accordance with the guidance given in the CIRIA SuDS Manual. None of the drainage infrastructure on the site is proposed to be taken in charge and will be maintained by a management company responsible for the data centre campus.

NATURE BASED SUDS

Figure 3-32. Retention Ponds (Regional Control)

TABLE 23.1 Operation and maintenance requirements for ponds and wetlands

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public areas	Monthly (during growing season)
	Cut the meadow grass	Half yearly (spring, before nesting season, and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half yearly
	Check any mechanical devices, eg penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1 m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1 m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay.	Every 1–5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays.	Every 5 years, or as required
Occasional maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, eg every 25–50 years
Remedial actions	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair / rehabilitate inlets, outlets and overflows.	As required

Figure 3-33. Swales (Source Control)

TABLE 17.1 Operation and maintenance requirements for swales

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Figure 3-34. Bioretention Areas (Source Control)

TABLE 18.3 Operation and maintenance requirements for bioretention systems

Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

Figure 3-35. Tree Pits (Source Control)

TABLE 19.3 Operation and maintenance requirements for trees (after CRWA, 2009)

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets and outlets	Inspect monthly
Occasional maintenance	Check tree health and manage tree appropriately	Annually
	Remove silt build-up from inlets and surface and replace mulch as necessary	Annually, or as required
	Water	As required (in periods of drought)
Monitoring	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly

FILTRATION SYSTEM SUDS

Figure 3-36. Filter Drains (Source Control)

TABLE 16.1 Operation and maintenance requirements for filter drains

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

Figure 3-37. Permeable Paving (Source Control)

TABLE 20.15 Operation and maintenance requirements for pervious pavements

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

PROPRIETARY TREATMENT SYSTEMS

Figure 3-38. Rainwater Harvesting (Source Control)

TABLE 11.6 Operation and maintenance requirements for RWH systems

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspection of the tank for debris and sediment build-up, inlets/outlets/withdrawal devices, overflow areas, pumps, filters	Annually (and following poor performance)
	Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and other debris	Annually (and following poor performance)
Occasional maintenance	Cleaning and/or replacement of any filters	Three monthly (or as required)
Remedial actions	Repair of overflow erosion damage or damage to tank	As required
	Pump repairs	As required

Figure 3-39. Petrol/ oil separators

TABLE 14.2 An example of operation and maintenance requirements for a proprietary treatment system

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	Six monthly
	Change the filter media	As recommended by manufacturer
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Six monthly
	Inspect filter media and establish appropriate replacement frequencies	Six monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every six months

3.11.7 Proposed Design of Sustainable Drainage System

The design of sustainable drainage systems, as per Chapter 6 of the Greater Dublin Strategic Drainage Study (GDSDS), is set out below and describes the performance of the proposed surface water drainage system when measured against the relevant GDSDS drainage criterion, namely.

- Criterion 1 – River Quality Protection
- Criterion 2 – River Regime Protection
- Criterion 3 – Level of Service (flooding) for the Site
- Criterion 4 – River Flood Protection

The requirements of SuDS are typically addressed through the provision of

- Interception Storage
- Treatment Storage (not required if interception storage is provided)
- Attenuation Storage
- Long Term Storage (not required if growth factors are not applied to Qbar when designing attenuation storage)
- In accordance with KCC WSD requirements, a Climate Change factor of 30% will be applied to the design of the surface water system.

RIVER QUALITY PROTECTION

OBJECTIVE

Interception storage of at least 5mm, and preferably 10mm, of rainfall where run-off to the receiving water *can be prevented.*

PROPOSAL

The 10mm rainfall event on site will be intercepted without discharging to the public system. The below is a summary of the interception storage provided per sub-catchment.

Table 3-5. Summary of drained areas

Area Description	Area (m^2)
Roofs	95,334
Hard standing	2,140
Porous & Permeable Paving	4,215

Therefore, the total area draining to the discharging to the drainage system is 108,614m^2. The required interception storage volume to accommodate the 10mm rainfall event is therefore 108,614 x 0.01 = 1086m^3

A summary of the interception volumes provided is as follows: -

- Blue/Green Roofs

  13.25m^3 per roof per roof = 79.5m^3

- Bioretention areas

  150mm of storage within crate system @ 2,070m^2 = 310m^3

- Permeable Paving

  5270m^2 x 0.3m depth of interception with 40% voids stone = 632m^3

- Swales - Filter Drain

  879m x 1.0m wide x 0.3m depth of interception with 40% voids stone = 105m^3

- BioSwales

  1600m x 3.0m wide x 0.2m depth of interception with 40% voids stone = 384m^3

- Retention Ponds

  6550m^2 x 0.1m depth of interception = 655m^3

The total provided interception storage = 2165m^3, while the total required interception storage is 1086m^3. Therefore, the interception storage provided on the site for the 10mm event exceeds the requirements of GDSDS and the River Quality Projection objective.

