M & P Gadsden
Consulting Engineers Ltd

Drainage Strategy Report

Proposed housing development at Accrington Road, Whalley

on behalf of

Oakmere®
CREATING QUALITY HOMES

REF: 21315-GAD-00-ZZ-RE-C-3000

Document Reference	**CN 21315**
Version	**P07**
Date Released	**20th April 2026**
Prepared By:	**Rob Bruce BEng (Hons)** [redacted]
Checked:	**Richard Gadsden** [redacted]

Contents

Appendices

Appendix A – Topographical Survey

Appendix B – United Utilities Mapping

Appendix C – Greenfield Runoff Calculations

Appendix D – Drainage Design Calculations

Appendix E – Management Company Maintenance Pack

Appendix F – SUDS Inspection Checklist Example

Appendix G – Householder Maintenance Pack

1 Introduction

1.1 Project Background

M & P Gadsden Consulting Engineers have been appointed by Oakmere Homes to undertake a Flood Risk Assessment in support of a full planning application for 17no family homes and 57no apartments at Accrington Road, Whalley, Lancashire.

The site will be accessed from two new junctions created on Accrington Road. One will be used to access 8 apartments and the other junction will give access to the remainder of the site. The new dwellings will be served by a mixture of tarmac and block paved highways. The site was previously used for agricultural purposes and there are no existing above ground structures on site.

The site currently has an extant planning approval (ref: 3/2012/0179) for 37 bungalows and 40 retirement apartments.

The purpose of this report is to discuss the proposed drainage strategy.

1.2 Surface Water Strategy

Current guidance commonly used for new development is the Local Authority SuDS Officer Organisation's (LASOO) "Non-statutory Technical Standards for Sustainable Drainage". This document is a best practice guidance document and covers the full spectrum of surface water drainage design from planning requirements, design criteria, flood risk and maintenance during the systems life.

The surface water drainage strategy for this site follows this guidance document wherever possible.

2 Existing Development Site

2.1 Site Characteristics

The site is located on the outskirts of Whalley and is currently vacant. To the north and west of the site are residential property, with agricultural land to the east. The River Calder borders the site to the south. The site is currently accessed off Accrington Road.

2.2 Existing Drainage Arrangements for the Site

There is currently no formal drainage network on most of the site itself.

United Utilities sewer records indicate that there are no existing sewers in Accrington Road to the north of the site. Further north along The Cloisters, there are both foul (150mm vitrified clay) and surface water (450mm concrete) sewers running from east to west. The foul then discharges into a combined sewer on Sydney Avenue.

The United Utilities sewer records can be seen in Appendix B.

2.3 Topography

The site is roughly square in shape and covers an area of approximately 2.87ha. The levels on site fall steeply from the north east corner to close to the middle of the site and then gently from east to west from that point. The high point of the site is at the north eastern corner at approximately 59.00m AOD and the low point is on the western boundary at 45.50m AOD.

The existing topographical survey can be viewed in Appendix A.

2.4 Hydrology

The River Calder runs from east to west directly to the south of the site. This forms part of the Ribble Catchment. The River Calder then discharges into the River Ribble further downstream. This river is classed as a main river and is the responsibility of the Environment Agency.

Mill Race watercourse is located approximately 85m to the west of the south western corner of the site. This runs from the River Calder upstream of Whalley Weir, through the Calder Vale area, and re-enters the River Calder again further downstream.

There is also an unnamed watercourse that runs from north to south along the eastern boundary of the site. The watercourse is culverted and discharges into the River Calder.

2.5 Contamination and Geology

Preliminary geological information has been sourced from bEk Enviro Preliminary Risk Assessment (Report Ref BEK-19545-1 April 2019) and the British Geological Survey website. A summary of this information is as follows:-

- Made Ground – no records of made ground on-site.
- Superficial geology – Glacio-fluvial deposits (sand & gravel), alluvium (clay, silt, sand & gravel) and Glacial Till (Boulder Clay).
- Bedrock – Bowland Shale formation in the north western corner of the site and the Pendle Grit Member in the south-east of the site.

3 Flood Risk Assessment

A Flood Risk Assessment was undertaken by JBA Consulting dated September 2022. The FRA states the following with regards to flooding:

- Fluvial: the site lies partially within Flood Zone 3 according to FMfP, however, updated modelling suggests that approximately 70% of the site is located Flood Zone 2 is a more appropriate classification (Medium Probability – land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding). The remainder of the site is within Flood Zone 1. The River Calder is shown to be the main risk of fluvial flooding according to hydraulic modelling
- Fluvial with climate change: with an allowance for climate change (+36% peak river flow), the predicted flood extent affects approximately 40% of the {} site (prior to proposed ground level changes);
- Surface water: Very low risk across the majority of the site. There is a localised area of low-high risk on the western boundary of the site which coincides with a topographic 'low'
- Reservoir breach: in the unlikely event that a breach of an upstream reservoir was to occur, the site could be at risk from reservoir flooding
- Groundwater: the results/observations reported following a ground investigation in 2019 suggest that the likelihood of groundwater emergence at the surface is low

4 Proposed Development & Future Flood Risk

4.1 Run Off Destination

Planning Policy guidance suggests the following hierarchy for surface water discharge: -

1. Into the ground (Infiltration)
2. To a surface water body;
3. To a surface water sewer;
4. To a combined sewer.

4.2 Runoff Assessment

The runoff rates have been calculated for the site for the pre-development and post development conditions at greenfield run off rate. The calculations have been undertaken for the 1 year, 30-year, 100 year and 100 year plus climate change events, which are based on the mean annual flood flow rate, QBAR (2.33-year event).

The total site area of the development is 2.90ha. Therefore, the site is less than 200ha and the greenfield calculations have been undertaken in accordance with methodology described in IoH 124 [11]. For catchments of less than 50ha the run-off rate is scaled according to the size of the catchment in relation to a 50ha site. As identified by reference to GEO Environmental Engineering PRA and BGS data, the site is expected to be underlain by low permeability clay. The soil index value has been estimated to reflect the expected in-situ ground conditions.

The runoff rate has been calculated using the area being proposed for development. Calculations can be seen in Appendix C and a summary of the results is included in Table 1 below:

Table 1 – Greenfield Runoff Rate Assessment

	Runoff Calculations - Pre-Development					
	Area (ha)	Qbar (l/s)	1year (l/s)	30year (l/s)	100year (l/s)	100year + cc (l/s)
Greenfield Pre-Development	1.80	15.36	13.36	26.11	31.95	47.93
Total	**1.80**	**15.36**	**13.36**	**26.11**	**31.95**	**47.93**

The post development runoff rates will be restricted to 1 year rate for the same return period and QBar for return periods up to 100 year plus 50% climate change with a 10% allowance for urban creep and a 35% allowance for the remaining greenfield areas. These measures will reduce flood risk downstream as the existing greenfield runoff rate will be matched for the 1 year event and Qbar will be matched for events up to the designed return period. This will provide an improvement for return periods above the 1 year event.

