Appendix 03 – 03 Drainage Strategy

Colliers Properties LLC

Linmere Island Site

Flood Risk Assessment and Drainage Strategy Report

Reference: 302321-ARP-XX-XX-RP-Z-0006

P02 | 18 December 2024

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Glossary

Acronym	Definition
AEP	Annual Exceedance Probability
BGS	British Geological Society
EA	Environment Agency
CDA	Critical Drainage Area
DMA	District Meter Area
FRA	Flood Risk Assessment
FRMS	Flood Risk Management Strategy
FZ	Flood Zone
LFRZ	Local Flood Risk Zone
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
PFRA	Preliminary Flood Risk Assessment
SFRA	Strategic Flood Risk Assessment
SPZ	(Groundwater) Source Protection Zone
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan

Executive Summary

Ove Arup and Partners Limited ("Arup") has been commissioned to prepare a Flood Risk Assessment and Drainage Strategy in support of the construction of 2 no. data centre buildings, comprising approximately 51,300 square metres of gross external floorspace with provision of internal roads and associated areas of hard and soft landscaping.

After a comprehensive review of flood risk data and publicly available information, this report concludes that the risk of flooding from all sources is low in line with the requirements of:

- National Planning Policy Framework.
- Central Bedfordshire Council (CBC) Local Plan 2015-2035 (adopted 2021).

A summary of flood risk is provided below:

Table 1: Flood risk summary

Flood Source	Pathway	Comment	Risk
Fluvial and Tidal	River Lee is approximately 750m to the south-east of the site	EA flood maps confirm the site is entirely located within flood Zone 1	Low
Groundwater	Through underlying strata when groundwater levels rise above surface levels	EA flood risk service states that groundwater flooding is unlikely in this area but the site is located on a high productivity chalk aquifer	Medium
Artificial sources	Reservoirs are located approximately 1km east of the site	EA flood risk service states that flooding from reservoirs is unlikely in this area	Low
Pluvial	Site topography is relatively flat with a mound to the north of the seat from east to west, reaching a max height of 10m.	EA flood mapping for a 1 in 100 year flood event shows that surface water flooding will be concentrated in the lower elevation points to the east of the site	Medium
Infrastructure Failure	180mm HPPE distribution main in the vicinity of the site	Affinity Water have categorised the burst activity in this DMA as low	Low

Surface water will be restricted from the site at a rate of 3 l/s/ha of impermeable surface, which equates to 15.0 l/s. The system is designed to a 1 in 100 year plus 40% climate change event. Attenuation of 4100 m^3 has been proposed through an attenuation pond. Other SuDS features include swales, bio-retention systems/rain gardens and permeable pavements.

Based on our understanding of the site setting and the proposals, it is considered that the development can be constructed and operated safely and will not increase flood risk elsewhere.

1. Introduction

This Flood Risk Assessment (FRA) and Drainage Strategy have been prepared by Ove Arup & Partners Ltd (Arup) on behalf of Colliers Properties LLC in support of an application for full planning permission to develop a data centre campus at the Linmere Island Site, Houghton Regis, Central Bedfordshire (hereafter the 'Site'). The Site falls within the administrative authority of Central Bedfordshire Council (hereafter 'CBC') and the planning application will therefore be determined by CBC as the Local Planning Authority. Proposals include the below:

- Construction of 2no. data centre buildings, comprising approximately 51,300 square metres of gross external floorspace.
- Construction of 1no. substation compound and 2no. MV switchrooms.
- Inclusion of emergency generators, exhaust flues and heat extraction stacks.
- Provision of internal roads and associated areas of hardstanding.
- Parking provision to include 100 car parking spaces (including 6 accessible spaces, 20 active electric vehicle spaces, 20 passive electric vehicle spaces) and 10 cycle parking spaces.
- Installation of security fencing and security guardhouse.
- Installation of 1no. sprinkler tank, 2no. above ground diesel storage tanks and 7no. water tanks.
- Formation of surface water attenuation pond.
- Provision of soft landscaping scheme and ecological enhancement.

This FRA has been prepared in accordance with the requirements of the National Planning Policy Framework (NPPF) (specifically Chapter 14) and Technical Guidance of the NPPF and will be submitted to Central Bedfordshire Council (CBC) as the Local Planning Authority (LPA). Figure 1 shows the development proposal.

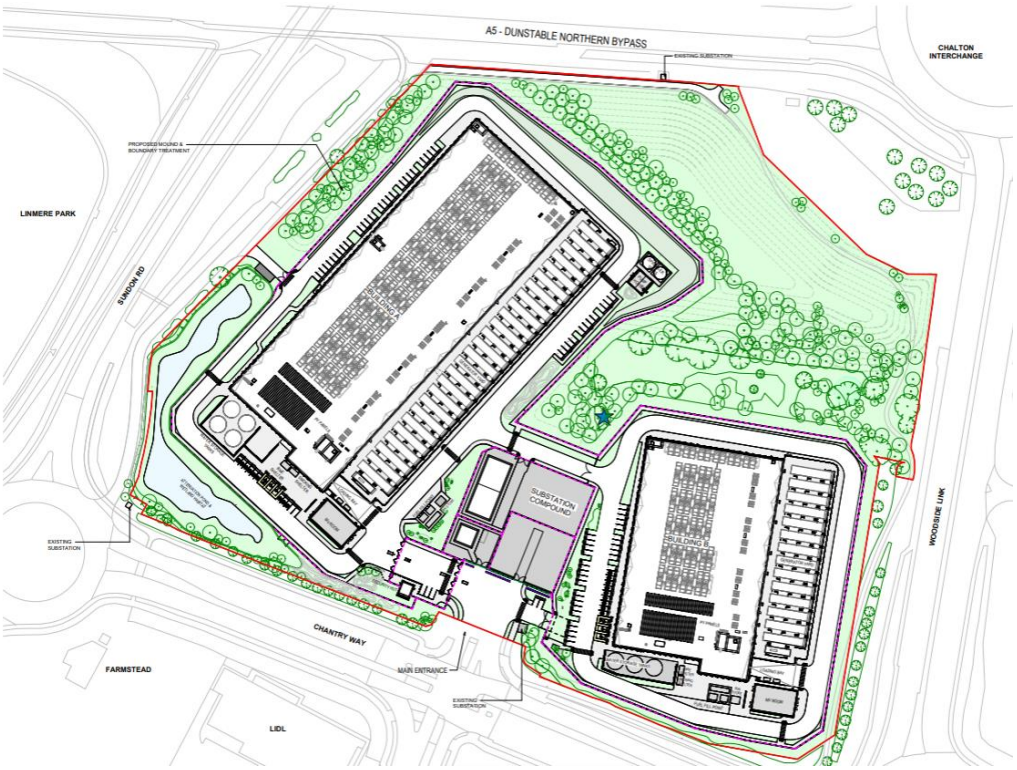


Figure 1: Development Proposal

1.1 Scope of Report

This report is written with reference to the NPPF and draws upon both regional and local policy pertinent to surface water and flood risk management and uses publicly available data. Under the requirements of the NPPF, a detailed Flood Risk Assessment is required as the Site area is greater than 1ha.

The purpose of this report is to provide an assessment of flood risk to demonstrate that the Site is at low risk from all sources and will:

- Identify and assess potential sources of flooding to the Site;
- Assess historical flood events associated with the Site;
- Assess the potential impacts of the development proposals upon the local hydrological regime;
- Outline maintenance requirements for drainage elements;
- Outline ways in which the site will sustainably manage surface water using SuDS and allowing for future climate change;
- Propose a surface water management strategy;
- Propose measures for the management of residual risks.

1.2 Sources of Information

The key sources of information reviewed as part of this study are listed in Table 2 below:

Table 2: Key Sources of Information

Title	Author	Date
UK National Planning Policy Framework	**Department for Levelling Up, Housing and Communities**	**December 2023**
Flood Mapping Data for Fluvial and Pluvial Sources	**Environmental Agency**	**October 2018**
Central Bedfordshire Council Local Plan 2015-2035	**Central Bedfordshire**	**July 2021**
CBC Local Plan (2015-2035) **Level 2 Strategic Flood Risk Assessment Volume 1**	**JBA Consulting**	**April 2018**
CBC Local Plan (2015-2035) **Level 2 Strategic Flood Risk Assessment Volume 2**	**JBA Consulting**	**April 2018**
Advice for the provision of surface water drainage systems on new developments	**Central Bedfordshire Council**	**December 2021**
Topographical Survey	**Plowman Craven**	**June 2022**

1.3 Consultation

This report has been prepared from a desktop assessment and consultation with the Local Planning Authority. Stakeholder engagement has also been undertaken prior to submission of the planning application, as discussed in detail within the Statement of Community Involvement.

1.3.1 Lead Local Flood Authority

An initial pre-application meeting with the Case Officer at CBC was held on 11 December 2023, where the indicative test-fit scheme design was presented. At the meeting, the Case Officer confirmed that the Proposed Development, including the departure from the parameters of the outline planning permission, was acceptable in principle.

A second pre-application meeting was held with CBC officers on 23 May 2024, where the project team presented an updated site layout, landscaping proposals, transport strategy and indicative approach to the external appearance of the data centre buildings. The CBC team responded positively to the updated proposals and commended the landscape-led design approach taken.

A third pre-application meeting was held with officers at CBC on 21 June 2024 to discuss the design approach for the data centre buildings and other detailed site layout matters.

1.3.2 Local Water Authority

Consultation with Anglian Water is ongoing. Due to the production of industrial waste on site, a Trade Effluent Consent application (G/02 form), including volumes and flow rates, will be submitted for Anglian Water approval.

Consultation with Bedford Group of Drainage Boards (who act on behalf of the LLFA) has been conducted and confirmed an 3l/s/ha of contributing impermeable area is an acceptable discharge rate.

1.4 Limitations

This report has been prepared for the use of Colliers Properties LLC (the Client) in relation to the proposed redevelopment of the Site for planning permission. It takes into account our Client's particular instructions and requirements and addresses their priorities at the time. It is not intended for and should not be used by any private third party in relation to any development outside of that which is detailed in this application. No responsibility is given to any private third party in relation to it, except as provided for in Arup's agreement with Colliers Properties LLC.

Arup has based this report on the sources detailed within it and believes them to be reliable but cannot and does not guarantee the authenticity or reliability of third-party information. Reasonable skill and care have been exercised in preparation of this report in accordance with the technical requirements of the brief.

This report has been prepared based on current legislation, statutory requirements, planning policy and industry good practice at the time of writing. Any subsequent changes or new guidance may require the findings, conclusions and recommendations made in this report to be reassessed in light of the circumstances. Should the proposed layout or use of the site change, the assessments and conclusions presented in this report may need to be revised.

2. Policy and Guidance

The following section details specific local policy and guidance pertinent to flood risk and surface water drainage that are applicable to the proposals.

2.1 Central Bedfordshire Local Plan 2015 to 2035

The Central Bedfordshire Local Plan was adopted in 2021 and is the key strategic planning document for Central Bedfordshire to guide and support the delivery of new infrastructure, homes and jobs. It sets out the Council's strategy for meeting the area's needs until 2035. Within this strategy document, there are policy guidelines on flooding and flood risk acceptability within the area. Policy CC3 on Flood Risk Management states:

A site-specific Flood Risk Assessment will be required for any site within 20m of any watercourse (including those not shown on the Environment Agency Flood Maps), or within an area at high risk of surface water flooding.

Development will be supported where:

- *It is located in areas at lowest risk of flooding (from all sources) and the Sequential and Exception Tests (where required) demonstrate that the site is appropriate for development and its intended use;*
- *A sequential approach to site layout is applied, directing the most vulnerable uses to the areas at lowest risk from all sources of flooding;*
- *It will be safe for the lifetime of the development, will not increase flood risk elsewhere or result in a loss of floodplain storage capacity or impede flowpaths, and reduces the overall flood risk within and beyond the site boundary where possible. Land that is required from current and future flood management will be safeguarded from development;*
- ***A site-specific assessment of flood risk has been undertaken following the criteria within this policy and the NPPF, which sets out appropriate flood risk management measures;***
- *Climate change implications are taken into account and occupants of the site will be safe during all flood events (including those which exceed the agreed design standard) or from residual risks or failure of the drainage system;*
- *Development must consider the impacts of the layout and land use on off-site flood risk. Measures should be identified and implemented, including passive measures to improve flood risk off-site;*
- *Surface water runoff is managed to pre-development rates and volumes, giving priority to the use of SUDS, and discharge locations have capacity to receive all foul and surface water flows from the development;*
- *The area of impermeable surface is minimised and porous and/or permeable surfaces are used wherever reasonably practicable;*
- *Mitigation measures maximise water efficiency and contribute to a net gain in water quality, biodiversity, landscape character and green infrastructure; and*
- *Building level flood avoidance, resilience and resistance measures are designed into the development where appropriate.*

Where necessary, planning permission will be conditional upon flood protection and/or runoff control measures being operative before other site works.

- *Development that increases the risk of flooding on or off the development site or would compromise the performance of flood defences will not be permitted.*

Ouzel Brook runs along the south boundary of the site, necessitating a site-specific Flood Risk Assessment. The site is located in Flood Zone 1, and does not increase flood risk elsewhere. A surface water management strategy accounting for climate change has been determined and outlined in Section 5 to ensure that the development is safe guarded throughout its lifetime. The Bedford Group of Drainage Boards has been consulted to determine discharge capacity and impermeable surfaces have been minimised where possible to

mitigate surface water flows. Proposed SuDS features (including an attenuation pond) have been developed to support biodiversity, water quality and efficiency. Building level flood avoidance, resilience and resistance measures have also been implemented, such as through the integration of SuDS and the avoidance of basement development.