RIVER REGIME PROTECTION

OBJECTIVES

2.1 Discharge rate equal to 1-year Greenfield site peak runoff rate or 2 l/s/Ha, whichever, is the greater. Site critical duration storm to be used to assess attenuation volume.

2.2 Discharge rate equal to 1 in 100-year Greenfield site peak run off rate. Site critical duration storm to be used to assess attenuation storage volume.

PROPOSALS

The surface water network has been designed to comply with these sub-criteria and prior to discharging to the existing Bluebell watercourse, the surface water runoff will be reduced to the existing total Greenfield runoff rate, Qbar, of 180.42l/s. To achieve this, it is proposed to limit the surface water runoff from the site via a proposed hydro brake flow control device fitted to the discharge manholes of each catchment. Site Qbar calculations are included in Appendix D.

LEVEL OF SERVICE (FLOODING) FOR THE SITE

OBJECTIVES

No flooding on site except where specifically planned flooding is approved. Summer design storms of 15 or 30 minutes are normally critical.

No internal property flooding. Planned flood routing and temporary flood storage accommodation on site for short high intensity storms. Site critical duration events.

No internal property flooding. Floor levels at least 500mm above Maximum River level and adjacent on-site storage retention.

No flooding of adjacent urban areas. Overland flooding managed within the development.

PROPOSAL

Engineering calculations included in Appendix D demonstrate that no pluvial out-of-manhole flooding of the proposed surface network occurs for storms up to and including a 1 in 100 Year plus 30% Climate Change. Therefore, no flooding of the site, internal properties or adjacent urban areas occurs. Pipe sizes and gradients have been designed to achieve self-cleansing velocities as per the requirements of the Building Regulations Part ‘H.’ The lowest proposed floor level is set at +79.00mOD which is a minimum of 1m freeboard to the top of water level in the lowest attenuated flood level. In the event of a storm exceeding a 1:100 Year plus 30% Climate Change event and the outfall becoming block, a high-level overflow is provided. Engineering Calculations included in Appendix D demonstrate that no pluvial out-of-manhole flooding occurs when the outfall is set to the high-level overflow level.

RIVER FLOOD PROTECTION

OBJECTIVES

Long-term floodwater accommodated on site for development runoff volume is more than the Greenfield volume. Temporary flood storage drained by infiltration on a designated flooding area brought into operation by extreme flood events only. 100-year, 6-hour duration storm to be used for assessment of the additional volume of runoff.

Infiltration storage provided equal in volume to long term storage and usually designed to operate for all events.

Maximum discharge rate of Qbar or 2 l/s/Ha, whichever is the greater, for all attenuation storage where separate long-term storage cannot be provided.

PROPOSALS

As noted above, the proposed Qbar for the total site is 180.42 l/s and as the surface water run-off generated on site does not exceed Qbar there is no requirement for long-term storage to limit the impact on the receiving watercourse.

3.11.8 CIRIA SuDS Health & Safety Risk Assessment

A risk assessment appropriate to the planning stage design has been carried out in accordance with good practice for attenuation ponds provided on the site. Consideration has been given to both authorised and unauthorised personnel accessing the site. Health & Safety mitigation measures associated with open waterbodies on the site that have been adapted include:

- The facility will be privately owned and managed, and the campus will not be open to members of the public with 24hr security in place on the site. Therefore, the risk of drowning is extremely low and measures that are provided are to address unauthorised access.

- Access for normal maintenance will be provided for site personnel and H&S mitigation will form part of site-specific training for maintenance/facility staff.

- Open ponds are sited in areas that are not visible from the public roads and will be fenced off with warning signs.