4.3 Proposed Scheme

It has been assumed that infiltration drainage is not suitable on this site as it is underlain by impermeable strata. The surface water from the development will be discharged into the River Calder. The discharge will be restricted to greenfield runoff rates.

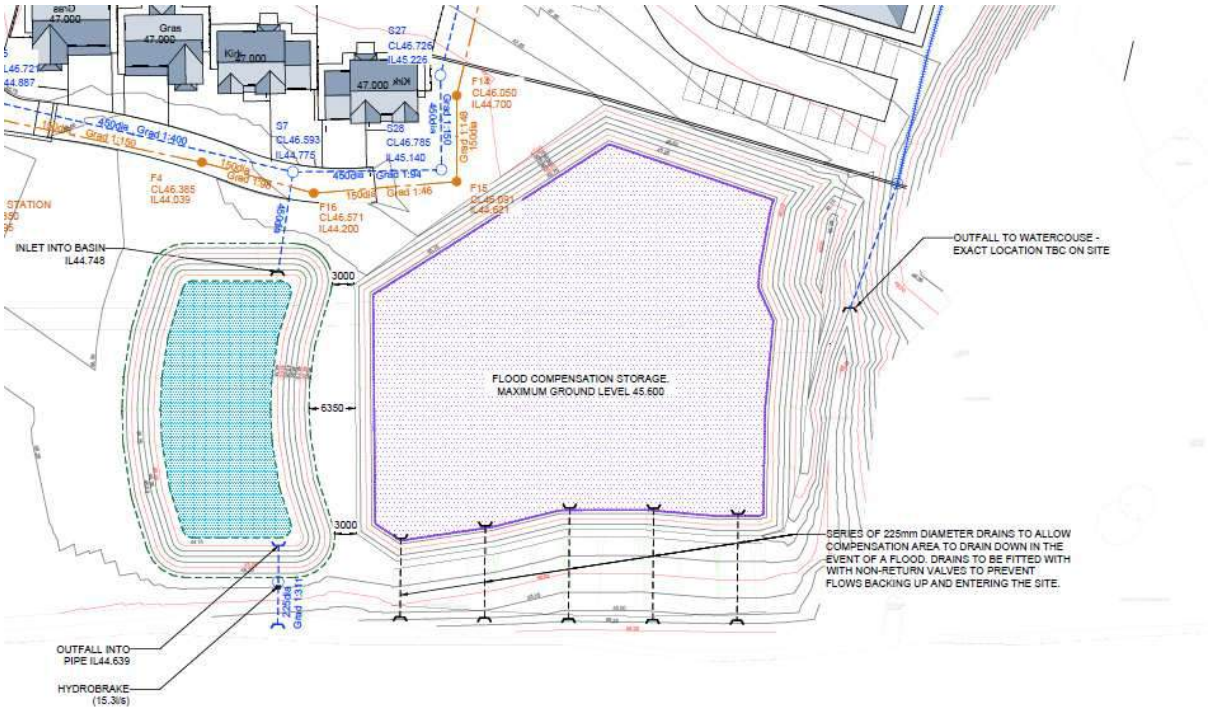
As part of the site falls within a functional floodplain, compensatory storage will be provided for the land raising within the 100 year + climate change allowance.

JBA Consulting modelled the compensatory storage with the information included in their report – Accrington Road, Whalley - FRA (Ref: OAKMERE-JBAU-XX-XX-RP-0002-S3-P05) dated September 2022. It states: *The proposed development causes no additional flood risk to other properties in the area. A sample of locations in adjacent residential areas were selected and comparisons were made for peak water levels before and after the proposed development. All locations showed either no change or reduced water levels following the proposed development.*

Modelled flood levels and flows for locations within watercourses downstream of the development site. The locations include downstream of Whalley Weir, Whalley Bridge and within the Mill Race near Calder Vale. There is no difference in water level between the existing/baseline and proposed development scenarios in the 1%AEP event plus 36% for climate change. The flows in the proposed scenario showed minor differences compared to the baseline but were within +/-0.1m3/s and do not affect flood levels, so flood risk remains unchanged.

The area for flood compensatory storage can be seen in the figure below (in purple), with the maximum ground level in this area being 45.600m AOD.

Figure 2 – Flood Compensatory Storage



The highways have been designed to follow the existing topography of the land where possible. All highway runoff will be collected by gullies and enter a piped network. Driveway runoff will be collected by aco (or similar) channel drains and enter a piped network.

The site will drain via a traditional gravity fed piped network with the flow restricted to the existing greenfield rate. The flow will be restricted via a Hyrdrobrake flow control unit and the storm water will be attenuated in the piped network and an attenuation basin. This basin has been designed for a 100 year return period + 50% climate change, a 10% allowance for urban creep and a 35% allowance for the remaining greenfield areas.

In addition to the SuDS treatments highlighted previously, back inlet gullies and silt trap manholes will also be provided to remove sediment/silt and therefore assisting with cleaning the water.

The foul drainage system will be a traditional gravity piped network to a low point to the east of the site, where there will be a pumping station that will pump the foul drainage to ultimately discharge into the existing combined sewer on Sydney Avenue.

The drainage design can be seen in Appendix D.

4.4 Future Flood Risk & Exceedance Routes

Flood risk to the new dwellings will be low. All finished floor levels will be lifted out of flood zone 3. In addition, all drainage attenuation features will be designed to a return period of 100 years plus 50% climate change, a 10% allowance for urban creep and a 35% allowance for the remaining greenfield areas.

A rill will be constructed along the western boundary of the site to protect the existing properties from any runoff from the raised levels within the application site. This will also protect the new properties from the existing surface water flood risk along that area.

A filter drain with a perforated pipe underneath will be installed along the bottom of the embankment to the north eastern and eastern boundary to protect the new properties from any overland flows from above. Due to the topography of the site it is difficult to locate the cut off drain directly on the boundary of the site. This will then discharge into the watercourse to the east at an unrestricted rate.

If a storm were to occur that is larger than the designed return period, flooding would first occur at the flow control manholes. Exceedance routes will need to be provided in order to guide the excess surface water away from new and existing property towards the River Calder.

4.5 Future Management

The developer will establish a management company that will be responsible for the maintenance and upkeep of the highways, attenuation basin and surface water drainage system. During the construction phase, the upkeep of the items listed will be the responsibility of the developer until they are formally handed over. See Appendix E for the management company maintenance pack and Appendix F for an example of a SuDS inspection checklist.

A Section 104 agreement will be entered into with United Utilities for the adoption of the main foul drainage for the site.