2.2 Central Bedfordshire Strategic Flood Risk Assessment (SFRA) April 2018

Volumes 1 and 2 of the CBC SFRA aid to provide guidance and information for residents, businesses, and developers to ensure that flood risk is well understood and that the risks are managed strategically and proactively. The Central Bedfordshire Strategic Flood Risk Assessment (SFRA) is presented in three volumes: Level 1 SFRA (2017), Level 2 SFRA- Volume I (2018), Level 2 SFRA- Volume II, considering the Council's final shortlisted small-medium sites for assessment.

The key aims of the Level 2 SFRA are:

- *Provide individual flood risk analysis for site options using the latest available flood risk data.*
- *Where available, re-run existing hydraulic modelling to account for the effects of climate change and any residual risk. Where flood risk information is unavailable or limited, conduct appropriate hydraulic modelling where possible to determine the flood risks to the proposed sites.*
- *Using available data, provide information and maps presenting flood risk from all sources for each proposed site.*
- *Where the Exception Test is required, provide recommendations for making the site safe throughout its lifetime.*
- *Take into account the most recent national and local policy and guidance documents, update information on the requirements for site-specific FRAs, considerations for suitable surface water management methods and opportunities to reduce flood risk to existing communities through new development.*

The SFRA collates historical flood and rainfall data to inform future policies which will in turn influence future development options and land use policies.

2.3 Central Bedfordshire Surface Water Advice Note December 2021

The surface water guidance note details surface water drainage strategy guidelines for planning application with surface water drainage implications. It details that a Surface Water Drainage Strategy must be clearly identified in an FRA, and that a failure to do so may result in an application not being made valid. It states that surface water drainage arrangements for proposed new development will:

1. Plan in SUDS from the start

2. Replicate natural drainage

3. Water re-use first

4. Enhance biodiversity

5. Focus on multi-functional uses

6. Minimise carbon and waste in SUDS

7. Design for easy access and maintenance

8. Linked design through every scale

9. Place making through SUDS design

10. Surface conveyance over pipes

2.4 Anglian Water Limited

In accordance with the Building Act 2000 Clause H3.3, positive connections to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable.

The disposal hierarchy being: 1st Soakaways; 2nd Watercourses; 3rd Sewers.

Only when it can be proven that soakage into the ground or a connection into an adjacent watercourse is not possible would Anglian Water consider a restricted discharge into the public surface water sewer network.

2.5 Bedford Group of Drainage Boards

In line with the Bedford group of Drainage Boards regulations, discharge will be restricted to 3 l/s per contributing impermeable area before discharging into the Ouzel Brook.

3. Environmental Setting

3.1 Site Location

The Proposed Development site is located within Houghton Regis, Bedfordshire and is located approximately 7km northwest of Luton town centre. The Proposed Development site is accessed via Chantry Way, located off the M1 and comprises a parcel of land measuring approximately 9 hectares. The Proposed Development site forms part of a wider network of sites that comprise a strategic mixed-use development, known as 'HRN1' (Houghton Regis North 1). The HRN1 site obtained outline planning permission (OPP) under application ref: CB/12/03613 on 2nd June 2014, with the Proposed Development site permitted for mixed use, including data centre use.

The immediate surrounding context is informed by commercial and recreational uses, which form part of the Linmere strategic development. To the south-east lies the recently constructed Lidl Distribution Centre. Adjoining the site to the south is a community centre, 'The Farmstead' and a Lidl superstore, whilst to the west is a public open space, Linmere Park. Residential development approved as part of the OPP is currently being constructed further to the west of the site (adjoining Linmere Park).

Figure 2 shows the site location

Figure 2: Site Location

3.2 Existing Site Use

The existing site is predominantly greenfield with no current use. Existing buildings (Chalton Farm) to the east of the site were demolished in 2018. The site has a provisional Agricultural Land Classification of Grade 2, suggesting it is suitable for agricultural use.

3.3 Existing Topography

A topographical study was carried out 20th June 2022 by Plowman Craven. Maximum and minimum levels of the site range from around 140mAOD to 125mAOD, falling from north-east to south-west.

The general grade across the site is flat for the most part, with a gentle slope to the south-west corner. The major topographical change on the otherwise flat site is an engineered mound to the north. This embankment was built in 2021 to provide screening of the site and the adjacent commercial development within the HRN1

site from nearby sensitive views to the north-west. There is an L-shaped tree line close to the central boundary. Maximum levels of the bund are approximately 10m above the surrounding site, with bund slopes of approximately 1:3.

3.4 Geology

3.4.1 Bedrock Geology

The British Geological Society (BGS) geological mapping indicates that the Site is underlain with chalk including Totternhoe Stone Member and West Melbury Marly Chalk Formation sedimentary bedrocks

3.4.2 Superficial Deposits

The British Geological Society (BGS) geological mapping indicates that the Site is underlain by superficial deposits of Lowestoft Formation- Diamicton sedimentary superficial deposits. The Lowestoft Formation forms an extensive sheet of chalky till, together with outwash sands and gravels, silts and clays.

The soil is predominantly shallow lime-rich soils over chalk or limestone and freely draining lime-rich loamy soils.

An extract from BGS mapping online is shown below.

Figure 3: Extract from BGS online map

3.5 Hydrogeology

Information with respect to groundwater was not found in any of the BGS records around the site or from SFRA records. No records of groundwater flooding were mentioned in the SFRA within the site boundary. EA Groundwater vulnerability mapping is shown in Figure 4 and shows a medium-high and high risk of groundwater flooding. The site does not lie within a groundwater source protection zone. The Defra OGC preview EA historic flood map reveals that the site is not subject to historic flooding.

Figure 4: Groundwater vulnerability mapping (Magic Map)

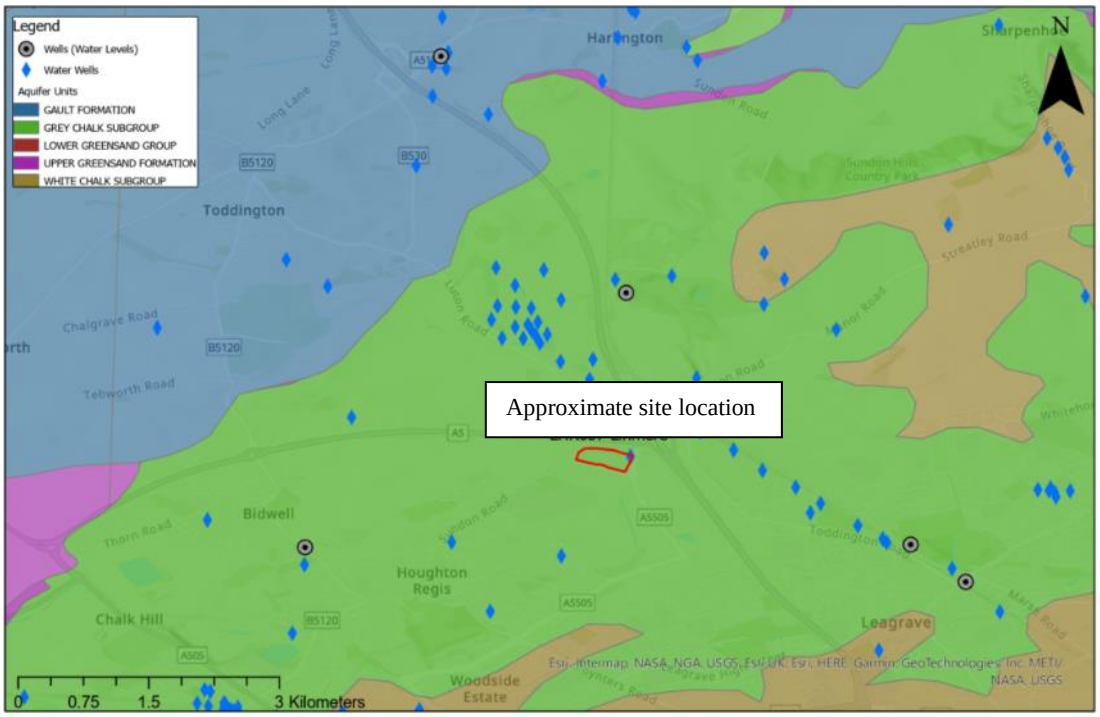


Figure 5: Aquifer bedrock and water wells within the site boundary

The site is underlain by a chalk aquifer according to the EA that is rated ‘highly productive’. Chalk aquifers have complex hydraulic properties, whereby the majority of the water available for supply is through secondary fractures. The Grey Chalk Subgroup is classified as a Principal Aquifer.

3.6 Existing Rivers/ Water Bodies

The nearest water body to the site is Ouzel Brook, which runs along the south boundary of the site and drains west towards the River Ouzel. The River Lee is located approximately 750m south of the site and the River Flit is located approximately 750m north of the site.

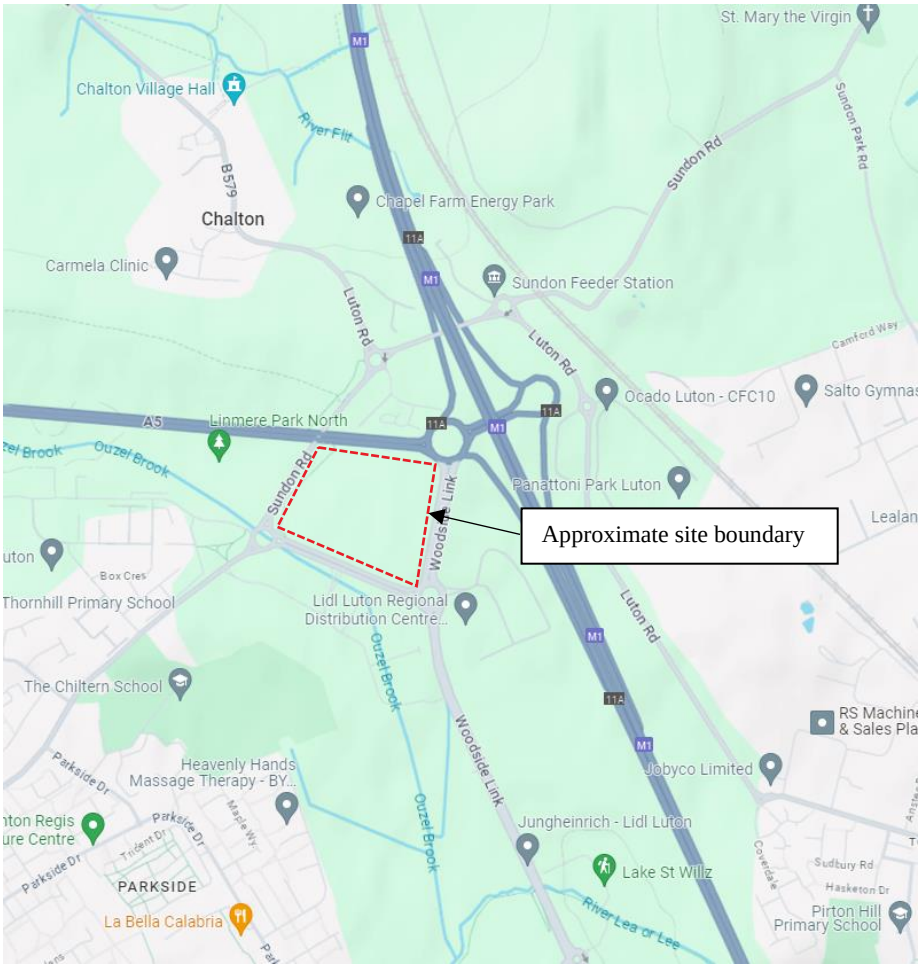


Figure 6: Location of existing water bodies and sources (Google Maps)

3.7 Existing Drainage Infrastructure

Figure 7 shows the existing drainage infrastructure. There is a privately owned sewer to the east and north of the site. The northern sewer drains into a foul rising main maintained and operated by Thames Water that runs in a south-easterly direction.