- Emergency buoyancy devices will be provided and clearly accessible.
- The design of the pond facilitates a shallow gradient benched edges that will be planted to mitigate against accidental access and have planted muddy edges that will deter access.
- Water levels will be maintained in periods of dry weather which are the minimum required to sustain biodiversity in terms of plant and aquatic life.
- Maximum water levels will only occur during periods of severe storms (1:30 to 1:100 years events) and water levels will dissipate at Qbar run off rates over an approximate 24-hour period to return the water levels to dry weather conditions. High level overflows will be provided so that top water levels for the 1:100 + climate change design scenarios are not exceeded.

3.11.9 Proposed Piped Surface Water Network Design Parameters

The surface water piped network and associated attenuation design calculations have been prepared using InfoDrainage Network Design Computer software by Innovyze. (Refer to Appendix D for calculations). The proposed surface water drainage system has been designed in accordance with I.S. EN 12056: 2000 'Gravity Drainage Systems inside Buildings', I.S. EN 752: 2017 'Drain & Sewer Systems outside Buildings', 'The Greater Dublin Region Code of Practice for Drainage Works', the recommendations of the 'Greater Dublin Strategic Drainage Study', (GDSDS) and the Building Regulations Technical Guidance Document Part H applying the following parameters.

Surface water drainage design method	Modified Rational Method
Storm Return period (years)	1 in 5 years
Allowable outflow (l/s)	180.42 l/s
Flooding Period	Up to and including a 1 in 100 Year + 30% CC.
Standard Annual Average Rainfall (SAAR) (mm)	848
M5-60 rainfall depth (mm)	16.2
Ratio, r	0.287
Allowance for Climate Change (%)	30
Minimum self-cleansing velocity (m/s)	0.75
Pipe roughness (mm)	0.6
Run-off coefficients	
Soft landscaped areas	30%
External hard standing areas	80%
Roof areas	95%

Refer to drawings 2232-DOB-ZZ-ZZ-DR-C-0200 to 2232-DOB-ZZ-ZZ-DR-C-0204, relating the proposed development's surface water drainage network.

3.11.10 Attenuation Design

The proposed surface water attenuation on the site shall be provided in a number of forms such as Roof structures, Permeable paving car parking, Bioretention areas, Bioswales and Pond structures. Each catchment analysis has been assessed to provide attenuation on site to cater for the 1 in 100 year + 30% climate change. The proposed attenuation volumes provided by each of the suds features proposed on site within each catchment is outlined in Figure 3-40 to Figure 3-42 Below.

Figure 3-40. Catchment 1 Attenuation Volumes

	Blue Roof	Permeable Paving	Swale	Bio Retention	Pond			
					1	2	3A	3B
Catchment 1	789	369	905	308	1512	2263	483	667
Sub Total m3	789	369	905	308	4925			
Total m3	7296							

Figure 3-41. Catchment 2 Attenuation Volumes

	Blue Roof	Permeable Paving	Swale	Bio Retention	Pond
					5
Catchment 2	265	107	541	83	3855
Sub Total m3	265	107	541	83	3855
Total m3	4851				

Figure 3-42. Catchment 3 Attenuation Volumes

	Blue Roof	Permeable Paving	Swale	Bio Retention	Pond		
					4	6A	6B
Catchment 3	530	215	1328	140	1827	1051	1270
Sub Total m3	530	215	1328	140	4148		
Total m3	6361						

