



Coopers Lane BESS, Kirkby

Surface Water Drainage Assessment

For Axis

KRS.0310.073.R.001.A

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Coopers Lane BESS, Kirkby

Project	Surface Water Drainage Assessment
Client	Axis
Status	Final
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EXECUTIVE SUMMARY

The purpose of this report is to assess the potential for disposing of surface water. This Surface Water Drainage Assessment demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of the National Planning Policy Framework (NPPF).

The development should not therefore be precluded on the grounds of flood risk or drainage.

1.0 INTRODUCTION

1.1 Background

This Surface Water Drainage Assessment has been prepared by KRS Enviro at the request of Axis to support a planning application for the proposed development at Coopers Lane, Kirkby.

It is recognised that developments that are designed without regards to the surface water runoff are likely to result in increased impact on existing off-site service provision and may lead to an increase in flood risk.

1.2 Purpose

This Surface Water Drainage Assessment complies with the principles of SuDS presented in the new Defra non-statutory technical standards for SuDS¹, and the National Planning Policy Framework (NPPF)². A Surface Water Drainage Assessment is presented with reference to the hydrological and hydrogeological context of the development.

The report findings are based upon professional judgement and are summarised below with detailed recommendations provided at the end of the report. The report includes baseline data on flood risk from the Environment Agency, rainfall data from the Flood Estimation Handbook (FEH) and hydrogeological information from the British Geological Survey (BGS). The assessment will summarise and refer to these datasets in the text.

1.3 Surface Water Management Overview

It is recognised that consideration of flood issues should not be confined to the floodplain. The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in the catchment, particularly flooding downstream. For example, replacing vegetated areas with roofs, roads and other paved areas can increase both the total and the peak flow of surface water runoff from the development site. Changes of land use on previously developed land can also have significant downstream impacts where the existing drainage system may not have sufficient capacity for the additional drainage.

A SuDS Strategy for the site proposals has been developed to manage and reduce the flood risk posed by the surface water runoff from the site. An assessment of the surface water runoff rates has been undertaken, in order to determine the surface water options and attenuation requirements for the site. The assessment considers the impact of the development compared to current conditions. Therefore, the surface water attenuation requirement for the developed site can be determined and reviewed against existing arrangements.

The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development unless specific off-site arrangements are made and result in the same net effect.

¹ Department for Environment, Food and Rural Affairs (2015) Non-statutory technical standards for SuDS (March 2015).

² Ministry of Housing, Communities and Local Government (2021). National Planning Policy Framework (NPPF).

1.4 What are SuDS?

A Sustainable Drainage System (SuDS) is designed to replicate, as closely as possible, the natural drainage from the site (before development) to ensure that the flood risk downstream of the site does not increase as a result of the land being developed. SuDS can also significantly improve the quality of water leaving the site and can enhance the amenity and biodiversity that a site has to offer.

There are a range of SuDS options available to provide effective surface water management that intercept and store excess runoff. The standards set out appropriate design criteria based on four main parameters:

- 1) Runoff Destination (in order of preference)
 - a. To ground;
 - b. To surface water body;
 - c. To road drain or surface water sewer;
 - d. To combined sewer
- 2) Peak flow rate and volume (pre-and post-development)
- 3) Water Quality (based on potential hazards arising from development and sensitivity of the runoff destination)
- 4) Function (design; flood risk; operation and maintenance)

These parameters are then used to develop a drainage strategy based on the following six principles;

- 1) Manage surface runoff at source
- 2) Manage on the surface
- 3) Utilise public space and integrate into the drainage design
- 4) Effective operation and maintenance
- 5) Account for climate change and changes in impermeable area
- 6) Affordability

This report aims identify the most practicable runoff destination and drainage parameters for the site and is presented with reference to the hydrological and hydrogeological context of the development.

1.5 Report Structure

This Surface Water Drainage Assessment has the following report structure:

- Section 2 details the location and the existing and proposed development;
- Section 3 details the possible surface water discharge destinations
- Section 4 outlines the surface water peak flow;
- Section 5 outlines the surface water drainage strategy; and

- Section 6 presents conclusions.

2.0 LOCATION & DEVELOPMENT DESCRIPTION

2.1 Site Location

The site is situated off Coopers Lane (A5208) in Kirkby, on a plot of land measuring approximately 0.4028 hectares (ha). The site is centred on approximate National Grid Reference (NGR) 343641, 397142. The location of the site is shown on Figures 1 and 2 below.