Maintenance of driveways and roof water drainage will be the sole responsibility of the homeowners. A householder sustainable drainage maintenance plan will be included within the sales pack for each property making the homeowners aware of their responsibilities relating to surface water (see Appendix G).

5 Summary

This report provides a detailed strategy for the management of surface water from the proposed housing development at Accrington Road, Whalley. The strategy accounts for the following restrictions, measures and improvements:-

- Updated modelling suggests the site to be in flood zone 2 with the River Calder being the main risk to fluvial flooding
- Very low risk of surface water flooding for the majority of the site, with localised low-high risk
- In the unlikely event that a breach of an upstream reservoir was to occur, the site could be at risk from reservoir flooding
- Groundwater flooding is deemed to be a low risk
- Attenuation will be provided in the form of an attenuation basin.
- All attenuation features have been designed to attenuate flows up to the 100 year +50% climate change rainfall event with a 10% allowance for urban creep and a 35% allowance for the remaining greenfield areas.
- The proposed development run off rates will match or better the existing greenfield run off rates for all return periods, reducing flood risk.
- The proposed development run off rates are restricted to Qbar for all return periods.
- A flood compensatory storage area will be provided
- The highway will remain private and maintained by a management company.
- Surface water drainage will remain private and maintained by a management company.
- The main foul drainage and pumping station will be put up for adoption with United Utilities under a S104 agreement.
- Individual plot drainage will be maintained by the homeowners.

Appendix A

N

Note:

Orientation to Existing Site Grid.
All levels relate to Existing Site Datum.

Survey Control Markers established for Mapping purposes only and should not be used for Construction without the written approval of Survey Operations Ltd.

SURVEY STATIONS

Name	Easting	Northing	Height
SO1	373402.99	435985.71	45.22
SO2	373412.67	436035.20	45.37
SO3	373458.74	436024.62	45.21
SO4	373468.51	436066.38	45.29
SO5	373433.87	435925.30	44.87
SO6	373468.45	435929.67	45.32
SO7	373521.60	435936.40	45.84
SO2A	373432.25	436125.22	46.52
SO3A	373454.24	436004.36	45.34

STANDARD REFERENCE & ABBREVIATIONS

(AR)........Assumed Route	IL..........Invert Level
AB..........Air Brick	IP..........Inlet Pipe
AV..........Air Valve	KO..........Kerb Outlet
B/W.........Barbed Wire	LB..........Letter Box
BAR.........Barrier	LP..........Lamp Post
BB..........Belisha Beacon	MG..........Multi-Girth
BH..........Borehole	MH..........Manhole
BL..........Bed Level	MKR.........Marker
BOL.........Bollard	MP..........Mooring Point
BS..........Bus Stop	NP..........Street Name Plate
BT Box......British Telecom Box	O/H.........Overhead
BT..........British Telecom IC	O/P.........Open Paling
BRTW........Brick Retaining Wall	OE..........Overhead Electric Wire
BW..........Brick Wall	OP..........Outfall Pipe
C/B.........Close Boarded	OSBM........Ordnance Survey Bench Mark
C/I.........Corrugated Iron	OT..........Overhead Telecom Wire
C/P.........Chestnut Paling	P/C.........Post & Chain
CB..........Control Box	P/R.........Post & Rail
CBW.........Concrete Block Wall	P/W.........Post & Wire
CCTV........Closed Circuit TV	PAV.........Paving
CD..........Cable Duct	PB..........Pillar Box
CEL.........Cellar Light	PC..........Pedestrian Crossing
CH/L........Chain Link	PP..........Petrol Pump
CHY.........Chimney	PT..........Post or Pillar
CL..........Cover Level	RE..........Rodding Eye
CM..........Cable Marker	RS..........Road Sign
COL.........Column	RTW.........Retaining Wall
CONC........Concrete	RWP.........Rain Water Pipe
CP..........Catch Pit	SAP.........Sapling
CRTW........Concrete Retaining Wall	SL..........Sump Level
CTV.........Cable Television	SoL.........Soffit Level
CUL.........Culvert	SP..........Sign Post
CW..........Concrete Block Wall	SPL.........Springing Level
DC..........Drainage Channel	SRTW........Stone Retaining Wall
DPC.........Damp Proof Course	SV..........Stop Valve (unspecified)
DR..........Drain	SVP.........Soil Vent Pipe
DSW.........Dry Stone Wall	SW..........Stone Wall
ECP.........Electricity Cable Pit	TAC.........Tactile Paving
EIC.........Electricity Inspection Cover	TB..........Traffic Bollard
EJ..........Expansion Joint	TBM.........Temporary Bench Mark
EJB.........Electricity Junction Box	TCB.........Telephone Call Box
EL SUB STN..Electricity Sub Station	TFR.........Taken From Records
EL..........Eaves Level	TIE.........Anchor Point (Masts/Poles)
ELB.........Electricity Box	TL..........Traffic Light
EP..........Electricity Pole	TLB.........Traffic Light Control Box
ER..........Earth Rod	TM..........Ticket Machine
ETL.........Electricity Transmission Line	TMC.........Tarmac
FB..........Flower Bed	TP..........Telecommunications Pole
FH..........Fire Hydrant	TPIT........Trial Pit
FL..........Floor Level	TS..........Trash Screen
FP..........Flagpole	U/C.........Under Construction
G*.*........Girth (of tree)	U/G.........Underground
G...........Gulley	UTL.........Unable to Lift (MH,IC etc)
GAB.........Gabion	UTS.........Unable to Survey
GIP.........Gas Inlet Pipe	VDP.........Vehicle Detector Pad
GMKR........Gas Marker	VP..........Vent Pipe
GST.........Gas Stop Tap (Domestic)	W/M.........Wire Mesh
GSV.........Gas Stop Valve (Mains)	WL..........Water Level
HSE.........Housing	WM..........Water Meter
Ht..........Height	WO..........Wash Out
HV..........High Voltage	WP..........Waste Pipe
I/R.........Iron Railing	WST.........Water Stop Tap (domestic)
IC..........Inspection Cover	WSV.........Water Stop Valve (mains)

Survey Operations
Smith Street, Skelmersdale, Lancs. WN8 8LN
Tel: 01695 725662 Fax: 01695 51816
Email: mail@survops.co.uk – www.survops.co.uk

ISO 9001
ISO 14001
OHSAS 18001
BUREAU VERITAS Certification
UKAS MANAGEMENT SYSTEMS 008

Client	Oakmere Homes
Drawing Title	Topographical Survey of Land at ACCRINGTON ROAD WHALLEY
Scale(s)	1:250
Surveyor	JD
Date	Nov 15
Drawn	AC
Job Number	15J270
Checked	SO
Sheet Size & Drg Number & Revision	A0 15J270/001

Appendix B

United Utilites Water Limited
Property Searches
Ground Floor Grasmere House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP
DX 715568 Warrington
Telephone 0370 751 0101

Property.searches@uuplc.co.uk

Your Ref: GRS00642
Our Ref: 14/ 1145619
Date: 8/10/2015

TECHNICS GROUP
Technics House
Merrow Business Centre
Merrow Lane
Guildford
GU4 7WA

FAO:

Dear Sirs

Location: 1 WOODFIELD VIEW WHALLEY CLITHEROE BB7 9TB

I acknowledge with thanks your request for information on the location of our services.