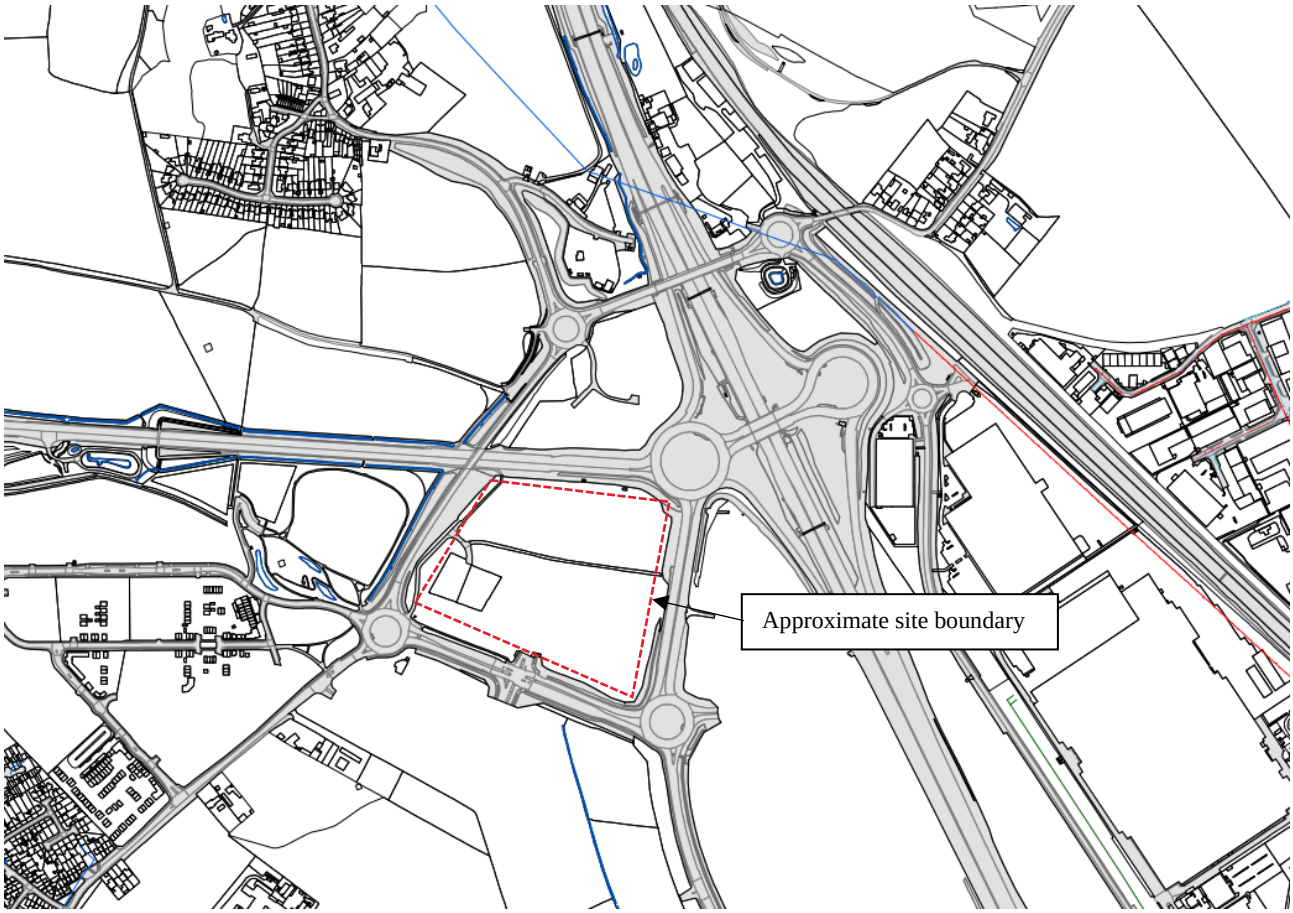


Figure 7: Thames Water asset search- Existing Drainage Infrastructure

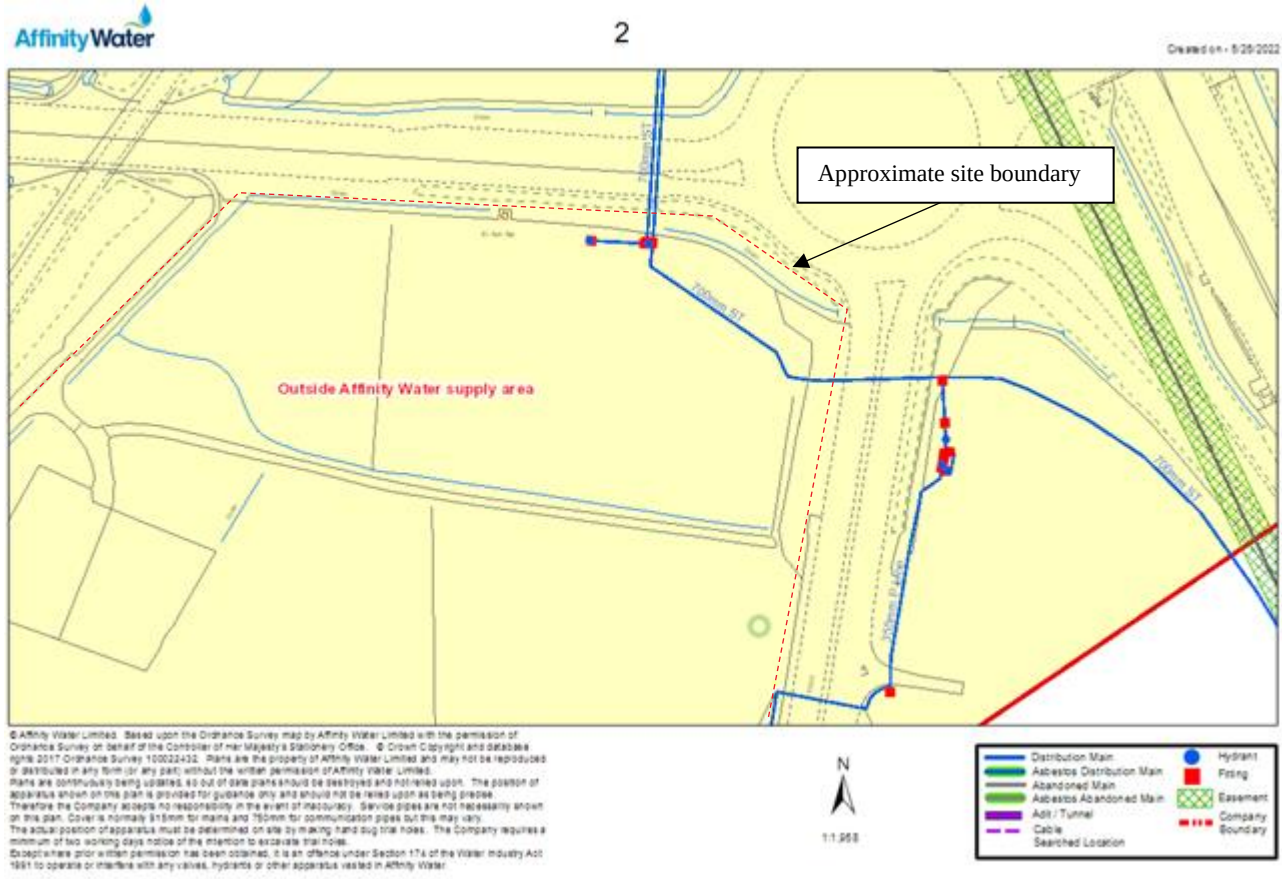


Figure 8: Affinity water asset search- North-east area in proximity to the site

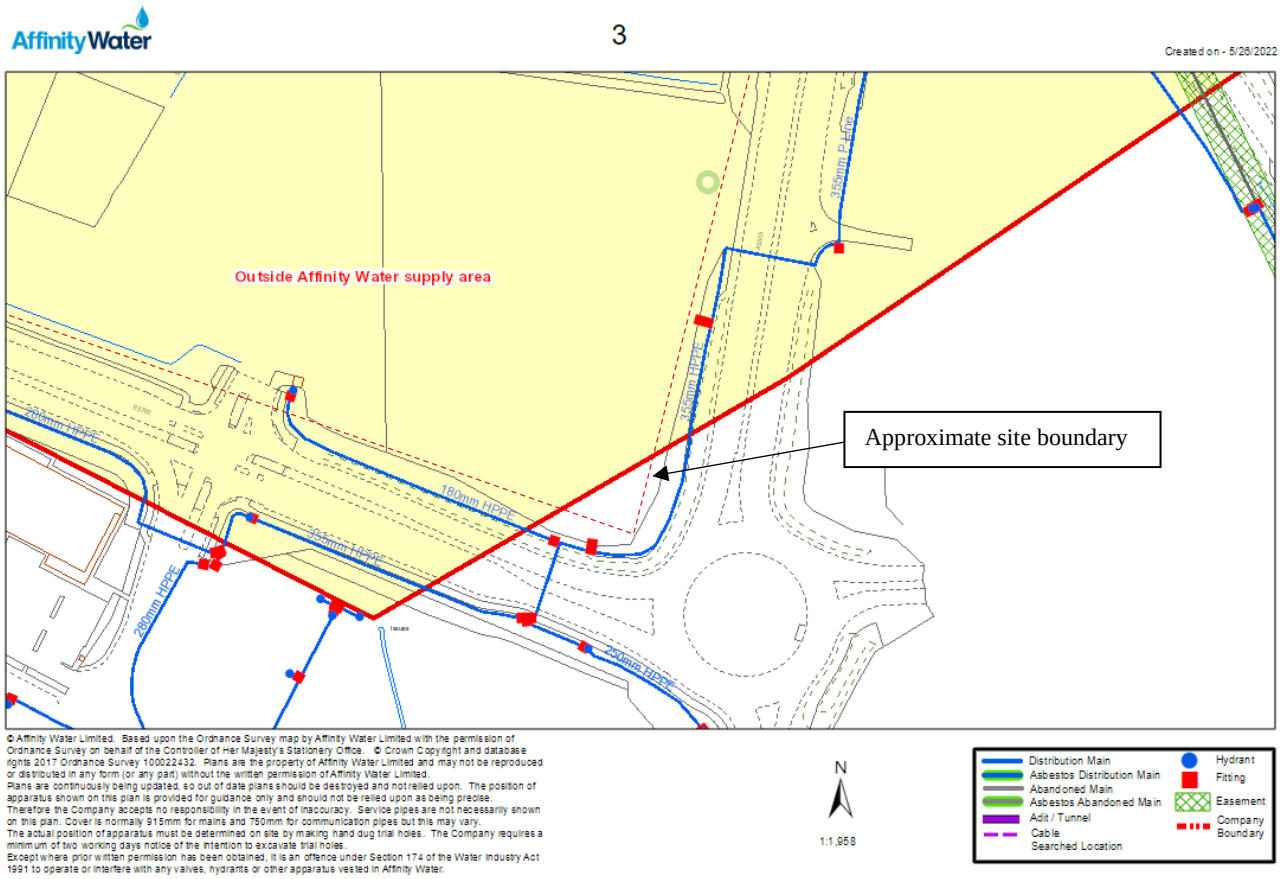


Figure 9: Affinity Water Asset Search- South-east area in proximity to the site

Affinity Water are the statutory potable water supplier for the proposed development site. The south-east of the site is bordered by a 200mm HPPE water main, a 180mm HPPE water main and a 355mm HPPE water main.

3.8 Historic Flooding

The EA historic flooding map shows no incidences of historic flooding on the site. The CBC SFRA has identified a strategic flood risk area to the east of the site and also notes no instances of historic flooding.

The Luton SFRA notes historic flooding instances in the town of Luton, with the city boundary located approximately 1km from the site. The information on historic flooding is largely anecdotal, with no record of the antecedent conditions giving rise to the flooding (therefore typically not attributed to a flood source) or reference to a flood return period. The reason for these historic flood events are stated in the Luton SFRA as most commonly a result of an inadequate drainage system that has not been upgraded since the town saw rapid growth in the 1950s and 1960s.

The areas of Wardown Park, the Telford Way roundabout and the confluence of Houghton Brook with the Upper Lee (within the LBC administrative boundary) are known to experience flooding problems, with flood events in 1947, 1987, 1990, 1992, 1995, 1998, 2005 and 2006.

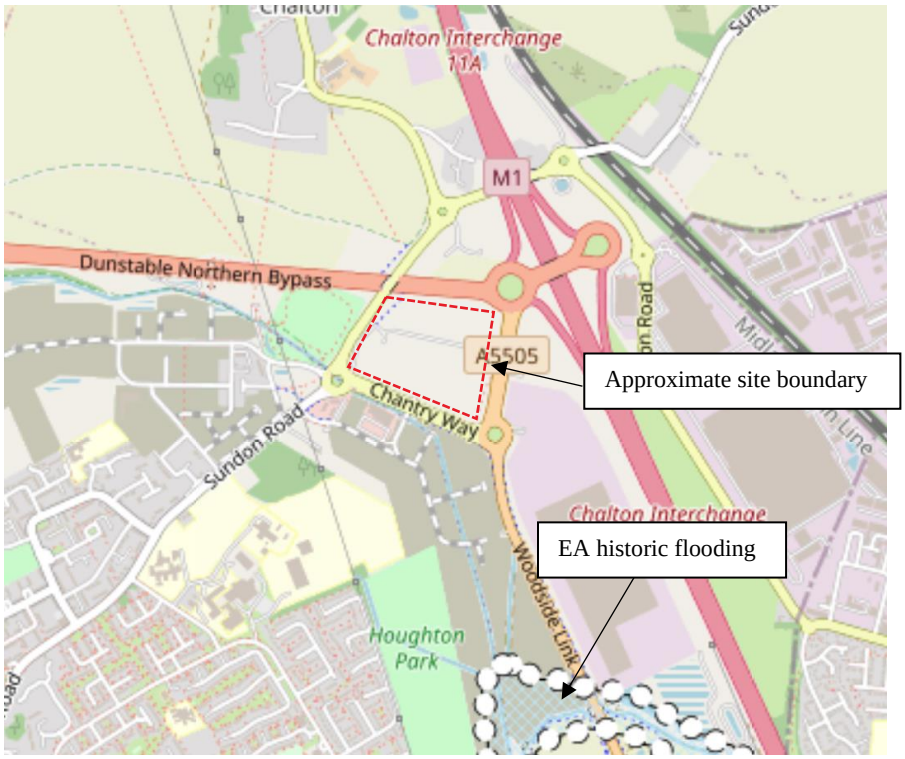


Figure 10: EA Historic Flood Map

4. Flood Risk Assessment

The technical guidance of the NPPF requires flood risk from the following sources to be assessed:

1. Fluvial and tidal sources (flooding from rivers and the sea);
2. Groundwater sources;
3. Artificial sources, canals, reservoirs etc;
4. Pluvial sources (flooding resulting from surface water/overland flows);

It also requires the risk from increases in surface water discharge to be assessed (surface water management).