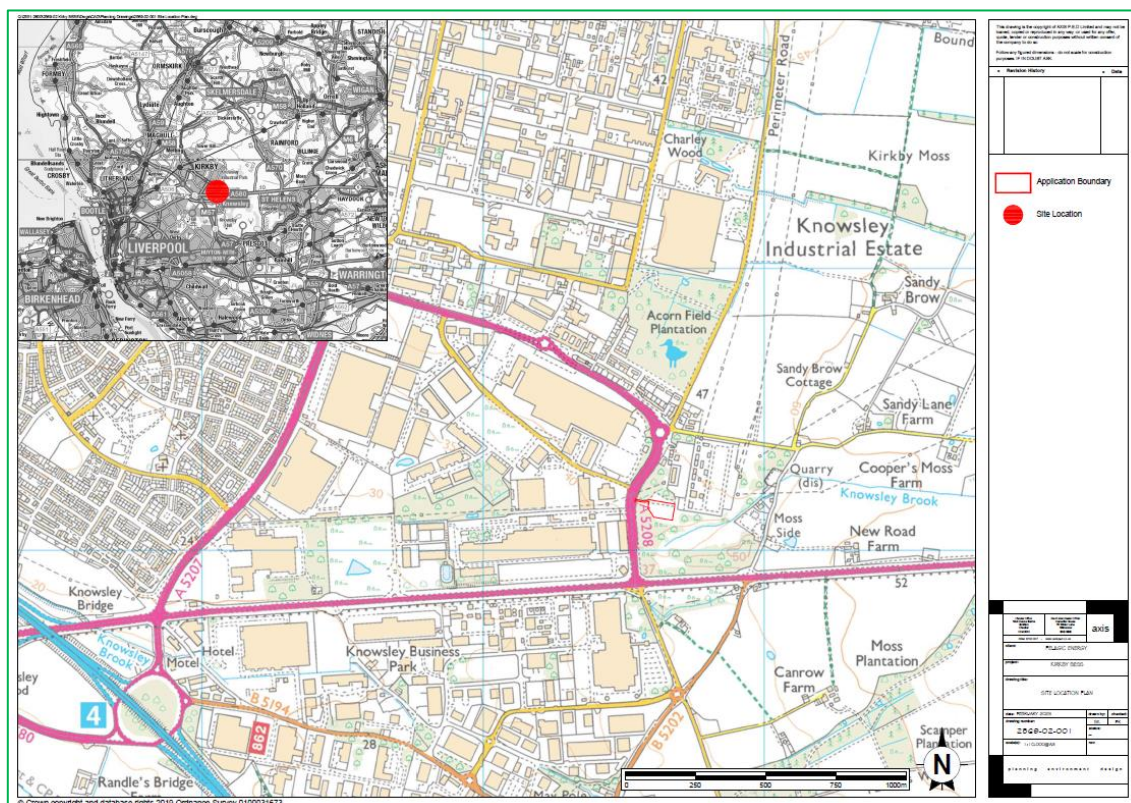


Figure 1 - Site Location

2.2 Existing Development

The site is currently a disused parcel of land that was formerly farmland.

2.3 Proposed Development

The proposed development is for a Battery Energy Storage System (BESS) on land adjacent to the Coopers Lane National Grid Substation (see Appendix 1). Further details with regard to the Proposed Development can be found in the accompanying information submitted with the planning application.

2.4 Ground Levels

A topographical survey of the site has recently been completed (see Appendix 2). The site falls from north to south, with ground levels of between 42.92 metres Above Ordnance Datum (mAOD) and 40.68mAOD.

2.5 Catchment Hydrology / Drainage

The Knowsley Brook is located approximately 40m to the south of the site and a drainage ditch is located approximately 35m to the north west of the site. The Knowsley Brook flows in a south westerly direction and is culverted to the south of the site beyond the East Lancashire Road. There are no other watercourses evident either on, or within the vicinity of the site. There are no public surface water sewers in the vicinity of the site (see Appendix 3).

2.6 Ground Conditions

The British Geological Survey (BGS) map shows that the superficial deposits consist of Till, Devensian - diamicton. Superficial deposits formed up to 2 million years ago in the Quaternary Period in a local environment previously dominated by ice age conditions. The bedrock deposits consist of the Chester Formation - sandstone. Sedimentary bedrock formed approximately 247 to 250 million years ago in the Triassic Period in a local environment previously dominated by rivers.