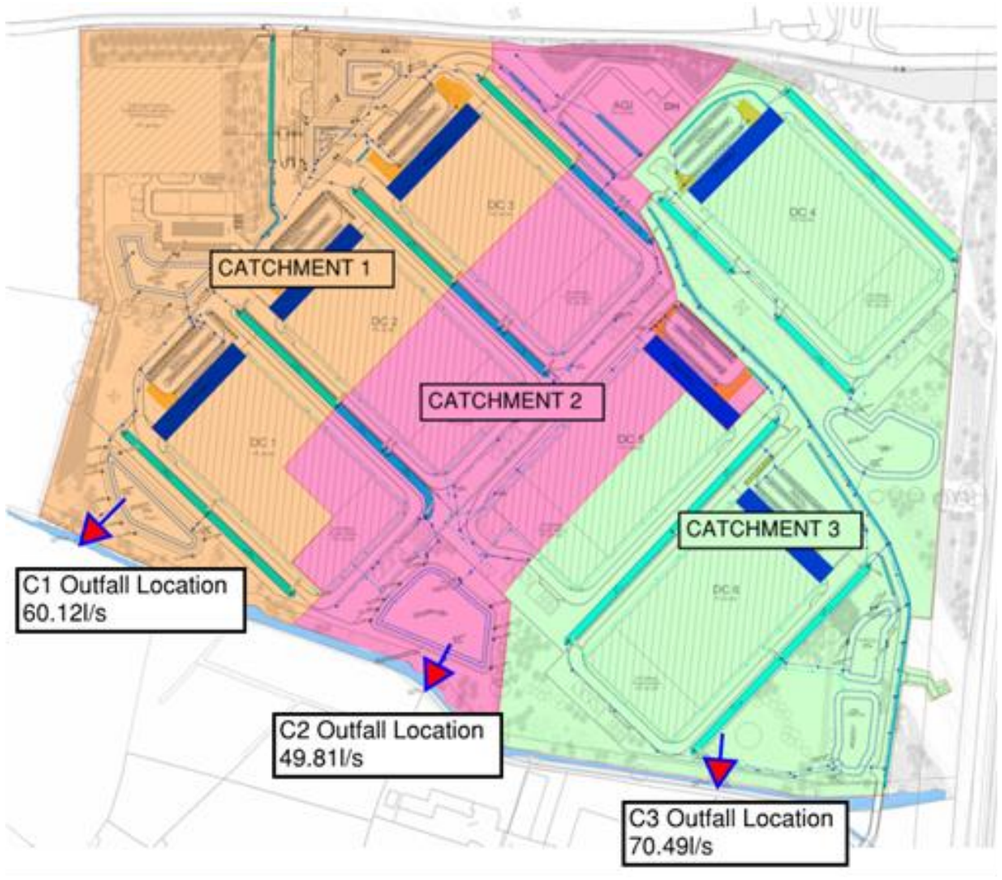
3.11.11 Proposed Surface Water Discharges

It is proposed to discharge surface water from the proposed application site at 3 No. Locations to the Bluebell Stream. The rate of each discharge will be dependent on the size of the drained catchment size and shall be a combined discharge rate of 180.42l/s. A summary of the proposed catchment areas and allowable discharges are indicated below.

Figure 3-43. Catchment Discharge Rates

	Soil Type	Alloawable discharge l/s/ha	Analysed Area	Discharge Rate	Discharge %
Catchment 1	3	6.0	10.020	60.12	33
Catchment 2	3	6.0	8.301	49.81	28
Catchment 3	3	6.0	11.748	70.49	39

Figure 3-44. Proposed SW Discharge Locations



Surface water discharging from the proposed retention ponds shall be restricted via a flow control device while a Non-Return Valve (NRV) shall be fitted to each of the outfall manholes adjacent to the Bluebell Stream. A high-level overflow shall be fitted to each of the flow control manholes to facilitate surface water discharge from the proposed development during storms which exceed a 1:100 Year + 30% Climate Change event. In addition, a high-level overflow shall be fitted to the final outfall manhole which shall facilitate surface water discharge from the proposed development in the unlikely event of a 1% HEFS Fluvial event occurring in the Bluebell Stream simultaneously with the normal low level surface water outfall becoming blocked combined with a failure of the NRV. Engineering Calculations included in Appendix D demonstrate that no pluvial “out-of-manhole” flooding of the proposed surface water network occurs when the outfall discharges via the high-level overflow.

3.11.12 Proposed Bluebell Watercourse Culvert- Section 50

As part of the development, it is proposed to provide an emergency vehicle access road to the south of the site to the existing M7 Business Park. This connection requires a crossing of the existing Bluebell watercourse which is designed and will be constructed in accordance with OPW Section 50 consent and requirements. The CFRAMS mapping for the Bluebell stream has determined a design flow of approx. 1.84m^3/ sec during a 0.1% AEP (1 in 1000-year flood event) at an upstream node adjacent to the M7.

For the purposes of the culvert design, a downstream CFRAMS flow of 3.13m^3/sec (0.1% AEP) has been used for the Section 50 culvert design. A 3m x 2m box culvert shall be installed to culvert the flows of the Bluebell stream which has also allowed for increased future flows due to climate change. Figure 3-45 below indicates the proposed culvert location and refer to drawing 2232-DOB-ZZ-ZZ-DR-C-1700 for full details of the proposed works. An OPW-Section 50 application, along with detailed structure drawings and calculations will be submitted following grant of permission for the development.