Please find enclosed plans showing the approximate position of our 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 - Wastewater & Water Distribution Plans which are shown overleaf.

I also attach United Utilities' General Condition and Information sheets regarding United Utilities wastewater network and water distribution apparatus, which details contact numbers for additional services (i.e. new supplies, connections, diversions) which we are unable to deal with at this office. You should ensure that the Condition and Information sheets are made available to anyone carrying out any works which may affect our apparatus.

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

If you have any queries regarding this matter please telephone us on 0370 7510101.

Yours Faithfully,

[redacted]

Sue McManus
Operations Manager
Property Searches

United Utilities Water Limited
Registered in England & Wales No. 2366678
Registered Office: Haweswater House,
Lingley Mere Business Park, Lingley Green Avenue,
Great Sankey, Warrington, WA5 3LP

Extract from Map of Public Sewers

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

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

United Utilities will not accept any liability for any damage caused by the actual positions being different from those shown.

LEGEND

Water Course
Overflow Pipe
Sludge Main
Highway Drain

Combined	Surface Water	Foul	Abandoned	
				Public Sewer
				Private Sewer
				Section 104
				Rising Main

1 Woodfield View
Whalley
Clitheroe
BB7 9TB

Printed By : Property Searches Date: 08/10/2015

DO NOT SCALE

Approximate Scale: 1:1250

United Utilities
helping life flow smoothly

Extract from Map of Water Mains

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

The actual positions may be different from those shown on the plan private service pipes may be shown by a broken blue line.

United Utilities will not accept any liability for any damage caused by the actual positions being different from those shown.

LEGEND

Proposed	Abandoned	Live
		Distribution Main
		Trunk Main
		Comms Pipe
		Private Pipe
		Raw Water
		LDTM Raw Water
		LDTM Treated Water

1 Woodfield View
Whalley
Clitheroe
BB7 9TB

Printed By : Property Searches Date: 08/10/2015

DO NOT SCALE

Approximate Scale: 1:1250

United Utilities
helping life flow smoothly

Conditions and Information regarding wastewater network

These general conditions and precautions apply to the wastewater network of United Utilities

Please ensure that a copy of these conditions is passed to your representative and contractor on site.

1 United Utilities provides the approximate locations of its sewers according to its records. These records are not necessarily accurate or complete nor do they normally show the positions of every sewer culvert or drain, private connections from properties to the public sewers or the particulars of any private system. No person or company shall be relieved from liability for any damage caused by reason of the actual positions and/or depths being different from those indicated. The records do indicate the position of the nearest known public sewer from which the likely length of private connections can be estimated together with the need for any off site drainage rights or easements.

2 Special requirements relative to our sewers may be indicated. United Utilities employees or its contractors will visit any site at reasonable notice to assist in the location of its underground sewers and advise any precautions that may be required to obviate any damage. To arrange a visit or for further information regarding new supplies, connections, diversions, costing, or any notification required under these General Conditions, please call us on **0345 602 0406**.

3 Where public sewers are within a site which is to be developed and do not take any drainage from outside the area, they are from an operational viewpoint redundant. The developer must identify all redundant sewers affected by the development and apply to United Utilities in writing for these sewers to be formally closed. The developer shall bear all related costs of the physical abandonment work.

4 Public sewers within the site that are still live outside the area will be subject to a “Restricted Building zone”. This would normally be a surface area equivalent to the depth of the sewer measured from the centre line of the sewer on either side. No construction will be permitted within that zone. The developer should also note that deep and wide rooted trees must not be planted in close proximity to live sewers. Access to public sewers must be maintained at all times and no interference to manholes will be permitted during construction work.

5. Where there is a public sewer along the line of a proposed development/building, arrangements shall be made by the developer at his cost to divert the sewer around the development. Where this is not possible and as a last resort, a “Building Over Agreement” will need to be completed under section 18 of the Building Act 1984. The developer shall design building foundations to ensure that no additional loading is transferred to the sewer and submit such details both to the Local Authority’s Building Control Officer and to United Utilities for approval/acceptance. United Utilities on a rechargeable basis would normally undertake all aspects of design work associated with the diversion of any part of the operational wastewater network. For further advice please email wastewaterdeveloperservices@uuplc.co.uk

6. Where there is a non-main river watercourse/culvert passing through the site, the landowner has the responsibility of a riparian owner for the watercourse/culvert and is responsible for the maintenance of the fabric of the culvert and for all works involved in maintaining the unrestricted flow through it. Building over the watercourse/culvert is not recommended. The developer must contact the local authority before any works are carried out on the watercourse/culvert. Where it is necessary to discharge surface water from the site into the watercourse/culvert the developer shall make an assessment of the available capacity of the watercourse/culvert (based on a 1 in 50 year event) and ensure that the additional flow to be discharged into the watercourse/culvert will not cause any flooding. In appropriate cases, flooding may be prevented by on-site storage. The developer shall submit the relevant details required to substantiate his development proposals. Details of any outfall proposed shall also be submitted to the Environment Agency, PO Box 12, Richard Fairclough House, Knutsford Road, Warrington, Cheshire, WA4 1HT for their approval.

7. Where there is a main river watercourse/culvert passing through the site, the developer shall submit all proposals affecting the river to the Environment Agency at the address stated in paragraph 6 for approval/acceptance.

8. Your attention is drawn also to the following:

Private drains or sewers which may be within the site.

On 1 October 2011 all privately owned sewers and lateral drains which communicate with (that is drain to) an existing public sewer as at 1 July 2011 will become the responsibility of the sewerage undertaker. This includes private sewers upstream of pumping stations that have yet to transfer, but excludes lengths of sewer or drain that are the subject of an on-going appeal or which have been excluded from transfer as a result of an appeal or which are on or under land opted-out by a Crown body. The transfer specifically excludes sewers and lateral drains owned by a railway undertaker. Sewers upstream of such assets, however, are transferred. Such assets may not be recorded on the public sewer record currently as it was not a requirement to keep records of previously private sewers and drains.

Applications to make connections to the public sewer.

The developer must write to United Utilities requesting an application form that must be duly completed and returned. No works on the public sewer shall be carried out until a letter of consent is received from United Utilities.

