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Member of the SNC-Lavalin Group

NGD Data Centre 3, North Lake Drive, Imperial Park, Newport

Drainage Strategy

Next Generation Data

23/10/2020

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This document has 24 pages including the cover.

Document history

Revision	Purpose description	Origin-ated	Checked	Reviewed	Authorised	Date
P01	For planning consultation	TR	SF	AM	JP	23/10/2020

Client signoff

Client	Next Generation Data
Project	NGD Data Centre 3, North Lake Drive, Imperial Park, Newport
Job number	5197938
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Contents

Executive Summary

Site Name and Address	NGD Data Centre 3 North Lake Drive, Imperial Park Newport NP10 8UL (nearest postcode)

Grid Reference:	ST 28503 84499	Size (hectares):	2.56 ha

Current Use:		Proposed Use:	
Greenfield		Residential	
Brownfield (disused)	X	Commercial/Retail	
Industrial		Industrial	X
Commercial		Hospital	
Landfill		Educational	
Rail		Rail	
Residential		Landfill	
Other		Other (Construction)	

Comment:	Total Greenfield area = 2.56 ha	Comment:	The new scheme comprises the development of a new data centre facility to meet growing demand for data storage services.

Flood Zone:	Zone A	Vulnerability:	Low vulnerability
Sequential Test:	N/A	Exception Test:	N/A

This Drainage Strategy is compliant with the requirements set out in the Planning Policy Wales Edition 10 in accordance with the Statutory National Standards for Sustainable Drainage Systems (SuDS) for Wales and Statutory Instruments.

It has been produced on behalf of the Next Generation Data (NGD) in support of a planning application and tender process for the proposed new site on land located in the south eastern corner of Imperial Park, Newport.

This report demonstrates that the scheme and proposed works are not at significant risk of flooding and the proposed works will not increase surface water runoff rates.

The proposed scheme will have a network of SuDS features, in conjunction with pipes to convey the surface water runoff from the site generated by the new impermeable area and attenuate it within a detention basin, permeable pavement sub-base and below ground storage tank before discharging to an existing private surface water drainage system to the north west of the site.

The drainage network will mitigate water quality impacts caused by the new site as pollutants will be managed in the source control SuDS.

Surface water runoff from the new site will be restricted to a maximum Greenfield QBAR of 6.9 l/s by using a pumped discharge from the attenuation tank.

The design will provide a total of 1765m^3 of attenuation storage for all events up to and including the 1 in 100 year plus 40% climate change rainfall event. Use of above ground storage features has been maximised within the site constraints, with supplementary below ground features used to provide additional storage.

Foul water from the proposed scheme will be discharged to the existing private foul system and the public sewer.

1. Introduction

1.1. Background

Atkins, on behalf of NGD, has prepared a drainage strategy, which incorporates a surface water management plan (SWMP) for the proposed scheme, on land located in the south eastern corner of Imperial Park (see Figure 1-1 for location plan). The strategy will focus on the disposal of surface water runoff and foul effluent by detailing the planned use of the scheme and its anticipated impact on the site's existing drainage regime. It has been produced to be compliant with the Statutory National Standards for Sustainable Drainage Systems (SuDS) in Wales.