4.1 Fluvial and Tidal Flood Risk

Environment Agency (EA) Flood Maps confirm that the site is wholly located within Flood Zone 1 (FZ1), defined as land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%) – very low.

The risk of flooding from fluvial/tidal sources is Low. The nearest river is the River Lee, with the topography around the area generally sloping towards the river.

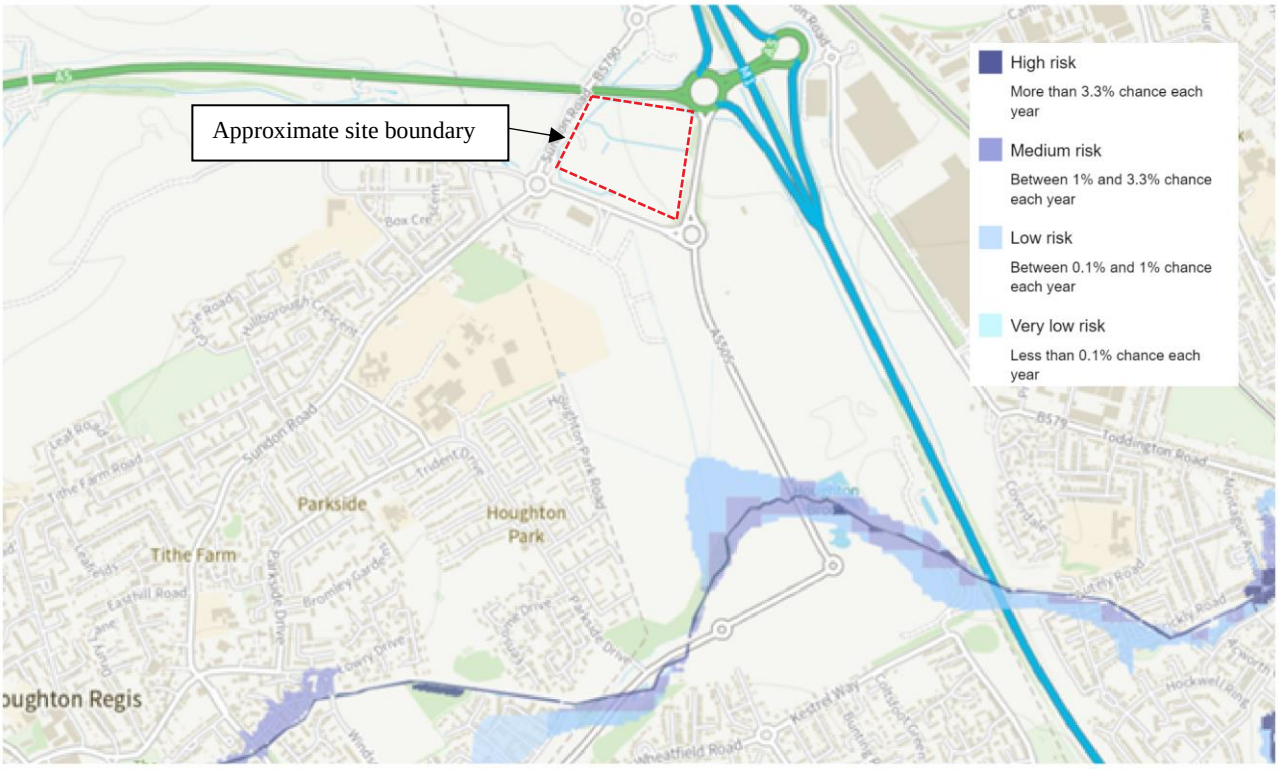


Figure 11: Fluvial and tidal flood risk EA mapping

The fluvial and tidal risk is predominantly located around the River Lee, which is located approximately 750m south of the site.

4.2 Groundwater Flood Risk

Groundwater flooding occurs as a result of water rising up from the underlying aquifer or from water flowing from ephemeral springs. This, and it tends to occur following periods of prolonged wet weather when the water table is high, and the areas at most risk are often low-lying where the water table is more likely to be at shallow depth.

The area around Luton has extensive aquifers, many being used for potable and/or industrial water supply. In addition, most of the watercourses in the area are spring-fed, indicating groundwater levels are at or very close to the ground surface in some locations throughout the study area. The EA website states that groundwater flooding is unlikely in this area and this is confirmed in the Central Bedfordshire Council Level 2 SFRA.

The site is underlain by a highly productive Grey Chalk subgroup aquifer according to the EA aquifer designation map. However, the EA long term flood risk service identifies the groundwater flooding as unlikely in the area. A conservative risk level has been adopted in this design to classify groundwater flood risk as Medium.

4.3 Flooding from Artificial Sources

In general, reservoir flooding is extremely unlikely to occur and there has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, the EA ensures that reservoirs are inspected regularly, and essential safety work is carried out.

Reservoir mapping provided by the EA indicates that the site is not shown to be at risk of reservoir flooding or from any artificial sources. There is a risk of reservoir flooding 1km to the east of the site.

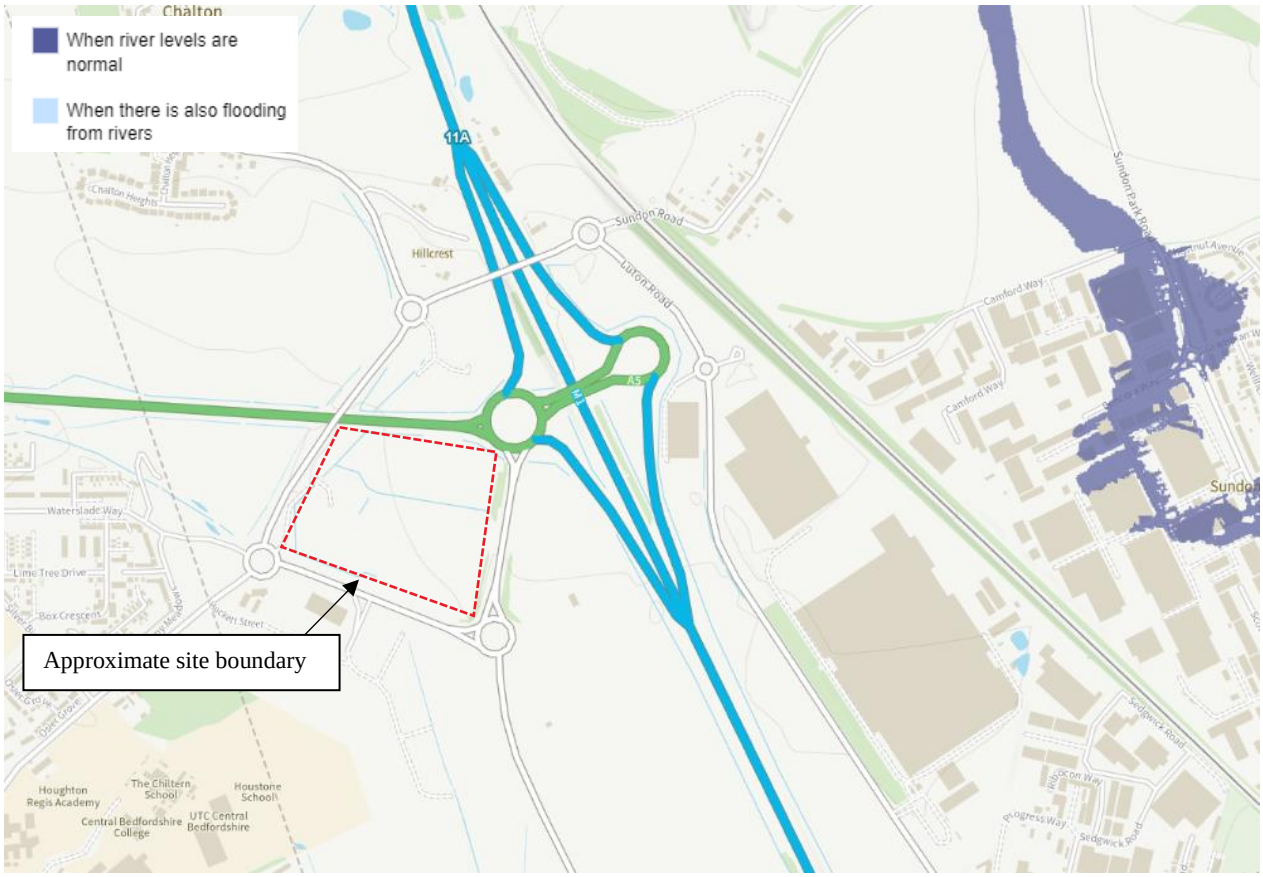


Figure 12: Reservoir flood risk EA mapping

4.4 Pluvial Flood Risk

Flooding attributable to surface water/overland flows typically arises when surface water is unable to discharge directly to a sewer or watercourse. The EA's Flood Maps for Surface Water provide a general indication of potential flow routes or areas that may be at risk of surface water ponding in extreme events. They take a broad account of existing drainage, topography and typical storms which are likely to cause flooding. The creation of surface water flooding mapping often relies on coarse LiDAR data and does not

always take into consideration any localised changes in level. EA surface water flood mapping for the Site is provided in Figure 13 below.

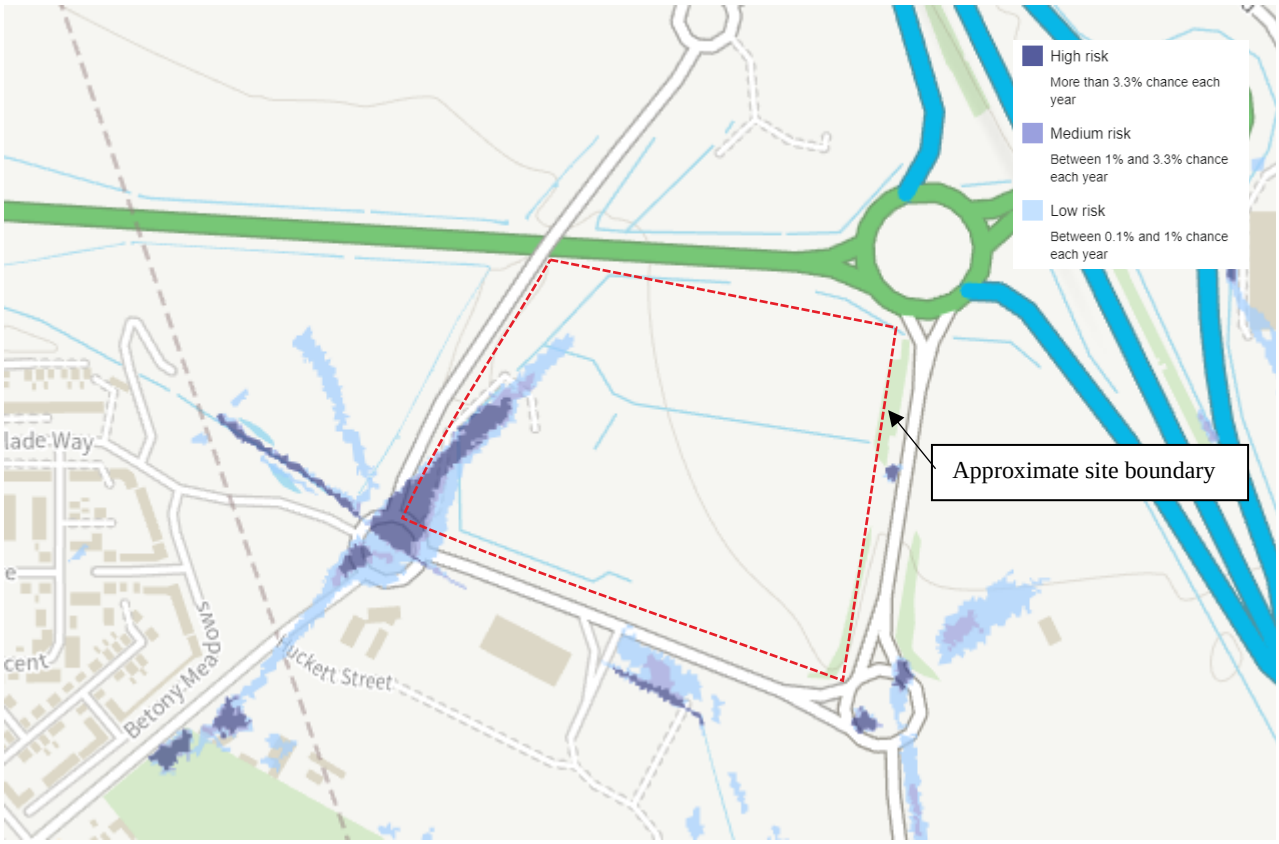


Figure 13: Surface Water Flood Risk Hotspots

Figure 13 shows the extent of surface water flooding at the Site for the 1 in 30-year annual probability (high risk), between 1 in 30-year and 1 in 100-year annual probability (medium risk), between 1 in 100-year and 1 in 1000-year probability (low risk) and then in excess of the 1 in 1000-year probability (very low).

Existing topography of the site is relatively flat with a mound to the north of the site, resulting in reduced overland flow from the north. Surface water flooding will be mitigated through the proposed drainage strategy. The mapping highlights the lower points on the site where pooling is likely to occur and has the potential to form flow paths and ponding.