Sewers for adoption If an agreement for the adoption of sewers under Section 104 of the Water Industry Act 1991 is being contemplated, a submission in accordance with "Sewers for Adoption", Seventh Edition, published by the Water Research Centre (2001) Plc, Henley Road, Medmenham, PO Box 16, Marlow, Buckinghamshire, SL7 2HD will be required, taking into consideration any departures from the general guide stipulated by United Utilities.

Further consultation with United Utilities.

Developers wishing to seek advice or clarification regarding sewer record information provided should contact United Utilities to arrange an appointment. A consultation fee may be charged, details of which will be made available at the time of making an appointment.

9. Combined sewers, foul sewers, surface water sewers, and pumped mains. These are shown separately in a range of colours or markings to distinguish them on our drawings, which are extracts from the statutory regional sewer map. A legend and key is provided on each extract for general use, although not all types of sewer will be shown on every extract.

Combined sewers shown coloured red carries both surface water and foul sewage, especially in areas where there is no separate surface water sewerage system.

Foul sewers coloured brown may also carry surface water and there may be no separate surface water system indicated in the immediate area. Both combined and foul sewers carry wastewater to our treatment works before it can safely be returned to the environment.

Surface water sewers coloured blue on our drawings are intended only to carry uncontaminated surface water (e.g. rainfall from roofs, etc) and they usually discharge into local watercourses. It is important for the protection of the environment and water quality that only uncontaminated surface water is connected to the surface water sewers. Improper connections to surface water sewers from sink wastes, washing machines and other domestic use of water can cause significant pollution of watercourses.

Pumped mains, rising mains and sludge mains will all be subject to pumping pressures and are neither suitable nor available for making new connections.

Highway drains, when included, show as blue and black dashed lines. Highway drains are not assets belonging to United Utilities and are the responsibility of local authorities.

1. For information regarding future proposals for construction of company apparatus please write to United Utilities, PO Box 453, Warrington, WA5 3QN.
2. For information regarding easements, deeds, grants or wayleaves please write to United Utilities Property Solutions, Coniston Buildings, Lingley Mere Business Park, Lingley Green Avenue, Great Sankey, Warrington, WA5 3UU **Tel: 01925 731 365**

Conditions and Information regarding water distribution apparatus

These general conditions and precautions apply to the water distribution system of United Utilities

Please ensure that a copy of these conditions is passed to your representative and contractor on site.

1. United Utilities provides approximate locations of its water mains or apparatus according to its records. These records are not necessarily accurate or complete nor do they normally show the positions of private service pipes from the mains to properties. Where service pipes are shown, a blue broken line indicates their approximate position. No person or company shall be relieved from liability for any damage caused by reason of the actual positions and/or depths being different from those indicated.
2. Special requirements relative to our apparatus may be indicated. United Utilities employees will visit any site at reasonable notice to assist in the location of its underground water apparatus and advise any precautions that may be required to obviate any damage. To arrange a visit or for further information regarding new supplies, connections, diversions, costing, future proposals for construction of company apparatus or any notification required under these General Conditions, please telephone us on **0345 746 2200** or write to United Utilities, PO Box 453, Warrington, WA5 3QN.
3. In order to achieve safe working conditions adjacent to any water apparatus the following should be observed;
   (a) All water apparatus should be located by hand digging prior to the use of mechanical excavation.

   (b) During construction work where heavy plant may have to cross the line of a water main, and the main is not under a carriageway of adequate standard of construction, crossing points should be suitably reinforced with sleepers, steel plates or a specially constructed reinforced concrete raft as necessary. These crossing points should be clearly indicated and crossing the line of the water main at other places should be prevented. United Utilities employees will advise on the type of reinforcement necessary. This is particularly important on agricultural or open land, where tilling or erosion may have significantly reduced the original cover.

   (c) No explosive should be used within 32 metres of any United Utilities apparatus without prior consultation with United Utilities.

   (d) Where it is proposed to carry out piling within 15 metres of any water main United Utilities should be consulted so that the affected main may be surveyed.

4. During any excavation, it is important that measures should be taken to ensure continued support for any water main:

   (a) Where excavation of trenches adjacent to any water main is likely to affect its support, the main must be supported to the satisfaction of United Utilities.

   (b) Where a trench is excavated crossing or parallel to the line of a water main, the backfill should be adequately compacted to prevent any settlement which could subsequently cause damage to the main. In special cases it may be necessary to provide permanent support to a main which has been exposed over the length of the excavation before back-filling and reinstatement is carried out. No back-filled concrete should contact the main.

5. No other apparatus should be laid over and along the line of a water main irrespective of clearance. A minimum clearance of 450 millimetres should be allowed between any plant being installed and an existing main, to facilitate maintenance and repair, whether the adjacent plant is parallel to or crossing the main. No manhole, chamber, or other obstruction should be built over or around a water main.

6. Where a water main is coated with special wrapping and the wrapping is damaged, even to a minor extent, United Utilities must be notified, and the excavation must be left open for ready access so that repairs can be made. In case of any material damage to the main itself causing leakage, or weakening of the mechanical strength of the pipe, the person or body responsible should immediately notify United Utilities in order that the necessary remedial work can be carried out. The full cost of the necessary remedial work will be charged to the person or body responsible for the damage.

1. If you propose to change existing levels over water mains you will need to inform us. We will need specific locations to be identified together with precise details as to the scale of the proposed changes to existing ground levels. Changes to existing levels may require the diversion of our apparatus at your cost. However, in certain circumstances we may wish to leave our apparatus where it is. On these occasions you will usually be required to protect our apparatus by means of a concrete raft and either raise or lower any surface boxes affected.
2. Under no circumstances should our surface boxes be either buried or left in a situation where they are raised above finished ground levels. You should reuse and re-set any surface boxes affected by your works into the new surface so that they align over the water apparatus below. You will be responsible for the cost of repairing any damage to our apparatus as a result of your works.
3. Where proposals involve resurfacing, you must notify United Utilities if your excavation will be greater than 750mm in the highway and 300mm in a footpath, verge or other location.
4. For information regarding easements, deeds, grants, licences or wayleaves, please write to United Utilities Property Solutions, Coniston Buildings, Lingley Mere Business Park, Lingley Green Avenue, Great Sankey, Warrington WA5 3UU (**Tel 01925 731 365**).

Tree planting restrictions over water mains

a) Poplar and willow trees have extensive root systems and should not be planted within 10 metres of any water main.

b) The following trees and those of a similar size, whether they are deciduous or evergreen, should not be be planted within six metres of any water main:

- Ash, beech, birch, elm, horse chestnut, lime, oak, sycamore;
- Apple trees and pear trees;
- Most conifers.

c) United Utilities requires access to the route of its mains at all times to inspect for leaks and carry out surveys. We recommend that no shrubs or bushes which might obstruct or interfere with our access should be planted within one metre of the centre line of any water main.