The superficial Till is classified as a Secondary (undifferentiated) aquifer. A Secondary (undifferentiated) aquifer has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type. The underlying bedrock is described as a Principal Aquifer. These are layers of rock or drift deposits that have high intergranular and/or fracture permeability – meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

Information from the National Soil Resources Institute details the site area as being situated on naturally wet very acid sandy and loamy soils. The Wallingford Winter Rain Acceptance Potential (WRAP) map indicates that the site lies within WRAP Class 4: clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

2.7 Source Protection Zone

The site is not located within a Source Protection Zone (SPZ). SPZ's have been defined by the Environment Agency around major public water supplies with the intent to show the risk of contamination from any activities that might cause pollution in the area. Three zones are defined: SPZ 1 is the Inner Zone (highest risk); SPZ 2 is the Outer Zone (average risk); and SPZ 3 is the Total Catchment (least risk).

3.0 SURFACE WATER RUNOFF DESTINATION

3.1 Opportunities for Runoff of Surface Water

Possible receptors for surface water runoff generated onsite have been assessed in line with the prioritisation set onsite out in the Defra non-statutory technical standards for SuDS. There are four possible options to discharge the surface water. The Runoff Destination is (in order of preference):

- a) To ground;
- b) To surface water body;
- c) To road drain or surface water sewer;
- d) To combined sewer

It is necessary to identify the most appropriate method of controlling and discharging surface water. The design should seek to improve the local runoff profile by using systems that can either attenuate runoff and reduce peak flow rates or positively impact on the existing surface water runoff.

3.2 Discharge to Ground

In determining the future surface runoff from the site, the potential of using infiltration devices has been considered. An overview of the general ground conditions may be used to gauge if there is potential for their application. The thickness of the superficial deposits is likely to determine the permeability of the ground. The superficial Till is a low plasticity clay and has a relatively high sand and gravel content increasing the infiltration capacity.

Figure B11-2 of the Knowsley Borough Council Strategic Flood Risk Assessment (SFRA) identifies the site as lying in an area with a 'Medium 2' potential suitability for SuDS. The groundwater is likely to be less than 3m below the surface. There are no surface water features or marsh/poorly drained areas therefore, the infiltration rate will be good, surface water features and marsh/poorly drained areas would be present if the infiltration rate was poor. The permeability of the site is anticipated to be low to moderate. Superficial Till have an infiltration rate which is appropriate for design purposes, an infiltration rate of 0.00001m/s has been used within this report.

Whilst the permeability and infiltration rate of the site would be confirmed by a site investigation into the hydrogeology of the site prior to construction, the ground conditions suggest infiltration techniques would provide a suitable option at the site. At this stage, it is proposed that the surface water runoff from the site will discharge to infiltration SuDS methods.

3.3 Discharge to surface Water Body

Should infiltration be found to be unsuitable, the next option is discharge to a surface water body. The Knowsley Brook is located approximately 40m to the south of the site and a drainage ditch is located approximately 35m to the north west of the site.

The surface water runoff from the site would be attenuated on-site before being discharged to the drainage ditch of the Knowsley Brook at a restricted runoff rate. Any attenuated and controlled surface water discharge would have minimal effect on the water levels within either of the watercourses. Therefore, it would be possible to discharge surface water runoff from the

site into a watercourse. If required, this option would be explored further and would be subject to separate approvals.

3.4 Discharge to Road Drain or Surface Water Sewer

In the event that discharge of surface water to a surface water body is not possible, the next option is discharge to a public surface water sewer or road drain. However, there are no public surface water sewers in the vicinity of the site. Therefore, discharge of surface water runoff to a highway drain or public sewer will not be possible.

3.5 Discharge to a Combined Sewer

In the event that discharge of surface water to a public surface water sewer is not possible, the next option is discharge to a public combined sewer. However, there are no public combined sewers within the vicinity of the site. Therefore, it will not be possible to discharge the surface water runoff to a public combined sewer.

3.6 Summary

For the purposes of this assessment the most likely scenario of discharging surface water runoff via infiltration has been considered. The option of discharge via infiltration is the preferred option for the discharge of surface water runoff from the site.

4.0 SURFACE WATER PEAK FLOW

4.1 Climate Change

Projections of future climate change, in the UK, indicate more frequent, short-duration, high intensity rainfall and more frequent periods of long duration rainfall. Guidance included within the NPPF recommends that the effects of climate change are incorporated into FRA. Recommended precautionary sensitivity ranges for peak rainfall intensities and peak river flows are outlined in the flood risk assessments: climate change allowances guidance³.