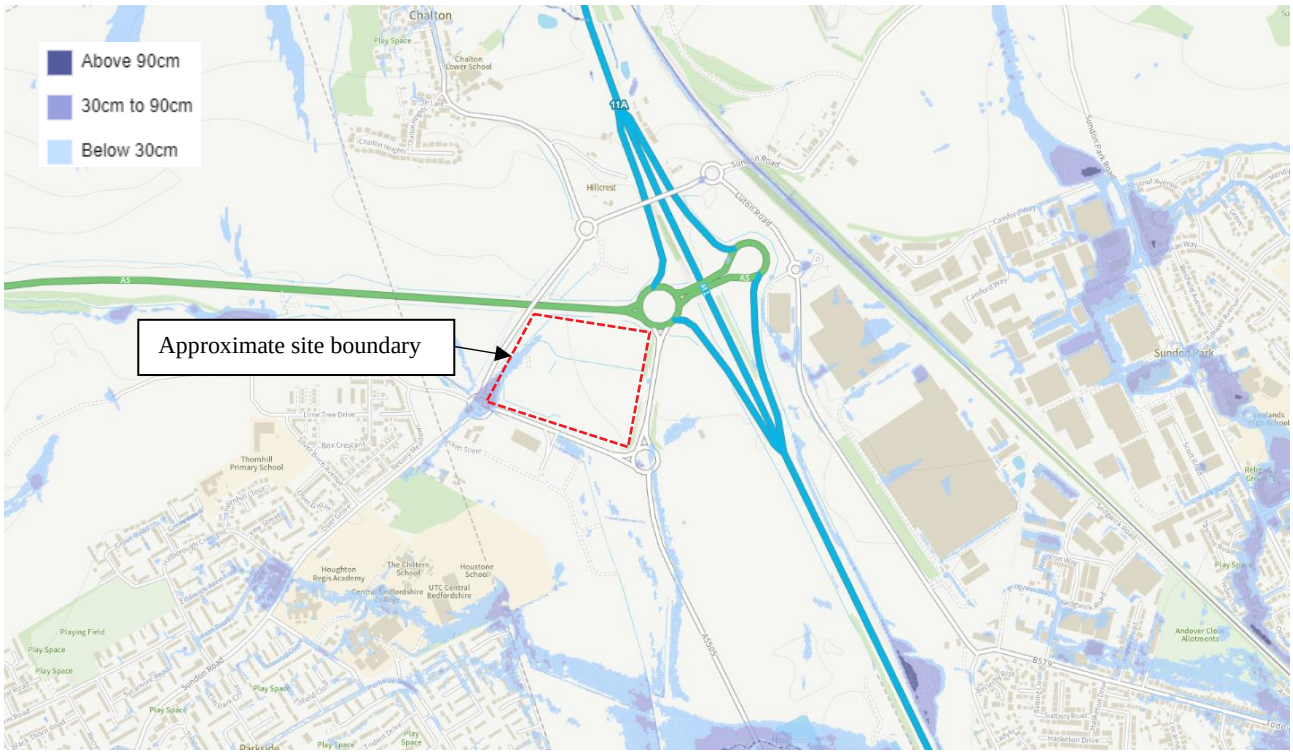


Figure 14: Surface water EA flood mapping depth for a Low risk (0.1% chance each year) flood event

EA flood mapping for a 1 in 100 year flood event shows that surface water flooding will be concentrated in the lower elevation points to the west of the site, with the maximum depth being 30 to 90cm within this zone. This surface water flood risk will be mitigated using an attenuation pond and surface water drainage network . To the south-west of the site along Ouzel Brook there is likely to be some surface water flooding in a low risk flood event. There is a known culvert to the south of the site and a likely conveyance route via the existing culverted ditch along the southern boundary. This flows in a westerly direction which discharges into Ouzel Brooke which makes its way in a south-westerly direction towards the River Ouzel.

Based upon the above evidence and acknowledging that the proposals will introduce a new surface water management strategy across the Site, the risks from pluvial flooding and overland flow is Medium

4.5 Sewer Flooding

Public sewers are designed to protect properties from the risk of flooding in normal wet weather conditions. However, in extreme weather conditions there is a risk that sewer systems can become overwhelmed and result in sewer flooding. Flooding might also be a result of blocked or damaged pipes, but if these are owned by Thames Water or Anglian Water such flooding is the responsibility of the respective Water Utility Company. In certain instances, flooding from sewers can be a combined issue as a result of heavy rainfall resulting in surface water flooding surcharging the underground pipe systems.

Historic sewer flooding instances have occurred in Luton town, however no historic instances of sewer flooding have been noted in the CBC SFRA, where the site is located. Therefore, the risk of sewer flooding is considered low.

The site is not located within a Critical Drainage Area. With Critical Drainage Area (CDA) defined as: *"A discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure."*

4.6 Infrastructure Failure

The water mains are operated and managed by Anglian Water and Affinity Water in the vicinity of the development.

The potable water network in the vicinity of the site consists of a 180mm HPPE distribution main that runs along Woodside Link at the south-eastern boundary of the site. An existing 225 mm diameter foul sewer connection is located at the main entrance of the site. This is currently connected to the foul water network, which is subject to a S104 application for adoption by Anglian Water.

The Affinity Water system resilience is reviewed on a 5-year plan basis, assessing proposed future demand against water available for supply. The postcode is located within the Park Road North (Houghton Regis) District Meter Area (DMA) and Affinity Water have categorised the burst activity in this DMA as low, with only a handful of mains bursts reported per year in recent times.

It is considered that the risk of the site being flooded due to a burst water main is Low.

4.7 Flood Risk Summary

A summary of flood risk is provided in Table 1, following the above assessment from all sources. The level of risk is defined as low, medium, or high and as described by the following:

Low: Probability of flooding is low-negligible and risk to people or property should not form a material consideration for development. There is little or no residual risk.

Medium: Whilst probability of flooding is low, residual risk to people or property may be severe and require the development proposals to consider mitigation or further investigation. Mitigation may include flood resilience measures or protection of key infrastructure.

High: Flooding is likely to occur and should be specifically addressed as part of the development proposals. There is a significant risk to people or property and a flood management plan, evacuation plan/safe refuge plan or permanent flood prevention measures should be provided. May require further modelling, investigation, survey or consultation with LLFA/EA/Drainage Authority.

Table 3: Flood risk summary

Flood Source	Pathway	Comment	Risk
Fluvial and Tidal	River Lee is approximately 750m to the south-east of the site	EA flood maps confirm the site is entirely located within flood Zone 1	Low
Groundwater	Through underlying strata when groundwater levels rise above surface levels	EA flood risk service states that groundwater flooding is unlikely in this area but the site is located on a high productivity chalk aquifer. In the event of groundwater flooding, levels will be designed to direct flows towards on site attenuation.	Medium
Artificial sources	Reservoirs are located approximately 1km east of the site	EA flood risk service states that flooding from reservoirs is unlikely in this area	Low
Pluvial	Site topography is relatively flat with a mound to the north of the seat from east to west, reaching a max height of 10m.	EA flood mapping for a 1 in 100 year flood event shows that surface water flooding will be concentrated in the lower elevation points to the east of the site. Due to proposed development and associated drainage network this risk is limited.	Medium
Infrastructure Failure	180mm HPPE distribution main in the vicinity of the site	Affinity Water have categorised the burst activity in this DMA as low	Low

4.8 Impacts on Local Flood Regime

The proposed SuDS and attenuation features will minimise discharge from the Site to alleviate off Site flood risk/surcharging and ensure that surface water within the development is managed to appropriate levels (including climate change). The above approach ensures that the development proposals offer betterment to the wider local flood regime for storm events up to the 1 in 100-year rainfall event and offer future resilience to the potential effects of climate change.

The proposed drainage network will be designed to the following standards:

- No surcharging on Site for the 1 in 1-year rainfall event;
- No flooding on Site from a 1 in 30-year rainfall event
- No flooding which may pose a significant risk to people and property from a 1:100-year rainfall event (including an allowance for climate change)

5. Development Proposals

5.1 Proposed Development Layout

Development proposals for the site include a data centre campus at the Linmere Island Site, Houghton Regis, Central Bedfordshire. The Site falls within the administrative authority of Central Bedfordshire Council and the planning application will therefore be determined by CBC as the Local Planning Authority.

Proposals include the below:

- Construction of 2no. data centre buildings, comprising approximately 51,300 square metres of gross external floorspace.
- Construction of 1no. substation compound and 2no. MV switchrooms.
- Inclusion of emergency generators, exhaust flues and heat extraction stacks.
- Provision of internal roads and associated areas of hardstanding.
- Parking provision to include 100 car parking spaces (including 6 accessible spaces, 20 active electric vehicle spaces, 20 passive electric vehicle spaces) and 10 cycle parking spaces.
- Installation of security fencing and security guardhouse.
- Installation of 1no. sprinkler tank, 2no. above ground diesel storage tanks and 7no. water tanks.
- Formation of surface water attenuation pond.
- Provision of soft landscaping scheme and ecological enhancement.

6. Surface Water Drainage Proposals

The following section of the report provides details of the greenfield runoff rates associated with the site. It also provides an indicative calculation for the scale of attenuation required to facilitate the proposals and a review of appropriate SuDS that can be considered viable based on the development proposals.

6.1 Existing Surface Water discharge

6.1.1 Greenfield Runoff Rates

Greenfield runoff rates have been obtained for the Site in accordance with FEH methodology using the www.uksuds.com greenfield runoff estimation tool. Rates are provided for the 1 in 1 year, 1 in 30 year and 1 in 100 year in Table below based on a Site area of 6.4ha:

Table 4: Greenfield Runoff Rates (FEH)

Rainfall Event	Greenfield Runoff Rate (l/s)
1 in 1 Year	18.5
1 in 30 Year	51.0
1 in 100 Year	75.6

6.2 Proposed Discharge Rates

In line with The Bedford Group of Drainage Boards, the proposed discharge rates have been calculated as 3l/s/ha of impermeable area, which equates to 15.0l/s.

6.2.1 Climate Change

Current NPPF Guidance stipulates that to allow for the predicted impacts of climate change on surface water runoff, increases to peak rainfall intensity should be used.

Table 5 is an extract from the updated government guidance in relation to climate change allowances for the Upper and Bedford Ouse Management Catchment for the 1% annual exceedance event. For development with a lifetime beyond 2100 the upper end allowances should be assessed at both the 1% and 3.3% annual exceedance probability events for the 2070s epoch.

The development should be designed for the upper end allowance in the 1% annual exceedance probability event.

Table 5: Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline) (Source: Environment Agency Climate Change Guidance)

Annual Exceedance Probability Event	Allowance	Total potential change anticipated for the '2050s' (Development lifetime up to 2060)	Total potential change anticipated for the '2070s' (Development lifetime 2061 to 2125)
3.3%	Upper end	35	35
3.3%	Central	20	25
1%	Upper end	40	40
1%	Central	20	25

Under the NPPF an allowance of 40% for the effects of climate change to the year 2125 should be used to achieve the policy requirements for the proposed redevelopment.

Applying a 40% additional allowance will enable surface water from storm events up to and including the 1 in 100-year event plus climate change to be safely stored on-site without detriment to existing flood risk. As a result, the proposed surface water drainage strategy will serve to improve the resilience of the existing Site to the anticipated changes in rainfall patterns.

6.3 Opportunities for SuDS

Chapter 14 of the NPPF recommends that Sustainable Drainage Systems (SuDS) should be utilised, where possible, within all new drainage schemes. SuDS generally mimic the natural drainage patterns of the undeveloped Site allowing infiltration into the ground (where feasible) and controlling outflow rates from the development. This reduces the impact and risk of flooding on downstream developments and can provide additional benefits such as pollution control, increased biodiversity, and provision of water-based amenity space.\

Table 6 below provides a detailed Site-specific assessment of the suitability of a variety of SuDS considered within the proposed surface water drainage strategy.