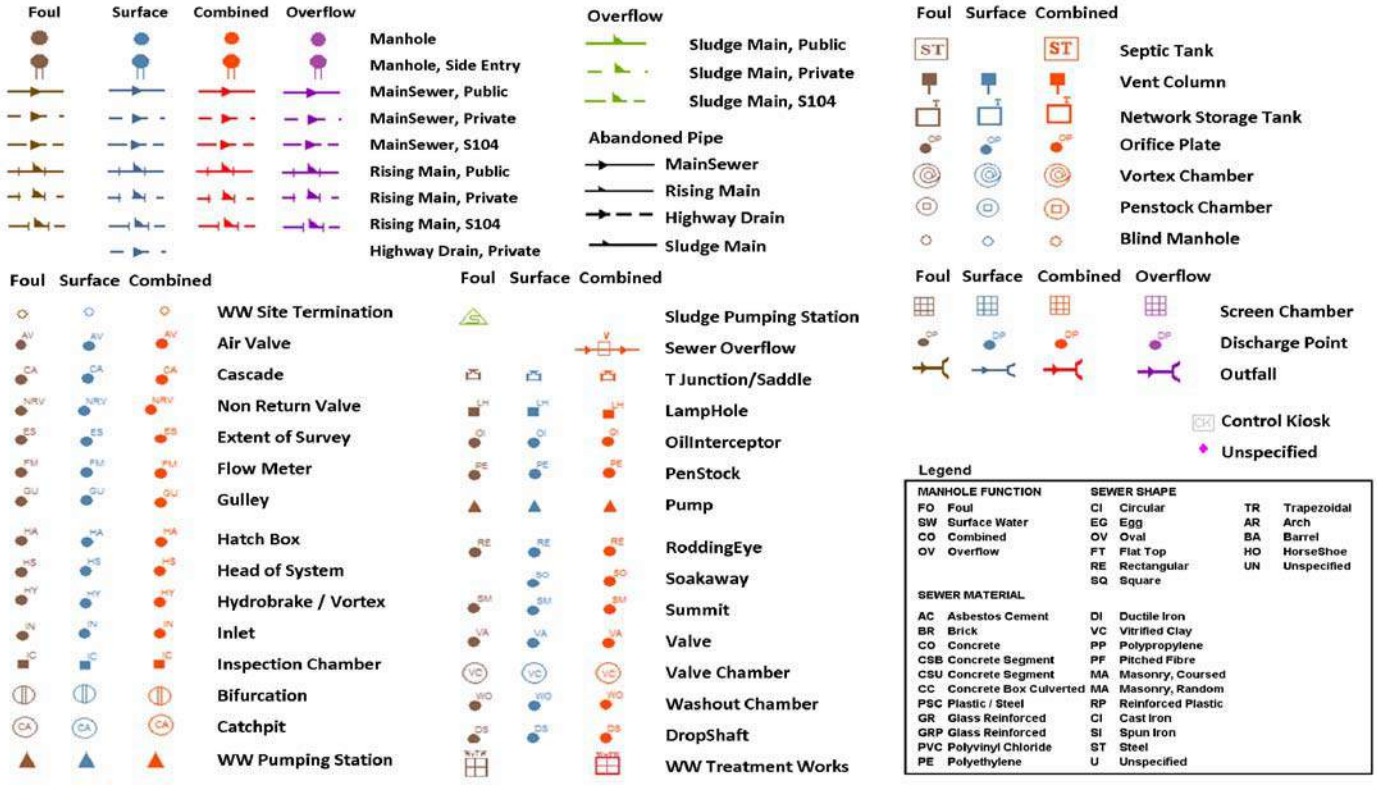
d) There may be instances when both United Utilities and the landowner will wish to plant shrubs or bushes close to the water main for screening or other purposes. The following shallow rooting shrubs would be suitable for this purpose:

- Blackthorn, broom, cotoneaster, elder;
- Hazel, laurel, privet, quickthorn, snowberry;
- Most ornamental flowering shrubs.

e) In areas where soft fruit is grown, blackcurrant, raspberries and gooseberries may be planted close to the main, provided that a path is left clear for inspection access and surveys. United Utilities can give additional advice where required in particular circumstances.

United Utilities

WASTE WATER SYMBOLOGY



Legend

MANHOLE FUNCTION		SEWER SHAPE			
FO	Foul	CI	Circular	TR	Trapezoidal
SW	Surface Water	EG	Egg	AR	Arch
CO	Combined	OV	Oval	BA	Barrel
OV	Overflow	FT	Flat Top	HO	HorseShoe
		RE	Rectangular	UN	Unspecified
		SQ	Square		

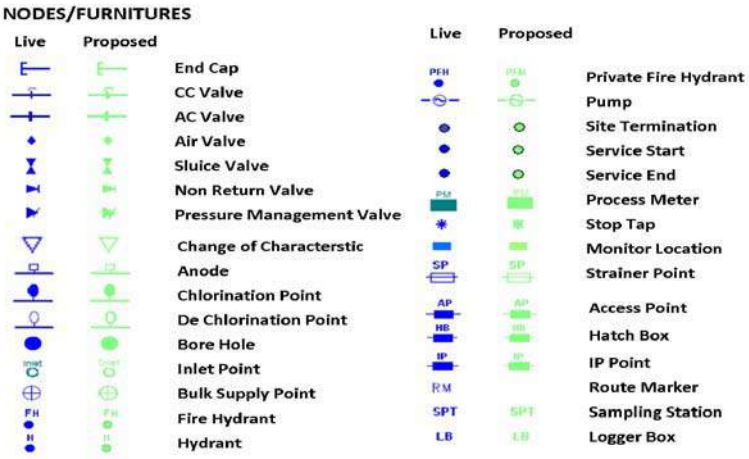
SEWER MATERIAL			
AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	VC	Vitrified Clay
CO	Concrete	PP	Polypropylene
CSB	Concrete Segment	PF	Pitched Fibre
CSU	Concrete Segment	MA	Masonry, Coursed
CC	Concrete Box Culverted	MA	Masonry, Random
PSC	Plastic / Steel	RP	Reinforced Plastic
GR	Glass Reinforced	CI	Cast Iron
GRP	Glass Reinforced	SI	Spun Iron
PVC	Polyvinyl Chloride	ST	Steel
PE	Polyethylene	U	Unspecified

CLEAN WATER SYMBOLOGY

PIPE WORK

ABANDONED PIPE

NODES/FURNITURES



PROPERTY TYPES

Legend

MATERIAL TYPES		LINING TYPES	
AC	ASBESTOS CEMENT	CL	CEMENT LINING
CI	CAST IRON	TB	TAR OR BITUMEN
CU	COPPER	ERL	EPOXY RESIN
CO	CONCRETE		
DI	DUCTILE IRON	INSERTION TYPES	
GI	GALVANISED IRON		
GR	GREY IRON	DD	DIE DRAWN
OT	OTHERS	DR	DIRECTIONAL DRILLING
PB	LEAD	MO	MOLING
PV	uPVC	PI	PIPELINE
SI	SPUN IRON	SL	SLIP LINED
ST	STEEL		
UN	UNKONWN		
PE	POLYETHYLENE		

TERMS AND CONDITIONS - WASTERWATER & 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:

1. 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.