Table 1 shows the anticipated changes in extreme rainfall intensity. The proposals will take into account a 45% increase in rainfall intensity due to climate change.

Table 1 - Peak Rainfall Intensity Allowance

Allowance Category	2050s	2070s
Upper End	+40%	+45%
Central	+25%	+30%

4.2 Surface Water Runoff Rates

Currently the majority of rainfall infiltrates into the soil substrate and/or runoff from the site. It is proposed that the proposed access track would be surfaced with compacted stone to provide an even surface for vehicle movements and to provide a stable base for installation and maintenance (when required). The transformer compound and control building would be located on concrete foundations. All these areas would have a low permeability and have been treated as impermeable. Therefore the impermeable areas of the site will be 995m² and the rest of the site will be constructed from freely draining stone or grass which will allow infiltration of rainfall.

An estimation of surface water runoff is required to permit effective site surface water management and prevent any increase in flood risk to off-site receptors. In accordance with The SuDS Manual, the Greenfield runoff from the site has been calculated using the Institute of Hydrology (IoH124) method. Table 2 shows the IoH 124 method Greenfield runoff rates calculated for the impermeable area of 995m². The mean annual maximum flow rate from a Greenfield site (QBAR: approximately a 2.30 year return period) has been calculated to be 0.23 litres/second (l/s) (see Appendix 4).

Table 2 - IoH124 method Greenfield Runoff Rates

Rainfall Event	Runoff Rate (l/s)
1	0.20
QBAR (rural)	0.23
30	0.40
100	0.49

The method used for calculating the runoff complies with the NPPF, as well as the new Defra non-statutory technical standards for SuDS and assumes that the excess runoff associated with

³ <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#high-allowances>

the proposed development (plus an allowance for future climate change) will need to be managed by the proposed SuDS scheme.

5.0 SURFACE WATER DRAINAGE SYSTEMS

5.1 SuDS Strategy

One of the aims of the NPPF is to provide not only flood risk mitigation but also to maximise additional gains such as improvements in runoff quality and provision of amenity and biodiversity. Systems incorporating these features are often termed SuDS and it is the requirement of NPPF that these are considered as the primary means of collection, control and disposal for storm water as close to source as possible.

The objective of this SuDS Strategy is to ensure that a sustainable drainage solution can be achieved which reduces the peak discharge rate to manage and reduce the flood risk posed by the surface water runoff from the site. The SuDS Strategy takes into account the following principles:

- No increase in the volume or runoff rate of surface water runoff from the site.
- No increase in flooding to people or property off-site as a result of the development.
- No surface water flooding of the site.
- The proposals take into account a 45% increase in rainfall intensity due to climate change.
- The proposals take into account an urban factor of +10%.

In line with adopting a 'management train' it is recommended that water is managed as close to source as possible. This will reduce the size and cost of infrastructure further downstream and also shares the maintenance burden more equitably. The Outline SuDS Strategy will take the form of:

- Permeable surfaces - crushed stone.
- Filter trenches.
- Underground crate soakaway/s.
- If required, attenuation crate storage with a restricted discharge into the drainage ditch of the Knowlsey Brook.

One of the aims of the NPPF is to provide not only flood risk mitigation but also to maximise additional gains such as improvements in runoff quality and provision of amenity and biodiversity. Systems incorporating these features are often termed SuDS and it is the requirement of NPPF that these are considered as the primary means of collection, control and disposal for storm water as close to source as possible.

The principle applied in the design of storage is to limit the discharge rate of surface water runoff from the developed site for events of similar frequency of occurrence to the same peak rate of runoff as that which takes place from a Greenfield site prior to development. It would not be practical to include a pond, or lagoon within the site it would also not be sustainable to install a green roof on the buildings/structures.

The SuDS Strategy will reduce peak flows, the volume of runoff, and slow down flows and will provide a suitable SuDS solution for this site. The adoption of a SuDS Strategy for the site

represents an enhancement from the current conditions as the current surface water runoff from the Site is uncontrolled, untreated, unmanaged and unmitigated. In adopting these principles, it has been demonstrated that a scheme can be developed that does not increase the risk of flooding to adjacent properties and development further downstream.

The proposed access track would be surfaced with compacted stone to provide an even surface for vehicle movements and to provide a stable base for installation and maintenance (when required). The transformer compound and control building would be located on concrete foundations. All these areas would have a low permeability and have been treated as impermeable.

