

MEADWAY, BURY

SUSTAINABLE DRAINAGE STRATEGY

Job Number: FRA 22 1125

Date: November 2022

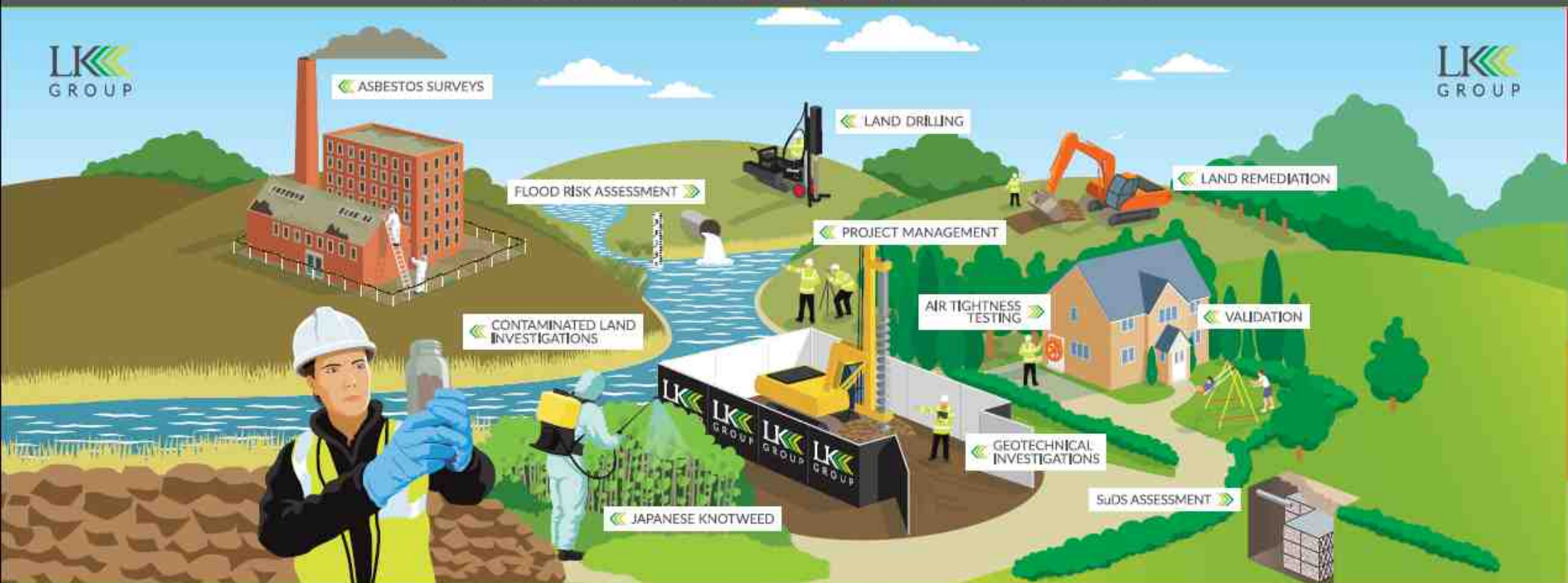
Client: SAC Property Developments Ltd



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LK Consult Document Verification			
Site Address	Land adjacent to 23 Meadway, Bury, BL9 9TY		
Report Title	Sustainable Drainage Strategy		
Job Number	FRA 22 1125	Document Ref.	FRA 22 1125 - R0
Date Issued	November 2022	Report Version	R0
Prepared By	Jenna Lowe - Flood Risk Engineer	Reviewed By	Mark Jones - Associate

Revision Record			
Revision No.	Date	Nature of Revision	Approved By

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EXECUTIVE SUMMARY

Scope and Background

This Sustainable Drainage (SuDS) Strategy has been undertaken by LK Consult Ltd (LKC) to support a planning application for the development of land adjacent to 23 Meadway, Bury. The development comprises residential properties and associated garages and soft landscaping.

LKC has prepared this SuDS Strategy in line with the NPPF and Technical Guidance where appropriate.

Consultations

Bury Metropolitan Borough Council – Lead Local Flood Authority (LLFA) and United Utilities (UU) have been contacted during preparation of this report.

The Environment Agency (EA) website has been utilised to assess if there are any limitations that may affect the form of SuDS that may be appropriate to this site. The records show that the site is partially within Flood Zone 2.

Drainage Strategy

The ground conditions beneath the site are recorded as Alluvium superficial deposits that mainly consist of clay, silt, sand, and gravel for the majority of the site and River Terrace deposits consisting of sand and gravel in the west over Sandstone Trencherbone Rock which have been confirmed by BGS records. There is a slight slope towards the southeast.

The outline drainage strategy considers the use of an infiltration-based SuDS not to be feasible given the underlying geology and potentially high-water table. It is assumed that surface water runoff arising from the development will discharge into the watercourse on the eastern boundary of the site.

The most effective strategy, in line with the SuDS management train, would be to have a detention facility located within the site boundary.

The flows from the site should be restricted to an acceptable level to the Lead Local Flood Authority and the EA considering that this is classed as a Main River.

The proposed development will increase the proportion of the site covered by impermeable surfaces and will therefore generate more runoff. Attenuation will be required to allow for climate change and restrictions placed upon the proposed development due to planning requirements.

The estimated volume can be stored within the site boundary.

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1 Introduction

1.1 Background

LK Consult Ltd (LKC) were commissioned by SAC Property Developments Ltd to carry out a Sustainable Drainage Strategy for land adjacent to 23 Meadway, Bury. The report was undertaken in support of a planning application (61369) to redevelop the site for residential use.

The report will consider the impact of the development on surface water runoff accounting for climate change. The sustainable drainage assessment in Section 4 will provide an overview of the SuDS techniques which could be considered on the site.

This preliminary SuDS assessment complies with the principles presented in the Draft National Standards for Sustainable Drainage Systems (Defra, 2015)¹ and the Planning Practice Guidance (PPG) March 2014². The sustainable 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. The report includes baseline data from the Environment Agency (EA), rainfall data from the Wallingford Studies and Hydrogeological information from the British Geological Survey (BGS). The assessment will summarise and refer to these datasets in the text.

Drainage on the site has been assessed by considering the following key constraints:

- » Topography of the site.
- » Local water features and hydrological context.
- » Underlying geology, soil types and permeability.
- » Layout and geometry of the proposed development.

¹ Non-statutory Technical Standards for Sustainable Drainage Systems – DEFRA March 2015

² Planning Practice Guidance – Department for Communities and Local Government July 2021

1.2 Site Details

A summary of the general site details is presented in Table 1-1. Plans, Drawings and Figures are provided in Appendix A. Figure 1 indicates the site location and boundary. Figure 2 indicates the proposed development.

Site Details	
Location	Land adjacent to 23 Meadway, Bury, Lancashire, BL9 9TY. Centred at approximate National Grid Reference 380780E, 408660N.
Area	Approximately 0.11 Ha.
Topography	69.62 metres above ordnance datum in the north of the site and 69.29m AOD in the southeast. The site is sloping gently towards the southeast.
Current Land Use	<u>Site</u> Grassland with mature trees towards the boundaries. <u>Surrounding Area/ Boundary Treatment</u> North: Meadway and residential properties. East: Mature trees and the River Roch. South: Mature trees and residential properties. West: Meadway and residential properties.
Proposed Development	Residential housing with gardens / soft landscaping. 2 no. detached dwellings with detached double garages and associated soft landscaping. Access will be from the private road off Meadway.

Table 1-1: Summary of site details.

2 Site Setting

2.1 Environmental Setting

LKC have previously undertaken a Preliminary Risk Assessment for the site³ and pertinent environmental information for the site is summarised in Table 2-1 below.

Summary of the Environmental Setting		
Geology	Superficial	Alluvium (Clay, Silt, Sand and Gravel) covers the majority of the site. River Terrace Deposits (Sand and Gravel) in the west of the site.
	Bedrock	Trencherbone Rock (Sandstone).
	BGS Boreholes	BH Ref: SD80NW145, 60m north: Soft to firm organic dark grey sandy very silty Clay with gravel and much reed and grass material to 0.60m, loose orange brown fine clayey silty Sand with some fine rootlets to 1.40m, firm to stiff mottled orange brown / dark grey sandy very silty Clay with occasional brick fragments to 2.00m, medium dense orange brown Sand and Gravel to 4.00m, stiff brown sandy silty Clay with some gravel to 5.30m and moderately weak purple grey mudstone / fine micaceous Sandstone to 6.20m (water encountered at 2.05mbgl rising to 1.9mbgl). BH Ref: SD80NW211, 200m east: Made Ground (hardcore, ash, brick with some clay) to 0.90m, ash and clay with some brick and gravel to 2.00m, soft grey very sandy Clay to 3.40m, loose brown silty Sand with some clay and peaty clay to 6.30m, soft light grey mottled very sandy Clay with small roots to 8.00m, soft light brown very sandy silty Clay to 10.60m, firm to stiff brown sandy gravelly Clay to 11.80m and dense coarse Sand and Gravel to 12.20m (water standing at 6.20mbgl).
	Defra Soilscape Mapping	Type 17 – Slowly permeable seasonally wet acid loamy and clayey soils.
		Superficial
		Bedrock
	Source Protection Zone (SPZ)	Site not within an SPZ.
Flood Zone (EA)	The site is partially within Fluvial Flood Zones 1 and 2. Very Low risk, with annual probability of flooding from rivers and the sea of less than 0.1% (1 in 1000). Low risk, with annual probability of flooding of 0.1 to 1.0% from rivers and 0.1 to 0.5% from the sea.	

Table 2-1: Summary of the Environmental Setting.

³ Phase 1 Preliminary Risk Assessment: LK Consult, LKC 22 1353, August 2022.

Summary of the Environmental Setting		
Hydrology	All adjacent and internal surface water sources	The River Roch (Spodden to Irwell) is approximately 25m to the east of the site. The Whittle Brock (Irwell) is approximately 275m to the southeast of the site. The River Irwell (Rossendale to Roch) is approximately 468m to the southwest of the site.
Site History		Historical mapping indicates that from 1848 until 1974 the site and surrounding area consisted of pastureland. From 1974 the surrounding area consists of a housing development. The Hampson Mill and associated reservoirs are present to the south of the site from 1851 until 1969 mapping. The River Roch is present to the east of the site. The associated Goit (Mill Race) is not present by 1984 mapping.

Table 2-1: Summary of the Environmental Setting (continued).

2.2 Site Reconnaissance

A site reconnaissance was undertaken in August 2022 and further photographs are provided below.

- Vacant recently mowed grassed area with multiple mature trees around the perimeter.
- The site is relatively flat. The centre of the site is slightly raised in relation to the remainder of the site.
- The surrounding area comprises a private road with shrubs to the south, residential houses to the west, a garage and woodland to the north and a public footpath along the River Roch to the east. The site is bounded by wooden fencing to the north, east and south and is open to the west.
- The surrounding topography slopes slightly towards the River Roch to the east.
- Manhole covers present to the west of the site in the private road and Meadway.

Hand dug pits were carried out in 3 no. locations and are summarised in Plate 2-1.

HD101	HD102	HD103
GL-0.4m – MADE GROUND – gravelly sandy clayey SILT with frequent rootlets (top 0.1m), occasional brick and rare pottery. Couldn't surpass 0.4m due to solid material.	GL-0.45m – MADE GROUND – gravelly sandy clayey SILT with frequent rootlets (top 0.1m), frequent brick and rare coal. Soil becoming clayey with depth. Couldn't surpass 0.45m due to solid material.	GL-0.4m – MADE GROUND – gravelly sandy clayey SILT with frequent rootlets (top 0.1m), frequent brick and rare coal and metal fragment. Soil becoming clayey with depth. Couldn't surpass 0.4m due to solid material.

Plate 2-1: Hand Dug Pit Logs.

Relevant photographs are provided in Plate 2-2.

	
Photograph 1: View of the north of the site.	Photograph 2: View across the northwest of the site towards the private road.
	
Photograph 3: View of the southeast of the site.	Photograph 4: View of the east of the site.
	
Photograph 5: View of the south of the site from the north.	Photograph 6: View of the west of the site.

Plate 2-2: Site photographs.

	
Photograph 7: View of the manhole cover in Meadway.	Photograph 8: View of a further manhole cover in Meadway.
	
Photograph 9: Manhole cover in the private road.	Photograph 10: View of the entrance to the private road.

Plate 2-2: (continued): Site photographs.

2.3 Site Levels

A topographic survey of the site was not provided, therefore opensource LiDAR levels have been extracted to OS GPS datum, and information is included on the drawings in Appendix B. The site elevation ranges from 69.29m AOD in the southeast to 69.62m AOD in north. The site falls slightly from the north towards the southeast.

3 Consultation

Information from consultees is summarised in Table 3-1 below.

Relevant correspondence is provided in Appendix C.

Source	Details	
Bury Metropolitan Borough Council (LLFA)	No information provided at the time of writing from Bury Council. Bury Council would require that Non-statutory technical standards for SuDS are followed.	
United Utilities (UU)	Sewer Map	There is a 980 x 1170mm diameter combined sewer running through the site from the north in a south westerly direction. There is a 150mm diameter combined sewer partially running through the site towards the west of the site. There is a further 150mm diameter combined sewer running in a westerly direction within the adjacent housing development towards the northwest of the site. There is a 225mm diameter surface water sewer towards the south of the site in Meadway running in a south westerly direction.
	Likely conditions for connecting into their sewerage system	UU would request conditions for a separate system with only foul draining to foul / combined sewers and surface water draining to soakaway/SuDS, watercourse or surface water sewer. UU would also request for a condition to prevent development within 3m either side of the sewer running through the site. All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80 of the National Planning Practice Guidance. Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible. If not feasible, UU will consider a connection to the 225mm diameter public surface water sewer located in Meadway at a pass forward flow to be agreed by the Lead Local Flood Authority. UU request that any agreed rate does not exceed 5l/s. Foul flow from this site will be allowed to drain into the public combined sewer system. UU's preferred point of discharge would be to the 980 x 1170mm diameter public combined sewer within the site boundary at an unrestricted rate. UU Developer Services was contacted regarding sewer flooding history for the site. UU confirmed that they did not have any record of internal or external sewer flooding of properties in the vicinity of the site as a result of overloaded sewers.

Table 3-1: Summary of Consultee Information.

4 Sustainable Drainage Strategy

4.1 Introduction

The NPPF recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface run-off from development sites through the use of Sustainable Drainage Systems (SuDS), this being complementary to the control of development within the floodplain.

SuDS will not alleviate flooding in an area prone to flooding; however, properly designed SuDS have the potential to prevent the surface water runoff from new development worsening the flood risk. The effective disposal of surface water from development is a material planning consideration in determining proposals for the development and use of land.

The accepted principles are that surface water arising from a developed area should, as far as practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

The Building Regulations Requirement H3⁴ stipulates that rainwater from roofs and paved areas is carried away from the surface to discharge to one of the following, listed in order of priority:

- an adequate soakaway or other adequate infiltration system,
- a watercourse or, where that is not practicable,
- a sewer.

The concept of a sustainable drainage system has been incorporated into the outline drainage strategy for the study area in order to comply with the Flood and Water Management Act 2010⁵.

Suitability of different SuDS will be governed by prevailing site conditions, such as the type and scale of development, topography, ground conditions (soil permeability, ground stability, depth to water table), local hydrogeology and risk of groundwater contamination (presence of sensitive aquifers and source protection zones) etc.

⁴ Building Regulations part H3 2010: Approved Document, Drainage and Waste Disposal.

⁵ Flood and Water Management Act 2010: UK Government.

4.2 Sustainable Drainage Hierarchy

4.2.1 Infiltration

The Groundwater Source Protection Zone mapping from the EA website shows that the site is not within any identified protection zones. A summary of the British Geological Survey superficial and bedrock aquifer descriptions and classifications supplemented by local records is shown in Table 4-1 below:

Classification	Description	Aquifer Classification	Recorded Water Table Depth	Soakaway Potential
Alluvium covers the majority of the site	Clay, Silt, Sand and Gravel	Secondary A	Approx. 1.9mbgl	Poor
River Terrace Deposits to the west	Sand and Gravel	Secondary Undifferentiated		Limited
Trencherbone Rock	Sandstone	Secondary A	N/A	Good

Table 4-1: Geological and Hydrogeological Setting.

Infiltration methods such as soakaways are unlikely to be feasible given the shallow water table depth recorded in nearby borehole records, but this may be investigated further at the detailed design stage, if required.

There is a slight slope over the site and surrounding area which indicates that groundwater in the vicinity of the site would likely drain towards the southeast.

4.2.2 Watercourses

There is an open watercourse running adjacent to the site that currently collects surface water. It is located to the east of the site.

4.2.3 Public Sewer

There are two combined sewers partially running through the site and Meadway to the west of the site.

There is a surface water sewer south of the site running along Meadway flowing to the south of the site.