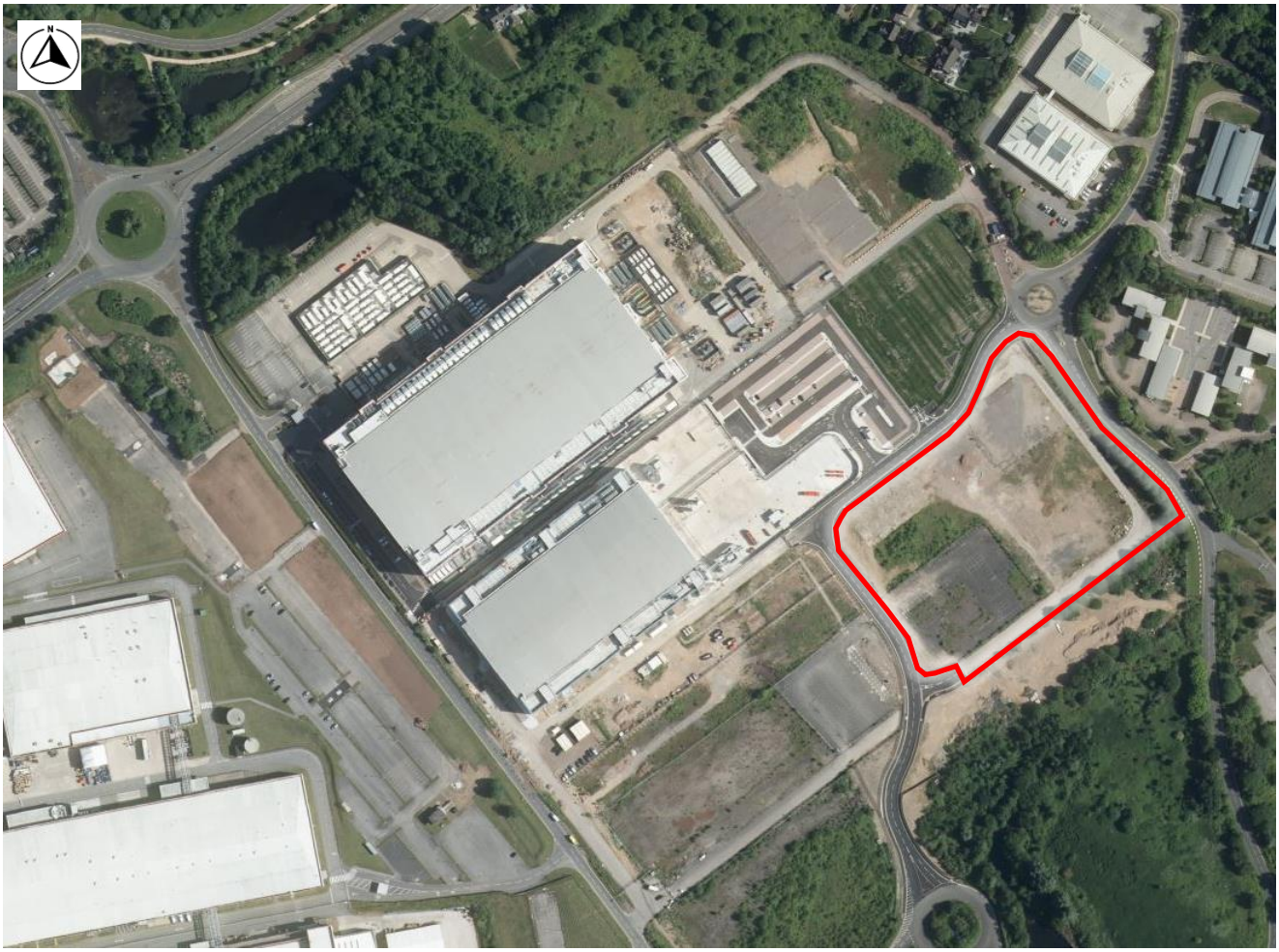


Figure 1-1 Site Location Plan

1.2. Report Scope

The scope of this report is to provide a drainage strategy to support the planning application for the NGD development. This will be achieved by providing detail on how the surface water runoff and foul effluent will be managed in accordance with local and national guidance. Development of the strategy includes the following:

- Review of relevant local and national development guidance stated in Table 2-2.
- Review of pre-development topographical survey data.
- Review of factual ground investigation data.
- Undertake an assessment of pre-development surface water runoff rates.
- Identify existing drainage regime, systems and assets.
- Identify potential outfalls from the site for both foul effluent and surface water runoff.
- Calculate the additional foul load anticipated and identify the most appropriate disposal mechanism.

- Future maintenance requirements.

1.3. Proposed Development

The Scheme comprises the development of a new data centre facility to meet growing demand for data storage services to continue to provide a service that meets NGD's clients' needs.

NGD is proposing to develop a single building, which contains multiple data hall spaces. Within each building the majority of the floorspace will be devoted to the data hall and their support spaces but there will be ancillary office floorspace which will accommodate administration functions and welfare facilities (toilets, showers, kitchen).

In addition to that, external areas will include a site road, car parking, landscaping and SuDS.

2. Policy Context

2.1 Rainfall Return Periods

Rainfall is a natural process that can present a range of different risks depending on its form. The Department of Food and Rural Affairs (DEFRA) define the risks presented by rainfall and associated flood risk according to an Annual Exceedance Probability (AEP), or as having a 'return period'.

Return period includes the statistical probability of an event occurring and the scale of the potential consequences. The 10-Year, 50-Year and the 100-Year return periods have a 10%, 2% and 1% chance of occurring in any given year, respectively. However, over a longer period the probability of flooding is considerably greater.

Table 2-1 below provides a summary of the relevant AEP and corresponding return period events of sensitivity.

Table 2-1 Definition of AEP and 'Return Period' Rainfall Events

AEP (%)	Return Period (Years)
100%	1 in 1 Year
10%	1 in 10 Years
2%	1 in 50 Years
3%	1 in 30 Years
1%	1 in 100 Years
0.5%	1 in 200 Years
0.1%	1 in 1000 Years

2.2 Local Development Policies

The design of surface water drainage systems for all developments in Wales that are larger than 100 square metres must conform to Schedule 3 of the Flood and Water Management Act 2010. The development must seek approval from the SUDS Approval Body (SAB) before construction can commence. The SAB in this instance is Newport City Council.

In addition, the design of all sewers and lateral drains must conform to BS EN 752, Building Regulations 2010 Part H, planning policy and best practice guidelines (such as Sewers for Adoption 7th Edition) wherever applicable.

In order to inform the strategy, a review has been undertaken of relevant local and national development policies as detailed in Table 2-2.

Table 2-2 Local Development Policies and National Guidance to Inform the Report

Document Name	Published By	Date
Statutory Standards for Sustainable Drainage Systems - designing, constructing, operating and maintaining surface water drainage systems	Welsh Government	2018

The key points extracted from the guidance pertinent to the proposed development are summarised in the following sections.

2.2.1 The Statutory Technical Standards for Sustainable Drainage Systems

The requirements are described in the Statutory Standards for Sustainable Drainage Systems for Wales, which also references the CIRIA SUDS Manual (C753).

There are criteria for prioritising the choice of destination for runoff, followed with standards which state the design criteria and how SUDS should be built, maintained and operated.

A summary of the criteria is provided below:

Runoff destination (Standard S1)

Surface water runoff destination priority levels:

Level 1	Collected for use
Level 2	Infiltrated to ground
Level 3	Discharge to surface water body
Level 4	Discharge to surface water sewer or drainage system
Level 5	Discharge to combined sewer

Hydraulic control (Standard S2)

A summary of standards and guidance on hydraulic criteria follows:

Interception

Surface water should be managed to prevent, so far as possible, any discharge from the site for the majority of rainfall events of less than 5 mm. A suggested target is 80% compliance in summer and 50% compliance in winter.

Run-off rate control

For previously developed sites, runoff rates should be reduced to the greenfield rates wherever possible. Betterment of at least 30% should be considered as a minimum requirement for Brownfield sites.

Run-off volume control

For previously developed sites, the surface water management system should be designed so the volume of runoff discharged for the 1 in 100 year 6-hour event is as close to greenfield conditions as possible. Where volumes cannot be sufficiently reduced, they should be discharged at a rate of 2 l/s/ha, or the average annual peak flow (QBAR), whichever is greater.

Flood protection

Protection against flooding for external areas should be ensured for events up to 1 in 30 year return period event. Protection against flooding of buildings should be ensured for events up to the 1 in 100 year return period event.

Water quality (Standard S3)

Treatment of surface water runoff should be provided to prevent negative impacts on the receiving water quality. The index approach in the SUDS manual should be followed.

Amenity & Biodiversity (Standards S4 and S5)

The design of surface water management systems should maximise amenity and biodiversity benefits.

Construction, operation and maintenance, and structural integrity (Standard S6)

All elements of the surface water drainage system should be designed so that they can be constructed, maintained and operated easily, safely and cost-effectively. Structural integrity of all elements under anticipated loading conditions should be ensured.

2.2.2 Climate Change

Planning Policy Wales advises an uplift on rainfall intensities of 30 per cent for climate change when designing for 2085 and beyond[1]. In this design, 40% climate change uplift has been used.