The options will be explored further during pre-construction activities with the agreement of the Local Planning Authority, the Lead Local Flood Authority and the Sewerage Undertakers, where required and it is suggested that a suitably worded planning condition requiring the detailed drainage proposals to be submitted and approved is included in any permission.

Assuming Infiltration

At this stage, ground conditions suggest that infiltration methods will work at the site. The site will be constructed from crushed stone and hardstanding (e.g. MoT Type 1 or similar). The areas of the site constructed from crushed stone, rather than compacted and sealed MoT Type 1, will be permeable which will allow infiltration of rainfall. The crushed stone will have a sufficient void ratio of 30% and permeability of granular fill to allow adequate percolation and to control the risk of blockage (examples include coarse aggregate 4-40mm (4/40), 4-20mm (4/20) as defined in BS 753313:2009 or Type 3 sub-base 0-40mm (0/40)).

A permeable/open-graded (reduced fines) sub-base layer (i.e. Type 3 with a void ratio of 30%) will be used as a drainage layer below the permeable surfaces which will be sufficiently permeable to allow water to drain through and to store water temporarily. The selected gravel fill and bedding would be clean, free-draining, angular shaped material in the specified size range.

Any rainfall falling on the impermeable areas will flow to the permeable areas of the site, which allow infiltration through to the soil substrate. Infiltration capacities of crushed stone are significantly greater than the design rainfall intensities and are not a limiting factor. A minimum value of 2500mm/hr is considered reasonable within The SuDS Manual. These are SuDS source control compliant and will as a minimum provide storage for the first 5mm (interception storage). Permeable surfaces, together with their associated substructures, are an efficient means of managing surface water runoff close to its source – intercepting runoff, reducing the volume and frequency of runoff, and providing a treatment medium. These systems encourage biological treatment of flow and extraction of oils and heavy metals from the runoff. Treatment processes that occur within the surface structure and the geotextile layers include:

- Filtration
- Absorption
- Biodegradation
- Sedimentation

It will also assist in reducing the flood profile of the site by significantly attenuating the runoff from the development within the sub base material. The site has an infiltration rate which is appropriate for design purposes, an infiltration rate of 0.00001m/s has been used within this

report. The area of crushed stone will be of more than an adequate size to allow infiltration of the surface water runoff from the post-development site.

Appendix 5 shows the volume of storage required for the proposed development estimated for the 1 in 100 year event, with a 45% allowance for climate change (increase in peak rainfall) and urban creep factor of +10% assuming the proposed 995m² a of impermeable area.

At this stage, it is proposed that permeable surfaces, filter trenches, underground crates soakaways and/or surface storage will be used to provide the required storage. Additional storage would be provided within the manholes, pipes and drainage gullies which will provide betterment over and above the 1 in 100 year (+45%) event.

Assuming No Infiltration

If after further investigations, the ground conditions prevent the use of infiltration, SUDS methods that are designed not to infiltrate can be considered. The 1 in 2 year greenfield runoff rate has been calculated to be 0.23l/s. Using a control device and practical minimum pipe sizes it is not practical to control the discharge rate to below 2.00l/s. Therefore, a value of 2.00l/s has been used as the limiting discharge rate before discharge into the drainage ditch of the Knowlsey Brook.

Appendix 6 shows the volume of storage required for the proposed development estimated for the 1 in 100 year event, with a 45% allowance for climate change (increase in peak rainfall) and urban creep factor of +10% assuming the proposed 995m² a of impermeable area with 2.00l/s used as the limiting discharge rate before discharge into a watercourse.

At this stage, it is proposed that underground storage tanks, oversized drainage networks, cellular storage and/or surface storage will be used to provide the required attenuation storage. Additional storage would be provided within the manholes, pipes and drainage gullies which will provide betterment over and above the 1 in 100 year (+45%) event.

5.2 Designing for Local Drainage System Failure

When considering residual risk, it is necessary to make predictions as to the impacts of a storm event that exceeds the design event, or the impact of a failure of the local drainage system. The SuDS Strategy applies a safe and sustainable approach to discharging rainfall runoff from the site and this reduces the risk of flooding however, it is not possible to completely remove the risk.

As part of the SuDS Strategy it must be demonstrated that the flooding of property would not occur in the event of local drainage system failure and/or design exceedance. It is not economically viable or sustainable to build a drainage system that can accommodate the most extreme events. Consequently, the capacity of the drainage system may be exceeded on rare occasions, with excess water flowing above ground.