Figure 3-45. Keyplan indicating proposed Culvert Location

3.11.13 Riparian Buffer

With the development located adjacent to the Bluebell watercourse to the south, consideration has been given to the site layout to the protection of wildlife and the reduction of impacts on the existing riparian environment along the watercourse.

The site layout and design has followed the Inland Fisheries Ireland's guidance documents 'Planning for Watercourses in the Urban Environment' and 4.5ha of existing agricultural land is provided with a fenced off buffer along the southern boundary to protects and enhance to riparian environment to the Bluebell stream. Following consultation with the Matthew Carroll, Environmental Officer in Inland Fisheries Ireland, a minimum Riparian buffer of 10m is considered adequate and has been provided from the existing watercourse. (Refer to email communication with Inland Fisheries in Appendix C).

A significantly larger riparian corridor being maintained right along the Bluebell boundary through undisturbed and enhanced landscaping as denoted in green in Figure 3-46 below.

Figure 3-46. Extent of undisturbed and enhances landscape adjacent to the Bluebell watercourse.

The typical extent of the planting and development along the Bluebell River can be seen in Figure 3-47 below, with the Riparian Buffer indicated in a dark green hatch adjacent to the watercourse. The measures that are being taken to ensure appropriate protection of the riparian zones include the following:

- The streamside zone of 10m left intact and undisturbed with existing hedgerows, trees, and stream vegetation. Vegetation enhancement will be provided with native marginal and emergent vegetation where required.
- Middle zone of 10m to 20m will be left intact and where disturbed due to proximity of road construction, will be landscaped appropriately with native plants and vegetation.
- The outer zone beyond the 20m middle zone contains both undisturbed ground and enhanced biodiverse landscaping. This area also incorporated bioretention ponds as part of the nature-based SuDS solutions for the site.

The Bluebell stream runs along the southern boundary of the site. The stream banks and vegetation will be retained and protected. An emergency access road through the adjoining M7 Business Park will cross the Bluebell stream at the southeastern corner of the site.

As part of the landscape treatment, it is proposed to plant native tree and scrub planting within the site to help visually integrate the proposed development and enhance site biodiversity. The proposed planting will strengthen the existing riparian corridor along the Bluebell stream. The proposed planting consists of native woodland planting between 10-20m in width along the riparian corridor, with gaps along the stream to provide variability. The planting area will include bat and bird boxes.

Inside the planting area, a security fence will enclose the data campus buildings. With the landscape treatment will consist of predominantly biofiltration basins and native long and short meadow area. The basins will connect into the Bluebell stream at three points along the southern boundary. These connections will be placed in locations to avoid impacts to existing vegetation, with natural vegetated earth-retaining surrounds to ensure minimal disturbance to the existing ecology.

Figure 3-47. Inland Fisheries Ireland's Riparian Buffer indicated in Dark Green adjacent to the Bluebell Stream