1 Planning Policy Wales: Technical Advice Note, July 2004

Planning policy and Sewers for Adoption 7th Edition require all surface water drainage systems to be designed to retain runoff on the site up to a 1 in 100 year rainfall event, with an allowance for climate change.

2.2.3 Hydraulic criteria

2.2.3.1 Surface Water

The minimum size of a gravity surface water sewer is to be 150 mm diameter. To provide a self-cleansing flow regime, the minimum velocity should be 1 m/s at pipe full flow.

The system should be designed so pipework is just full, not surcharged, in events up to and including a 1 in 2 year design storm.

The system should be designed not to flood the site in events up to and including a 1 in 30 year design storm. During events exceeding that threshold, consideration should be given to the flow paths of any water escaping from the system onto the site to ensure it is contained above ground temporarily[2].

To ensure sufficient treatment takes place in swales, the maximum velocity should be 0.3 m/s and the residence time should be at least 9 minutes in 1-year 15-minute rainfall events.

2.2.3.2 Foul Water

The minimum size of a gravity foul water lateral drain is to be 100 mm diameter and the minimum size of a gravity foul water sewer is to be 150 mm diameter. To provide a self-cleansing flow regime, the minimum velocity should be 0.75 m/s at one third design flow.

2.2.4 Physical criteria

Where possible, drainage systems outside of buildings will be designed with a minimum depth of cover as follows:

- 0.35 m in pathways without any possibility of vehicular access.
- 0.5 m in parking area with height restriction and max gross vehicle weight of 7.5 tonnes.
- 0.9 m in parking area with limited access for vehicles in excess of 7.5 tonnes, or public open spaces.
- 1.2 m in highways or unrestricted parking areas.

Sewers and lateral drains should be positioned such that the external face is:

- At least 1.2m from a building or structure, or a distance equivalent to the depth of the sewer below the foundation, whichever is greater.
- At least 1m from any kerb line.

The design of all drains must conform to BS EN 752, Building Regulations 2010 Part H, planning policy and best practice guidelines (such as Sewers for Adoption 7th Edition) wherever applicable. Sanitary systems within buildings should be designed in accordance with BS EN 12056-2.

2 Sewers for Adoption 7th edition, P55

3. Existing Site Information

3.1. Site Location

The proposed scheme will be located in the south eastern corner of Imperial Park, a business park on the western edge of Newport, near Junction 28 of the M4 motorway; post code: NP10 8UL. The grid reference for the site is ST 28503 84499. The location of the site is indicated on an aerial photograph in Figure 1-1.

3.2. Topography & Site Features

The land is believed to be brownfield, having previously been developed and seen various uses. However, for the drainage strategy it will be considered as undeveloped due to the length of time it has been un-occupied, the extent of permeable surfaces within the site and the lack of an operational drainage system for the majority of the site. Runoff from the site will be restricted to greenfield runoff rate. The total area of the site is 2.56 ha.

The site is generally flat with a very slight slope from the north to the south and varies in elevation between approximately 14.6 mAOD in the northern-most corner of the site to 14.3 mAOD in the south.

3.3. Ground Investigations and Geology

There are historical British Geological Survey (BGS) borehole records within approximately 60m of the site. These records show that the topsoil strata is loose, medium, to dark grey brown fine to medium sand with abundant rootlets and fine medium coarse gravel.

Made Ground is not shown to be present under the site based on published information from the BGS. However, Made Ground is anticipated at the site, associated with the construction and subsequent demolition works and development of neighbouring roads and industrial buildings.

Mapped geology of the proposed site consists of St Maughans Formation - Argillaceous Rocks And [subequal/subordinate] Sandstone, Interbedded[3]. These sedimentary rocks are fluvial in origin. They are detrital, ranging from coarse- to fine-grained and form beds and lenses of deposits reflecting the channels, floodplains and levees of a river or estuary (if in a coastal setting).

Historic ground investigation work has been made available, including soakaway testing undertaken at an adjacent site. This investigation included three trial pits between 3.2- 3.7m deep and approximately 100m from the proposed scheme. Geological information is available from these locations shown in Table 3-1 below and a plan showing the positions of the boreholes is shown in Figure 3-1.

Ground investigation, including soakaway testing in accordance with BRE 365, is in progress for the proposed site; the results of this site-specific ground investigation will be reviewed at later design stages and incorporated into the proposals wherever possible to minimise runoff volumes and attenuation storage requirements.

3 British Geological Survey: http://mapapps.bgs.ac.uk/geologyofbritain/home.html. Date Accessed Nov 2019.

Table 3-1 Ground Investigations

Monitoring location	SA01		SA02		SA03	
Depth (m)	3.7		2.8		3.2	
Soil infiltration rate (ms^{-1})	2.325×10^{-5}		1.88×10^{-5}		1.76×10^{-5}	
Geology summary logs	Dark brown silty sandy angular to subangular fine to coarse sandstone, crystalline, brick and concrete gravel with a high angular to rounded cobble and boulder content	0 – 1.6 mbgl	Light grey and brown sandy angular and subangular fine to coarse crystalline gravel with a high angular cobble content	0 – 0.2 mbgl	Brown and dark brown silty sandy angular to subangular fine to coarse sandstone, crystalline, quartz and brick gravel with a high subangular to well rounded cobble and boulder content.	0 – 1.3 mbgl
	Brown and dark brown silty very sandy subangular to well rounded fine to coarse sandstone and quartzite gravel with a high rounded to well rounded tabular cobble and boulder content	1.6 – 3.7 mbgl	Dark brown silty sandy angular fine to coarse crystalline, brick sandstone and concrete GRAVEL with a high angular to subrounded cobble and boulder content.	0.2 – 1.6 mbgl	Dark brown silty sandy angular to well rounded tabular fine to coarse sandstone and quartz gravel with a high rounded to well rounded cobble and boulder content.	1.3 – 1.9 mbgl
			Brown and dark brown silty very sandy sub-rounded to well rounded fine to coarse sandstone and quartzite GRAVEL with high well rounded tabular cobble and boulder content	1.6 – 2.8 mbgl	Dark brown silty sandy subrounded to well rounded fine to coarse sandstone and quartzite gravel with a high well rounded tabular cobble and boulder content	1.9 – 3.2 mbgl

Figure 3-1 Trial pit locations

3.4. Water Environment

3.4.1. Existing Water Features

Ordnance Survey mapping shows the nearest surface water features to comprise a lake approximately 250 m to the south of the site. There are also detention ponds approximately 500 m to the south.