4.3 Surface Water Drainage Strategy

Following the assessment of the site settings and existing constraints to the development. The drainage options relating to the final discharge of surface water for this section of the site are listed in Table 4-2 in order of priority within the NPPF:

Option No:	Drainage Solution	Most feasible solution	Reasoning
a	Soakaway/Infiltration	3	Not likely to be feasible due to the impermeable ground conditions and high-water table recorded in nearby borehole records.
b	Connection to Watercourse	1	The most feasible solution would be to discharge water to the River Roch to the east of the site. Would require LLFA and EA approval. Confirmation of the council's ownership of the land to the east of the site, approval would also be required from the owner.
c	Discharge into a sewer	2	A connection into the 225mm diameter surface water sewer to the south of the site in Meadway would be possible – subject to approval from LLFA and connection consent from UU.

Table 4-2: Drainage options.

Table 4-3 provides a summary of the SuDS options appraisal with consideration of CIRIA C697 (The SUDS Manual)⁶ for the development:

SuDS Option	Appropriate to Development	Comments
Soakaways	X	Due to the nature of the ground conditions, the use of infiltration systems may not be feasible.
Infiltration basin	X	Depressions that store and dispose of water via infiltration. May not be appropriate given the ground conditions.
Sand filter	*	Treatment devices using sand beds as filter media.
Filter drains	✓	Linear trenches filled with a permeable granular material, often with a perforated pipe in the base of the trench.
Detention basin	✓	Dry depressions designed to hold water for a specific retention time.
Swales	X	Swales are shallow grass-lined channels that provide capacity for conveying flows at a controlled rate into ponds and watercourses. The site may be too constrained in size for the use of swales and would require legal access to go through the land to the east of site.
Rainwater harvesting	*	Rainwater harvesting collects the rain which falls onto roofs, then stores it in a tank until required for a non-potable use. In the process, a volume of water is kept out of the storm-water management system, thereby helping to reduce flooding risks.
Green roofs	*	Green roof installations can help to reduce surface water runoff from roof areas depending on the system specified. Green roofs are not currently included in the development proposals.
Geo-cellular storage systems	✓	Modular block systems can be used to provide an underground storage facility. Any geo-cellular storage systems should be lined with a geo-membrane to provide attenuation storage.
Permeable Pavements – with granular and geo-cellular storage systems	✓	Permeable pavements allow inflow of rainwater into underlying construction. Any geo-cellular storage systems would have to be lined with an impermeable membrane to provide storage rather than infiltration for runoff from highways.
Ponds	*	Attenuation ponds can be used to offset the increase in surface water flows attributable to increased area of hard standing, in order to minimise the risk of flooding to and from the proposed development. Ponds will attenuate the surface water flow prior to discharging to the public surface water sewers. The storage volume afforded by these features should not include any permanent water in the pond.
Oversized Pipes	✓	Oversizing the pipes that make up the on-site drainage network is a cost-effective method for providing attenuation storage within the network. Such systems could be considered on the parts of the development where gradients are relatively flat.
Tanks	✓	Prefabricated underground tanks could be considered at the detailed design stage in order to provide storage to attenuate surface water runoff.
Flow control devices	✓	The peak flow rates will be controlled by flow control devices e.g. hydrobrake style flow control systems, and restricted orifices. Flow control devices enable the discharge to be restricted to a constant rate from the development.

Table 4-3: Summary of the SuDS options appraisal.

Notes

- ✓ Suitable for use given the nature and scale of the development
- * Possibly suitable for use – not included in the client and architect design proposal at present
- X Not suitable

⁶ CIRIA C697 - The SUDS Manual. London 2015

4.4 Surface Water Attenuation Requirements

In line with local guidance, the flow from this development should be limited to a 'greenfield scenario' for estimating the attenuation volumes required.

It is estimated from the supplied plan (see Appendix A) that the site will have the following designated areas (Table 4-4).

Designated Areas	Plot Area
Total area (ha)	0.11
Existing Impermeable Area (ha)	0
Green Infrastructure (ha)	0.11
Catchment	
Developable Area (ha)	0.07
Impermeable Area (ha)	0.04
Permeable Area (ha)	0.03

Table 4-4: Assumed plot areas.

Table 4-4 shows the assumed areas included within the calculations.

It can be seen that there is an increase in impermeable area for the existing usage to the proposed. This is likely to require attenuation to reduce the proposed flow off site to a level which is acceptable to the LLFA and to UU including an allowance for climate change.

4.4.1 Attenuation Estimate

Surface water storage and greenfield runoff estimations based on the HR Wallingford procedure IH 124⁷ have been undertaken for the development and the output report is presented in Appendix D.

For the contributing catchment an estimate has been produced assuming a developable area of 0.06ha and a public open space of 0.05ha. This gives the following runoff rates and attenuation requirements for this section based on the Wallingford IH 124 method:

» Q_{bar} :	0.780 l/s
» 1 in 1-year greenfield runoff rate:	0.660 l/s
» 1 in 30-year greenfield runoff rate:	1.305 l/s
» 1 in 100-year greenfield runoff rate:	1.631 l/s

As this is less than a minimum practical discharge rate of 5l/s, the 5l/s has been utilised.

UU has specified an allowable discharge rate of 5l/s to their surface water drain to the south of the site.

The following attenuation has been estimated for the development using 5l/s runoff rates and utilises the FSR methodology⁸ as:

- » Attenuation storage volume: **1.4 m³** (1 in 30-year event)
- » Retention on site volume: **3.8 m³** (1 in 100 year + 20% Climate Change)
- » Retention on site volume: **5.1 m³** (1 in 100 year + 40% Climate Change)

⁷ IH124 Flood Estimation of Small Catchments.

⁸ Flood Studies Report Wallingford NERC 1975.

Attenuation storage aims to limit the peak rate of runoff from the development to the 5l/s rates before discharging to the watercourse. As the flow from the development would be reduced there should be little change in the flows that enter the watercourse and thus the risk of flooding and the level of erosion created as a result from the development should not increase the risk of flooding off-site.

The attenuation required for a 1 in 30-year storm event, requires a storage volume of **1.4 m³** and for the 1 in 100-year event, a storage capacity of between **3.8 m³** and **5.1 m³** will be required from on-site storage as well as SuDS systems. All volumes can be stored within the site boundary and discharges will be limited by flow control devices to the adjacent watercourse.

4.5 Site Specific SuDS

The use of attenuation SuDS are deemed to be the most feasible and practical option for the development. The attenuation tank or similar will provide the required storage volume to limit peak runoff arising from the development.

Utilisation of a flow control device at the end of the system will control the peak flow rates.

The use of permeable paving may be viable dependant on the detailed design of the proposed development. If this drainage technique is considered to be feasible then it will reduce the requirement for attenuation as it will reduce the contributing impermeable area. The permeable paving will also provide some level of water treatment reducing effects of pollution in runoff on the environment.

Assuming that the outline drainage strategy is acceptable to the Local Authority, a more detailed design can be presented and agreed with the appropriate regulatory bodies during the detailed design phase.

4.6 Foul Drainage

The foul water could be discharged by gravity into the 980 x 1170mm diameter public combined sewer within the site boundary as relative levels indicate that this will be feasible in terms of fall. There are several possible alternative manholes for the connection of foul drainage from the site.

5 Conclusion

The site is currently vacant grassland with mature established trees towards the perimeter. The proposal is to develop two detached residential dwellings with detached double garages and associated soft landscaping.

An assessment of the site settings and existing constraints in conjunction with the development proposals have resulted in the following recommendations for the safe development of the site:

- » The recorded geology on site would indicate that infiltration may not be practical. This may be investigated at the detailed design stage by means of undertaking permeability testing.
- » The attenuation required for a 1 in 30-year storm event, requires a storage volume of **1.4 m³** and for the 1 in 100-year event, a storage capacity of between **3.8 m³** and **5.1 m³** will be required from on-site storage as well as SuDS systems.
- » The suitability and depth of a potential connection into the adjacent watercourse should be confirmed on site.
- » There is an existing connection of the site to the adjacent public sewer. A pre-development advice enquiry received from United Utilities considered that a flow rate of 5l/s would be acceptable if infiltration proved to be impractical.
- » All proposed outflow connections from the development should be agreed with the Lead Local Planning Authority and United Utilities.

APPENDIX A

FIGURES, PLANS AND DRAWINGS



Client: SAC Property Developments Ltd				Title: Site Location & Boundary Plan		LK CONSULT
Site: Meadway, Bury				Scale (see scale bar): 1:25,000 & 1:1,000 @ A4		
Job No.: FRA 22 1125	Drawn By: JL	Checked By: MJ	Drawn: Aug 2022	Figure: 1	Revision:	

APPENDIX B

SITE INFORMATION



LiDAR Elevation Key (m AOD)

A = 69.52

B = 69.42

C = 69.34

D = 69.63

E = 69.62

F = 69.41

G = 69.36

H = 69.45

I = 69.50

J = 69.21

K = 69.20

L = 69.13

M = 69.08

N = 68.92

O = 69.41

Geology 1:50,000 Maps Legends

Artificial Ground and Landslip

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	MGR	Made Ground (Undivided)	Artificial Deposit	Not Supplied - Holocene
	WGR	Worked Ground (Undivided)	Void	Not Supplied - Holocene
	WMGR	Infilled Ground	Artificial Deposit	Not Supplied - Holocene
	SLIP	Landslide Deposit	Unknown/Unclassified Entry	Not Supplied - Quaternary

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Not Supplied - Holocene
	TILLD	Till, Devensian	Diamicton	Not Supplied - Devensian
	GFDUD	Glaciofluvial Deposits, Devensian	Sand and Gravel	Not Supplied - Devensian
	HMGDD	Hummocky (Moundy) Glacial Deposits, Devensian	Diamicton	Not Supplied - Devensian
	GFSDD	Glaciofluvial Sheet Deposits, Devensian	Sand and Gravel	Not Supplied - Devensian
	GLLDD	Glaciolacustrine Deposits, Devensian	Clay and Silt	Not Supplied - Devensian
	GFICD	Glaciofluvial Ice Contact Deposits, Devensian	Sand and Gravel	Not Supplied - Devensian
	RTD1	River Terrace Deposits, 1	Sand and Gravel	Not Supplied - Quaternary
	HEAD	Head	Clay, Silt, Sand and Gravel	Not Supplied - Quaternary
	RTD2	River Terrace Deposits, 2	Sand and Gravel	Not Supplied - Quaternary
	PEAT	Peat	Peat	Not Supplied - Quaternary

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	MM	Manchester Marls Formation	Mudstone	Not Supplied - GUADALUPIAN
	CS	Collyhurst Sandstone Formation	Sandstone	Not Supplied - Cisuralian
	NR	Nob End Rock	Sandstone	Not Supplied - Westphalian

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	PMCM	Pennine Middle Coal Measures Formation	Mudstone, Siltstone and Sandstone	Not Supplied - Westphalian
	PMCM	Pennine Middle Coal Measures Formation	Sandstone	Not Supplied - Westphalian
	PR	Peel Hall Rock	Sandstone	Not Supplied - Westphalian
	TRBR	Trencherbone Rock	Sandstone	Not Supplied - Westphalian
	PLCM	Pennine Lower Coal Measures Formation	Mudstone, Siltstone and Sandstone	Not Supplied - Westphalian
	PLCM	Pennine Lower Coal Measures Formation	Sandstone	Not Supplied - Westphalian
	CAR	Cannel Rock (South Lancashire)	Sandstone	Not Supplied - Westphalian
	OL	Old Lawrence Rock	Sandstone	Not Supplied - Westphalian
	MLRS	Milnrow Sandstone	Sandstone	Not Supplied - Westphalian
	DF	Darwen Flags	Sandstone	Not Supplied - Westphalian
	HER	Helpet Edge Rock	Sandstone	Not Supplied - Westphalian
	GAS	Great Arc Sandstone	Sandstone	Not Supplied - Westphalian
	WH	Woodhead Hill Rock	Sandstone	Not Supplied - Westphalian
		Rock Segments		
		Faults		



Geology 1:50,000 Maps

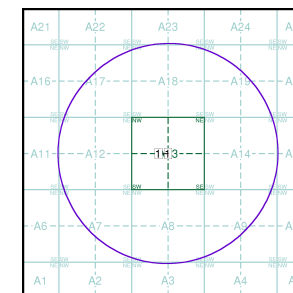
This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:50,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around the site. This mapping may be more up to date than previously published paper maps.

The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page. Not all layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:50,000 Maps Coverage

Map ID: 1
Map Sheet No: 085
Map Name: Manchester
Map Date: 2010
Bedrock Geology: Available
Superficial Geology: Not Available
Artificial Geology: Not Available
Faults: Not Supplied
Landslip: Not Available
Rock Segments: Not Supplied

Geology 1:50,000 Maps - Slice A



Order Details:

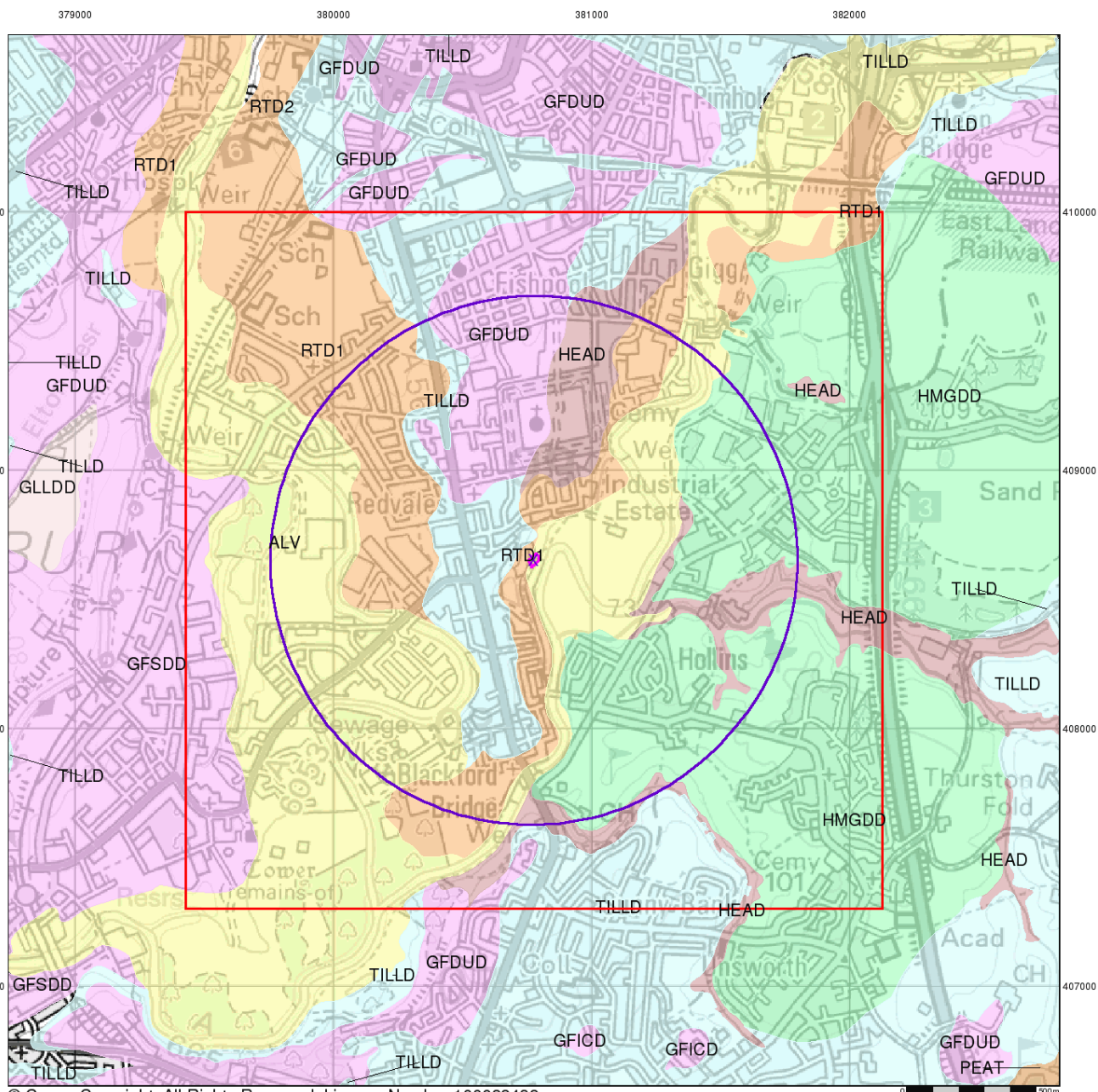
Order Number: 298857873_1_1
Customer Reference: LKC 22 1353
National Grid Reference: 380780, 408650
Slice: A
Site Area (Ha): 0.11
Search Buffer (m): 1000

Site Details:

Land adjacent to 23 Meadway, Bury, BL9 9TY

Landmark
INFORMATION GROUP

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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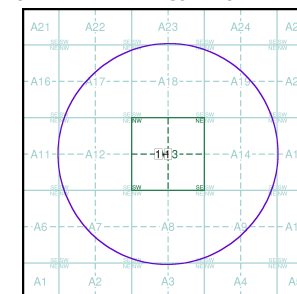
Superficial Geology

Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

Superficial Geology Map - Slice A



Order Details:

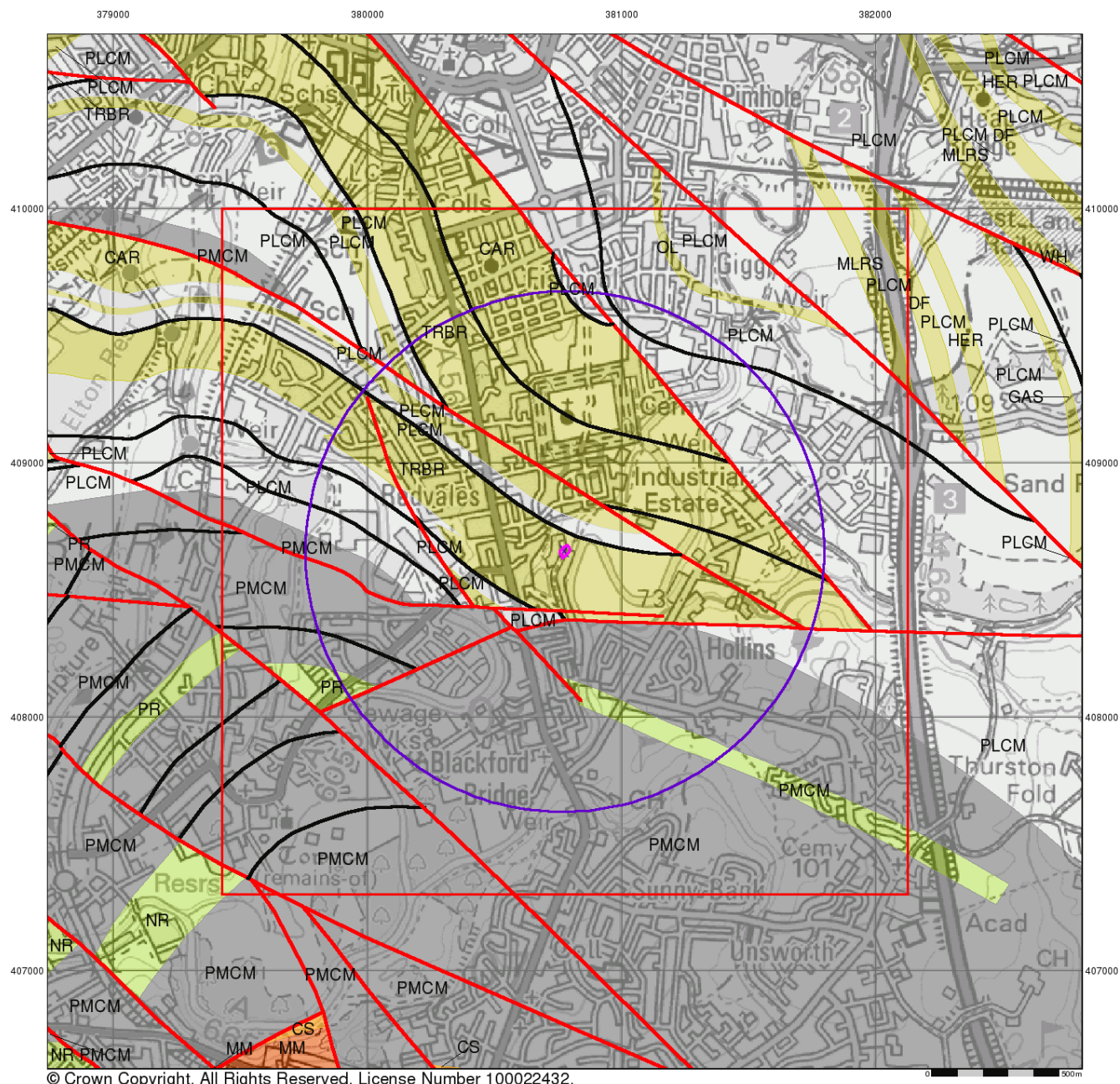
Order Number: 298857873_1_1
 Customer Reference: LKC 22 1353
 National Grid Reference: 380780, 408650
 Slice: A
 Site Area (Ha): 0.11
 Search Buffer (m): 1000

Site Details:

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Bedrock and Faults

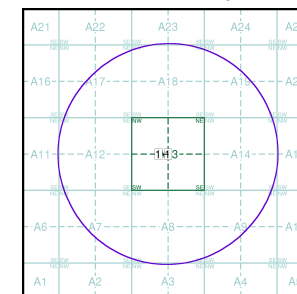
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults (e.g. normal, thrust), and thin beds mapped as lines (e.g. coal seam, gypsum bed). Some of these are linked to other particular 1:50,000 Geology datasets, for example, coal seams are part of the bedrock sequence, most faults and mineral veins primarily affect the bedrock but cut across the strata and post date its deposition.

Bedrock and Faults Map - Slice A



Order Details:

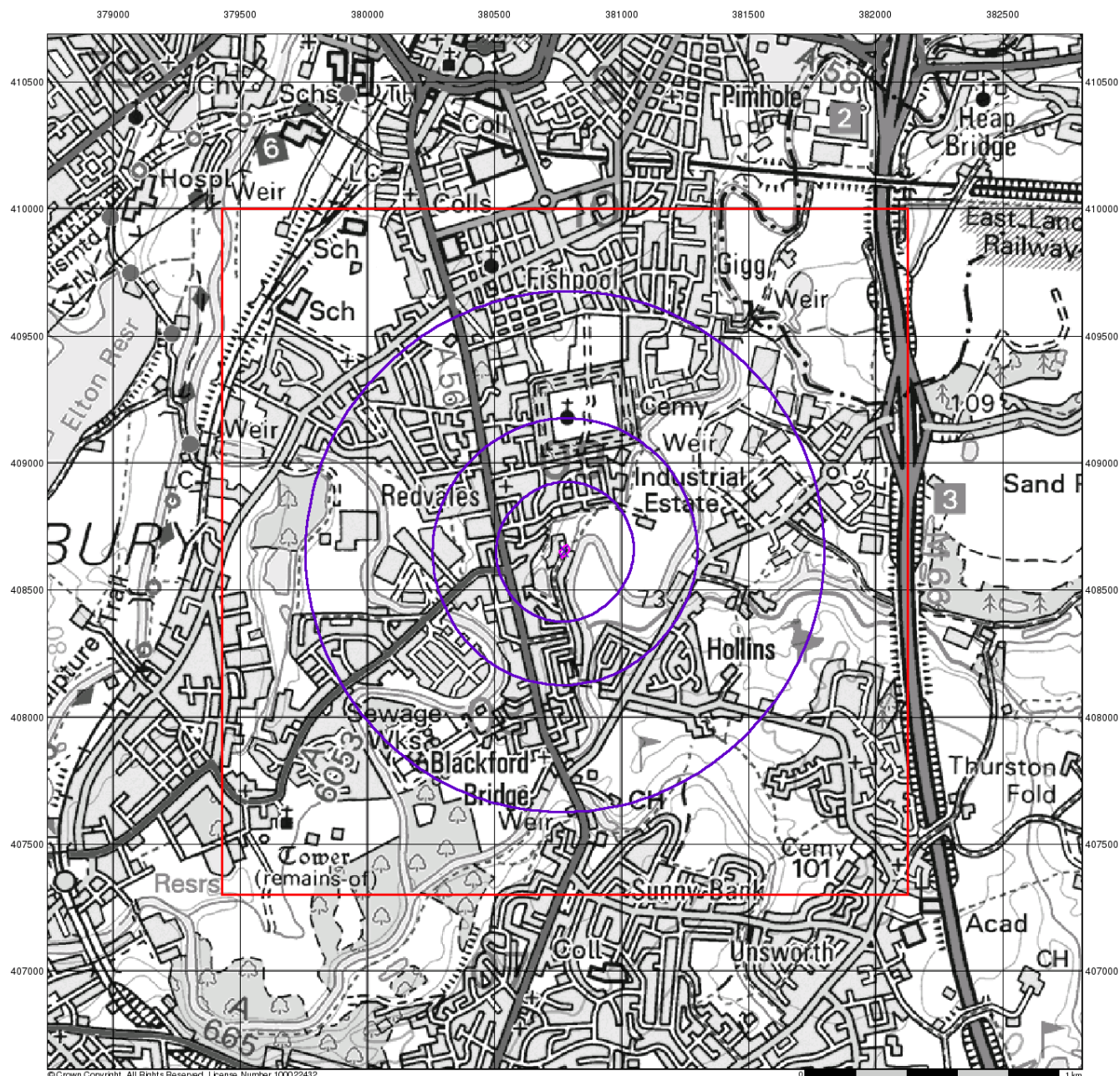
Order Number: 298857873_1_1
 Customer Reference: LKC 22 1353
 National Grid Reference: 380780, 408650
 Slice: A
 Site Area (Ha): 0.11
 Search Buffer (m): 1000

Site Details:

Land adjacent to 23 Meadway, Bury, BL9 9TY



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GROUP

Source Protection Zones

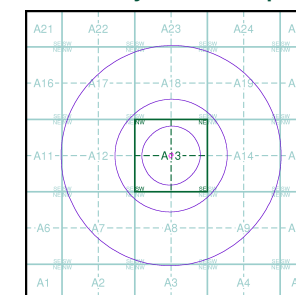
General

- ◆ Specified Site
- Specified Buffer(s)
- X Bearing Reference Point
- Slice
- B Map ID

Agency and Hydrological

- Inner zone (Zone 1)
- Inner zone - subsurface activity only (Zone 1c)
- Outer zone (Zone 2)
- Outer zone - subsurface activity only (Zone 2c)
- Total catchment (Zone 3)
- Total catchment - subsurface activity only (Zone 3c)
- Special interest (Zone 4)

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 298857873_1_1
 Customer Ref: LKC 22 1353
 National Grid Reference: 380780, 408650
 Slice: A
 Site Area (Ha): 0.11
 Search Buffer (m): 1000

Site Details

Land adjacent to 23 Meadway, Bury, BL9 9TY

Landmark
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Published 1894 - 1895

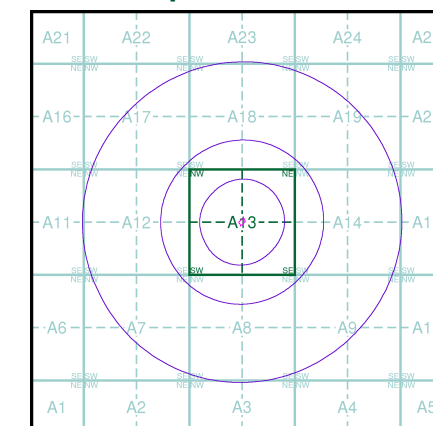
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)

087SE 1894 1:10,560	088SW 1894 1:10,560
095NE 1895 1:10,560	096NW 1894 1:10,560

Historical Map - Slice A



Order Details

Order Number: 298857873_1_1
Customer Ref: LKC 22 1353
National Grid Reference: 380780, 408650
Slice: A
Site Area (Ha): 0.11
Search Buffer (m): 1000

Site Details

Land adjacent to 23 Meadway, Bury, BL9 9TY



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LK GROUP

Manchester

Published 1975

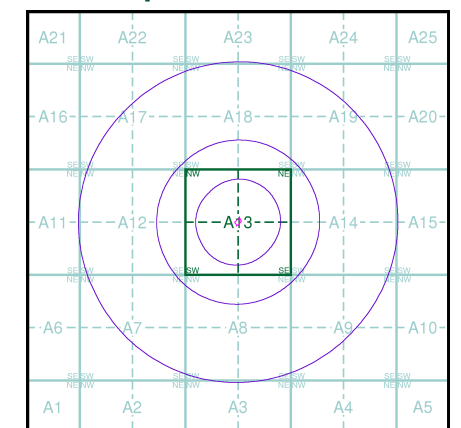
Source map scale - 1:25,000

These maps were produced by the Russian military during the Cold War between 1950 and 1997, and cover 103 towns and cities throughout the U.K. The maps are produced at 1:25,000, 1:10,000 and 1:5,000 scale, and show detailed land use, with colour-coded areas for development, green areas, and non-developed areas. Buildings are coloured black and important building uses (such as hospitals, post offices, factories etc.) are numbered, with a numbered key describing their use. They were produced by the Russians for the benefit of navigation, as well as strategic military sites and transport hubs, for use if they were to have invaded the U.K. The detailed information provided indicates that the areas were surveyed using land-based personnel, on the ground, in the cities that are mapped.

Map Name(s) and Date(s)

SD71 1975 1:25,000	SD81 1975 1:25,000
SD70 1975 1:25,000	SD80 1975 1:25,000

Russian Map - Slice A



Order Details

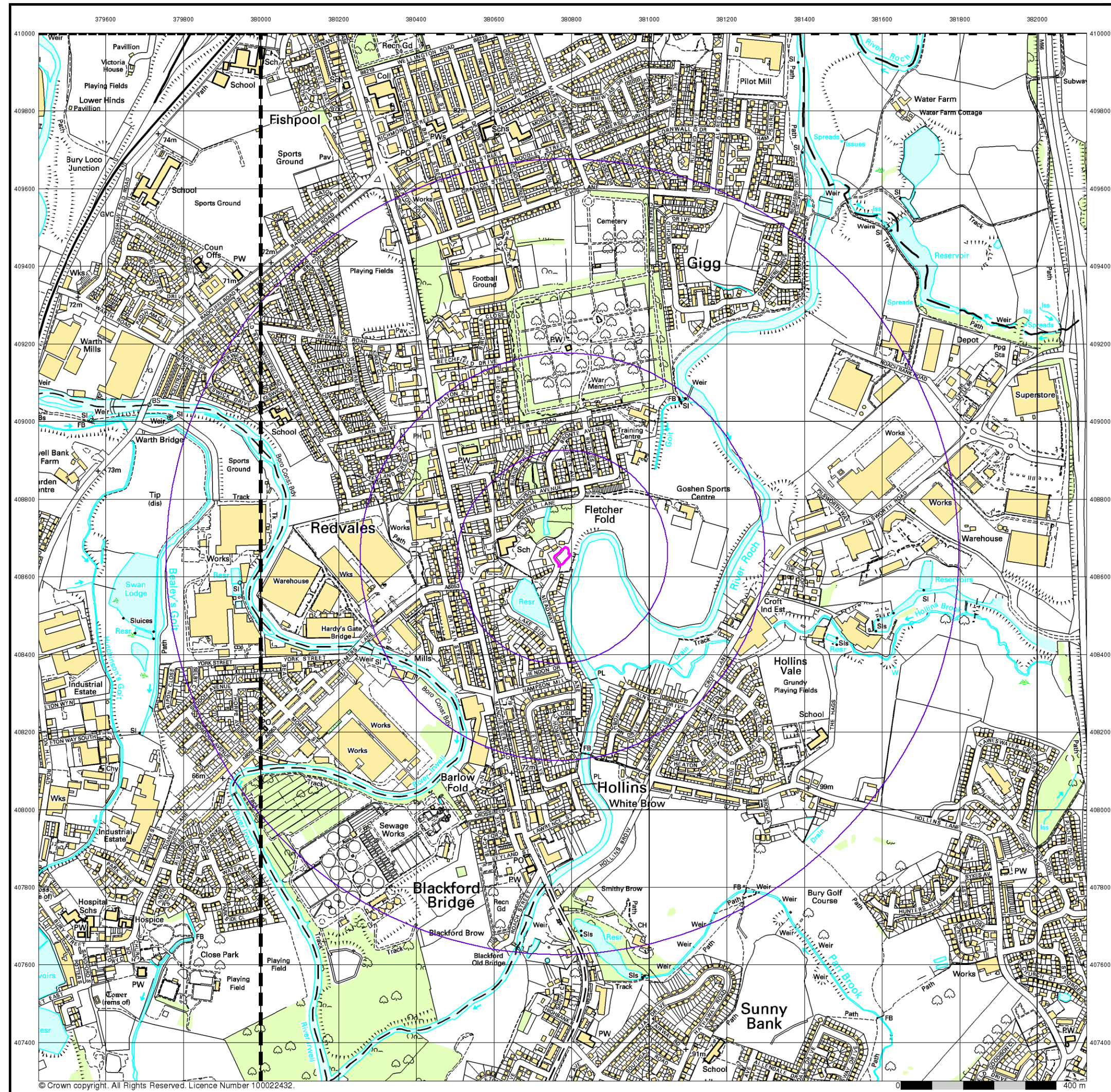
Order Number: 298857873_1_1
Customer Ref: LKC 22 1353
National Grid Reference: 380780, 408650
Slice: A
Site Area (Ha): 0.11
Search Buffer (m): 1000

Site Details

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Landmark
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Fax: 0844 844 9951
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LK GROUP

10k Raster Mapping

Published 2006

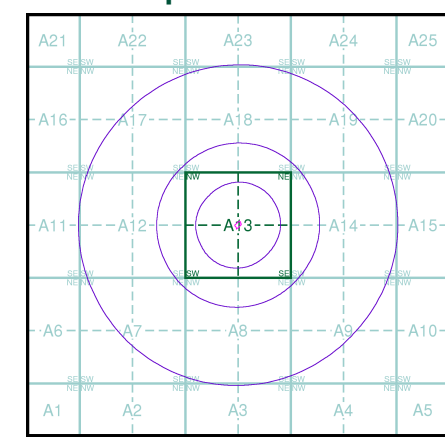
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey's 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)