The design of the site layout provides an opportunity to manage this local drainage system failure/exceedance flow and ensure that indiscriminate flooding of property does not occur. There will not be an extensive sewerage network on the proposed development site and therefore any potential exceedance flooding would be from the sewers and lateral drains connecting the buildings to the underground storage areas. It is very unlikely that a catastrophic failure would occur. An exceedance or blockage event of the sewers would not affect the proposed buildings/structures because the finished floor level will be raised above surrounding ground levels, ensuring any exceedance flooding would not affect the buildings/structures.

Exceedance flows would be contained within the highways adjacent to the site and within the site and would flow to the lower ground levels where the public open space is located. It is not considered that there is an increased risk to the properties on the site or located adjacent to the site.

In particular, the landscaped areas will include preferential flow paths that convey water away from structures. Surface water runoff would be directed to the drainage system through drainage gullies located around the perimeter of the structures and through contouring of the hardstanding areas.

When considering the impacts of a storm event that exceeds the design event, there is safety factor, even under the design event conditions. Consequently, if this event were to be exceeded there is additional capacity with the system to accommodate this (i.e. within the manholes, pipes etc.). If this freeboard was to be exceeded the consequences would be similar, if not less than for the local drainage system failure. Consequently, the impact of an exceedance event is not considered to represent any significant flood hazard.

The above manages and mitigates the flood risk from surface water runoff to the proposed properties from surface water runoff generated by the site development and to offsite locations as well the risk from surface water runoff generated offsite.

6.0 SUMMARY AND CONCLUSIONS

6.1 Conclusion

This Surface Water Drainage Assessment demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of the NPPF. The proposed development will considerably reduce the flood risk posed to the site and to off-site locations due to the adoption of a SuDS Strategy.

The proposed development should not therefore be precluded on the grounds of flood risk or drainage.

APPENDICES

APPENDIX 1 – Proposed Site Layout



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Follow any figured dimensions - do not scale for construction purposes. IF IN DOUBT ASK.

• Revision History	• Date

Application Boundary

Chester Office: Well House Barns Brutton CH4 5DH		South Manchester Office: Carnilla House 76 Water Lane Willeslow SK3 5BB	axis
0844 8700 007 - www.axisped.co.uk			
client: PELAGIC ENERGY			
project: KIRKBY BESS			
drawing title: GENERAL ARRANGEMENT			
date: JANUARY 2023	drawn by:	checked:	
drawing number: 2569-02-003		SK	PR
scale(s): 1:500@A3		status: --	
		rev:	
planning environment design			

APPENDIX 2 – Topographical Survey

APPENDIX 3 – Public Sewer Plan

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Property Searches
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WA5 3LP**

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

**Your Ref: Kirkby
Our Ref: UUPS-ORD-82573
Date: 01/02/2019**

Dear Sirs

Location: Kirkby

I acknowledge with thanks your request dated 31/01/2019 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



Karen McCormack
Property Searches Manager

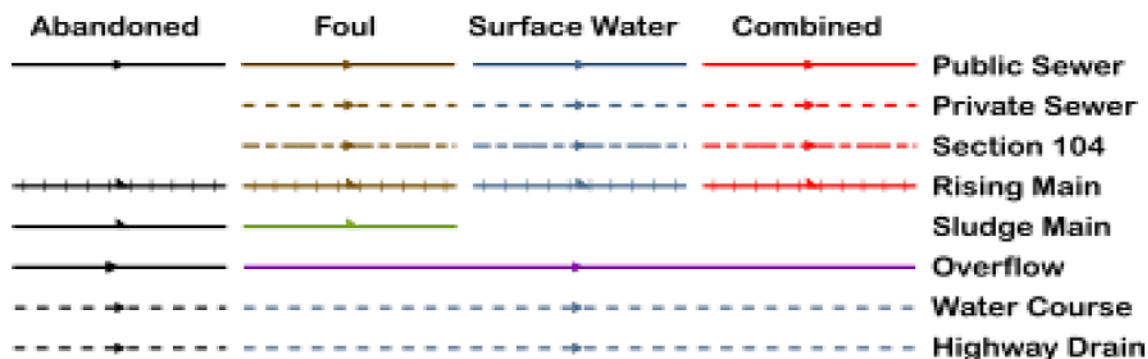
TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