Available published information from Natural Resource Wales indicates that the nearest main river to the site is the Drenewydd River, which is located approximately 1.5 km to the south-west.

3.4.2. Existing Drainage Systems

Available utilities records show that there are private surface and foul water systems within the site area and the Imperial Park area.

Roads within the site are currently drained to a separate private highways surface water system.

3.5. Existing Surface Water Runoff

Generally surface water runoff within the site will infiltrate into the ground, or runoff at greenfield rates to the site road network. The road network is not maintained in good working order, although it does have a drainage system its condition is not known.

The existing runoff rate has not been calculated for the site, in favour of using QBAR for the site design. The site greenfield runoff rate (mean annual) has been calculated using MicroDrainage as 2.77 l/s/ha (see Appendix A).

4. Drainage Strategy

4.1. Introduction

This section outlines the proposed surface and foul water drainage systems that will be constructed on the site (and that will be further developed during detailed design). It will also detail requirements for attenuation storage to mitigate the increased runoff volume from the proposed scheme and measures to be adopted to maintain water quality. This section should be read in conjunction with the drainage layout drawing provided in Appendix B.

4.2. Surface Water

4.2.1. Run-off destination S1

The Statutory standards for Sustainable Drainage Systems in Wales requires that surface water discharges from new developments to be restricted to the greenfield rate of runoff wherever possible. The surface water should be disposed of in accordance with the following hierarchy:

1. Surface water runoff is collected for use
2. Surface water runoff is infiltrated to the ground
3. Surface water runoff is discharged to a surface water body
4. Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system
5. Surface water runoff is discharged to a combined sewer

Table 4-1 below will review suitable surface water disposal options and identify the reasons for (if applicable) discounting any of the options stated above, at this stage.

Table 4-1 Surface Water Discharge Options

Destination Priority Levels	Method of Surface Water Discharge	Suitability for Site
Level 1	Collected for use	There is expected to be a significant water demand in plant cooling processes at the site facility. Rainwater harvesting is not expected to be able to satisfy this demand in full during the warm season, however due to the significant costs associated with importing potable water it will be exploited as much as possible to reduce operational expenditure. Storage volumes are yet to be determined, but will be at least equivalent to the average daily demand in order to satisfy the SuDS Standards.
Level 2	Infiltrated to ground	Soakaway test has been undertaken for a nearby site that conclude infiltration rate is $1.76x10^{-5}$ ms^{-1}. That indicates that infiltration systems may also be able to be used on this site. In situ soakaway tests have been commissioned to confirm this assumption in the next design stage, to explore opportunities to further reduce runoff volumes.
Level 3	Discharge to surface water body	As identified in Section 3.4.1, there is no nearby water course that can be used.
Level 4	Discharge to surface water sewer or drainage system	Surface water runoff from the site will be discharged at QBAR rate from the storage systems to the existing private drainage system
Level 5	Discharge to combined sewer	N/A

Based on the above, the preferred method of disposal for surface water runoff from the site is to harvest roof water for re-use (level 1), use infiltration systems (level 2) as much as possible, and discharge the remaining volume into the existing surface water drainage system (level 4) at attenuated rates.

4.2.2. Post Development Runoff Volume Control (S2)

The overall construction of the site will be made up of materials that will alter the permeability of the site and consequently will increase surface water runoff. Permeable pavement will be used to form some roads and car parking areas.

The impermeable area of the proposed site has been calculated and summarised in the table below.

Table 4-2 Proposed Scheme Surface Water Runoff Coefficients

Surface	Runoff Coef.	Area (m^2)	Area (ha)	Effective Impermeable Area (m^2)	Effective Impermeable Area (ha)
Paved areas – asphalt or concrete	1	8767	0.88	8767	0.88
Buildings	1	13442	1.34	13442	1.34
Grassed Areas – verges and vegetated areas	0.3	835	0.08	251	0.03
SuDS	0.7	1146	0.11	802	0.08
Permeable Pavement	1	1400	0.14	1400	0.14
Total		25590	2.56	24312	2.47

As stated in Table 4-2, the introduction of different surfaces and materials will alter runoff characteristics. These values correspond to the various materials that will form the proposed scheme and have been factored to determine the change in impermeable area from the existing state to the post development condition.

The existing site contains 0.37 hectares of road, with the rest of the site being permeable. As such, the construction of proposed scheme will result in a 2.1 hectare increase in impermeable area.

The required volume of surface water attenuation storage has been estimated, using MicroDrainage Source Control. A hydraulic model of the site has been created to refine the storage volume required. The surface water runoff from the new site will be restricted to QBAR of 6.9 l/s using a pumped discharge and other attenuating features within the site. The calculated attenuation storage volume required is $1765m^3$ and will be further refined during the detailed design stage.

4.2.3. Use of Sustainable Drainage Systems

Sustainable Drainage Systems (SuDS) will be used across the development to manage surface water in accordance with current legislation. SuDS work through mimicking natural drainage systems, reducing runoff and peak flows from a site and reducing the risk of flooding. In addition to reducing flood risk, SuDS can also improve water quality (which is discussed in Section 4.2.6). It may be necessary to include pipework to convey flow between features, however this shall be kept to a minimum.

The SuDS Manual provides a management train and indicates that flows within a development should preferably be managed using a range of SuDS techniques and providing SuDS features to offer amenity and biodiversity benefits. Table 4-3 below sets out the techniques that have been considered for this development.

In addition, the following recommendations to improve water quality have also been adopted from the SuDS Manual:

i. Pollution prevention by avoiding contaminants mixing with run-off.
ii. Treatment **-** Implementing SuDS systems (in series where required) to treat runoff.
iii. Maintenance and remedial work - to remove captured pollutants and maintain system performance.