2. 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.

3. 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.

4. 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. 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.

Appendix C

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Rob Bruce
Site name:	ACCRINGTON ROAD
Site location:	WHALLEY

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

Site Details

Latitude:	53.81972° N
Longitude:	2.40268° W
Reference:	3863048619
Date:	Oct 28 2022 09:30

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1.8

Methodology

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

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	1139	1139
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	15.36	15.36
1 in 1 year (l/s):	13.36	13.36
1 in 30 years (l/s):	26.11	26.11
1 in 100 year (l/s):	31.95	31.95
1 in 200 years (l/s):	36.4	36.4

Appendix D

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.500
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.073	5.00	48.646	1200	373579.669	436076.937	1.350
2	0.131	5.00	47.857	1200	373574.622	436055.014	1.507
3	0.091	5.00	47.579	1200	373553.423	436059.839	1.509
11	0.118	5.00	47.109	3000	373522.844	436080.478	1.726
12	0.128	5.00	47.961	3000	373542.195	436074.493	2.727
4	0.069	5.00	47.458	3000	373544.597	436055.593	2.345
5	0.069	5.00	47.428	3000	373540.747	436047.898	2.358
6	0.158	5.00	46.691	3000	373531.367	436003.860	1.804
26	0.236	5.00	48.097	1500	373605.848	436047.500	2.044
27	0.253	5.00	46.923	1500	373596.676	436010.732	1.697
28	0.000	5.00	46.785	1500	373593.195	435994.385	1.670
7	0.152	5.00	46.593	1500	373572.955	435994.085	1.818
8	0.000		46.474	1500	373571.516	435985.437	1.726
9	0.000		46.474	1500	373573.098	435937.872	1.835
10			46.168	1500	373573.032	435932.522	1.552

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	22.496	0.600	47.296	46.350	0.946	23.8	150	5.18	50.0
1.001	2	3	21.741	0.600	46.350	46.070	0.280	77.6	300	5.38	50.0
1.002	3	4	9.794	0.600	46.070	45.383	0.687	14.3	300	5.42	50.0
2.000	11	12	20.255	0.600	45.383	45.234	0.149	135.9	450	5.19	50.0
2.001	12	4	19.052	0.600	45.234	45.113	0.121	157.5	450	5.39	50.0
1.003	4	5	8.604	0.600	45.113	45.070	0.043	200.1	450	5.52	50.0
1.004	5	6	45.026	0.600	45.070	44.887	0.183	246.0	450	6.10	50.0
1.005	6	7	42.721	0.600	44.887	44.780	0.107	400.0	450	6.81	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	2.073	36.6	9.9	1.200	1.357	0.073	0.0
1.001	1.786	126.2	27.6	1.207	1.209	0.204	0.0
1.002	4.185	295.8	40.0	1.209	1.775	0.295	0.0
2.000	1.742	277.0	16.0	1.276	2.277	0.118	0.0
2.001	1.617	257.2	33.3	2.277	1.895	0.246	0.0
1.003	1.433	228.0	82.7	1.895	1.908	0.610	0.0
1.004	1.291	205.4	92.0	1.908	1.354	0.679	0.0
1.005	1.010	160.7	113.4	1.354	1.363	0.837	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
3.005	26	27	37.895	0.600	46.053	45.376	0.677	56.0	300	5.30	50.0
3.006	27	28	16.714	0.600	45.226	45.115	0.111	150.0	450	5.47	50.0
3.007	28	7	20.242	0.600	45.140	44.925	0.215	94.1	450	5.63	50.0
1.006	7	8	8.767	0.600	44.775	44.753	0.022	400.0	450	6.95	50.0
1.007	8	9	47.591	0.600	44.748	44.639	0.109	436.6	450	7.77	50.0
1.008	9	10	5.350	0.600	44.639	44.616	0.023	232.6	225	7.88	50.0

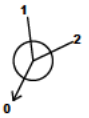
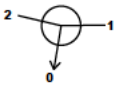
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
3.005	2.105	148.8	32.0	1.744	1.247	0.236	0.0
3.006	1.657	263.6	66.3	1.247	1.220	0.489	0.0
3.007	2.095	333.2	66.3	1.195	1.218	0.489	0.0
1.006	1.010	160.7	200.3	1.368	1.271	1.478	0.0
1.007	0.966	153.7	200.3	1.276	1.385	1.478	0.0
1.008	0.853	33.9	200.3	1.610	1.327	1.478	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	22.496	23.8	150	Circular_Default Sewer Type	48.646	47.296	1.200	47.857	46.350	1.357
1.001	21.741	77.6	300	Circular_Default Sewer Type	47.857	46.350	1.207	47.579	46.070	1.209
1.002	9.794	14.3	300	Circular_Default Sewer Type	47.579	46.070	1.209	47.458	45.383	1.775
2.000	20.255	135.9	450	Circular_Default Sewer Type	47.109	45.383	1.276	47.961	45.234	2.277
2.001	19.052	157.5	450	Circular_Default Sewer Type	47.961	45.234	2.277	47.458	45.113	1.895
1.003	8.604	200.1	450	Circular_Default Sewer Type	47.458	45.113	1.895	47.428	45.070	1.908
1.004	45.026	246.0	450	Circular_Default Sewer Type	47.428	45.070	1.908	46.691	44.887	1.354
1.005	42.721	400.0	450	Circular_Default Sewer Type	46.691	44.887	1.354	46.593	44.780	1.363
3.005	37.895	56.0	300	Circular_Default Sewer Type	48.097	46.053	1.744	46.923	45.376	1.247
3.006	16.714	150.0	450	Circular_Default Sewer Type	46.923	45.226	1.247	46.785	45.115	1.220
3.007	20.242	94.1	450	Circular_Default Sewer Type	46.785	45.140	1.195	46.593	44.925	1.218
1.006	8.767	400.0	450	Circular_Default Sewer Type	46.593	44.775	1.368	46.474	44.753	1.271
1.007	47.591	436.6	450	Circular_Default Sewer Type	46.474	44.748	1.276	46.474	44.639	1.385
1.008	5.350	232.6	225	Circular_Default Sewer Type	46.474	44.639	1.610	46.168	44.616	1.327