Table 6: Detailed SuDS Suitability Appraisal

SuDS Type	Site Suitability		
Blue Roof	A roof specifically intended and designed to store water. This can be via open water surfaces, storage within or beneath porous medium or modular surfaces, within shallow geo-cellular crates or below a raised decking/impermeable surface.		×
	Advantages	**Disadvantages**	
	No additional land take making them effective within dense urban Sites and can contribute significantly to overall Site attenuation requirements.	Additional weight and cost to structure (compared to normal roof design). Damage to waterproof membrane can be critical. Does not always provide treatment dependent on system.	
Site Suitability	Due to plant operations, blue roof options have not been considered feasible		
Green Roof	Multi-layered system that covers the roof of a building with vegetation/landscaping over a drainage layer. Designed to intercept and retain rainfall, reducing the volume of runoff and attenuating peak flows. Typically, either defined as intensive or extensive systems depending on the nature of the selected flora.		×
	Advantages	**Disadvantages**	
	Mimics greenfield state of building footprint for high density developments, good removal of pollutants, ecological benefits, insulates buildings, sound absorption.	Additional weight, not appropriate for steep roofs, maintenance of roof vegetation. Damage to waterproof membrane can be critical.	
Site Suitability	Due to plant operations, green roof options have not been considered feasible		
Rainwater Harvesting	The collection of rainwater (usually within underground storage tanks) for later re-use in either buildings (treated), wash down facilities (commercial) or irrigation.		~
	Advantages	**Disadvantages**	
	Can provide source control of storm water runoff, reduces demand on mains water.	Use is dependent on demand requirements, contributing surface area, and seasonal rainfall characteristics	
Site Suitability	Considered suitable for the site but will be subject to an energy and carbon assessment for treatment to a required standard for use as process water.		
Infiltration Systems/ Soakaways	Any system which stores and discharges water directly to the underlying soils. These are typically soakaways, infiltration trenches, infiltration basins or infiltration blankets.		×
	Advantages	**Disadvantages**	
	Provides groundwater recharge, ease of construction and can have minimal land take	Increased risk of groundwater ingress and pollution. Not suitable for poor draining soils or	

SuDS Type	Site Suitability		
	subject to design. Manages surface water at source.	where infiltrating water may pit structural foundations at risk. Uncertainty over long term performance. Requires comprehensive geotechnical knowledge of underlying soils.	
Site Suitability	Due to existing geology and lack of infiltration, soakaway features have been discounted at the Site.		
Swales	Swales are linear vegetated drainage features in which surface water can be stored or conveyed. They can be designed to allow infiltration, where appropriate.		✓
	Advantages	**Disadvantages**	
	Can be incorporated into landscaping proposals, offers good removal of pollutants, and reduces runoff rates and volumes. Relatively low cost.	Not suitable for steep areas and requires significant land take (not suitable for high density urban Sites). Not suitable in areas with roadside parking.	
Site Suitability	Swales have been incorporated where possible and have been designed specifically to treat as much highway land as possible. Flows will drain through a swale before joining the wider network.		
Filter Drains	Filter drains are shallow trenches filled with stone/gravel that accept runoff through sheet flow and provide temporary subsurface storage (typically provided adjacent to highways or as interception features). They can drain via infiltration or be lined and positively drained via a perforated collection pipe.		✗
	Advantages	**Disadvantages**	
	Hydraulic benefits achieved with filter trenches, trenches can be incorporated into Site landscaping and fit well beside roads and car parks.	High clogging potential without effective pre-treatment, limited to small catchments, high cost of replacing filter material.	
Site Suitability	Due to congestion of underground utilities, filter drains have been discounted from the proposed development.		
Bio-retention Systems/Rain Gardens	Shallow planted features, which receive runoff directly from adjacent hardstanding. Typically under drained, surface water will infiltrate to the underlying piped drainage system and in doing so promote storage, plant up-take and filtration.		✓
	Advantages	**Disadvantages**	
	Easily incorporated into soft landscaping, flexible shape and planting mix and provide good degree of storage (reducing the below ground requirement). High degree of pollutant removal and high biodiversity potential. Reduces need for surface drainage (gullies, channels etc) and low cost.	Requires considered use of water tolerant plant species and landscaping & management. Susceptible to clogging if poorly managed and not suitable for steeply sloping Sites.	
Site Suitability	Where possible, roof areas (typically of smaller buildings such as security offices and water tank houses) will drain into a rain garden, prior to connecting into the wider drainage network. This not only provides a water cleaning features, it also offers amenity space for members of staff on site.		
Tree Pits	Tree pit systems generally accept sheet runoff from adjacent hardstanding areas in the same manner as bio-retention systems. They can be used in urban settings and provide a range of aesthetic benefits.		✗
	Advantages	**Disadvantages**	
	Easily incorporated into soft landscaping with high degree of pollutant removal and high biodiversity potential. Reduces need for surface drainage (gullies, channels etc) and low cost.	Limited tree species/size depending on system and requires careful co-ordination with services due to root spread	
Site Suitability	Due to congestion of underground utilities, tree pits have been discounted from the proposed development.		
Permeable Pavements	Pavements that allow rainwater to infiltrate through the surface and into the underlying layers. The water is temporarily stored before infiltrating the ground (unlined) or discharging to the sewerage system (lined).		✓
	Advantages	**Disadvantages**	

SuDS Type	Site Suitability		
	Provides low-level treatment of highway-derived pollutants (as recognised by the EA) and reduces need for surface drainage (gullies, channels etc). Available in a range of surface types (not just block paving).	Often requires increased construction depth and not suitable for use with Type 1 sub-base. May not be applicable for heavy traffic loadings and irregular maintenance required in certain situations. Not suitable for utility routes.	
Site Suitability	Permeable paving is proposed in all parking spaces. Flows will be captured, cleaned through subbase and then discharge into the proposed network.		
Detention Basins	Detention basins are surface storage basins that provide flow control through attenuation of storm water runoff. They facilitate settling of particulate pollutants. Typically dry, they can also offer multi-functional recreational use.		
	Advantages	**Disadvantages**	
	Can cater for a wide range of rainfall events, easy to maintain, potential for dual land use, can be incorporated in to landscaping proposals and low cost.	Not suitable for steep areas, significant land take and little reduction in runoff volume	✖
Site Suitability	Detention basin is not proposed due to Pond proposal as described below.		
Ponds	Ponds can provide both storm water attenuation and treatment. They are designed to support emergent and submerged aquatic vegetation along their shoreline.		
	Advantages	**Disadvantages**	
	Good removal capability of urban pollutants, high potential ecological, aesthetic and amenity benefits, can cater for all storm events and good community acceptability.	No reduction in runoff volume; Anaerobic conditions can occur without regular inflow; Significantly land take; No suitable for steep Sites;	✓
Site Suitability	A well designed and detailed wetland area will be provided to attenuate and control flows drained from across the site. This area will provide amenity space for site occupants, opportunities for wildlife and vegetation to thrive. The pond will have varying depths with low flow channels and areas of permanent water.		
Sub-Surface/Geo-cellular Storage	Oversized pipes, tank systems and modular geo-cellular systems that can be used to create a below ground storage structure.		
	Advantages	**Disadvantages**	
	Modular and flexible, dual usage (infiltration/storage, high void ratios, can be installed beneath trafficked and soft landscaped areas.	No water quality treatment.	✖
Site Suitability	Deemed unnecessary as attenuation is fully provided within above ground pond.		
Rills/Canals	Formal linear drainage features in which surface water can be stored or conveyed. They can be incorporated with water features such as ponds or waterfalls where appropriate.		
	Advantages	**Disadvantages**	
	Negate the need for underground pipework. Can provide some attenuation. Possible reduction in runoff volume via plant uptake and infiltration.	Potential trip/wheel hazard, disabled access issues.	✖
Site Suitability	Not suitable within the site due to lack of available space.		

Legend

✓ - Suitable for consideration on Site

✖ - Not suitable for consideration on Site

~ - Further consideration to be carried out during detailed design

6.4 Proposed Attenuation

All impermeable areas will be captured within a privately maintained surface water network, draining flows towards an attenuation pond located along the south-western corner of the site. The attenuation pond will provide 4100m^3 and control discharge to the agreed rate of 15.0l/s in all storms up to and including the 1 in 100 year event plus 40% climate change. This area will provide amenity space for site occupants, opportunities for wildlife and vegetation to thrive. The pond will have varying depths with low flow channels and areas of permanent water.

Outfall from the attenuation feature is directly into an Anglian Water 300mm diameter sewer, which drains in a southerly direction towards Ouzel Brook.

6.5 Surface Water Treatment

The integration of SuDS will ensure that surface water runoff will be of sufficient quality so as not to cause contamination of downstream surface waters.

In determining the necessary SuDS treatment methods, reference is made to Table 26.2 and Table 26.3 of the SuDS Manual (CIRIA C753), which have been duplicated in Table 7 and Table 8. The tables outline the 'Simple Index Approach' which sets out the water treatment criteria in relation to land use and SuDS performance evidence.

To ensure sufficient treatment is proposed for surface waters, the total pollution mitigation index of the selected SuDS must equal or exceed the pollution hazard index for the site (land use in blue cells applicable to the development).

Table 7: Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro- carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, home zones and general access roads) and non- residential car parking with infrequent change (e.g. schools, offices)	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro- carbons
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways	High	0.8	0.8	0.9

Table 8: Indicative SUDS mitigation indices for discharges to surface waters

	Mitigation indices		
Type of SuDS component	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bio retention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8

Table 9: Indicative SuDS mitigation indices for proposals

For surface water discharge from residential roofs and parking areas and low traffic toads <300 traffic movements/day			
Pollution hazard indices	Pollution indices		
Land use	TSS	Metals	Hydrocarbons
Commercial yard and delivery areas, non- residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways	0.7	0.6	0.7
Type of SuDS component provided	Required mitigation indices		
Swale	0.5	0.6	0.6
Pond	0.7	0.7	0.5
Total treatment	0.85	0.95	0.85

Following the above assessment, it is demonstrated that the proposals will be able to achieve suitable levels of surface water treatment prior to entering the stormwater system.

In addition to SuDS treatment across the site, a fuel interceptor is proposed prior to offsite discharge, alongside an impermeable liner within the pond to ensure any potential contamination cannot seep into the ground below.

6.6 Exceedance Routes

Exceedance events will be mitigated using surface water drainage features outlined above. During exceedance events, proposed levels across the site will:

- Direct exceedance flows towards landscaped areas away from property
- Fall away from building thresholds

Overflows are expected to be conveyed by Ouzel Brook to drain south-west towards the River Ouzel. The proposed SuDS mitigation features for the development are expected to provide additional retention time and prevent peak flows downstream.

6.7 SuDS Maintenance Schedules

It is the intention that the surface water drainage and SuDS features will be managed and maintained by the building management.

The following tables outline the minimum maintenance requirements for the different elements of the proposed strategy and are intended to form the basis of a final detailed operation and maintenance strategy document produced by the appointed private management company.

Maintenance requirements have been informed by the guidance outlined within CIRIA C753 and current best practice. The following information would also be supplemented by manufacturer's specifications and be dependent on the specific type of system/products used.

Table 10: Operation and Maintenance Requirements for Drainage Pipes

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Remove sediment and debris from inspection chambers and flow control chambers	Annually
	Cleaning of gutters and any filters on downpipes	Annually
	Remove any root ingress	As Required
Occasional Maintenance	CCTV survey of drains to check alignment, cracking and joint displacement	10 Year Intervals

Table 11: Operation and Maintenance Requirements for Swales

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Litter and debris removal.	Monthly (or as required)
	Grass cutting – to retain grass height within specified design range (35-50mm).	Monthly (during growing season, or as required
	Manage other vegetation and remove nuisance plants.	Monthly (at start, then as required)

Maintenance Schedule	Required Action	Frequency
	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	Check for poor vegetation growth due to lack of sunlight or dropping of lead litter and reseed, and cut back adjacent vegetation where possible. Alter plants to better suit conditions (if required)	Annually, 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
	Re-level 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

Table 12: Operation and Maintenance Requirements for Permeable Block Paving

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Brushing and vacuuming (standards	3 times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site specific observations of clogging or manufacturers recommendations
Occasional Maintenance	Repair/rehabilitate inlets, outlet, overflows and vents.	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 strip, has been raised to within 50mm of the level of paving	Annually
	Remedial work to any depressions and rutting considered detrimental to the structural performance of the pavement or a hazard to users	As required
	Rehabilitation of surface and upper sub-structure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to clogging)

Maintenance Schedule	Required Action	Frequency
Monitoring	Initial inspection	Monthly 3 months after installation
	Inspect for evidence of poor operation and/or weed growth. If required, take remedial action	3-monthly, 48 hours after a large storm
	Inspect silt accumulation rates and establish appropriate brushing rates	Annually
	Monitor inspection chambers	Annually

Table 13: Maintenance Regime for Ponds

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Litter removal	As required
	Grass Cutting – public areas	Monthly (during growth season)
	Grass Cutting – meadow grass	Half yearly (spring – before nesting season, and Autumn)
	Inspect vegetation to pond edge and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from waters edge to a minimum of 1.0m above water level	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from forebay	1-5 years, or as required
	Remove sediment from one quadrant of the main boday of ponds without sediment forebays	2-10 years
Occasional Maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	>25 years (usually)
Remedial Actions	Repair of erosion or other damage	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realignment of rip-rap or other damage	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
Monitoring	Inspect structures for evidence of poor operation	Monthly/after large storms
	Inspect banksides, structures, pipework etc… for evidence of physical damage	Monthly/after large storms
	Inspect silt accumulation rates and establish appropriate silt removal frequencies	Half yearly
	Check penstocks and other mechanical devices	Half yearly

7. Foul Water Drainage Proposals

Although not a mandatory requirement of the NPPF this FRA has considered the management of foul water disposal from the development.

7.1 Existing Foul Drainage

Due to the current site being greenfield land, there are currently no foul flows from the development.

7.2 Proposed Foul Drainage

Foul flows produced by the development will comprise domestic flows from staff areas, trade effluent produced from building activities and fuel storage points. Prior to the connection into the main network, a full separator is proposed to offer cleansing to areas near the fuel storage point. A Trade Effluent Consent application (G/02 form), including volumes and flow rates, will be submitted for Anglian Water approval.

Due to the depth of drainage outlet connection from the Data Centre and the invert level of the proposed point of connection, a portion of the western development will drain towards a package pumping station. Flows from this will be pumped via a short rising main towards a gravity break chamber before discharging into the wider gravity network.

7.3 Point of Connection to Existing Public Sewer

The proposed point of connection is in to the existing Anglian Water network located near the main entrance to the development along the southern boundary.