SD71SE	SD81SW
2006	2006
1:10,000	1:10,000
SD70NE	SD80NW
2006	2006
1:10,000	1:10,000

Historical Map - Slice A

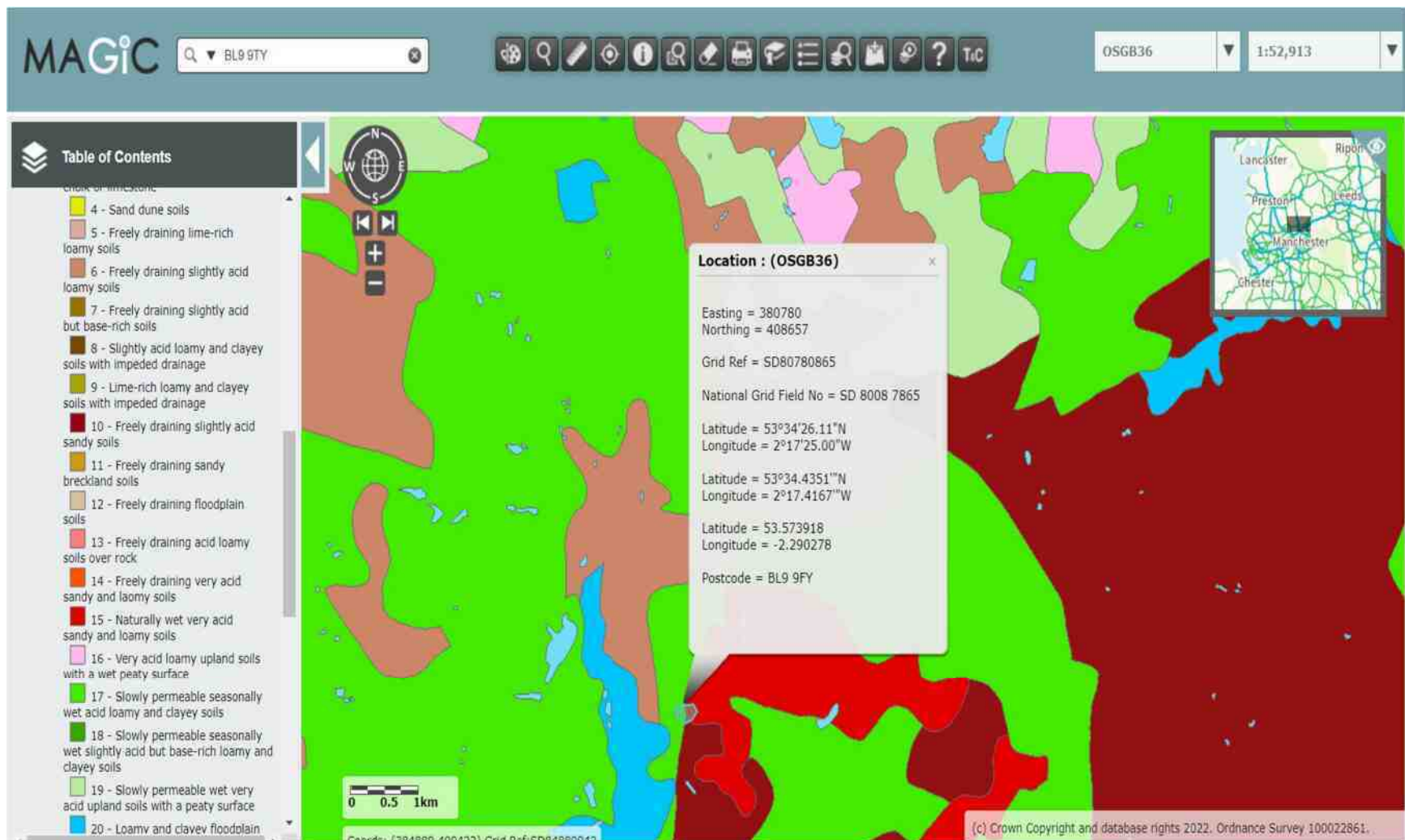


Order Details

Order Number: 298857873_1_1
Customer Ref: LKC 22 1353
National Grid Reference: 380780, 408650
Slice: A
Site Area (Ha): 0.11
Search Buffer (m): 1000

Site Details

Land adjacent to 23 Meadway, Bury, BL9 9TY



Defra Soilscape Mapping - (c) Crown Copyright and database rights 2021. Ordnance Survey 100022861

SD 80 NW 145

 GEOTECHNICAL DEVELOPMENTS GEOTECHNICAL INVESTIGATION SERVICES Telephone (0788) 565115. Fax (0788) 547111.					BOREHOLE LOG Borehole 2 Sheet 1 of 1	
Method Shell & Auger.		Date 20/04/90 - 20/04/90		Site HEADWAY: BURY		
Dia mm		Coord		Ground Level m.00		Client G C McDONALD AND PARTNERS
Soil Samples/Tests		Water & Progress	OD Level m.	Depth m.	Description of Strata	Legend
Type/Test	Depth m.					
B1	0.00 - 0.60				Soft to firm organic dark grey sandy very silty CLAY with gravels and much reed and grass material. (FILL) (0.60)	
S1 N=5	0.60 - 1.05			0.60	Loose orange brown fine clayey silty SAND with some fine rootlets (1.40)	XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX
D1	1.30				becoming firm to stiff mottled orange brown / dark grey sandy very silty CLAY with occasional brick fragments and plant debris.	XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX
U1 (18*) B2	1.60 - 2.05 1.60 - 2.00			2.00	Medium dense orange brown SAND AND GRAVEL. (2.00)	XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX
C2 N=22 B3	2.05 - 2.50 2.00 - 3.50	STRIKE at 2.05m rose to 1.9m				
C3 N=31	3.05 - 3.50					
U2 (S1)	4.05 - 4.50			4.00	Stiff brown sandy silty CLAY with some gravels (GLACIAL TILL) (1.30)	-X- -X- -X- -X- -X- -X- -X- -X- -X- -X-
D2	5.00			5.30	Moderately weak purple grey MUOUSTONE/ fine micaceous SANDSTONE (0.90)	
S4 N=52	5.75 - 6.20			6.20	(WESTPHALIAN A - COAL MEASURES) "Trencherbone Rock"	
Remarks Water encountered at 2.05m, rose to 1.9m after 20 mins, after casing pulled rose to 2.05m bgl Chiselling from 2.0 to 4.0m took 0.75hours and at 5.3 to 5.75m took 0.75hours U100 at 1.6m no recovery					Logged by JCE Scale 1:50 End Casing Depth m. 4.10 Job No. E09390 Sample/Test key: U () U100 sample (blows) D Disturbed sample B Bulk sample W Water sample - Progress & Day Penetration Tests S () Standard (N value) C () Cone (N value) * Blows and penetration when 300mm not achieved	

Norwest Holst Soil Engineering Ltd.						Borehole No. 1	
BOREHOLE LOG						Sheet <u>1</u> of <u>2</u> Chainage <u>SD80NW 211</u> Ground Level <u>76.9</u> m.A.O.D. Date <u>28/10/80 - 29/10/80</u>	
Contract No. <u>F4767</u> Location <u>Pilsworth - Bury</u> Client <u>Metropolitan Borough of Bury</u> Method of Boring <u>Percussion</u> Diameter of Borehole <u>150mm</u>						<u>SD80NW 211</u> <u>8127 6858</u>	
Description of Strata	Legend	Depth Below G.L. (m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/R.Q.D.%	Daily Progress
MADEGROUND : Hardcore, ash, brick with some clay		0.90	76.0		0.50	63	
MADEGROUND : Ash and clay with some brick and gravel		2.00	74.9		1.50 2.00	12	
MADEGROUND : Soft grey very sandy clay		3.40	73.5		3.00 3.50	12	
Loose brown silty SAND with some clay and peaty clay (madeground?)		4.50			4.50	11	
		5.50			5.50	12	
		6.30	70.6		6.50		
Soft light grey mottled very sandy CLAY with small roots		8.00	68.9		7.50 8.00		
Soft light brown very sandy silty CLAY					9.00		
Type of Sample Is S.P.T. Undisturbed Ic. C.P.T. X Vane O Jar Δ Water ● P.U.T.		Remarks (Observations of Ground Water etc.) Water seepage from 3.40m - dried up Water standing at 6.20m, in morning casing 7.0m Strong flow from lower gravel Piezometer installed at 9.50m seals at 8.00 Piezometer standing level 13/Nov. 4.60m " " " 4/Dec. 4.00m					

Flood risk

Low risk: depth

Location

BL9 9TY



Surface water flood risk: water depth in a low risk scenario

Flood depth (millimetres)

Over 900mm 300 to 900mm Below 300mm Location you selected

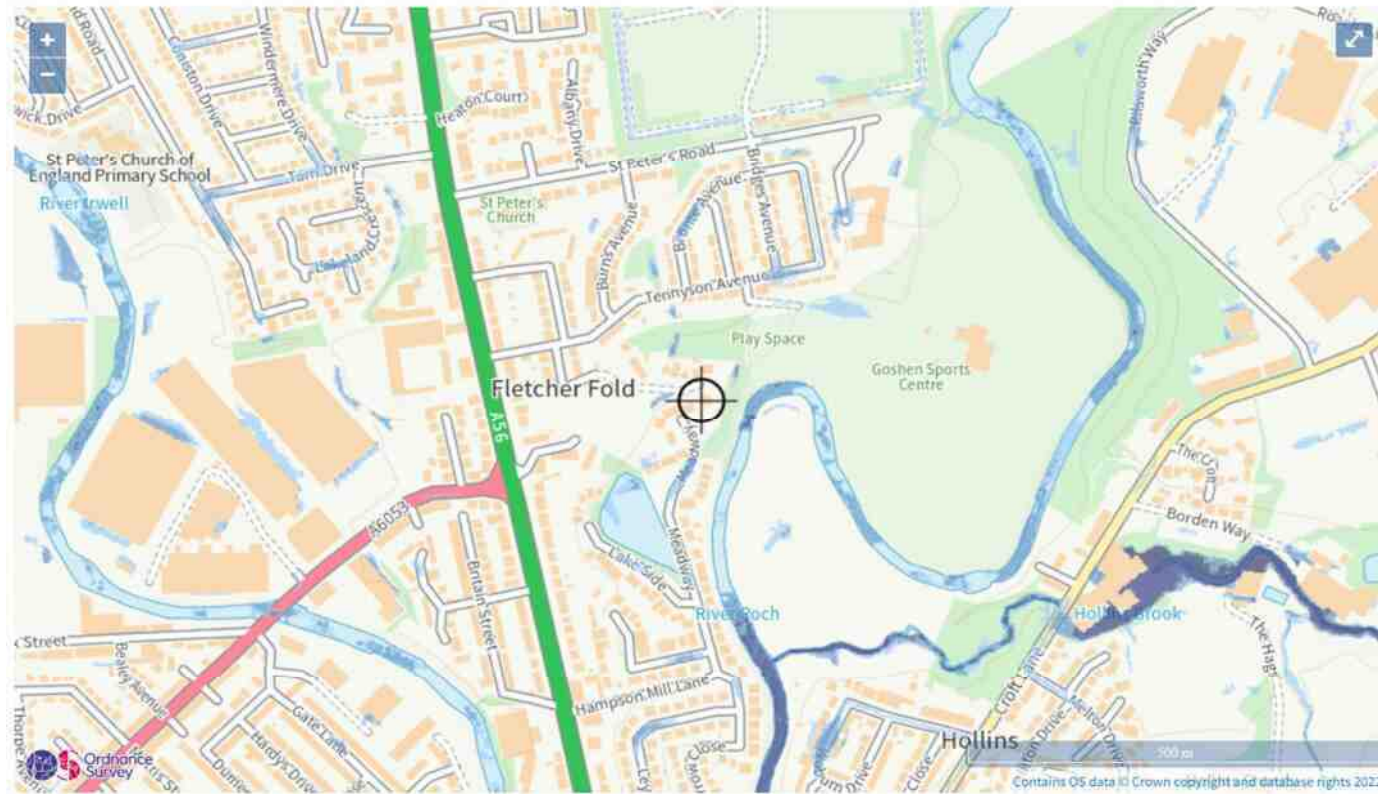
Low Surface Water Risk of Flooding - © Crown copyright and database rights 2021 OS 100024198

Flood risk

Medium risk: depth

Location

BL9 9TY



Surface water flood risk: water depth in a medium risk scenario

Flood depth (millimetres)

Over 900mm 300 to 900mm Below 300mm Location you selected

Medium Surface Water Risk of Flooding - © Crown copyright and database rights 2021 OS 100024198.

Flood risk

High risk: depth

Location

BL9 9TY



Surface water flood risk: water depth in a high risk scenario

Flood depth (millimetres)

● Over 900mm
 ● 300 to 900mm
 ● Below 300mm
 ⊕ Location you selected

APPENDIX C

CONSULTEE CORRESPONDENCE

LKGroup**Unit 29 Eton Business Park
Unit 29, Eton Business Park,
Radcliffe, Greater Manchester
M26 2ZS****FAO:****How to contact us:****United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP****Telephone: 0370 7510101****E-mail: propertysearches@uuplc.co.uk****Your Ref: FRA 22 1125
Our Ref: UUPS-ORD-419594
Date: 05/08/2022****Dear Sirs****Location: 23 MEADWAY, BURY, BL9 9TY**

I acknowledge with thanks your request dated 02/08/2022 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.