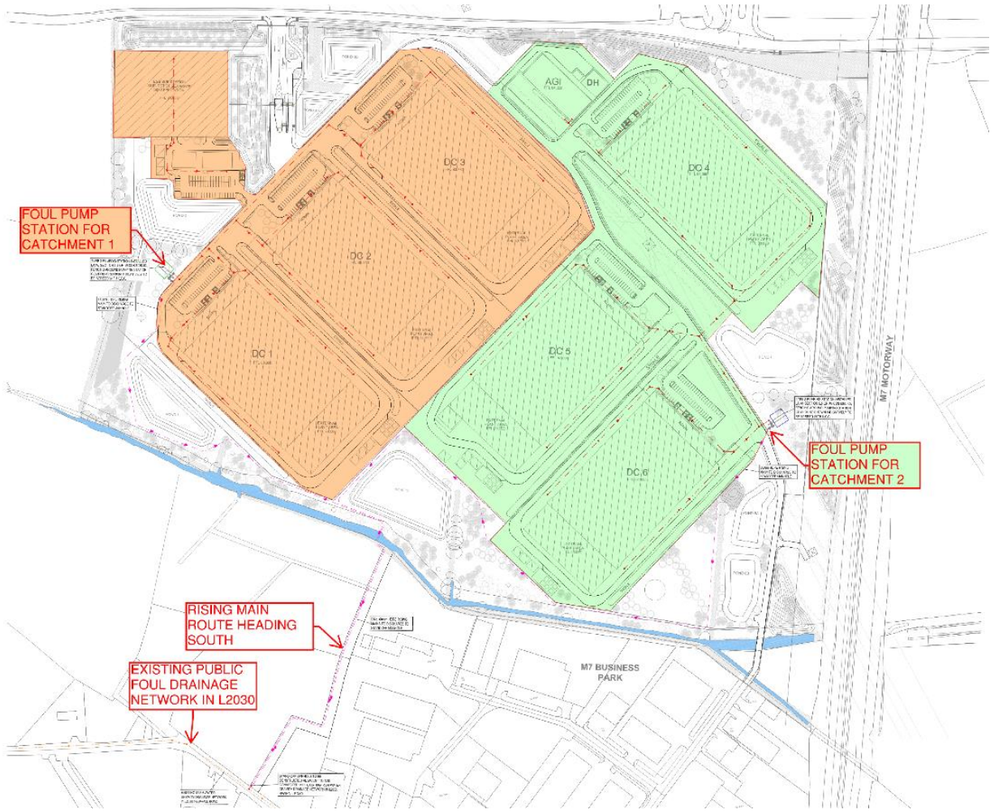
3.12 Foul Water

3.12.1 Proposed Foul Drainage Strategy

The proposed foul strategy will be to provide a new foul drainage network to collect effluent from the new development via a local piped network. Each data centre building shall be served by its own local foul drainage network which conveys flows to a main gravity line discharging to a pumping station located on the site. There are 2 No. foul drainage catchments on the proposed site. DC Buildings 1,2 and 3 and the adjacent SID Substation (Catchment 1) shall discharge to a pumping station located to the west of the site while DC buildings 4, 5 and 6 and the AGI building (Catchment 2) shall discharge to a pumping station at the Eastern portion of the site.

Foul effluent will be pumped via two separate rising mains (one from each pumping station) and crosses agricultural lands located south of the Bluebell Stream to discharge to the main public foul drainage network which is located along the L2030 via a stand-off manhole. A letter of consent from the adjoining landowner is included as part of this application. The layout of the proposed foul drainage network is included on engineering drawings 2232-DOB-ZZ-ZZ-DR-C-0300 - 0304 included with this application.

Figure 3-48. Foul Drainage Catchments



3.12.2 Proposed Foul Network Design

The foul sewer network as shown on drawings 2232-DOB-ZZ-ZZ-DR-C-0300 to 2232-DOB-ZZ-ZZ-DR-C-0304 has been designed in accordance with the principles and methods set out in Irish Water's Code of Practice for Wastewater Infrastructure IW-CDS-5030-03 (Revision 1 – December 2017), IS EN 752 Drain & Sewer Systems outside Buildings, IS EN 12056 Gravity Drainage Systems inside Buildings and the Building Regulations Technical Guidance Document Part H Drainage & Wastewater.

- The foul network shall convey effluent generated on the site as follows:
- Domestic activities on the site from the estimated workforce of approximately 400 persons.
- The network will receive an amount of "blow-down" water generated by the cooling system processes within each data centre. This volume of water is generated primarily during peak summer weather periods. A full breakdown of the expected blow-down water generated by this process is included in Appendix H as part of the foul drainage calculations.
- The foul system has been designed to facilitate a potential discharge generated by the activation of a sprinkler system in each data hall. The available foul pump station storage has been sized based on the water runoff from a fire event (400m^3 per data hall).

Figure 3-49. Proposed Post-Development Domestic and Commercial Foul Flows

COMMERICAL Predicted Development Foul Flows						
Use Type	Floor Area (m^2)	Occupancy Rate (persons/m^2)	Population (P)	Loading (l/ person/ day)	Daily Loading (l/ day)	Daily Loading (l/s)
Business	-	-	400	100	40000	0.46
Industrial	-	-	-	-	-	0.04
Dry Weather Flow (1 DWF)						0.50
Design Foul Flow (6 DWF)						3.01

The estimated peak foul loading generated by the proposed development's Dry Weather Flow is 0.50l/s while the Design Foul Flow of 6DWF is 3.01l/s as calculated in Figure 3-49 above. A pumped foul connection from the proposed development shall be made via a rising main and stand-off manhole arrangement to the existing 300mm diameter public foul sewer, located to the south of the site along the L2030 (Newhall Road).