Table 4-3 Assessment of suitability of applicable SuDS Features

SuDS Group	SuDS Technique	Description	Suitable	Reasons
Source Control	Site layout & management	Good housekeeping and good design.	Yes	Include provision for SuDS at early design stage; drainage facilities to control on-site runoff and prevent off-site flooding. Storage of materials and fuel oils in accordance with best practice to reduce risk of contaminants entering the drainage system.
	Rainwater harvesting and re-use	Larger-scale collection of rainwater for attenuation or for reuse in appropriate ways (e.g. toilet flushing or irrigation).	Yes	Large demand for water in site processes. Limited space available on site for harvested water store, but this will be utilised to maximum extent possible.
	Permeable pavement	Allows inflow of rainwater into underlying soil or construction.	Yes	Appropriate and will be used where space for 'green' SuDS is not available due to operational constraints on design.
	Green roofs	Vegetated roofs that reduce runoff volume and rate.	No	Not suitable for anticipated site use due to operational requirement for extensive mechanical plant on roofs (data storage centre).
Retention	Rainwater attenuation	Collection of rainwater within storage tanks to reduce runoff rates (until tank capacity reached).	Yes	This would be a suitable solution although will only form part of the attenuation stragey.
Detention	Detention basin	Dry depressions designed to store water for a specified retention time and quantity.	Yes	Detention basins will be suitable. A suitable area to the north of the new site has been identified to accommodate the basin.
Filtration	Linear drains	Linear drains or trenches filled with permeable material, often with piped drainage in the base.	Yes	This would be a suitable solution although not preferred in accordance with standards.
	Filter Strip	Vegetated strips of gently sloping ground designed to drain water evenly from impermeable surfaces and filter out particles.	Yes	This would be a suitable solution although not preferred in accordance with standards.
	Bio-retention areas	Vegetated areas for collecting and treating water before discharging or infiltrating.	Yes	Areas have been identified to include rain gardens.
	Sand filters	Treatment devices using sand beds as filter media.	No	More appropriate for treatment of industrial areas.
	Silt removal devices	Manhole or other devices to remove silt.	Yes	Detention basins and source control are considered to be more effective in managing silt.
Infiltration	Soakaways	Sub-surface storage and infiltration systems	Yes	This would be a suitable solution although not preferred in accordance with standards.

SuDS Group	SuDS Technique	Description	Suitable	Reasons
	Infiltration trenches	Similar to filter drains but allow infiltration through trench bases and sides.	Yes	This would be a suitable solution although not preferred in accordance with standards.
	Infiltration basins	Depressions that store and dispose of water via infiltration.	Yes	This would be a suitable solution although not preferred in accordance with standards.
Open Channel	Swales	Shallow, vegetated channels to convey or retain water and provide filtration (permitting infiltration when unlined).	Yes	Open channels can be utilised to remove pollutants and for flow conveyance. Infiltration to be confirmed by subsequent ground investigation.
Wetland	Ponds	Depressions used for storing and treating water with permanent pool and marginal aquatic vegetation.	No	This is not considered to be an appropriate solution as often they are reliant on a continuous through-flow of water and/or high groundwater levels which are unlikely to be available on this site.
	Shallow pond or pocket wetland	Shallower ponds where runoff flows through aquatic / wetland vegetation for attenuation and infiltration, but which may dry out.	No	
Other	Pipes and subsurface storage	Oversized pipes as conveyance measures and/or storage. Can be combined with sedimentation and filter media systems.	Yes	To provide additional storage capacity in underground drain systems and transport flow to an outfall at the lower end of the site.

Table 4-4 has identified the available SuDS measures and has considered their potential applications within the new site environment. Based on this, the proposed drainage will comprise of a system of open channels/ swales, a detention basin, the use of permeable pavement (water quality measures are discussed in the section 4.2.6), rainwater harvesting, and an underground attenuation tank.

4.2.4. Proposed Drainage Layout

In order to mitigate against an increased flood risk, surface water runoff from the new site will be restricted to QBAR of 6.9 l/s. A network of swales, permeable pavement and a detention basin will be utilised to manage the runoff. The outfall flow rate will be controlled by a pumping station (due to depths) before discharging into the existing drainage system.

Swales will be placed in parts of the site to intercept runoff from roads, provide storage and remove sediment. The gradient of the swales will be minimised to reduce velocity and promote settlement of sediments before discharging into the detention basin or storage tank.

Permeable pavement is also used to intercept surface runoff from the road areas and pedestrian areas.

The basin will be located in the northern corner of the site. The basin will overflow to a below ground tank, which is emptied by a controlled pumped discharge to an existing pipe that runs along the northern boundary of the site that is connected to the rest of the network and discharges into the existing drainage system.

4.2.5. Exceedance Flows and Surrounding Land

For rainfall events that exceed the drainage design (1 in 30 Year rainfall event) up to and including the 1 in 100 Year rainfall event (plus climate change allowance), any surface water flooding will be fully contained and managed within the boundaries of the site and not flood areas downstream. Any exceedance flows will be controlled in a manner that will avoid flooding of buildings or vulnerable areas, plus ensure that the associated depths and velocities are safe.

In order to provide a robust design and support the management of exceedance flows, SuDS features provided on the site will be sufficiently sized to provide capacity to convey and store the 1 in 100 Year rainfall event including climate change without flooding. At the time of writing it is expected that all rainfall for events up to 1 in 100 year will be able to be contained within the drainage system shown in Appendix B without flooding.

For storms with a return period greater than the 1 in 100 Year + CC rainfall event then any exceedance may overtop the proposed drainage system (depending on rain fall intensity) and will flow overland to the existing drainage system.

4.2.6. Water Quality (S3)

Due to the nature of the activities that will be undertaken within the new site, the main sources of pollution will be caused by traffic movement (lorries and cars). There is the potential for surface water to become contaminated with both hydrocarbons and suspended sediment.

Impacts to water quality can be mitigated through the use of source control measures and a SUDS treatment-train. The following measures are proposed to be adopted on the site and the requirements will be further developed during the detailed design stage.

i. Development of Site Management Plans prior to commencement of construction.
ii. Where feasible maintaining vegetated buffer strips to intercept/trap sediment from runoff.

The SUDS Manual index approach should be followed (Chapter 26). It is summarised below, as applicable to the site.