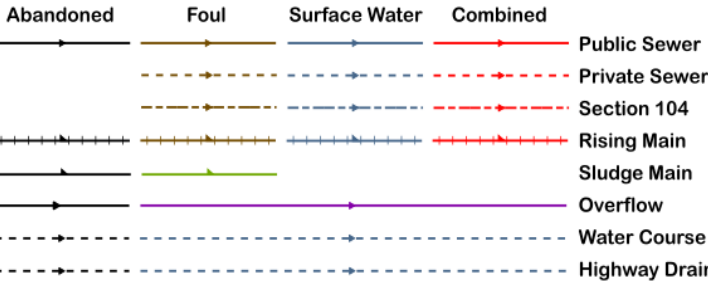


The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Reho	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
6410	75.8	FO	74.42	225	150	VC	VC	27.01851	1 in 450
6502	69.62	CO	67.82	0	225	VC	VC	9.155483	
7415	CO	0	225	150	VC	VC	27.02094		
7802	71.68	CO	0	225	VC	VC	12.89913		
7513	CO	0	225	150	VC	VC	64.07027		
7606	76.4	CO	74.95	0	150	VC	VC	21.14462	
6802	CO	0	150	VC	VC	12.11814			
7414	CO	0	225	150	VC	VC	58.82177	1 in 178	
7315	CO	0	100	VC	VC	2.17247			
6402	FO	0	225	150	VC	VC	6.622126		
6313	66.65	FO	74.82	150	VC	VC	20.79784		
6906	76.45	CO	0	225	VC	VC	11.51005	1 in 348	
7320	74.43	CO	70.36	525	VC	VC	66.09841		BR
5801	71.17	CO	69.18	225	VC	VC	4.122468		
7803	71.17	CO	69.18	225	VC	VC	67.25337	1 in 154	
5801	76.02	BR	72.12	525	VC	VC	67.25337	1 in 210	
6309	76.02	SW	72.12	225	VC	VC	58.69412	1 in 147	
7904	CO	0	225	150	VC	VC	46.01709		
7512	CO	0	100	VC	VC	16.69025			
7408	69.77	FO	67.32	225	VC	VC	20.56386		
5404	74.76	FO	0	300	VC	VC	19.16314	1 in 156	
7308	CO	0	67.23	225	VC	VC	34.9285		
7417	CO	0	150	VC	VC	17	1 in 340		
7313	CO	0	150	VC	VC	4.433194			
7511	CO	0	150	VC	VC	18.75631			
5801	76.53	CO	75.07	225	VC	VC	8.241064	1 in 119	
8314	CO	0	100	VC	VC	102.1812			
5401	CO	0	225	150	VC	VC	8.341479		
4702	76.97	CO	73.02	525	VC	VC	20.86667	1 in 107	
7903	70.84	CO	0	225	VC	VC	96.32368		
7610	CO	0	150	VC	VC	17.26268			
7312	69.25	FO	67.04	100	VC	VC	5.113854		
7301	69.25	FO	67.04	225	VC	VC	4.43584		
6404	69.16	CO	67.40	150	VC	VC	23.03713	1 in 264	
7602	67.88	SW	65.82	225	VC	VC	11.53187		
7508	CO	0	225	150	VC	VC	44.82187		
8309	CO	0	150	VC	VC	15.81139			
7454	68.79	SW	65.77	300	VC	VC	5.54128		
7319	CO	0	300	VC	VC	14.33767	1 in 68		
5502	CO	0	300	VC	VC	19.64888			BR
5308	74.56	CO	73.45	225	VC	VC	15.4685		
5506	CO	0	500	VC	VC	49.71727			
8312	CO	0	150	VC	VC	72.55721			
5401	74.71	CO	71.13	525	VC	VC	14.52945	1 in 140	
7401	68.52	FO	67.76	100	VC	VC	8.277785	1 in 137	
6312	CO	0	150	VC	VC	72.39992			
7416	69.62	SW	67.24	0	VC	VC	18.74277		
6305	69.62	SW	67.24	225	VC	VC	15.59489	1 in 75	
7801	73.38	CO	71.01	150	VC	VC	27.01851	1 in 58	
7325	CO	0	100	VC	VC	44.35468			
6306	69.68	SW	67.71	375	VC	VC	7.001054		
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8313	CO	0	225	150	VC	VC	31.57331	1 in 158	
7452	69.21	SW	66.28	225	VC	VC	5.212826		
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7420	CO	0	100	VC	PSC	12.48057			
7427	CO	0	100	VC	VC	6.754305			
7410	CO	0	0	VC	VC	4.014751			
7405	68.82	CO	67.18	225	VC	VC	44.2078		
8316	CO	0	150	VC	VC	7.823361			
5501	CO	0	960	VC	VC	49.64877			
7418	CO	0	150	VC	VC	13.64921			
5504	CO	0	225	VC	VC	110.4219			
7311	CO	0	100	VC	VC	6.613274	1 in 449		
7453	68.68	SW	65.48	375	VC	VC	71.8401		
7309	CO	0	150	VC	VC	6.290102			
5305	CO	0	100	VC	VC	33.98943			
8902	72.52	CO	70.63	225	VC	VC	61	1 in 59	
7426	CO	0	150	VC	VC	7.073895			
6307	CO	0	225	VC	VC	100.5885			
7324	CO	0	100	VC	VC	11.07938			
7408	CO	0	100	VC	VC	10.60043			
7310	CO	0	100	VC	VC	8.148169			
5309	74.65	CO	73.23	225	VC	VC	40.26164	1 in 61	
7351	69.27	CO	66.53	375	VC	VC	10.44031		
6804	CO	0	150	VC	VC	10.47135			
6705	CO	0	150	VC	VC	30.70055			
6314	CO	0	100	VC	VC	16.66336			
8315	CO	0	150	VC	VC	14.9712	1 in 144		
6305	CO	0	150	VC	VC	16.5237			
6708	69.37	FO	66.88	150	VC	VC	7.084733		
6503	SW	0	225	VC	VC	82.28442			
6405	FO	0	150	VC	VC	17.98336			
6805	CO	0	150	VC	VC	8.201804			
7616	CO	0	100	VC	VC	7.078815			
6701	76.28	CO	74.16	225	VC	VC	13.15295	1 in 132	
6504	69.39	CO	67.84	225	VC	VC	82.45242	1 in 238	
4404	74.73	CO	66.72	1000	VC	VC	5.09902	1 in 14	
4525	CO	0	150	VC	VC	8.035588			
6715	CO	0	150	VC	VC	14.92883			PE
5503	74.79	CO	72.37	300	VC	VC	75.09697		
6909	CO	0	225	VC	VC	10.78852			
4405	74.48	CO	66.35	2500	VC	VC	118.0436	1 in 1686	
7553	68.27	SW	65.52	225	VC	VC	27.73855	1 in 277	
6903	70.85	CO	69.27	225	VC	VC	41.7732	1 in 190	
5901	77.13	CO	75.41	300	VC	VC	62.96281		
5406	74	CO	0	225	VC	VC	84.92938		
6716	CO	0	150	VC	VC	22.44625			
8801	70.67	CO	69.02	150	VC	VC	47.85384	1 in 141	
6801	76.22	CO	74.58	225	VC	VC	62.80127	1 in 363	
6901	71.13	CO	69.59	225	VC	VC	46.87217	1 in 53	
4403	CO	0	225	VC	VC	33.95585			
5714	CO	0	150	VC	VC	7.140135			
8801	70.31	CO	66.96	1000	VC	VC	85.22443	1 in 341	
7505	68.09	SW	65.88	225	VC	VC	23.4094	1 in 156	
7303	CO	0	225	VC	VC	21.47891			
7802	71.83	CO	68.9	300	VC	VC	53.60037	1 in 101	
8702	68.85	CO	66.69	900	VC	VC	46.09772		BR
7605	CO	0	150	VC	VC	6.151576			
5703	76.04	CO	74.29	225	VC	VC	30.59412	1 in 180	
8807	CO	0	100	VC	VC	17.84146			
6714	CO	0	150	VC	VC	8.816494			
7451	68.57	SW	65.32	450	VC	VC	36.76955		
8804	70.28	CO	68.12	525	VC	VC	3.895551		
7509	68.16	SW	0	225	VC	VC	44.01136		
7432	CO	0	150	VC	VC	10.15911	1 in 421		
5302	69.28	CO	67.18	1400	VC	VC	78.94279	1 in 373	
8301	69.29	CO	66.97	1550	VC	VC	26.12129		ST
7905	CO	0	150	VC	VC	17.67862	1 in 3722		
8701	70.4	CO	66.71	1000	VC	VC	37.21559		
6316	FO	0	100	VC	VC	14.95826	1 in 83		
7503	68.42	SW	66.93	150	VC	VC	5		
5713	CO	0	150	VC	VC	31.95725			
7804	71.1	CO	68.91	300	VC	VC	60.01666	1 in 162	
8803	70.61	CO	68.33	525	VC	VC	16.12452	1 in 90	
7306	69.06	SW	0	300	VC	VC	59.03125		
7806	CO	0	150	VC	VC	11.70332			
8802	70.84	CO	68.37	375	VC	VC	19.19497	1 in 478	
7501	68.65	CO	67	225	VC	VC	24.22322	1 in 11	
0301	69.28	CO	67.14	1400	VC	VC	104.5466		
9901	71.25	CO	68.39	225	VC	VC	21.05052		

LEGEND



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

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

MANHOLE FUNCTION

- FO Foul
- SW Surface Water
- CO Combined
- OV Overflow

SEWER SHAPE

- CI Circular
- TR Trapezoidal
- EG Egg
- AR Arch
- OV Oval
- BA Barrel
- FT Flat Top
- HO HorseShoe
- RE Rectangular
- UN Unspecified
- SQ Square

SEWER MATERIAL

- AC Asbestos Cement
- BR Brick
- PE Polyethylene
- RP Reinforced Plastic Matrix
- CO Concrete
- CSB Concrete Segment Bolted
- CSU Concrete Segment Unbolted
- CC Concrete Box Culvert
- PSC Plastic / Steel Composite
- GRC Glass Reinforced Plastic
- DI Ductile Iron
- PVC Polyvinyl Chloride
- CI Cast Iron
- SI Spun Iron
- ST Steel
- VC Vitrefied Clay
- PP Polypropylene
- PF Pitch Fibre
- MAC Masonry, Coursed
- MAR Masonry, Random
- U Unspecified

Address or Site Reference:

23 MEADWAY,
BURY,
BL9 9TY

Jenna Lowe

From: wastewaterdeveloperservices@uuplc.co.uk
Sent: 09 August 2022 15:09
To: Jenna Lowe
Subject: Pre Development Enquiry for: LAND ADJACENT TO 23 MEADWAY BURY BL9 9TY UU
Reference Number : 02578331

Good afternoon Jenna,

Pre Development Enquiry for: LAND ADJACENT TO 23 MEADWAY BURY BL9 9TY UU Reference Number : 02578331

We have carried out an assessment of your application which is based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your drainage strategy will need to be reviewed by other competent authorities as part of the planning process, and we advise that you carry out the necessary site investigations to confirm the viability of your proposals.

If your investigations require access to our public sewer network, we ask that you contact our network engineers with a request for an access certificate via our main contact telephone number 0345 6723 723 or refer to the link below:

<https://www.unitedutilities.com/builders-developers/working-near-our-assets/>

Foul Water

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system.

Our preferred point of discharge would be to the 980 x 1170mm diameter public combined sewer within the site boundary of your proposed development at an unrestricted rate.

If you are able to identify an alternative, more suitable point of discharge, we request that you contact us at your earliest convenience so that we can assess suitability.

In accordance with our infrastructure plans we may ask you to change your point of connection. Therefore please contact us when you are ready to formalise your drainage proposals, we would suggest before you submit for Full Planning.

Surface Water

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you prioritise the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.

This is outlined as follows, in order of priority:

1. **into the ground (infiltration);**

2. **to a surface waterbody;**
3. **to a surface water sewer or highway drain;**
4. **to a combined sewer.**

For guidance, The [North West SuDS Pro-Forma](#) provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

Infiltration

Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible.

A detailed evidence based feasibility assessment must be carried out in line with Chapter 25 of the CIRIA SuDS Manual 2015 to determine whether infiltration is a suitable method of surface water disposal.

Particular attention must be paid to Ground Water Source Protection Zones to ensure that the risk of pollution to these valuable resources is not compromised. Details can be obtained from the government website:

<https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs#find-groundwater-spzs>

If your site is in a Groundwater Source Protection Zone, you should have regard to the Environment Agency's approach to Groundwater Protection. Information on this is available via the link below:

<https://www.gov.uk/government/publications/groundwater-protection-position-statements>

Please note that such a location could have implications for the principle of your development and the need for additional mitigating measures to protect the groundwater environment and public water supply in the detailed design of your site.

Waterbody

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you contact the Lead Local Flood Authority and/or Environment Agency to discuss a point of discharge to the open ordinary watercourse located 11m East of the proposed site.

We would encourage you to identify and engage with any third party landowner and riparian owner to agree access and discharge rights to the water body if this is not in your ownership.

Highway Drainage

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you investigate the possibility of draining surface water to the highway drain where this ultimately discharges to a watercourse, by contacting the relevant Highway Authority.

Public Sewer

In accordance with the hierarchy of drainage options within the National Planning Practice Guidance, both discharge to ground via infiltration and discharge to a waterbody should be discounted prior to consideration of discharging surface water to the public sewer system. Evidence should be provided to demonstrate how these have been discounted, as outlined in the North West SuDS pro-forma.

Once evidence is provided as outlined above, United Utilities will consider a connection to the 225mm diameter public surface water sewer within Meadway located South of the proposed site at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 5l/s.

As a Water Company, we have no obligation to accept highway drainage into our public sewer network. However, should your proposals include runoff from highways, we would request that consideration is given to SuDS components that deliver source control are incorporated within the design of the scheme to reduce the volume and frequency of discharges of these flows to the public sewer.

Levels

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist, we recommend that you contact us to discuss further. It could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

Land drainage / Overland flows / track drainage

United Utilities have no obligation, and furthermore we do not accept land drainage, overland flows or track drainage into the public sewerage network under any circumstances

Existing Wastewater Assets Crossing the Site

We have significant assets crossing this site that cannot realistically be diverted. We would ask that you obtain a copy of our asset data records from your provider and plan your development around them ensuring that all legal easements are observed. If any work is required that may impart vibration into the ground we would ask that you contact us for further advice.

Please be aware that any proposed diversion may require modelling. This process may take up to 6 months in order to reach an acceptable design.

Please refer to the link below to obtain full details of the processes involved with sewer diversions:

<https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-diversions/>

Existing Water Assets Crossing the Site

It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address:

DeveloperServicesWater@uuplc.co.uk. Further information for this service can be found on our website via the link

below:

<https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/>

Historic Flooding

I can confirm that we have no current record of sewer flooding on our DG5 register within the vicinity of the proposed development. The DG5 register is a register of properties that have flooded as a result of hydraulic inadequacy of the public sewer network.

Please note that United Utilities Water Limited (Uuw) can only record and check flooding events which are reported to us and we have to comply with our Regulators instructions on the qualification of flooding events to place on the register.

Our response does not include:

- any sewer flooding events caused by blockages or collapses which are the result of third party actions, natural events or other actions over which Uuw has no control and not a facet of sewer capacity; or
- any historical sewer flooding events that have been removed from the register as a result of investment in our infrastructure.

Connection Application

Although we may discuss and agree discharge points and rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimately inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below:

<https://www.unitedutilities.com/builders-developers/wastewater-services/sewer-connections/sewer-connection/>

We recommend that the detailed design should confirm the locations of all utilities in the area and ensure that any proposed drainage solution considers routing and clash checks where required.

If we can be of any further assistance please don't hesitate to contact us further.

Kind regards,



Ashleigh Bellerby
Assistant Developer Engineer
Developer Services & Metering
Customer Services
T: 07826891650
unitedutilities.com

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----- Original Message -----

From: wastewaterdeveloperservices@uuplc.co.uk [wastewaterdeveloperservices@uuplc.co.uk]

Sent: 03/08/2022 14:48

To: j.lowe@thelkgroup.com

Subject: 02578331 LAND ADJACENT TO 23 MEADWAY BURY BL9 9TY

Dear Jenna

PRE DEVELOPMENT APPLICATION AT: – UU Ref 02578331

Please accept this email as receipt of your application received on 3/8/2022 for the above development. This has now been logged on our system and the job reference is 02578331 we would ask that you quote this reference in all future correspondence.

I have reviewed your application (and attachments) and can confirm this is suitable to be passed to Ashleigh Bellerby for technical assessment. You will receive their response within 8 working days.

Kind regards Jill



Jill Ellis

Customer Advisor Advanced
Developer Services & Metering
Customer Services

Direct Tel: 01925 233 064

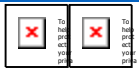
Tel: 0345 072 6067

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Jenna Lowe

From: Jenna Lowe
Sent: 02 August 2022 15:28
To: development.control@bury.gov.uk; planning.policy@bury.gov.uk
Subject: SuDS QUERY - FRA 22 1125 - Meadway, Bury
Attachments: Fig1_location and boundary plan_compress.pdf; GSS22015.2 - Meadway, Bury - 004 - Proposed Site.pdf

Dear Sir/Madam,

LK Consult Ltd. has been commissioned to undertake a Sustainable Drainage Strategy (SuDS) a site adjacent to 23 Meadway, Bury, BL9 9TY, centred at approximate National Grid Reference 380780E, 408648N.

The area of interest appears to be within Flood Zone 2.

The site location is attached to this email.

To complete the SuDS, we would be grateful if you could supply us with the following, if available, for the vicinity of the site:

- Details of any flood defences in the immediate area, including their extent, crest levels (and datum), assumed level of standard, construction and maintenance regime, as well as any other structures which may influence the local hydraulics.
- Records of any historic flood events and potential sources of flooding from rivers, land drainage, groundwater, foul and surface water sewers on site and in the area.
- Any restrictions applied to ordinary watercourses and sewers in the area.
- Highway drainage restrictions and records.
- Indications if the site is within the Critical Drainage Area.
- Policies that may relate to Sustainable Drainage Systems (SuDS).

If you have any queries, please do not hesitate to get in touch.

We are, of course, happy to pay your reasonable charge for this service. Please let me know by return what information is available, what the charge will be, and we will pay the relevant fees by debit card as soon as possible.

Any advice or recommendations you may have regarding the potential discharges from the development of this site would also be appreciated.

We will be in contact with all other relevant authorities to get a more complete understanding of the issues in the area.

Regards,
Jenna

APPENDIX D

CALCULATIONS



MasterDrain
HY 11.0

The LK Group www.thelkgroup.com		Eton Business Park, Eton Hill Road, Radcliffe M26 2ZS Tel: 0161 763 7200 email: m.jones@thelkgroup.com		Job No.	
				Sheet no. 1	
				Date 22/08/22	
Project Greenfield Runoff Meadway, Bury				By	Checked
Title Greenfield Runoff Meadway, Bury					Reviewed

Hydrological Data:-

FSR Hydrology:-

Location = MEADWAY	Grid reference = SD 8008
M5-60 (mm) = 18.8	r = 0.32
Soil runoff = 0.45	SAAR (mm/yr) = 1050
WRAP = 4	Area = England & Wales
Hydrological area = 10	Hydrological zone = 7

Soil classification for WRAP type 4

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Design data:-

Area = 0.0011 Km² - 0.11 Ha - 1100 m²

Calculation method:-

Runoff is calculated from:-

$$Q_{\text{BAR(rural)}} = 0.00108 \text{ AREA}^{0.89} \cdot \text{SAAR}^{1.17} \cdot \text{SOIL}^{2.17}$$

where

AREA = Site area in Km²
 SAAR = Standard Average Annual Rainfall (mm/yr)
 SOIL = Soil value derived from Winter Rainfall Acceptance Potential
 Q_{BAR(rural)} = Runoff (cumecs)

Q_{BAR(rural)} is then multiplied by a growth factor - GC(T) - for different storm return periods derived from EA publication W5-074/A.