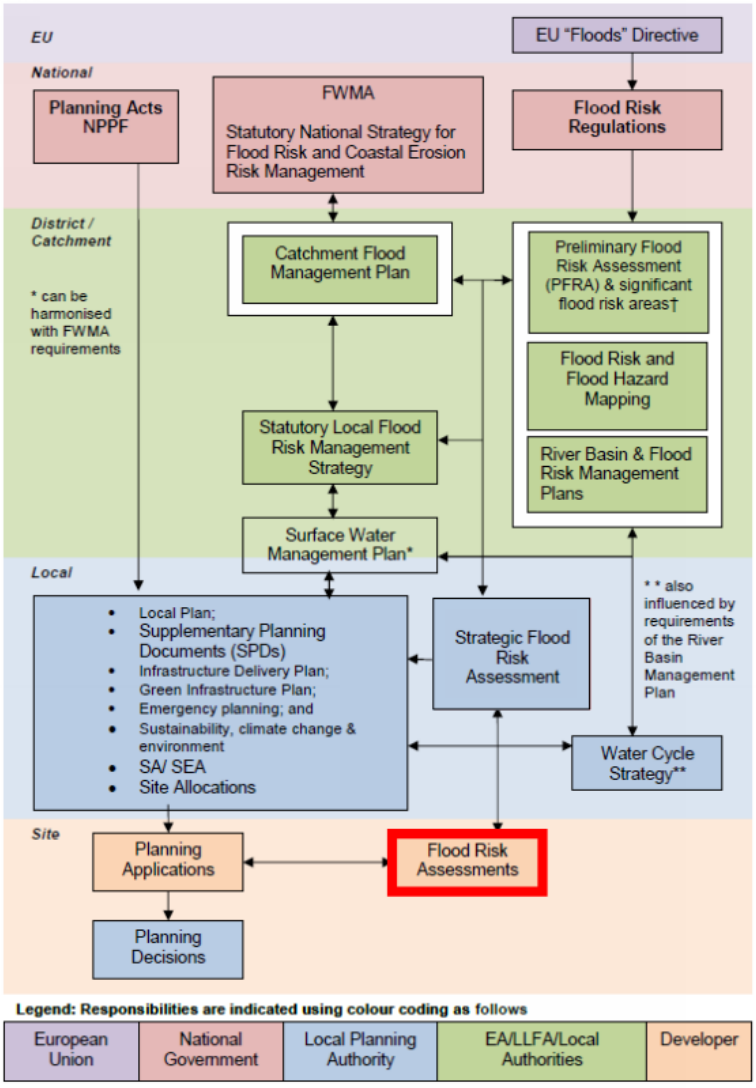
8. Conclusion

This FRA is based on observations, a review of published data and hydraulic modelling. The following points are considered pertinent to the proposed development's suitability for this Site:

- The site is located within Flood Zone 1.
- Flood risk from tidal/fluvial sources, artificial sources and infrastructure failure are all considered to be low, with pluvial and groundwater flood risk considered medium.
- In accordance with the requirements of Chapter 14 of the NPPF consideration has been given both to risk to the site, and to potential offsite risk as a result of the proposed development.
- Based on our understanding of the site setting and the proposals, it is considered that the development can be constructed and operated safely and will not increase flood risk elsewhere.
- Proposed surface water discharge rate of 15.0l/s, in line with Bedford Group of Drainage Boards guidance (3 l/s/ha of impermeable contributing area).
- Designs provide resilience for all storm events up to and including the 1 in 100 year event, plus 40% climate change realised over that time period.
- Surface water drainage proposals include a site wide network of permeable paving, swales, rain gardens and an attenuation pond – all of which provide cleansing to surface water prior to discharge into the Ouzel Brook.
- Foul flows will be collected within a privately maintained drainage network and discharge into the existing Anglian Water foul network within the highway beyond the southern boundary.
- The proposal for surface water management is consistent with the aims of the NPPF and demonstrates a sustainable approach consistent with current best practice. This ensures that the site is not at increased risk of flooding and provides future resilience to the effects of climate change.

Appendix A

The overarching aim of development and flood risk planning policy in the UK is to ensure that the potential risk of flooding is considered at every stage of the planning process. The following diagram outlines the key planning policy for flood risk management and associated documents.



A.1 International Planning Policy

A.1.1 Water Framework Directive (2000/60/EC)

The Water Framework Directive (WFD) sets out objectives prioritising future water protection across the European Union, with the aim of achieving improvements in the quality of polluted water bodies and maintaining the quality of clean water bodies.

Member states were required to transpose the Water Framework Directive (WFD) into domestic law by December 2003. This took place in England and Wales through the WFD England and Wales Regulations 2003 (WFD Regulations). In the UK, the Environmental Agency (EA) is the 'competent authority' under the WFD Regulations.

Member water bodies are categorised as: 'rivers'; 'lakes'; 'transitional waters'; 'coastal waters'; or 'groundwaters'. Each is identified within each category as being 'at risk'; 'probably at risk'; 'probably not at

risk'; or 'not at risk' of failing WFD objectives with regard to 'water abstraction and flow regulation'; 'physical or morphological alteration'; or 'alien species'.

Under the WFD Regulations, each river basin district must have a river basin management plan in place which sets out environmental objectives for the district and a programme of measures to be applied in order to achieve those objectives. Water in rivers, estuaries, coasts and aquifers will improve as a result of the measures set out in the river basin management plans.

A.1.2 EU Floods Directive (2007/60/EC)

The aim of the Directive is to provide a consistent approach across the European Union to reducing and managing the risks posed by flooding to human health, the environment, cultural heritage and economic activity. The Floods Directive is to be delivered in conjunction with the objectives of the Water Framework Directive (2000/60/EC) to deliver a better water environment through river basin management.

In the UK, the Floods Directive is transposed into law via the Flood Risk Regulations by setting out the duties of local government in assessing flood risk to their area.

A.2 National Policy and Guidance

A.2.1 Environmental Permitting Regulations (2016)

The Environmental Permitting Regulations 2016 consolidate and replace the 2010 Regulations and subsequent amendments. The permitting regime covers a range of activities that release emissions to land, air and water, or that involve waste.

Schedule 21 relates to water discharge activities and Schedule 25 relates to flood risk activities. Schedule 22 relates to groundwater activities and the regulations place a duty on regulating authorities to implement the Water Framework Directive.

A.2.2 The Water Resources Act (1991) and Water Acts (2003, 2014)

The Water Resources Act 1991 provides legislation for the control of the pollution of water resources. Under this Act, offences of polluting controlled waters occur if a person knowingly permits any poisonous, noxious or polluting matter or any solid waste matter to enter any controlled waters. The Water Resources Act 1991 also provides an all-embracing system for the licensing of the abstraction of water for use, which is administered by the EA. The Water Acts (2003, 2014) modernise water legislation and amend the Water Resources Act 1991 to improve long-term water resource management.

A.2.3 Flood Risk Regulations (2009)

The Flood Risk Regulations 2009 transpose the Floods Directive (2007/60/EC) into law in England and Wales.

The regulations required the Lead Local Flood Authority (LLFA), to produce:

- A Preliminary Flood Risk Assessment (PFRA) by December 2011;
- Flood hazard and flood risk maps by December 2013; and
- A Local Flood Risk Management Strategy by December 2015.

A.2.4 The Flood and Water Management Act (2010)

The Flood and Water Management Act 2010 (FWMA), which received Royal Assent on 8 April 2010, takes forward some of the proposals in three previous documents published by the UK Government:

- Future Water;
- Making Space for Water; and
- The Government's Response to the Sir Michael Pitt's Review of the summer 2007 Floods.

The FWMA gives the EA a strategic overview of the management of flood and coastal erosion risk in England. In accordance with the Government's Response to the Pitt Review, it also gives upper tier local authorities in England responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

A.2.5 Land Drainage Acts (1991, 1994)

The water quality and flood risk management of controlled waters including rivers and aquifers is protected by legislation under the Land Drainage Acts (1991, 1994).

A.2.6 National Planning Policy Framework (2023)

The NPPF includes policies on flood risk and minimising the impact of flooding under Section 14, Meeting the challenge of climate change, flooding and coastal change (Paragraphs 157 – 179). The NPPF supersedes the Planning Policy Statement 25 (PPS25).

The NPPF states that:

Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards.

All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property.

When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment59. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- *within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;*
- *the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;*
- *incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;*
- *any residual risk can be safely managed; and*
- *safe access and escape routes are included where appropriate, as part of an agreed emergency plan.*

A.2.7 Sewerage Section Guidance Appendix C – Design and Construction Guidance (2020)

[Design and Construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England ("the Code")]

Adopted drainage networks needs to meet the criteria outlined in the Design and Construction Guidance (2020). A piped drainage system is required to not surcharge for a 1 in 1-, 1 in 2-, or 1 in 5-year event depending on site conditions or flood the ground in a 1 in 30-year event using a design storm with the critical

duration relevant to the site (i.e. the worst-case for a given return period). Private drainage systems also tend to use these criteria as a basis for design. Adoption of new sewers or abandonment of old sewers should take place in accordance with the Water Industry Act 1991, Sections 104 and 116 respectively.

A.2.8 DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems (2015)

The DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems provides guidance on:

- Flood risk outside the development;
- Peak Flow Control;
- Volume Control;
- Flood Risk within the development;
- Structural Integrity;
- Designing for Maintenance Considerations
- Construction

Key extracts from this document are provided below:

Peak flow control

S2 For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.

Volume control

S4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.

S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

Flood risk within the development

S7 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.

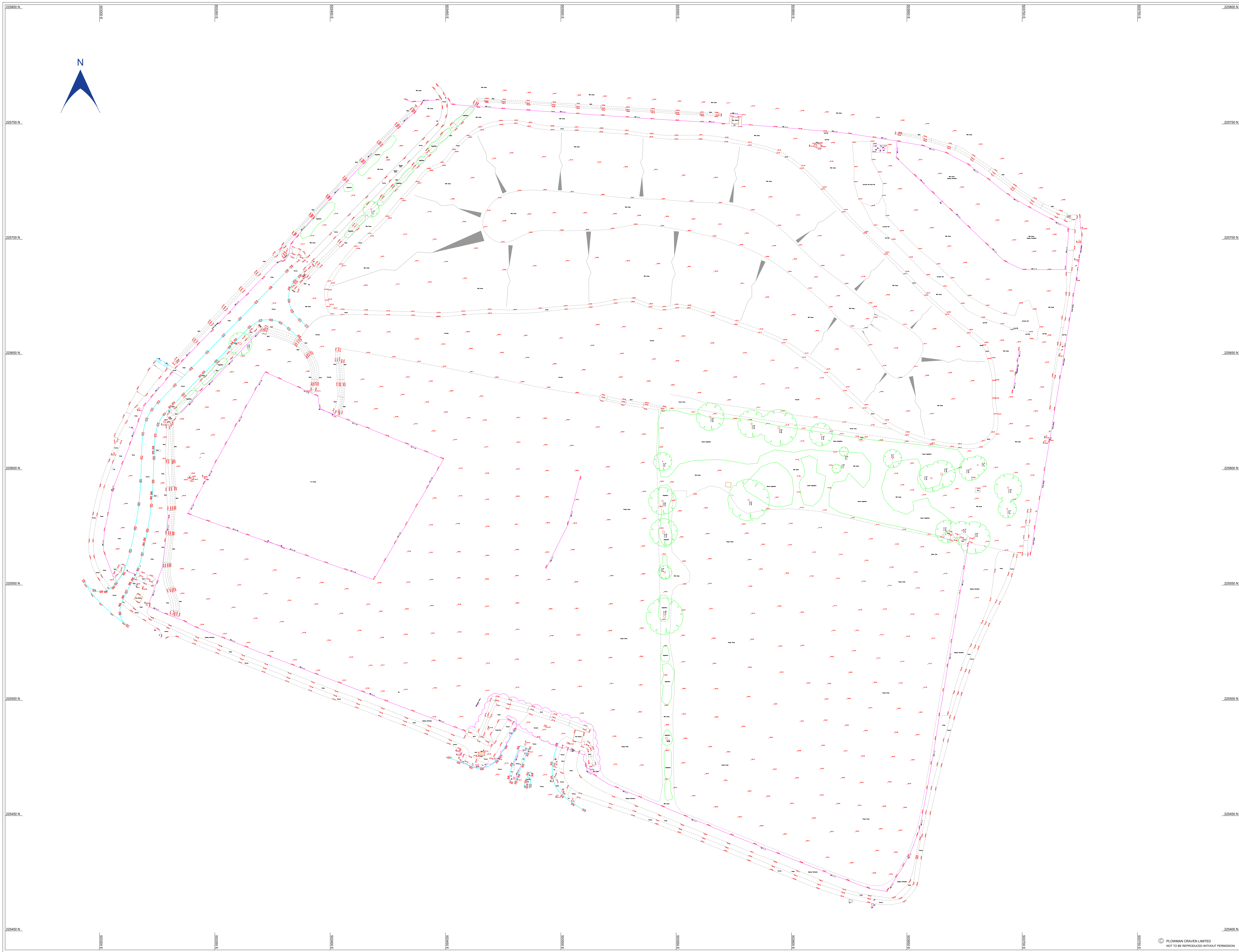
S8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.

S9 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.

The standards are supported by Practice Guidance prepared by the Local Authority SuDS Officer Organisation (LASOO).