A full foul drainage network analysis and output calculations developed using MicroDrainage modelling software have been included in Appendix H of this report. Refer to following drawings relating the proposed development's foul drainage networks: -

2232-DOB-ZZ-ZZ-DR-C-0300 - 0304 Proposed Foul Water Drainage (Sheets 1 to 4)

2232-DOB-ZZ-ZZ-DR-C-1450 - 1452 Proposed Foul Water Longitudinal Sections (Sheets 1 to 3)

FOUL PUMP STATIONS

The proposed foul pumping stations have been designed with minimum 24-hour storage capacity in the event of a failure of both the duty and standby pumps. The pumping stations will be designed to Irish Water standards, although they will not be taken in charge and will be maintained by the facilities management company responsible for the data centre site. The rising mains have been designed to allow for sufficient turn-over of effluent such that septic conditions do not occur. The retention time based on the daily design is less than 8 hours. The pumping stations will also function as short-term storage for potentially contaminated sprinkler water in the event of an internal fire in any data hall on the site. Therefore, storage of 440m^3 will be provided at each pumping station and fire water will be pumped to Osberstown Treatment works via foul network, following consultation with Kildare County Council.

3.13 Consultations with Uisce Éireann (Formally Irish Water)

Uisce Éireann (UE) were consulted in relation to the proposed development and a pre-connection enquiry was submitted to UE, UE responded with a Confirmation of Feasibility (CoF) (Appendix E) noting that a new water connection is feasible but limited to potable water demand of 1.3l/s.

4 Mechanical Engineering

4.1 District Heating Interface Building

4.1.1 District Heating

Two of the electrical power generation gas turbine units located within the compound outside data center building DC5 shall be provided with heat reclaim from their exhaust stacks. It is estimated that the available heat quantity of each would be in the order of 5MW when running at full capacity. The heat reclaim shall be via heat exchangers positioned within the turbine exhaust flues. The two turbines selected will operate in duty / stand-by arrangement to provide a resilient source of heat. A data center campus district heating system, of pipes and circulation pumps, will connect the heat reclaim from the turbines to the District Heating Interface Building on the campus.

The two turbine flues will incorporate bypass arrangements around the flue heat exchangers should the heat source not be required and to allow for maintenance.

The District Heating Interface Building shall provide a connection between the data center campus district heating system and an external district heating network. The District Heating Interface Building shall contain pressurisation units, expansion vessels, filtration, chemical dosing, circulation pumps, controls, and plate heat exchangers (duty / standby), etc. for the data center campus side. Space shall be provided for an external district heating network operator to connect their pipework, required plant and equipment for the external district heating network side. Interface between the two systems shall be at the plate heat exchangers and fluid in the two systems shall remain distinct and separate.

Through discussions with Kildare County Council, a Feasibility Assessment has been carried out to identify potential heat loads either now or in the future as the town of Naas is developed. This Feasibility Assessment of a District Heating Network is included within the planning submission and details all the likely loads, locations, and potential connectivity. It is recommended that the Council engage with an experienced Heat Network Operator to assess the viability of bringing a district heating system to the west of Naas.

5 Electrical Engineering

5.1 Substation

Whilst power to all data center buildings and ancillary loads is supported by turbine engines that operate 24/7, direct connection to the local power grid will also be provided. The connection will primarily be for export purposes with infrequent import of power in a limited quantity. The substation will be subject to a separate SiD application.

5.2 Turbine Engines

Large capacity turbine plant will provide the primary power source for each data center. The turbines will operate on gas fuel sourced from the local gas supply network. A backup liquid fuel source (HVO or diesel) will be provided to each data center with 24hrs capacity in the event the gas supply is unavailable.

The turbine plant will operate on a 24/7 basis and will be coupled with battery systems to provide conditioned and resilient power to all building loads.

5.3 Battery Energy Storage Systems

Both electrical topologies use Battery Energy Storage Systems (BESS) that supply all critical loads with a minimum backup supply duration of 4 minutes at end of battery life (EOL). The upper limit of battery up time that can be accommodated is in the range of 15 to 20mins.