Calculated data:-

For areas less than 50Ha, a modified calculation which multiplies the 50Ha runoff value by the ratio of the site area to 50Ha is used
Reducing factor used for these calculations is 0.002

Mean Annual Peak Flow $Q_{\text{BAR(rural)}} = 0.78 \text{ l/s}$



MasterDrain
HY 11.0

The LK Group

www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 2		
Date 22/08/22		
By	Checked	Reviewed

Project **Greenfield Runoff Meadway, Bury**

Title **Greenfield Runoff Meadway, Bury**

Values for $Q_{BAR(rural)}$

Ret. per. 1yr	m ³ /hr	l/s	l/s/ha	Ret. per. 100yr+20%	m ³ /hr	l/s	l/s/ha
2yr	2.600	0.722	6.566	100yr+30%	7.632	2.120	19.274
5yr	3.383	0.940	8.542	100yr+40%	8.219	2.283	20.756
10yr	3.858	1.072	9.743	200yr	6.710	1.864	16.944
30yr	4.697	1.305	11.861	200yr + 30%	8.723	2.423	22.027
50yr	5.172	1.437	13.061	500yr	7.632	2.120	19.274
100yr	5.871	1.631	14.826	1000yr	8.499	2.361	21.462

Growth factors -

1yr	2yr	5yr	10yr	30yr	50yr	100yr	200yr	500yr	1000yr
0.85	0.93	1.21	1.38	1.68	1.85	2.10	2.40	2.73	3.04

The above is based on the Institute of Hydrology Report 124
to which you are referred for further details (see Sect 7).
Note that the 200 and above year growth curves were taken from W5-074.



MasterDrain
SW

The LK Group

www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 1		
Date 11/11/22		
By	Checked	Reviewed

Project	30 Years Storage Event Meadway, Bury
Title	30 Years Storage Event Meadway, Bury

Data:-

FSR Hydrology:-

Location = MEADWAY
M5-60 (mm) = 18.8
Soil index = 0.45
Return period = 30
UCWI = 109.6

Grid reference = SD 8008
r = 0.32
SAAR (mm/yr) = 1050
WRAP = 4
Climate change = 0

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Runoff factor (RF) = 46.0, calculated from:-

$$\text{Runoff factor} = (0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$$

where

PIMP = Impervious Area*100/(Impervious Area+Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 400 m²
Total area (TA) = 700 m²
Mean disch. rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 300 m²
Equiv area = 322 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 0

Calculated data:-

Time to max = 7.0 mins
Rainfall at max = 94.23 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 1.4 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 8.00 mm/hr

Calculated storage volume = 0.0 m³
Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	183.4	1125	1.4	400 x 600	8.0	500 x 500	5.8
150	81.5	1200	1.3	600 x 900	3.5	500 x 750	3.8
225	36.2	1275	1.1	800 x 1200	2.0	500 x 1000	2.9
300	20.4	1350	1.0			750 x 1000	1.9
375	13.0	1425	0.9			750 x 1200	1.6
450	9.1	1500	0.8			750 x 1500	1.3
525	6.7	1575	0.7			1000 x 1000	1.4
600	5.1	1650	0.7			1000 x 1200	1.2
675	4.0	1725	0.6			1000 x 1500	1.0
750	3.3	1800	0.6			1000 x 1800	0.8
825	2.7	1875	0.5			1000 x 2000	0.7
900	2.3	1950	0.5			1500 x 1500	0.6
975	1.9	2025	0.4			1500 x 1800	0.5
1050	1.7	2100	0.4			1500 x 2000	0.5



MasterDrain
SW

Data:-

The LK Group

www.thelkgroup.com

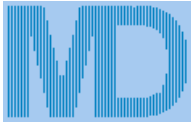
Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 2		
Date 11/11/22		
By	Checked	Reviewed

Project	30 Years Storage Event Meadway, Bury
Title	30 Years Storage Event Meadway, Bury

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	81.0	4.329	3.000	1.329
20	56.0	6.060	6.000	0.060
30	45.0	7.183	9.000	0.000
40	37.0	8.034	12.000	0.000
50	33.0	8.726	15.000	0.000
60	29.0	9.313	18.000	0.000
70	26.0	9.824	21.000	0.000
80	24.0	10.278	24.000	0.000
90	22.0	10.688	27.000	0.000
100	21.0	11.061	30.000	0.000
110	19.0	11.404	33.000	0.000
120	18.0	11.721	36.000	0.000
130	17.0	12.017	39.000	0.000
140	16.0	12.293	42.000	0.000
150	16.0	12.553	45.000	0.000
160	15.0	12.798	48.000	0.000
170	14.0	13.029	51.000	0.000
180	14.0	13.249	54.000	0.000
190	13.0	13.458	57.000	0.000
200	13.0	13.657	60.000	0.000
210	12.0	13.847	63.000	0.000
220	12.0	14.029	66.000	0.000
230	12.0	14.204	69.000	0.000
240	11.0	14.371	72.000	0.000
250	11.0	14.532	75.000	0.000
260	11.0	14.693	78.000	0.000
270	10.0	14.851	81.000	0.000
280	10.0	15.004	84.000	0.000
290	10.0	15.153	87.000	0.000
300	10.0	15.299	90.000	0.000
310	9.0	15.440	93.000	0.000
320	9.0	15.578	96.000	0.000
330	9.0	15.713	99.000	0.000
340	9.0	15.844	102.000	0.000
350	9.0	15.973	105.000	0.000
360	8.0	16.099	108.000	0.000
370	8.0	16.222	111.000	0.000
380	8.0	16.343	114.000	0.000
390	8.0	16.461	117.000	0.000
400	8.0	16.577	120.000	0.000
410	8.0	16.690	123.000	0.000
420	7.0	16.802	126.000	0.000
430	7.0	16.912	129.000	0.000
440	7.0	17.019	132.000	0.000
450	7.0	17.125	135.000	0.000
460	7.0	17.229	138.000	0.000
470	7.0	17.331	141.000	0.000
480	7.0	17.431	144.000	0.000
490	7.0	17.530	147.000	0.000
500	7.0	17.628	150.000	0.000
510	6.0	17.723	153.000	0.000
520	6.0	17.818	156.000	0.000
530	6.0	17.911	159.000	0.000
540	6.0	18.003	162.000	0.000
550	6.0	18.093	165.000	0.000
560	6.0	18.182	168.000	0.000
570	6.0	18.270	171.000	0.000
580	6.0	18.357	174.000	0.000
590	6.0	18.442	177.000	0.000
600	6.0	18.527	180.000	0.000

Storage volume (m³) = 1.4 m³



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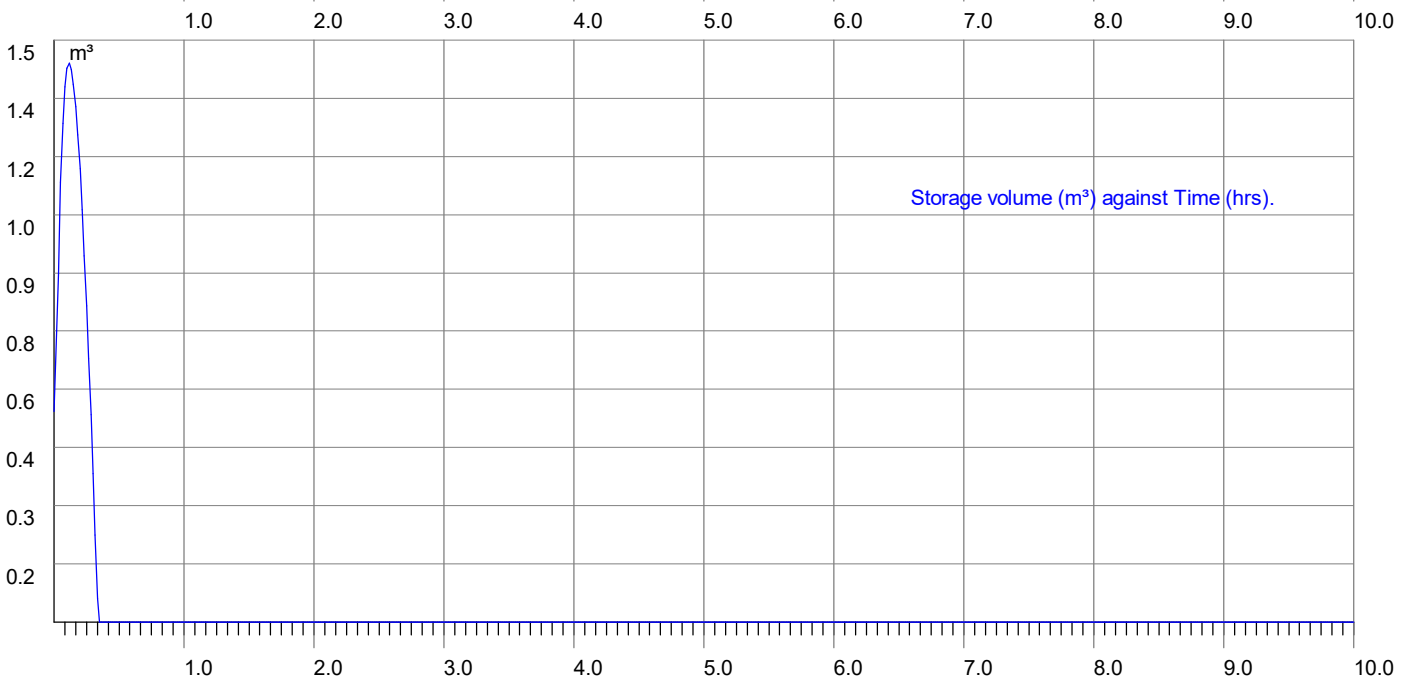
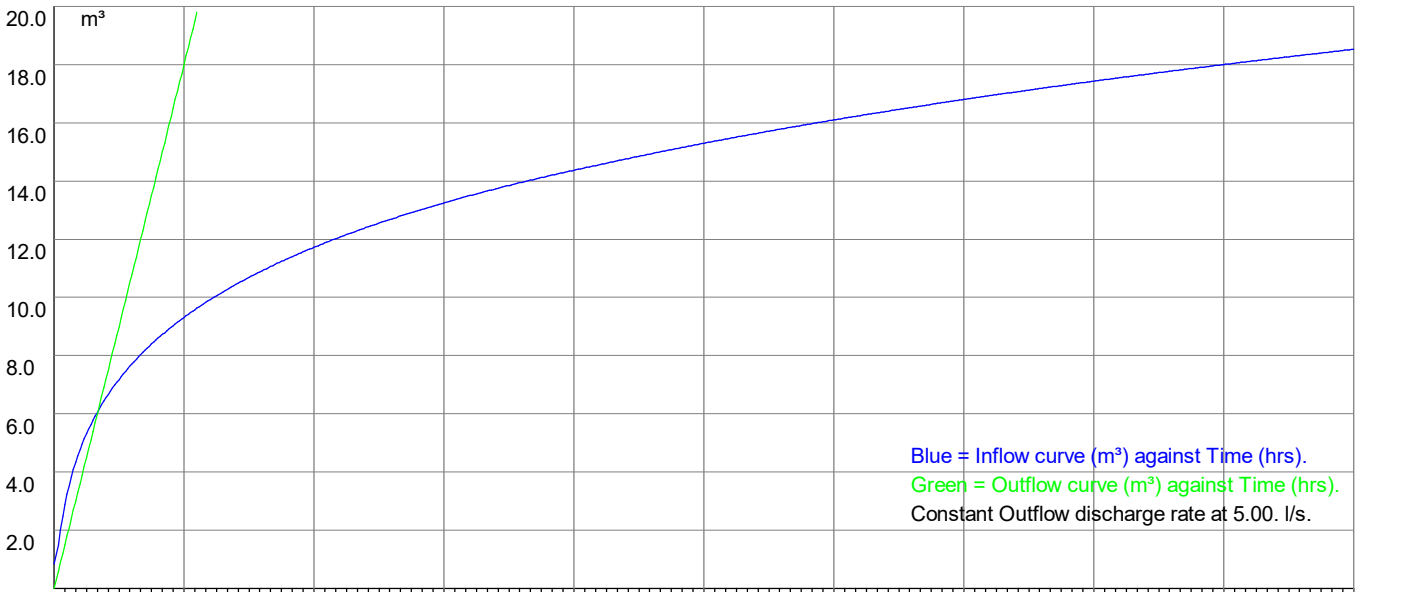
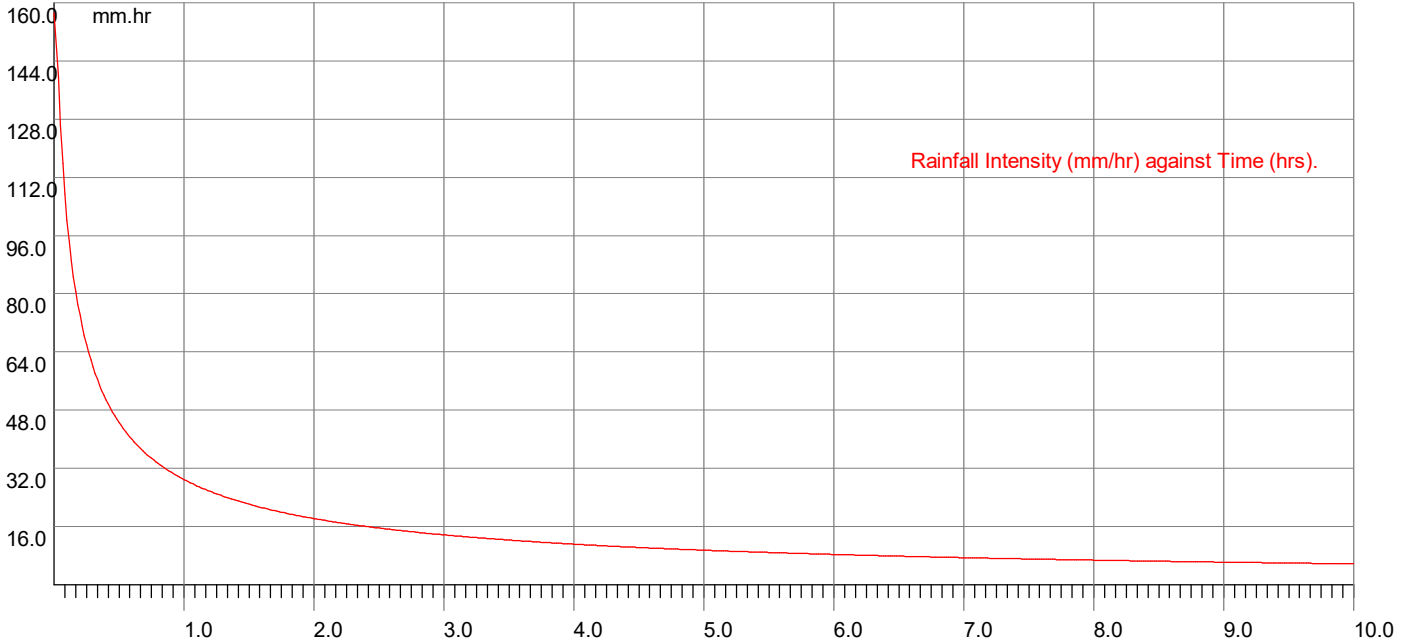
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Eton Hill Road,
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Tel: 0161 763 7200
email: m.jones@thelkgroup.com

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Project **30 Years Storage Event Meadway, Bury**

Title **30 Years Storage Event Meadway, Bury**





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Project **30 Years Storage Event Meadway, Bury**

Title **30 Years Storage Event Meadway, Bury**

Explanatory notes for Peak Flow Storage

- 1) This system uses the rainfall intensity/ duration curve calculated using either the Wallingford or FEH method as selected.
- 2) The balance is calculated from the inflow minus the outflow.
- 3) The storage volume is the maximum value of the balance curve.
- 4) This method was described by Davis (1963) - see Butler & Davies, 2nd edition, p294
- 5) References to 'storm duration' relate only to the hydrograph method (qv).
- 6) There are always 600 steps in the calculation process, thus a 'run' time of 10 hours will be sampled every minute,

Explanatory notes for Hydrograph Storage

- 1) The user has the choice of Summer or Winter curves
- 2) The mean intensity varies with the duration of the storm curve
- 3) There are always 120 steps in the calculation process, irrespective of storm duration.
- 4) The balance is calculated from the inflow minus the outflow.
- 5) The storage volume is the sum of the balance values for each step.
- 6) Varying durations should be tried to find the maximum storage value - this can be narrowed down very closely.

*Modelling using the flow characteristics of the restrictor is available using Vortex Control modelling function. Please be aware that this function needs the full design data file to function.

Why do the two methods give different results?

The rainfall characteristics for each method are very different.

The Peak flow (using the Intensity/Duration/Frequency curve) does not model the actual rainfall. This curve is joined points which represent the mean intensity of a storm at a given duration i.e. a value of 19.5 mm/hr for a 60 minute storm indicates that over the sixty minute period, the mean intensity was 19.5 mm/hr. The calculation method samples the IDF curve for a given location and frequency (Return Period) and calculates the storage for that rate and duration less the outflow volume. The maximum value is displayed as the 'worst case' storage. The outflow volume is constant throughout the process at the specified discharge rate.

The hydrograph method uses a standard curve for either Winter or Summer storms. Traditionally these are symmetrical about the central peak. UK rainfall does not fit into this convenient curve, so the calculations are dealing with a stylised set of data. The mean intensity for the storm is calculated from the IDF curve and applied to the curve data, calculating the storage for that step less the outflow volume. The final storage volume is the sum of the storage for all the steps. The outflow volume varies with the hydraulic head on the control device using flow equations provided by the control manufacturer. This is a far more accurate method than the peak flow method and often results in bigger storage volumes.