Appendix B

B.1 Topographical Survey



STANDARD ABBREVIATIONS

A/C	Air Conditioner	LB	Litter Bin
ATM	Automated Telling Machine	LP	Lamp Post
B	Bollard	Max	Maximum
BB	Belisha Beacon	Mb	Multibole
Bh	Borehole	MH	Manhole
Br	Brick	Min	Minimum
BrS	Brick Setts	Mkr	Marker
BRW	Brick Retaining Wall	NB	Notice Board
BS	Bus Stop	NP	Name Plate
BT	British Telecom	OBF	Open Boarded Fence
BW	Brick Wall	O/H	Overhead
BWF	Barbed Wire Fence	OSBM	Ordnance Survey Bench Mark
CBF	Close Boarded Fence	P	Post
CCTV	Closed Circuit Television	PB	Pillar Box
CIF	Corrugated Iron Fence	PGM	Permanent Ground Marker
CL	Cover Level	PLt	Pavement Light
CLF	Chain Link Fence	PM	Parking Meter
Col	Column	PRF	Post and Rail Fence
Conc	Concrete	PS	Paving Stones
CoW	Cable on Wall	PWF	Post and Wire Fence
CPS	Concrete Paving Slabs	RE	Rodding Eye
CTV	Cable Television IC	RG	Road Gully
d	depth	RS	Road Sign
DC	Duct Cover	RSJ	Rolled Steel Joist
DH	Duct Height	RWP	Rain Water Pipe
DP	Down Pipe	s	spread
DrC	Drainage Channel	SB	Sign Board
EIC	Electrical Inspection Cover	SBM	Site Bench Mark
EJB	Electrical Junction Box	SC	Stop Cock
EP	Electricity Pole	SF	Security Fence
ER	Earthing Rod	ShB	Shrub Bed
ESG	Electrical Switchgear	SL	Sump Level
FB	Flower Bed	SO	Smoke Outlet
FH	Fire Hydrant	SP	Sign Post
FL	Floor Level	SV	Stop Valve
Flt	Floodlight	T	Telephone
g	girth	Tac	Tactile Paving
G	Gully	TBM	Temporary Bench Mark
GC	Gas Cock	TCB	Telephone Call Box
GM	Gas Meter	TCP	Traffic Control Post
GP	Gate Post	TIC	Telephone Inspection Cover
GV	Gas Valve	TJB	Telephone Junction Box
h	height	TL	Traffic Light
HR	Handrail	TLCB	Traffic Light Control Box
IB	Illuminated Bollard	TLIC	Traffic Light Inspection Cover
IC	Inspection Cover	TP	Telephone Pole
IL	Invert Level	Typ	Typical
IRF	Iron Railing Fence	V	Vent
IRS	Illuminated Road Sign	VP	Vent Pipe
JB	Junction Box	W	Window
KO	Kerb Outlet	WM	Water Meter
L	Light	WV	Water Valve

LEGEND

2.70	Floor to ceiling height
F2.70	Floor to false ceiling height
22.70	Ceiling level
F22.70	False ceiling level
	Stair/step arrows point up
	Sloping ceiling arrows point up
	Roof arrows point down
	Assumed detail

The identification of service covers has been made by a surface inspection only - critical identifications should be verified by the lifting of covers or a full utilities survey

Due to the inherent instability of paper materials, drawings plotted on paper may be stretched and distorted - dimensions scaled from paper plots should therefore be treated with caution

ISSUES & REVISIONS

Issue	Details	By	Date
A	Original Issue	PC	30/06/2022

This survey is commensurate with band F accuracy, as outlined in the RICS survey detail accuracy banding table, presented at 1:500

All levels are in metres and are above Ordnance Survey Newlyn Datum derived by multiple network RTK GPS observations

The survey grid shown on this drawing is positioned on Ordnance Survey (OS) National Grid, obtained by multiple network RTK GPS observations

Unless otherwise stated, levels have been taken to finished floor surface

All quoted dimensions are in metres

Drawing units are metres

CLIENT
Arup

Central Square
Forth Street
Newcastle Upon Tyne
NE1 3PL

PROJECT TITLE

NDA Houghton Regis
Sundon Road

Topographical Survey

PRESENTATION SCALE 1:500 @ A0

DATE OF ORIGINAL SURVEY June 2022

PC PROJECT No. 47464 CHECKED DGS

DRAWING No. 47464T-05 ISSUE A

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Appendix C

C.1 Drainage Strategy Drawing & Calculations

A0

A5 - DUNSTABLE NORTHERN BYPASS

EXISTING SUBSTATION

CHALTON INTERCHANGE

PROPOSED MOUND & BOUNDARY TREATMENT

LINMERE PARK

SUNDON RD

POND INLET HEADWALL
IL = 125.95

BUILDING A

SPRINKLER TANKS

PUMP HOUSE

PROPOSED RAIN GARDEN

GENERATOR YARD

PROPOSED SWALE

PV PANELS

WATER STORAGE TANKS

POND OUTLET HEADWALL
IL = 125.75

FLOW CONTROL CHAMBER RESTRICTING FLOWS TO 15.0 l/s

POINT OF CONNECTION INTO EXISTING 300mm DIAMETER SEWER
IL = 125.64

BIKE SHELTER

SMOKING SHELTER

LOADING BAY

MV ROOM

ATTENUATION POND & WETLAND HABITAT

FUEL FILL POINT

BIN STORE

SUBSTATION COMPOUND

INDICATIVE LOCATION OF EXISTING SURFACE WATER NETWORK

EXISTING SUBSTATION

INDICATIVE LOCATION OF PETROL INTERCEPTOR PRIOR TO OUTLET INTO POND

POND INLET HEADWALL
IL = 125.80

FOOTPATH

SECURITY HUT

PROPOSED RAIN GARDEN

FOUL PUMPING STATION

GRAVITY BREAK CHAMBER

BUILDING B

PV PANELS

GENERATOR YARD

WATER STORAGE TANKS

SMOKING SHELTER

BIKE SHELTER

LOADING BAY

BIN STORE

FUEL FILL POINT

MV ROOM

WOODSIDE LINK

CHANTRY WAY

POINT OF CONNECTION INTO EXISTING FOUL NETWORK

MAIN ENTRANCE

INDICATIVE LOCATION OF EXISTING FOUL WATER NETWORK

EXISTING SUBSTATION

FARMSTEAD

LIDL

1. THIS DRAWING SHOULD BE PRINTED IN COLOUR AND READ IN CONJUNCTION WITH ALL ASSOCIATED DESIGN DOCUMENTATION, PROVIDED AS PART OF THIS PLANNING APPLICATION.
2. DO NOT SCALE FROM THIS DRAWING. REFER TO ARCHITECT'S DRAWINGS FOR BUILDING DIMENSION INFORMATION.

LEGEND

- PLANNING BOUNDARY

EXISTING

- EXISTING SURFACE WATER
- EXISTING FOUL WATER

SURFACE WATER

- MANHOLE
- PIPE
- HEADWALL
- CHANNEL DRAIN
- GULLY
- PETROL INTERCEPTOR
- PERMEABLE PAVING

FOUL WATER

- INSPECTION CHAMBER/ MANHOLE
- PIPE
- RISING MAIN
- PUMPING STATION
- FULL RETENTION SEPERATOR
- LINEAR CHANNEL

INDUSTRIAL WATER

- PIPE
- INDUSTRIAL WATER MANHOLE

Issue	Date	Description
P01	04/10/2024	Issued for Planning

0 5 10 20 Metres
Scale 1:500

N

ARUP

8 Fitzroy Street
London W1T 4BD
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www.arup.com

Client
Colliers Properties LLC

Project Title
Linmere Island Site,
Houghton Regis

Key Plan

Drawing Title
SITE - SURFACE AND FOUL WATER DRAINAGE - OVERALL PLAN

Scale at A0	Dsg/Drw/Chkd/Appd
1:500	TC/TC/SJ/SJ

Role: Civils
Status: Planning

Arup Job No	Rev
302321	P01

ID
302321-ARP-S-XX-DR-C-1001

Do not scale

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	126.243	0.493	14.9	1281.4	O K
30 min Summer	126.381	0.631	14.9	1671.3	O K
60 min Summer	126.518	0.768	14.9	2067.5	O K
120 min Summer	126.647	0.897	14.9	2457.2	O K
180 min Summer	126.717	0.967	14.9	2672.2	O K
240 min Summer	126.762	1.012	14.9	2811.1	O K
360 min Summer	126.819	1.069	14.9	2990.2	O K
480 min Summer	126.855	1.105	14.9	3106.9	O K
600 min Summer	126.879	1.129	14.9	3184.8	O K
720 min Summer	126.896	1.146	14.9	3237.3	O K
960 min Summer	126.913	1.163	14.9	3293.6	O K
1440 min Summer	126.914	1.164	14.9	3297.2	O K
2160 min Summer	126.880	1.130	14.9	3186.7	O K
2880 min Summer	126.843	1.093	14.9	3067.9	O K
4320 min Summer	126.769	1.019	14.9	2833.8	O K
5760 min Summer	126.692	0.942	14.9	2592.7	O K
7200 min Summer	126.611	0.861	14.9	2346.6	O K
8640 min Summer	126.537	0.787	14.9	2125.1	O K
10080 min Summer	126.469	0.719	14.9	1924.1	O K
15 min Winter	126.299	0.549	14.9	1437.3	O K
30 min Winter	126.452	0.702	14.9	1875.1	O K
60 min Winter	126.602	0.852	14.9	2321.2	O K
120 min Winter	126.746	0.996	14.9	2763.1	O K
180 min Winter	126.824	1.074	14.9	3006.1	O K
240 min Winter	126.873	1.123	14.9	3164.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	139.706	0.0	1082.2	34
30 min Summer	91.224	0.0	1244.9	49
60 min Summer	56.713	0.0	1985.5	78
120 min Summer	34.065	0.0	2306.2	138
180 min Summer	24.952	0.0	2382.1	198
240 min Summer	19.892	0.0	2359.9	256
360 min Summer	14.403	0.0	2305.9	374
480 min Summer	11.456	0.0	2259.5	494
600 min Summer	9.585	0.0	2220.9	612
720 min Summer	8.282	0.0	2187.7	730
960 min Summer	6.572	0.0	2131.4	968
1440 min Summer	4.737	0.0	2040.1	1444
2160 min Summer	3.409	0.0	4303.8	1940
2880 min Summer	2.697	0.0	4233.3	2292
4320 min Summer	1.936	0.0	3857.3	3080
5760 min Summer	1.528	0.0	5436.6	3912
7200 min Summer	1.272	0.0	5651.1	4624
8640 min Summer	1.094	0.0	5827.0	5440
10080 min Summer	0.963	0.0	5964.6	6160
15 min Winter	139.706	0.0	1174.8	34
30 min Winter	91.224	0.0	1256.0	49
60 min Winter	56.713	0.0	2193.4	78
120 min Winter	34.065	0.0	2389.8	136
180 min Winter	24.952	0.0	2351.3	194
240 min Winter	19.892	0.0	2316.2	252

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	126.937	1.187	14.9	3370.8	O K
480 min Winter	126.979	1.229	14.9	3508.5	O K
600 min Winter	127.007	1.257	14.9	3602.7	O K
720 min Winter	127.027	1.277	14.9	3668.7	O K
960 min Winter	127.050	1.300	14.9	3746.2	O K
1440 min Winter	127.060	1.310	14.9	3779.6	O K
2160 min Winter	127.033	1.283	14.9	3688.9	O K
2880 min Winter	126.985	1.235	14.9	3529.8	O K
4320 min Winter	126.896	1.146	14.9	3237.1	O K
5760 min Winter	126.799	1.049	14.9	2927.3	O K
7200 min Winter	126.689	0.939	14.9	2585.2	O K
8640 min Winter	126.570	0.820	14.9	2224.0	O K
10080 min Winter	126.464	0.714	14.9	1910.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.403	0.0	2264.8	368
480 min Winter	11.456	0.0	2228.7	484
600 min Winter	9.585	0.0	2201.3	600
720 min Winter	8.282	0.0	2179.3	718
960 min Winter	6.572	0.0	2145.8	948
1440 min Winter	4.737	0.0	2109.0	1402
2160 min Winter	3.409	0.0	4439.9	2056
2880 min Winter	2.697	0.0	4291.1	2624
4320 min Winter	1.936	0.0	3961.7	3292
5760 min Winter	1.528	0.0	6086.3	4216
7200 min Winter	1.272	0.0	6325.0	5128
8640 min Winter	1.094	0.0	6522.4	5880
10080 min Winter	0.963	0.0	6682.1	6656

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.413	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 4.970

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.000	4	8	1.000	8	12	1.000	12	16	1.000	16	20	0.970

Model Details

Storage is Online Cover Level (m) 127.500

Tank or Pond Structure

Invert Level (m) 125.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2438.0	1.500	3500.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0167-1500-1500-1500
Design Head (m)	1.500
Design Flow (l/s)	15.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	167
Invert Level (m)	125.750
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	15.0	Kick-Flo®	0.951	12.1
Flush-Flo™	0.442	14.9	Mean Flow over Head Range	-	13.0

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.0	0.800	13.8	2.000	17.2	4.000	23.9	7.000	31.3
0.200	13.5	1.000	12.4	2.200	18.0	4.500	25.3	7.500	32.4
0.300	14.5	1.200	13.5	2.400	18.7	5.000	26.6	8.000	33.4
0.400	14.9	1.400	14.5	2.600	19.5	5.500	27.9	8.500	34.4
0.500	14.9	1.600	15.5	3.000	20.9	6.000	29.1	9.000	35.4
0.600	14.7	1.800	16.3	3.500	22.5	6.500	30.2	9.500	36.3