The battery cell chemistry is proposed to be Lithium Iron Phosphate (LiFePO4) which are a space efficient battery type with long lifetimes and reduced maintenance needs compared with traditional Led-Acid batteries.

6 Public Health Engineering

6.1 Design Parameters

6.1.1 Water Services

HOT, COLD, AND DRINKING WATER SERVICES

Maximum flow rates:

The water services pipe sizing will be in accordance with CIPHE Design Guide, based on table 15 (loading units), graph 3 (copper) and will have a maximum velocity of 2 m/s and achieve the flow rates in the table below. There will also be a minimum operating pressure at the outlets of between 2.0 to 3.0 bar.

Table 6-1. Maximum Flow Rates

Equipment	Hot Water maximum flow rates	Cold Water maximum flow rates	Loading Units (LU)	Comments
Wash Basin	0.15 l/s	0.15 l/s	2 LU	Thermostatic valve required
WC's	-	0.1 l/s	2 LU	-
Sink	0.20 l/s	0.20 l/s	5 LU	-
Shower	0.15 l/s	0.15 l/s	3 LU	Thermostatic valve required

Note: The sanitaryware selection for the project by others will need to be cognizant of these values.

The contractor will allow and install flow restrictors to achieve the above flow rates unless provided as part of the sanitary ware.

Cold water storage tank volume will be based on 20 litres per person.

7 Fire Protection

Please refer to the Fire Hazards Analysis Report (FHAR) which is located as a specific appendix within the EIAR.

7.1 Design Criteria

In respect of the engineering systems, the mechanical and electrical systems, a set of fire detection and protection systems are proposed, summarised, and not be limited to the following:

- Point detection, smoke, and heat with manual call points
- Early warning aspirating detection system
- Monitoring of all plant conditions, particularly gas turbines, engines, and battery storage systems
- Wet pipe sprinklers
- Dry pipe pre action system sprinklers
- Gas extinguishing systems
- Dry power extinguishing systems
- Gas shut off valves.
- Fire Extinguishers

Each data center building will be protected by the above fire suppression technologies throughout the building.

All fire detection and alarm systems will be installed by a certified and approved contractor. Fire protection system will be designed by a certified specialists to comply with NFPA and UL standards where applicable, but also in compliance with European standards, local codes, and the insurer's requirements, all of which take precedence, some of these are listed in the table below.

Table 7-1. Fire Protection Systems European Standards

Document Type	Document No.	Title
FMG Data Sheet	DS 2-0	Installation Guidelines for Automatic Sprinklers
Irish/European Standard	IS EN 12845	Fixed firefighting systems Automatic sprinkler systems Design, installation, and maintenance
Irish/European Standard	IS 15004-1:2020	Fixed firefighting systems. Gas extinguishing systems. Design, installation, and maintenance
Irish/European Standard	IS EN 15004 -10:2017	Fixed firefighting systems. Gas extinguishing systems. Physical properties and system design of gas extinguishing systems for IG-541
FMG Data Sheet	DS 3-2	Water Tanks for Fire Protection
FMG Data Sheet	DS 3-7	Fire Protection Pumps
FMG Data Sheet	DS 3-29	Reliability of Fire Protection Water Supplies
FMG Data Sheet	DS 5-32	Data centers and Related Facilities
FMG Data Sheet	DS 4-9	Halocarbon & Inert Gas (Clean Agent) Fire Extinguishing Systems

8 Energy, Environmental and Sustainability

Please refer to the following separate documents:

- Appendix K for the Energy Efficiency and Climate Change Adaptation Design Statement.
- Energy Policy Compliance Report.

Appendix

Appendix A. Engineering Document and Drawing Register
Appendix B. Site Investigation Report Part 1 & 2
Appendix C. KCC Water Services Department Meeting Notes & Inland Fisheries Consultation
Appendix D. Surface Water Network Engineering Calculations
Appendix E. Uisce Eireann Confirmation of Feasibility Letter
Appendix F. Fire Hydrant Flow Simulation Testing
Appendix G. Correspondence with KCC Roads Department
Appendix H. Foul Drainage Network Calculations
Appendix I. Sabre Electrical Lighting Design for R409
Appendix J. Road Safety Audit
Appendix K. Energy Efficiency and Climate Change Adaptation Design Statement
Appendix L. Mobility Management Plan