It can be seen that these two methods are very different, and the user may have the choice of which result to use. This is not an exact science, though is often treated as such by those that do not understand the principles of the calculations.



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email: m.jones@thelkgroup.com

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Project	100 Years + 20% CC Storage Event Meadway, Bury
Title	100 Years + 20% CC Storage Event Meadway, Bury

Data:-

FSR Hydrology:-

Location = MEADWAY
M5-60 (mm) = 18.8
Soil index = 0.45
Return period = 100
UCWI = 109.6

Grid reference = SD 8008
r = 0.32
SAAR (mm/yr) = 1050
WRAP = 4
Climate change = 20

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Runoff factor (RF) = 46.0, calculated from:-

$$\text{Runoff factor} = (0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$$

where

PIMP = Impervious Area*100/(Impervious Area+Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 400 m²
Total area (TA) = 700 m²
Mean disch. rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 300 m²
Equiv area = 322 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 20

Calculated data:-

Time to max = 13.0 mins
Rainfall at max = 109.94 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 3.8 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 13.00 mm/hr

Calculated storage volume = 0.0 m³
Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	480.1	1125	3.8	400 x 600	20.9	500 x 500	15.1
150	213.4	1200	3.3	600 x 900	9.1	500 x 750	10.1
225	94.8	1275	3.0	800 x 1200	5.1	500 x 1000	7.5
300	53.3	1350	2.6			750 x 1000	5.0
375	34.1	1425	2.4			750 x 1200	4.2
450	23.7	1500	2.1			750 x 1500	3.4
525	17.4	1575	1.9			1000 x 1000	3.8
600	13.3	1650	1.8			1000 x 1200	3.1
675	10.5	1725	1.6			1000 x 1500	2.5
750	8.5	1800	1.5			1000 x 1800	2.1
825	7.1	1875	1.4			1000 x 2000	1.9
900	5.9	1950	1.3			1500 x 1500	1.7
975	5.1	2025	1.2			1500 x 1800	1.4
1050	4.4	2100	1.1			1500 x 2000	1.3



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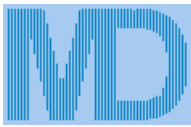
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Radcliffe M26 2ZS
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Project	100 Years + 20% CC Storage Event Meadway, Bury
Title	100 Years + 20% CC Storage Event Meadway, Bury

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	124.0	6.648	3.000	3.648
20	88.0	9.435	6.000	3.435
30	70.0	11.248	9.000	2.248
40	59.0	12.622	12.000	0.622
50	51.0	13.737	15.000	0.000
60	46.0	14.680	18.000	0.000
70	41.0	15.498	21.000	0.000
80	38.0	16.222	24.000	0.000
90	35.0	16.871	27.000	0.000
100	33.0	17.459	30.000	0.000
110	30.0	17.996	33.000	0.000
120	29.0	18.490	36.000	0.000
130	27.0	18.948	39.000	0.000
140	26.0	19.374	42.000	0.000
150	25.0	19.771	45.000	0.000
160	23.0	20.144	48.000	0.000
170	22.0	20.494	51.000	0.000
180	22.0	20.823	54.000	0.000
190	21.0	21.135	57.000	0.000
200	20.0	21.430	60.000	0.000
210	19.0	21.710	63.000	0.000
220	19.0	21.975	66.000	0.000
230	18.0	22.228	69.000	0.000
240	17.0	22.469	72.000	0.000
250	17.0	22.699	75.000	0.000
260	16.0	22.936	78.000	0.000
270	16.0	23.168	81.000	0.000
280	16.0	23.393	84.000	0.000
290	15.0	23.612	87.000	0.000
300	15.0	23.825	90.000	0.000
310	14.0	24.032	93.000	0.000
320	14.0	24.234	96.000	0.000
330	14.0	24.431	99.000	0.000
340	13.0	24.623	102.000	0.000
350	13.0	24.811	105.000	0.000
360	13.0	24.994	108.000	0.000
370	13.0	25.173	111.000	0.000
380	12.0	25.349	114.000	0.000
390	12.0	25.520	117.000	0.000
400	12.0	25.689	120.000	0.000
410	12.0	25.853	123.000	0.000
420	12.0	26.015	126.000	0.000
430	11.0	26.173	129.000	0.000
440	11.0	26.329	132.000	0.000
450	11.0	26.482	135.000	0.000
460	11.0	26.632	138.000	0.000
470	11.0	26.779	141.000	0.000
480	10.0	26.924	144.000	0.000
490	10.0	27.066	147.000	0.000
500	10.0	27.206	150.000	0.000
510	10.0	27.344	153.000	0.000
520	10.0	27.480	156.000	0.000
530	10.0	27.613	159.000	0.000
540	10.0	27.745	162.000	0.000
550	9.0	27.874	165.000	0.000
560	9.0	28.002	168.000	0.000
570	9.0	28.128	171.000	0.000
580	9.0	28.252	174.000	0.000
590	9.0	28.374	177.000	0.000
600	9.0	28.495	180.000	0.000

Storage volume (m³) = 3.8 m³



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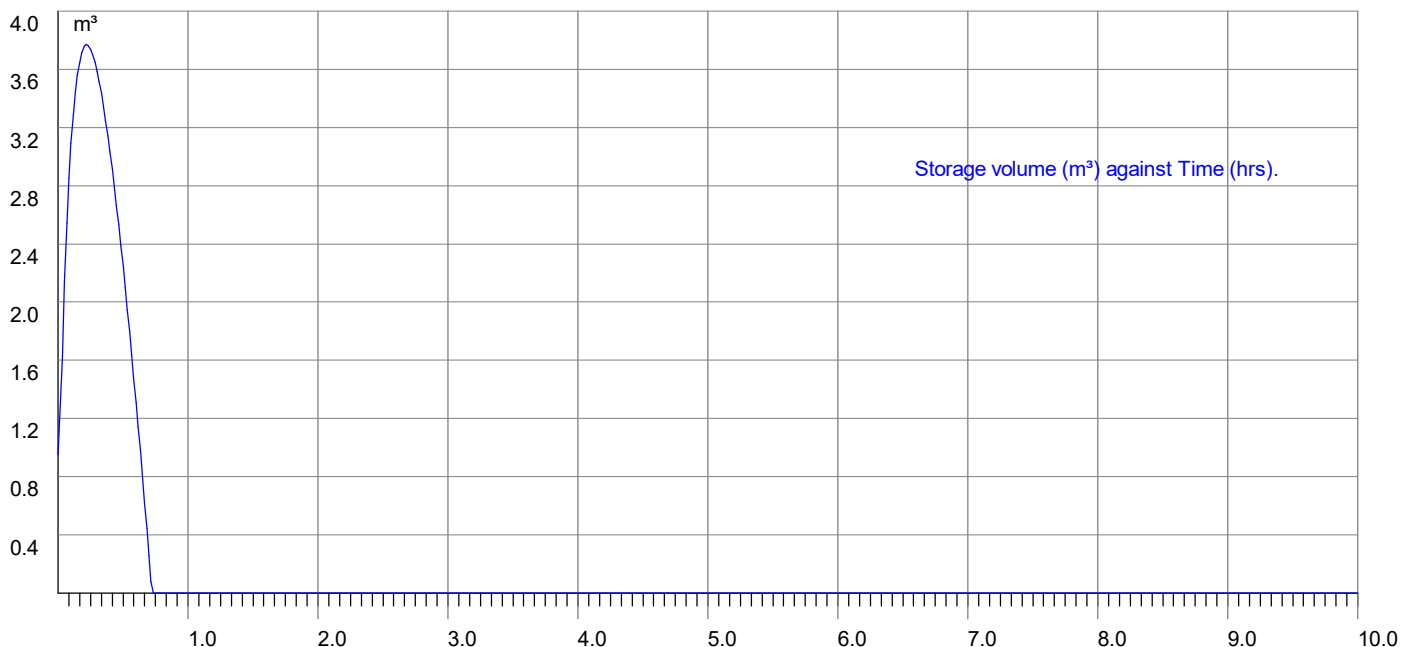
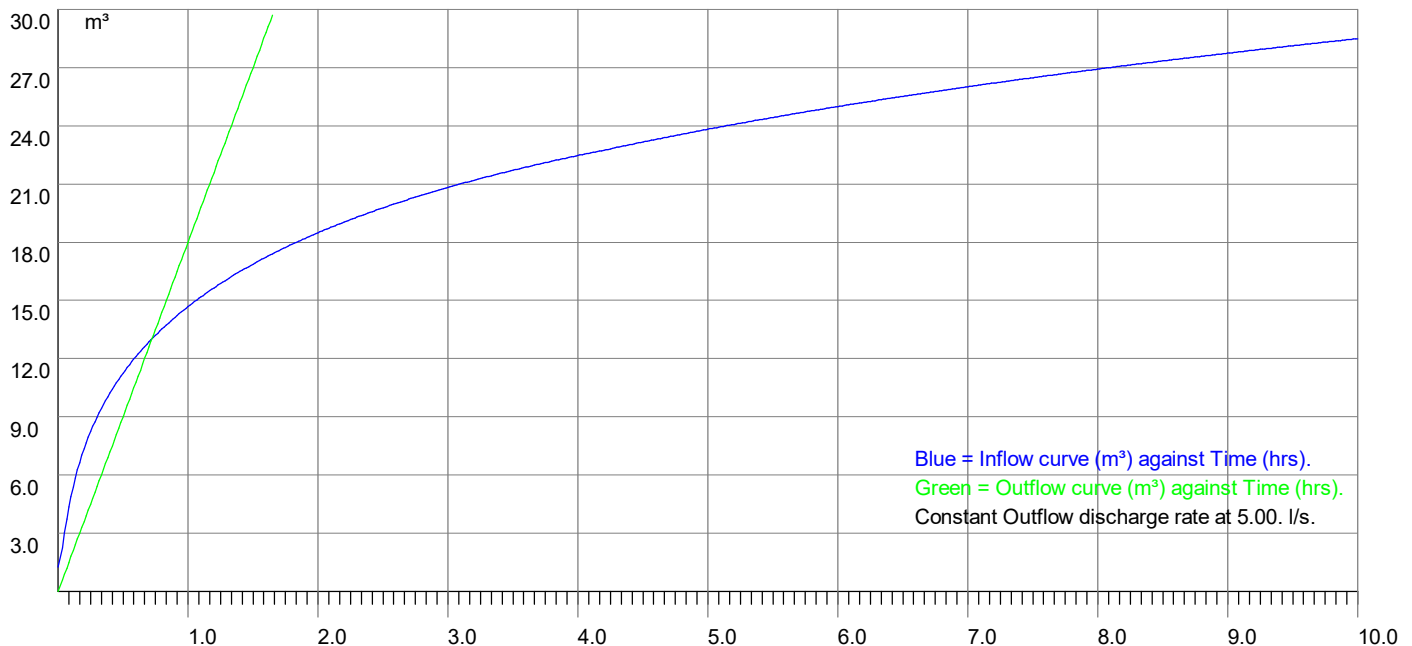
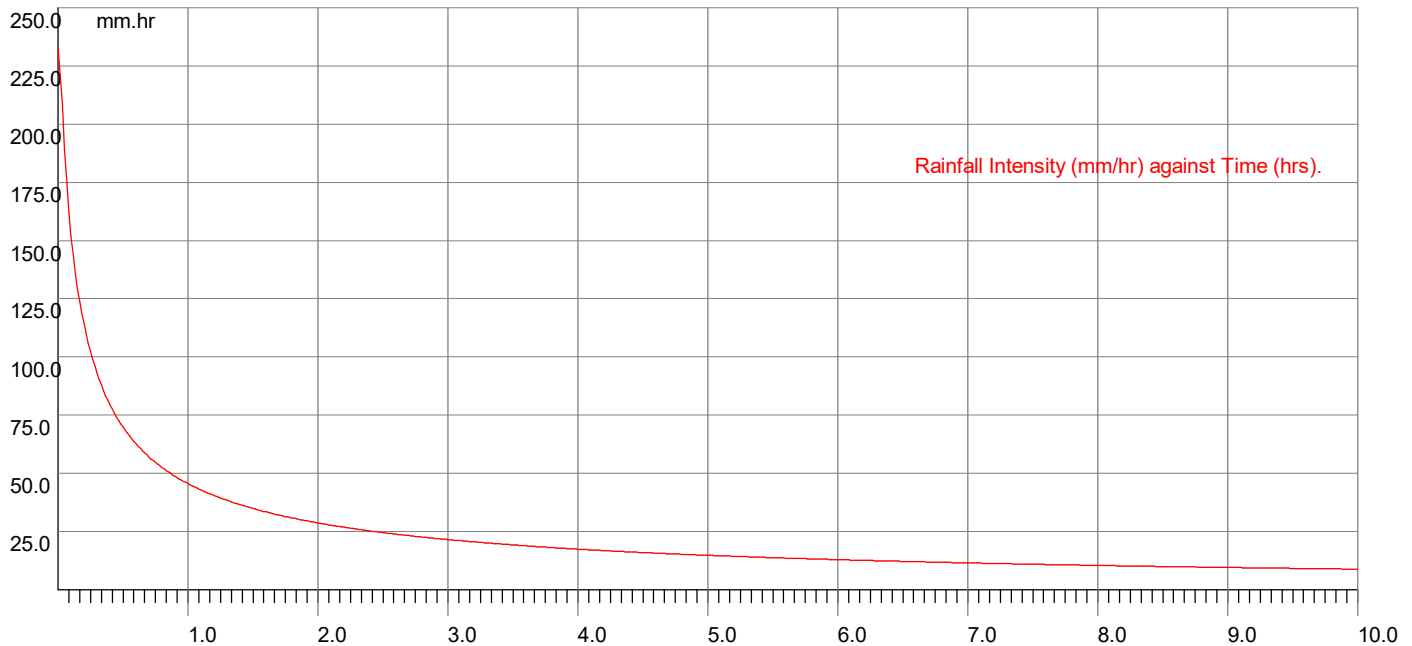
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Project **100 Years + 20% CC Storage Event Meadway, Bury**

Title **100 Years + 20% CC Storage Event Meadway, Bury**





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Project **100 Years + 20% CC Storage Event Meadway, Bury**
Title **100 Years + 20% CC Storage Event Meadway, Bury**

Explanatory notes for Peak Flow Storage

- 1) This system uses the rainfall intensity/ duration curve calculated using either the Wallingford or FEH method as selected.
- 2) The balance is calculated from the inflow minus the outflow.
- 3) The storage volume is the maximum value of the balance curve.
- 4) This method was described by Davis (1963) - see Butler & Davies, 2nd edition, p294
- 5) References to 'storm duration' relate only to the hydrograph method (qv).
- 6) There are always 600 steps in the calculation process, thus a 'run' time of 10 hours will be sampled every minute,

Explanatory notes for Hydrograph Storage

- 1) The user has the choice of Summer or Winter curves
- 2) The mean intensity varies with the duration of the storm curve
- 3) There are always 120 steps in the calculation process, irrespective of storm duration.
- 4) The balance is calculated from the inflow minus the outflow.
- 5) The storage volume is the sum of the balance values for each step.
- 6) Varying durations should be tried to find the maximum storage value - this can be narrowed down very closely.

*Modelling using the flow characteristics of the restrictor is available using Vortex Control modelling function. Please be aware that this function needs the full design data file to function.

Why do the two methods give different results?

The rainfall characteristics for each method are very different.

The Peak flow (using the Intensity/Duration/Frequency curve) does not model the actual rainfall. This curve is joined points which represent the mean intensity of a storm at a given duration i.e. a value of 19.5 mm/hr for a 60 minute storm indicates that over the sixty minute period, the mean intensity was 19.5 mm/hr. The calculation method samples the IDF curve for a given location and frequency (Return Period) and calculates the storage for that rate and duration less the outflow volume. The maximum value is displayed as the 'worst case' storage. The outflow volume is constant throughout the process at the specified discharge rate.

The hydrograph method uses a standard curve for either Winter or Summer storms. Traditionally these are symmetrical about the central peak. UK rainfall does not fit into this convenient curve, so the calculations are dealing with a stylised set of data. The mean intensity for the storm is calculated from the IDF curve and applied to the curve data, calculating the storage for that step less the outflow volume. The final storage volume is the sum of the storage for all the steps. The outflow volume varies with the hydraulic head on the control device using flow equations provided by the control manufacturer. This is a far more accurate method than the peak flow method and often results in bigger storage volumes.

It can be seen that these two methods are very different, and the user may have the choice of which result to use. This is not an exact science, though is often treated as such by those that do not understand the principles of the calculations.