Table 4-4 Pollution hazard indices (Table 26.2 excerpt)

Land use	Pollution hazard level	TSS	Metals	Hydrocarbons
Other roofs	Low	0.3	0.2	0.05
Low traffic roads Non-residential car parking (school/office)	Low	0.5	0.4	0.4

Table 4-5 SuDS pollution mitigation for discharge to surface waters (Table 26.3 excerpt)

SuDS component	TSS	Metals	Hydrocarbons
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6

Table 4-6 SUDS pollution mitigation indices (Table 26.4 excerpt)

Material through which runoff percolates	TSS	Metals	Hydrocarbons
Dense vegetation, underlain by soil* of at least 300mm depth	0.6	0.5	0.6
Permeable pavement, underlain by soil* of at least 300mm depth	0.7	0.6	0.7
Bioretention, underlain by soil* of at least 300mm depth	0.8	0.8	0.8

*Soil should have good contaminant removal potential.

A single stage of treatment in any of the proposed SUDS components will be sufficient to remove pollutants from either of the contributing land use types.

4.2.7. Amenity & biodiversity (S4 and S5)

Through the involvement of a suitably qualified landscape architect, the SuDS scheme has been integrated into the landscape design. This will ensure maximisation of benefits to the site amenity and biodiversity from the components.

Amenity

Due to the industrial nature of the proposed site, the design has focused on surface water management and water treatment element through a variety of SuDS elements which has holistically informed the proposed landscape design for the scheme.

Swales have been used to create green corridors of planting to enhance the visual appeal of the external spaces.

The detention basin is a large organic landform, that has informed adjacent landscape enhancing the visual appeal of the soft landscape areas.

Biodiversity

Each SuDS element provides the opportunity for a diverse planting scheme and creation of dry to marshy habitats. The planting will include: species rich grassland along swale edges, and wildflower planting in the swale base. The diverse mix of planting will establish to become a valuable food and habitat refuge for wildlife.

The detention basin will be planted with native and non-native trees that are able to withstand extreme wet and dry conditions. Once established the trees will offer a valuable habitat of food and shelter to wildlife. Importantly, the arrangement of the SuDS elements combined with the diverse planting species creates a green corridor for wildlife to live, thrive and commute across the site.

Existing trees along the eastern edge of the site will be kept.

4.2.8. Maintenance (S6)

The on-site drainage systems will be maintained by the site owner, typical frequencies are set out in Table 4-6; the schedule will be reviewed and updated as necessary on completion of detailed design.

Table 4-6 Surface Water and Foul Effluent Features Maintenance Schedule

Maintenance Frequency	Swales	Detention Basin
Weekly	Inspection and removal of debris.	Inspect inlets, outlets and overflows for blockages, clear as required.
Monthly	Removal of litter and debris. Manage vegetation and remove nuisance plants.	Removal of litter and debris. Manage vegetation and remove nuisance plants. Inspect banksides, structures, pipework etc for evidence of physical damage.
Six Monthly	Inspect to identify evidence of erosion, compaction, ponding, sedimentation and contamination. Inspect for clogging or items that are blocking the route. Inspect silt accumulation rates and establish appropriate removal frequencies.	Manage other vegetation and remove nuisance plants.
Annually	n/a	Check needs for sediment removal. Inspect inlets and facility surface for silt accumulation. Check any penstocks and other mechanical devices. Remove sediment from inlets, outlet and forebay as required.

Following each significant storm event	Inspect swales for signs of erosion and damage. Repair as necessary.	Inspect the detention basin for signs of damage and check for blockages at outlets. Repair as necessary.

4.3. Foul Water

The design of all foul sewers and lateral drains must conform to BS EN 752, BS EN 16933, Building Regulations 2010 Part H, planning policy and best practice guidelines (such as Sewers for Adoption 7th Edition) wherever applicable. Sanitary systems within building should be designed in accordance with BS EN 12056-2.

4.3.1. Design Parameters

Welfare facilities on the site need to be designed for approximately 40 staff. The appropriate foul effluent value has been defined by the British Water Flows and Loads – 4[4], as 100 Litres per person, per day for office with Full-time Day Staff.

4.3.2. Peak Flow Calculation

Peak flows have been calculated as 0.31 l/s, as follows:

Peak flow = 6 x (PG + I), where P = population, G = consumption of water, I = infiltration.

Population is 40 staff.

Consumption of water has been based on British Water Code of Practice “Flows and Loads – 4” for office with Full-time Day Staff which is 100 l/h/d.

Infiltration has been allowed for at 10 per cent of PG.

*individual pipework will be sized according to the Discharge Unit method during the detailed design stage, as this is the most appropriate methodology for small populations.

Table 4-7 Peak flow calculation

PG	40 x 100	4000 l/d	0.046 l/s
I	4000 x 0.1	400 l/d	4.6×10^{-3} l/s
PG+I	4000+ 400	4400 l/d	0.051 l/s
6x(PG+I)	6 x 4400	26400 l/d	**0.31 l/s**

In addition to foul flows from the population, there will be trade effluent arising from cooling processes on the site. Peak water demand for cooling is expected to be in the region of 600 m3 per day. This will be purged in a controlled manner at a rate yet to be determined.

4.3.3. Capacity of receiving network

DCWW will need to be consulted to confirm suitable points of connection and determine available network capacity. It is expected that flows will be connected to existing private foul discharge and likewise existing discharge points. Section 106 agreement will need to be in place.

4 British Water Flows and Loads – 4, Sizing Criteria, Treatment Capacity for Sewage Treatment Systems

5. Design Development

The design of drainage systems will be developed further based on this strategy. Based on the SAB guidance for full planning applications further information will be required to be submitted on completion of the detailed design stage. This includes:

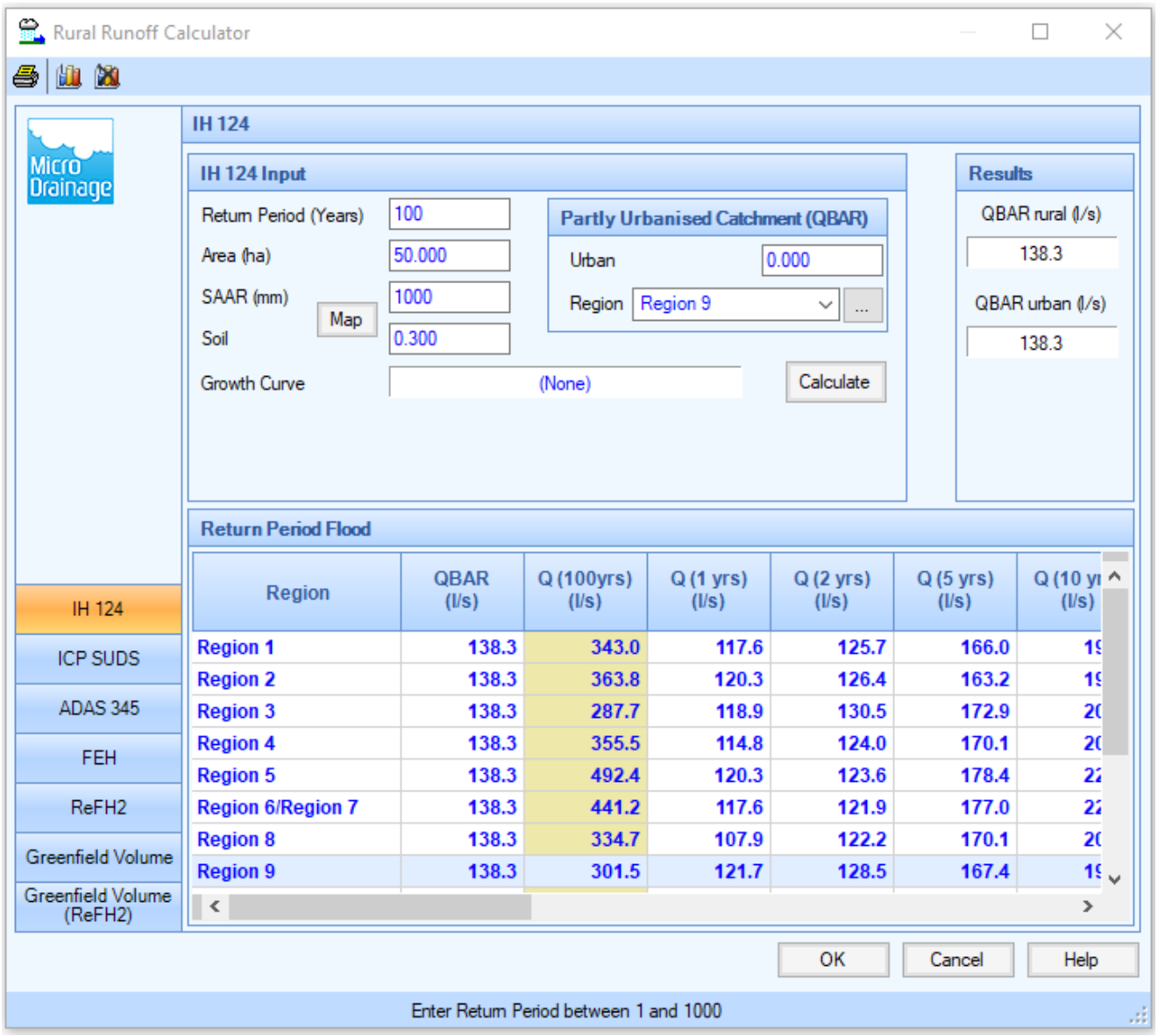
- Soakaway test results in accordance with BRE365 and/or CIRIA R156.
- Detailed drainage layout including drainage pipe sizes, gradients and pipe quantities.
- Specific details of flow controls to be used.
- Confirmed sizing of:
    - basins
    - swales
    - carrier pipes
    - attenuation tank volumes
    - rainwater harvesting tank volumes
- MicroDrainage hydraulic model results, including overland exceedance depths and flow routes.
- Construction details.
- Updated maintenance schedules.

Appendices

Appendix A. Greenfield Runoff Calculations

The calculation uses a 50 hectare area to obtain flow rates. This is factored down to obtain a per-hectare value.