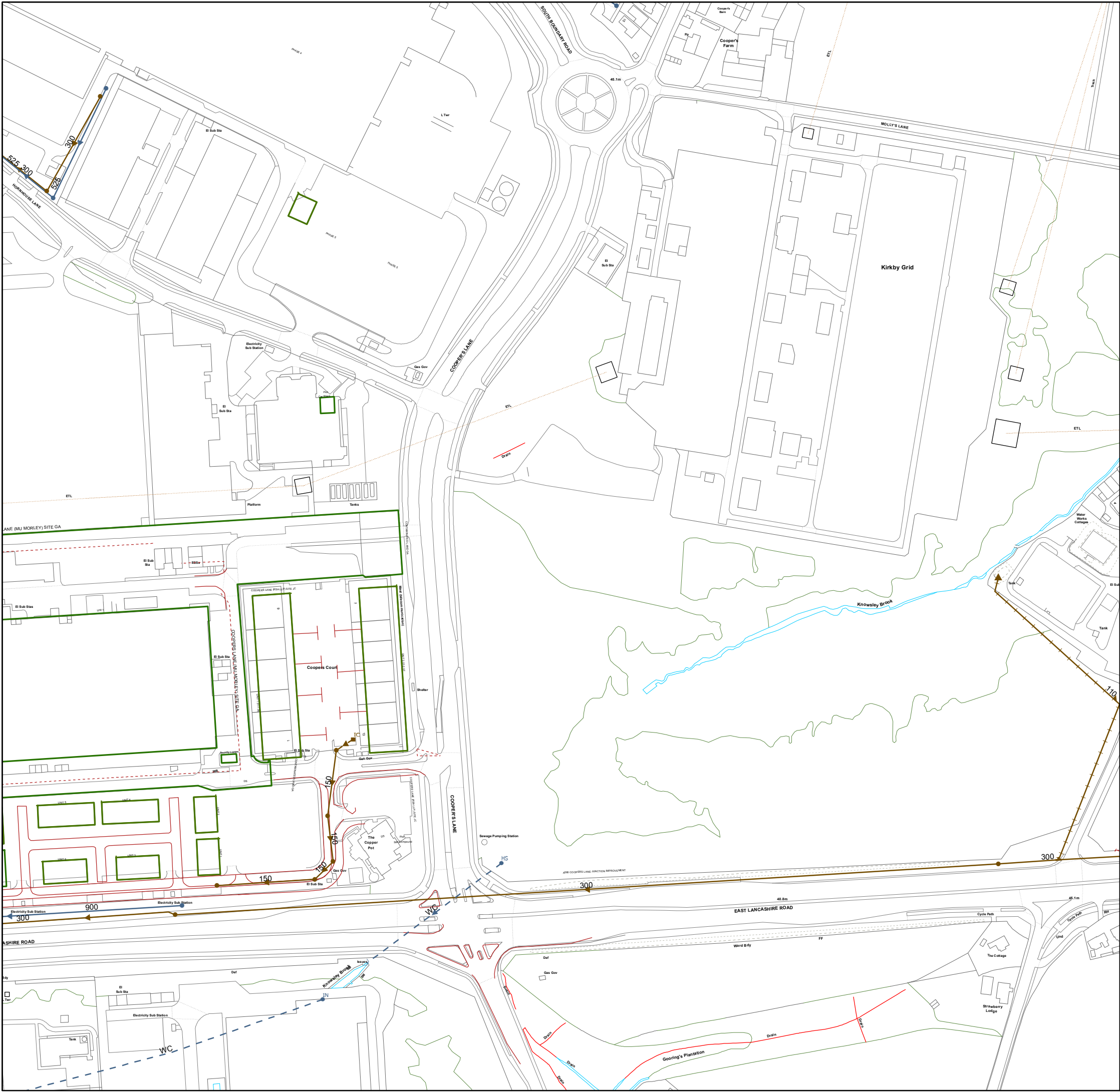
- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

Wastewater Symbolology



All point assets follow the standard colour convention: **red** – combined **brown** - foul
blue – surface water **purple** - overflow

- | | |
|-------------------------|---------------------------------|
| Manhole | Side Entry Manhole |
| Head of System | Outfall |
| Extent of Survey | Screen Chamber |
| Rodding Eye | Inspection Chamber |
| Inlet | Bifurcation Chamber |
| Discharge Point | Lamp Hole |
| Vortex | T Junction / Saddle |
| Penstock | Catchpit |
| Washout Chamber | Valve Chamber |
| Valve | Vent Column |
| Air Valve | Vortex Chamber |
| Non Return Valve | Penstock Chamber |
| Soakaway | Network Storage Tank |
| Gully | Sewer Overflow |
| Cascade | Ww Treatment Works |
| Flow Meter | Ww Pumping Station |
| Hatch Box | Septic Tank |
| Oil Interceptor | Control Kiosk |
| Summit | |
| Drop Shaft | Change of Characteristic |
| Orifice Plate | |



Extract from Map of Public Sewers

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available.