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email: m.jones@thelkgroup.com

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Project	100 Years + 40% CC Storage Event Meadway, Bury
Title	100 Years + 40% CC Storage Event Meadway, Bury

Data:-

FSR Hydrology:-

Location = MEADWAY
M5-60 (mm) = 18.8
Soil index = 0.45
Return period = 100
UCWI = 109.6

Grid reference = SD 8008
r = 0.32
SAAR (mm/yr) = 1050
WRAP = 4
Climate change = 40

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Runoff factor (RF) = 46.0, calculated from:-

$$\text{Runoff factor} = (0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$$

where

PIMP = Impervious Area*100/(Impervious Area+Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 400 m²
Total area (TA) = 700 m²
Mean disch. rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 300 m²
Equiv area = 322 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 40

Calculated data:-

Time to max = 16.0 mins
Rainfall at max = 115.49 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 5.1 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 15.00 mm/hr

Calculated storage volume = 0.0 m³
Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	651.6	1125	5.1	400 x 600	28.4	500 x 500	20.5
150	289.6	1200	4.5	600 x 900	12.4	500 x 750	13.6
225	128.7	1275	4.0	800 x 1200	7.0	500 x 1000	10.2
300	72.4	1350	3.6			750 x 1000	6.8
375	46.3	1425	3.2			750 x 1200	5.7
450	32.2	1500	2.9			750 x 1500	4.5
525	23.6	1575	2.6			1000 x 1000	5.1
600	18.1	1650	2.4			1000 x 1200	4.3
675	14.3	1725	2.2			1000 x 1500	3.4
750	11.6	1800	2.0			1000 x 1800	2.8
825	9.6	1875	1.9			1000 x 2000	2.6
900	8.0	1950	1.7			1500 x 1500	2.3
975	6.9	2025	1.6			1500 x 1800	1.9
1050	5.9	2100	1.5			1500 x 2000	1.7



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Data:-

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Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

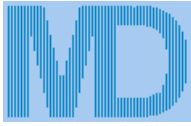
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Project **100 Years + 40% CC Storage Event Meadway, Bury**

Title **100 Years + 40% CC Storage Event Meadway, Bury**

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	145.0	7.756	3.000	4.756
20	103.0	11.008	6.000	5.008
30	82.0	13.122	9.000	4.122
40	69.0	14.725	12.000	2.725
50	60.0	16.026	15.000	1.026
60	53.0	17.126	18.000	0.000
70	48.0	18.081	21.000	0.000
80	44.0	18.925	24.000	0.000
90	41.0	19.682	27.000	0.000
100	38.0	20.368	30.000	0.000
110	36.0	20.995	33.000	0.000
120	33.0	21.572	36.000	0.000
130	32.0	22.106	39.000	0.000
140	30.0	22.603	42.000	0.000
150	29.0	23.066	45.000	0.000
160	27.0	23.501	48.000	0.000
170	26.0	23.909	51.000	0.000
180	25.0	24.294	54.000	0.000
190	24.0	24.658	57.000	0.000
200	23.0	25.002	60.000	0.000
210	22.0	25.328	63.000	0.000
220	22.0	25.638	66.000	0.000
230	21.0	25.933	69.000	0.000
240	20.0	26.214	72.000	0.000
250	20.0	26.482	75.000	0.000
260	19.0	26.758	78.000	0.000
270	19.0	27.029	81.000	0.000
280	18.0	27.292	84.000	0.000
290	18.0	27.547	87.000	0.000
300	17.0	27.796	90.000	0.000
310	17.0	28.038	93.000	0.000
320	16.0	28.273	96.000	0.000
330	16.0	28.503	99.000	0.000
340	16.0	28.727	102.000	0.000
350	15.0	28.946	105.000	0.000
360	15.0	29.160	108.000	0.000
370	15.0	29.369	111.000	0.000
380	15.0	29.574	114.000	0.000
390	14.0	29.774	117.000	0.000
400	14.0	29.970	120.000	0.000
410	14.0	30.162	123.000	0.000
420	13.0	30.351	126.000	0.000
430	13.0	30.536	129.000	0.000
440	13.0	30.717	132.000	0.000
450	13.0	30.895	135.000	0.000
460	13.0	31.070	138.000	0.000
470	12.0	31.242	141.000	0.000
480	12.0	31.411	144.000	0.000
490	12.0	31.577	147.000	0.000
500	12.0	31.741	150.000	0.000
510	12.0	31.901	153.000	0.000
520	11.0	32.060	156.000	0.000
530	11.0	32.216	159.000	0.000
540	11.0	32.369	162.000	0.000
550	11.0	32.520	165.000	0.000
560	11.0	32.669	168.000	0.000
570	11.0	32.816	171.000	0.000
580	11.0	32.961	174.000	0.000
590	10.0	33.103	177.000	0.000
600	10.0	33.244	180.000	0.000

Storage volume (m³) = 5.1 m³



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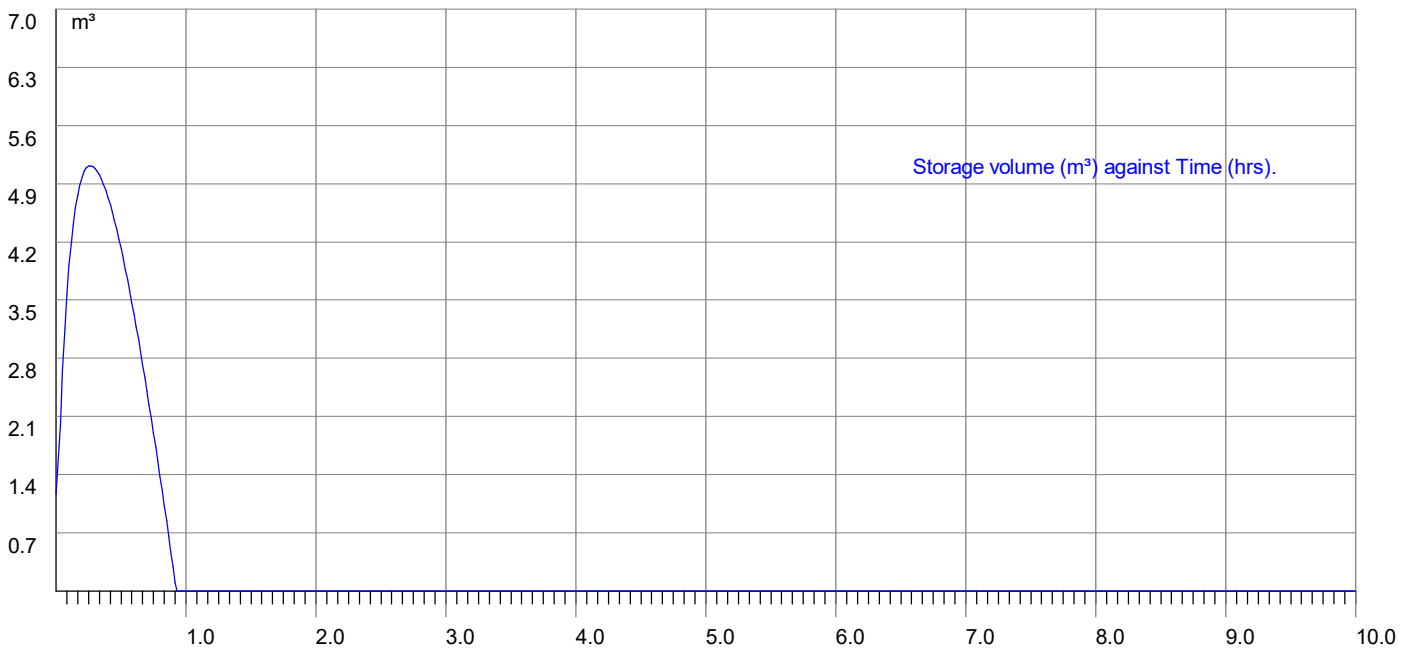
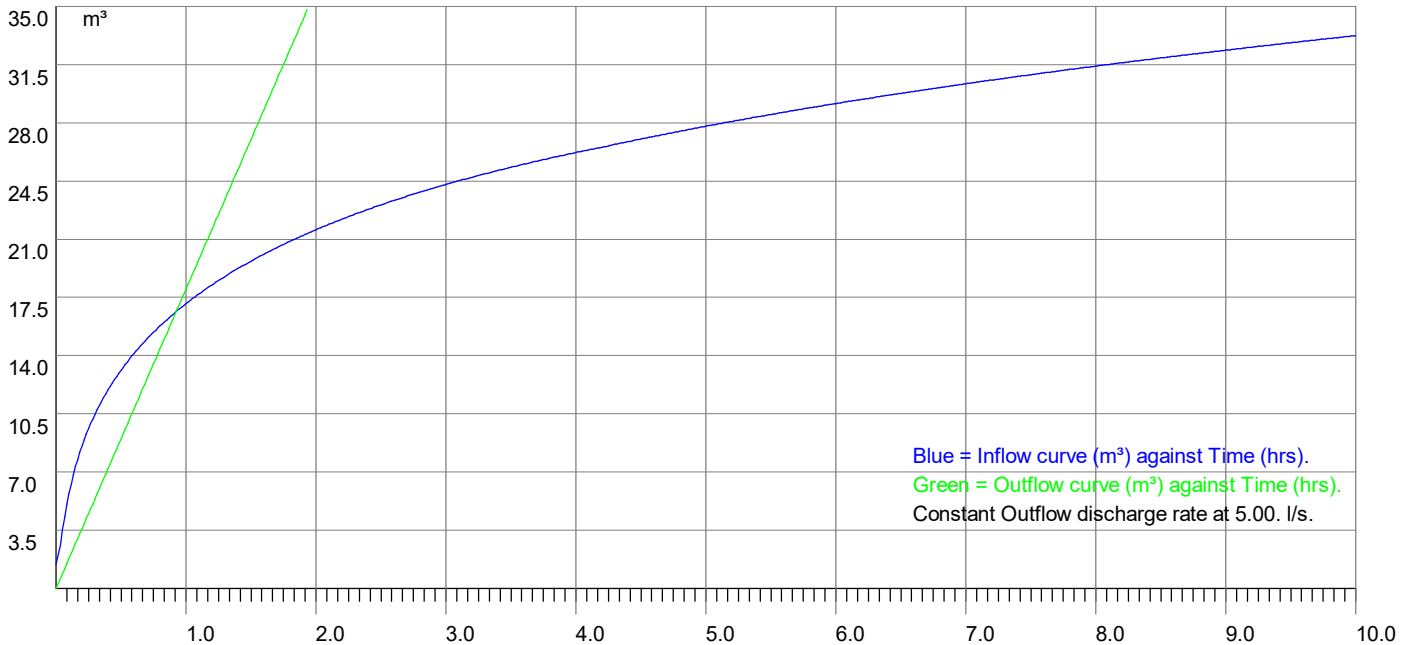
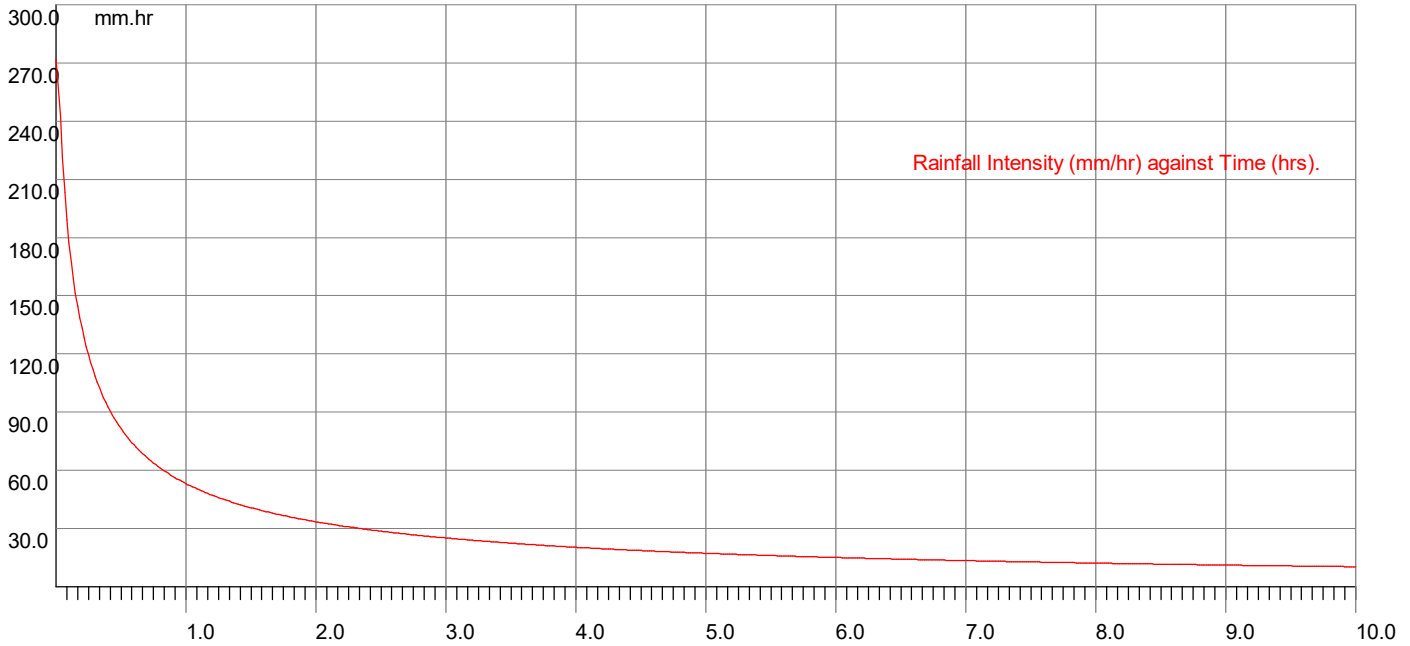
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email: m.jones@thelkgroup.com

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Project **100 Years + 40% CC Storage Event Meadway, Bury**

Title **100 Years + 40% CC Storage Event Meadway, Bury**





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email: m.jones@thelkgroup.com

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Sheet no. 4		
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By	Checked	Reviewed

Project **100 Years + 40% CC Storage Event Meadway, Bury**

Title **100 Years + 40% CC Storage Event Meadway, Bury**

Explanatory notes for Peak Flow Storage

- 1) This system uses the rainfall intensity/ duration curve calculated using either the Wallingford or FEH method as selected.
- 2) The balance is calculated from the inflow minus the outflow.
- 3) The storage volume is the maximum value of the balance curve.
- 4) This method was described by Davis (1963) - see Butler & Davies, 2nd edition, p294
- 5) References to 'storm duration' relate only to the hydrograph method (qv).
- 6) There are always 600 steps in the calculation process, thus a 'run' time of 10 hours will be sampled every minute,

Explanatory notes for Hydrograph Storage

- 1) The user has the choice of Summer or Winter curves
- 2) The mean intensity varies with the duration of the storm curve
- 3) There are always 120 steps in the calculation process, irrespective of storm duration.
- 4) The balance is calculated from the inflow minus the outflow.
- 5) The storage volume is the sum of the balance values for each step.
- 6) Varying durations should be tried to find the maximum storage value - this can be narrowed down very closely.

*Modelling using the flow characteristics of the restrictor is available using Vortex Control modelling function. Please be aware that this function needs the full design data file to function.

Why do the two methods give different results?

The rainfall characteristics for each method are very different.

The Peak flow (using the Intensity/Duration/Frequency curve) does not model the actual rainfall. This curve is joined points which represent the mean intensity of a storm at a given duration i.e. a value of 19.5 mm/hr for a 60 minute storm indicates that over the sixty minute period, the mean intensity was 19.5 mm/hr. The calculation method samples the IDF curve for a given location and frequency (Return Period) and calculates the storage for that rate and duration less the outflow volume. The maximum value is displayed as the 'worst case' storage. The outflow volume is constant throughout the process at the specified discharge rate.

The hydrograph method uses a standard curve for either Winter or Summer storms. Traditionally these are symmetrical about the central peak. UK rainfall does not fit into this convenient curve, so the calculations are dealing with a stylised set of data. The mean intensity for the storm is calculated from the IDF curve and applied to the curve data, calculating the storage for that step less the outflow volume. The final storage volume is the sum of the storage for all the steps. The outflow volume varies with the hydraulic head on the control device using flow equations provided by the control manufacturer. This is a far more accurate method than the peak flow method and often results in bigger storage volumes.

It can be seen that these two methods are very different, and the user may have the choice of which result to use. This is not an exact science, though is often treated as such by those that do not understand the principles of the calculations.

Based across the UK with
offices in Manchester,
London, Liverpool and Glasgow.

Manchester (Head Office)

Unit 29,
Eton Business Park
Eton Hill Rd, Radcliffe
M26 2ZS

t: 0161 763 7200
e: info@thelkgroup.com

London

Brooklands Business Park
Wellington Way
Weybridge
KT13 0TT

t: 01932 871872
e: info@thelkgroup.com

Glasgow

Wright Business Centre
1 Lonmay Road
Glasgow
G33 4EL

t: 0141 773 6269
e: info@thelkgroup.com

Liverpool

The Corn Exchange
Fenwick Street
Liverpool
L2 7QL

t: 0151 235 8716
e: info@thelkgroup.com

Swindon

39 Bowman House Business Centre
Bowman Court
Whitehill Lane
Royal Wootton Bassett
Swindon
SN4 7DB

t: 01793 987 390
e: info@thelkgroup.com



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