QBAR = 2.77 l/s/ha



Appendix B. Drainage Layout Drawing

DO NOT SCALE

Millimetres 0 10 100

N

El Sub Sta

UTILITY BUILDING

ATTENUATION TANK. 1325m3
PUMPED OUTLET. DISCHARGE RATE = QBAR OF 6.9l/s

EXISTING DRAINAGE TO BE DIVERTED AROUND ATTENUATION TANK. EXTENTS TBC

BASIN 1.0
442m3
TWO TIERED PROFILE TO BANKS. DEPTH 1.5m.
BASE 12.596

OVERFLOW

SW 3.006
US IL 11.944
DS IL 11.759

SW 1.006
US IL 10.514
DS IL 10.295

INCOMING PIPE
IL 13.265

F 2.005
US IL 12.846
DS IL 12.728

SW 8.001
US IL 13.360
DS IL 13.265

F 2.03

INCOMING PIPE
IL 13.476

EXISTING
300mm Ø SW PIPE
TO PRIVATE SW
NETWORK

EXISTING MH
IL 13.100

F 2.04

SW 7.000
US IL 13.603
DS IL 13.476

PERMEABLE PAVEMENT
SITE ROAD, RECEIVES
RUNOFF FROM ROAD AND
GENERATOR SLAB AREAS

F 2.004
US IL 12.865
DS IL 12.846

F 2.05

F 2.006
US IL 12.728
DS IL 12.411

SW 3.004
US IL 12.493
DS IL 12.004

SW 5.000
US IL 13.520
DS IL 13.064

S 8.01
IL 13.360

SW 1.005
US IL 11.058
DS IL 10.514

SW 3.003
US IL 12.519
DS IL 12.493

SW 3.005
US IL 12.004
DS IL 11.944

GENERATOR REFUEL
AREA 2.0
PERIMETER CHANNEL
DRAIN WITH CLASS 1
FORECOURT SEPARATOR

F 2.06

F 2.003
US IL 13.053
DS IL 12.865

GENERATORS

F 2.002
US IL 13.204
DS IL 13.053

SW 3.002
US IL 12.946
DS IL 12.519

SW 5.001
US IL 13.064
DS IL 12.708

GENERATOR REFUEL
AREA 3.0
PERIMETER CHANNEL
DRAIN WITH CLASS 1
FORECOURT SEPARATOR

F 2.07

SWALE 2.0
RECEIVES RUNOFF
FROM ADJACENT
ROADS AND
FOOTPATHS

GENERATOR REFUEL
AREA 1.0
PERIMETER CHANNEL
DRAIN WITH CLASS 1
FORECOURT SEPARATOR

F 2.001
US IL 13.382
DS IL 13.204

F 2.08

SW 3.001
US IL 13.115
DS IL 12.946

SW 5.002
US IL 12.708
DS IL 12.307

F 2.09

F 2.007
US IL 12.411
DS IL 12.094

SW 1.004
US IL 11.601
DS IL 11.058

SW 3.000
US IL
DS IL

F 2.000
US IL 13.560
DS IL 13.382

MAIN BUILDING

RAINWATER HARVESTING TANK 2
IL 9.290
10mX14mX2.5m
(VOLUME TBC IN LATER STAGE
OF DESIGN) OVERFLOW TO
SWALE 2.0

F 2.008
US IL 12.094
DS IL 11.999

SW 5.004
US IL 11.954
DS IL 11.786

SW 5.003
US IL 12.307
DS IL 11.954

ROOF WATER DRAINAGE
SYSTEM WITH SOLIDS
FILTERS DISCHARGING TO
RAINWATER HARVESTING
TANK

F 1.008
US IL 11.054
DS IL 11.011

RAIN GARDEN 1.0

SW 2.000
US IL 12.960
DS IL 12.716

EXISTING MH
IL 10.95

F 1.009
US IL 11.011
DS IL 10.950

F 1.007
US IL 11.242
DS IL 11.054

F 1.01

SW 5.005
US IL 11.786
DS IL 11.670

SW 1.003
US IL 11.760
DS IL 11.601

F 1.02

SWALE 1.0
RECEIVES RUNOFF FROM
ADJACENT ROADS AND
FOOTPATHS

SW 1.002
US IL 11.902
DS IL 11.760

F 1.03

F 1.006
US IL 11.393
DS IL 11.242

RAIN GARDEN 2.0

ROOF WATER DRAINAGE
SYSTEM WITH SOLIDS
FILTERS DISCHARGING TO
RAINWATER HARVESTING
TANK

F 1.10

F 1.005
US IL 11.571
DS IL 11.393

GENERATORS

RAINWATER HARVESTING
TANK 1
IL 13.224
40mX15mX2.5m
(VOLUME TBC IN LATER STAGE
OF DESIGN). TANK TO HAVE
HIGHLEVEL OVERFLOW TO
SWALE 1.0

F 1.09

F 1.000
US IL 12.350
DS IL 12.273

SW 6.000
US IL 13.200
DS IL 12.941

SW 1.001
US IL 12.420
DS IL 11.902

GENERATOR REFUEL
AREA 6.0
PERIMETER CHANNEL
DRAIN WITH CLASS 1
FORECOURT SEPARATOR

RAIN GARDEN 3.0

F 1.001
US IL 12.273
DS IL 11.962

F 1.004
US IL 11.749
DS IL 11.571

F 1.04

PERMEABLE PAVEMENT
SITE ROAD, RECEIVES
RUNOFF FROM ROAD AND
GENERATOR SLAB AREAS

SW 6.001
US IL 12.941
DS IL 12.675

GENERATOR REFUEL
AREA 5.0
PERIMETER CHANNEL
DRAIN WITH CLASS 1
FORECOURT SEPARATOR

F 1.05

F 1.003
US IL 11.884
DS IL 11.749

SW 1.000
US IL 12.850
DS IL 12.420

ROOF WATER DRAINAGE
SYSTEM WITH SOLIDS
FILTERS DISCHARGING TO
RAINWATER HARVESTING
TANK

F 1.08

SW 6.003
US IL 12.545
DS IL 11.981

F 1.06

F 1.07

GENERATOR REFUEL
AREA 4.0
PERIMETER CHANNEL
DRAIN WITH CLASS 1
FORECOURT SEPARATOR

RAIN GARDEN 4.0

BIORETENTION 1.0
SERVES ADJACENT
VEHICLE AREAS

F 1.002
US IL 11.962
DS IL 11.884

SW 6.002
US IL 12.675
DS IL 12.545

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION

- DEEP EXCAVATIONS
- CONFINED SPACES

MAINTENANCE/CLEANING

- DEEP EXCAVATIONS
- CONFINED SPACES

DECOMMISSIONING/DEMOLITION

NONE IDENTIFIED

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

NOTES :

1. DRAWING ONLY TO BE USED FOR THE PURPOSE FOR WHICH IT WAS CREATED.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
3. ONLY DIMENSIONS SHOWN SHALL BE USED, DO NOT SCALE.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER CONTRACT DRAWINGS.
5. SAFETY, HEALTH AND ENVIRONMENT INFORMATION TO BE READ IN CONJUNCTION WITH PRE CONSTRUCTION INFORMATION.
6. THE SURFACE WATER DRAINAGE DESIGN WILL REQUIRE APPROVAL BY THE SAB (SUDS APPROVING BODY).
7. FOUL DRAINAGE CONNECTION WILL REQUIRE WATER INDUSTRY ACT SECTION 106 AGREEMENT TO BE IN PLACE BEFORE CONNECTION CAN BE MADE.

LEGEND :

- SURFACE WATER NETWORK
- EXISTING PRIVATE SW SEWER
- EXISTING DCWW SW SEWER
- FOUL WATER NETWORK
- EXISTING FOUL SEWER
- PERFORATED PIPE
- FLOW DIRECTION
- PROJECT BOUNDARY
- GREEN SUDS AREA
- HARD PERMEABLE SURFACES
- RAINWATER HARVESTING TANK

5m 0m 5m 10m 15m

Scale 1:250

Rev.	Date	Description	By	Chk'd	App'd

Drawing Status: FOR INFORMATION
Suitability: S2

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Client: NEXT GENERATION DATA (DC3)

Project Title: DATA CENTRE THREE

Drawing Title: DRAINAGE LAYOUT PLAN

Scale	Designed	Drawn	Checked	Authorised
1:500	SF	SF	TR	--
Original Size	Date	Date	Date	Date
A1	23/10/2020	23/10/2020	23/10/2020	--

Drawing Number: 5197938-ATK-XX-XX-DR-CE-281001
Revision: P01