The actual positions may be different from those shown on the plan and private pipes, sewers or drains may not be recorded.

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Kirkby

Printed By: Property Searches Date: 01/02/2019

DO NOT SCALE
Approximate Scale: 1:5000



APPENDIX 4 – IoH Method Greenfield Runoff Rates

Calculated by: Emma Serjeant

Site name: Coopers Lane BESS

Site location: Coopers Lane

Site Details

Latitude: 53.46741° N

Longitude: 2.84956° W

Reference: 3074927727

Date: Apr 19 2023 16:54

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.1

Methodology

 Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics

Default

Edited

SOIL type: 2 2

HOST class: N/A N/A

SPR/SPRHOST: 0.3 0.3

Hydrological
characteristics

Default

Edited

SAAR (mm): 868 868

Hydrological region: 10 10

Growth curve factor 1 year: 0.87 0.87

Growth curve factor 30 years: 1.7 1.7

Growth curve factor 100
years: 2.08 2.08Growth curve factor 200
years: 2.37 2.37

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

Default

Edited

 Q_{BAR} (l/s): 0.23 0.23

1 in 1 year (l/s): 0.2 0.2

1 in 30 years (l/s): 0.4 0.4

1 in 100 year (l/s): 0.49 0.49

1 in 200 years (l/s): 0.56 0.56

APPENDIX 5 – Storage Calculations Assuming Infiltration

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Clear

INFILTRATION SYSTEMS DESIGN Comparison

GEOMETRY

Rectangular soakaway 1				
Width (m)	10			
Length (m)	15			
Diameter (m)				
Soakaway base area (m2)	150			

PARAMETERS

Porosity	0.9			
Effective porosity				
Infiltration coefficient (m/h)	0.036			
Factor of safety	3			

AREA TO BE DRAINED

Contributing area				
Impermeable Area +10%	1095			
Total area (m2)	1095			

DESIGN RAINFALL

M5-60 rainfall depth (mm)	20			
Rainfall ratio r	0.4			
Climate change factor	1.45			
FEH factor	1			
Return period (years)	100			
Rainfall Duration (h)	Intensity (mm/h)			
0.083333333	249.255			
0.166666667	174.479			
0.25	146.353			
0.5	92.798			
1	58.87			
2	35.12			
4	20.538			
6	15.187			
10	9.844			
24	5.111			

RESULTS

Maximum water depth (m)	0.65			
Time for half-emptying (h)	20.98			

APPENDIX 6 – Storage Calculations Assuming No Infiltration

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Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by: Keelan Serjeant

Site name: Coopers Lane BESS

Site location: Coopers Lane

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site characteristics

Total site area (ha):	0.1
Significant public open space (ha):	0
Area positively drained (ha):	0.1
Impermeable area (ha):	0.1
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.1
Net impermeable area for storage volume design (ha):	0.1
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Design criteria

Climate change allowance factor:	1.45
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Site Details

Latitude:	53.46776° N
Longitude:	2.85039° W
Reference:	791827387
Date:	Apr 24 2023 12:26

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	2	2
SPR:	0.3	0.3

Hydrological characteristics	Default	Edited
Rainfall 100 yrs 6 hrs:	--	63
Rainfall 100 yrs 12 hrs:	--	81.62
FEH / FSR conversion factor:	1.06	1.06
SAAR (mm):	868	868
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 10 year:	1.38	1.38
Growth curve factor 30 year:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Q_{BAR} for total site area (l/s):	0.23	0.23
Q_{BAR} for net site area (l/s):	0.23	0.23

Site discharge rates	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	2	2
1 in 100 year (l/s):	2	2

Estimated storage volumes	Default	Edited
Attenuation storage 1/100 years (m³):	51	51
Long term storage 1/100 years (m³):	0	0
Total storage 1/100 years (m³):	51	51

This report was produced using the storage estimation tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at <http://uksuds.com/terms-and-conditions.htm>. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