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	4	3000	Manhole	Adoptable
2.000	11	3000	Manhole	Adoptable	12	3000	Manhole	Adoptable
2.001	12	3000	Manhole	Adoptable	4	3000	Manhole	Adoptable
1.003	4	3000	Manhole	Adoptable	5	3000	Manhole	Adoptable
1.004	5	3000	Manhole	Adoptable	6	3000	Manhole	Adoptable
1.005	6	3000	Manhole	Adoptable	7	1500	Manhole	Adoptable
3.005	26	1500	Manhole	Adoptable	27	1500	Manhole	Adoptable
3.006	27	1500	Manhole	Adoptable	28	1500	Manhole	Adoptable
3.007	28	1500	Manhole	Adoptable	7	1500	Manhole	Adoptable
1.006	7	1500	Manhole	Adoptable	8	1500	Manhole	Adoptable
1.007	8	1500	Manhole	Adoptable	9	1500	Manhole	Adoptable
1.008	9	1500	Manhole	Adoptable	10	1500	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	373579.669	436076.937	48.646	1.350	1200		0 1.000	47.296	150
2	373574.622	436055.014	47.857	1.507	1200		1 1.000	46.350	150
							0 1.001	46.350	300
3	373553.423	436059.839	47.579	1.509	1200		1 1.001	46.070	300
							0 1.002	46.070	300
11	373522.844	436080.478	47.109	1.726	3000		0 2.000	45.383	450
12	373542.195	436074.493	47.961	2.727	3000		1 2.000	45.234	450
							0 2.001	45.234	450
4	373544.597	436055.593	47.458	2.345	3000		1 2.001	45.113	450
							2 1.002	45.383	300
							0 1.003	45.113	450
5	373540.747	436047.898	47.428	2.358	3000		1 1.003	45.070	450
							0 1.004	45.070	450
6	373531.367	436003.860	46.691	1.804	3000		1 1.004	44.887	450
							0 1.005	44.887	450
26	373605.848	436047.500	48.097	2.044	1500		0 3.005	46.053	300
27	373596.676	436010.732	46.923	1.697	1500		1 3.005	45.376	300
							0 3.006	45.226	450
28	373593.195	435994.385	46.785	1.670	1500		1 3.006	45.115	450
							0 3.007	45.140	450
7	373572.955	435994.085	46.593	1.818	1500		1 3.007	44.925	450
							2 1.005	44.780	450
							0 1.006	44.775	450
8	373571.516	435985.437	46.474	1.726	1500		1 1.006	44.753	450
							0 1.007	44.748	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
9	373573.098	435937.872	46.474	1.835	1500	1	1.007	44.639	450
						0	1.008	44.639	225
10	373573.032	435932.522	46.168	1.552	1500	1	1.008	44.616	225

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	✓
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.300	Check Discharge Rate(s)	✓
Summer CV	0.750	Check Discharge Volume	✓
Winter CV	0.840	100 year 360 minute (m³)	
Analysis Speed	Detailed		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	50	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m³)	

Node 9 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	44.639	Product Number	CTL-SHE-0172-1500-1200-1500
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	15.0	Min Node Diameter (mm)	1500

Node 8 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	44.748
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	525.0	0.0	1.725	1115.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	47.348	0.052	9.4	0.1140	0.0000	OK
15 minute winter	2	10	46.448	0.098	26.1	0.2806	0.0000	OK
15 minute winter	3	10	46.148	0.078	37.4	0.1820	0.0000	OK
15 minute winter	11	10	45.452	0.069	15.1	0.5840	0.0000	OK
15 minute winter	12	11	45.337	0.103	31.0	0.8220	0.0000	OK
15 minute winter	4	11	45.325	0.212	75.6	1.6210	0.0000	OK
15 minute winter	5	11	45.272	0.202	84.0	1.5445	0.0000	OK
15 minute winter	6	12	45.190	0.303	103.4	2.6748	0.0000	OK
15 minute winter	26	10	46.146	0.093	30.3	0.3790	0.0000	OK
15 minute winter	27	10	45.388	0.162	61.9	0.7709	0.0000	OK
15 minute winter	28	11	45.281	0.166	61.1	0.2926	0.0000	OK
15 minute winter	7	12	45.136	0.361	171.5	1.2428	0.0000	OK
120 minute winter	8	102	45.033	0.285	71.8	164.2495	0.0000	OK
120 minute winter	9	98	45.032	0.393	14.9	0.6948	0.0000	SURCHARGED
15 minute summer	10	1	45.612	0.996	0.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	9.3	1.061	0.253	0.1969	
15 minute winter	2	1.001	3	25.7	1.497	0.203	0.3739	
15 minute winter	3	1.002	4	37.0	2.718	0.125	0.1335	
15 minute winter	11	2.000	12	14.6	0.698	0.053	0.4303	
15 minute winter	12	2.001	4	30.3	0.619	0.118	0.9567	
15 minute winter	4	1.003	5	75.7	1.065	0.332	0.6113	
15 minute winter	5	1.004	6	84.3	0.972	0.410	4.0336	
15 minute winter	6	1.005	7	98.4	0.807	0.612	5.3036	
15 minute winter	26	3.005	27	29.5	1.630	0.198	0.6872	
15 minute winter	27	3.006	28	61.1	1.180	0.232	0.8654	
15 minute winter	28	3.007	7	61.1	1.418	0.183	1.1294	
15 minute winter	7	1.006	8	171.7	1.394	1.069	1.0749	
15 minute winter	8	1.007	9	17.3	0.481	0.112	3.3090	
120 minute winter	9	Hydro-Brake®	10	15.0				189.4

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	47.382	0.086	22.9	0.1892	0.0000	OK
15 minute winter	2	10	46.514	0.164	63.8	0.4709	0.0000	OK
15 minute winter	3	9	46.195	0.125	91.6	0.2912	0.0000	OK
15 minute winter	11	12	45.801	0.418	50.7	3.5271	0.0000	OK
15 minute winter	12	12	45.779	0.545	70.7	4.3649	0.0000	SURCHARGED
15 minute winter	4	12	45.770	0.657	175.9	5.0279	0.0000	SURCHARGED
15 minute winter	5	12	45.738	0.668	158.9	5.1161	0.0000	SURCHARGED
15 minute winter	6	12	45.609	0.722	188.6	6.3647	0.0000	SURCHARGED
15 minute winter	26	10	46.208	0.155	74.1	0.6328	0.0000	OK
15 minute winter	27	11	45.519	0.293	152.0	1.3904	0.0000	OK
15 minute winter	28	12	45.440	0.325	149.3	0.5744	0.0000	OK
240 minute winter	7	232	45.419	0.644	101.0	2.2131	0.0000	SURCHARGED
240 minute winter	8	232	45.418	0.670	99.0	429.8787	0.0000	SURCHARGED
240 minute winter	9	272	45.474	0.835	36.6	1.4756	0.0000	SURCHARGED
15 minute summer	10	1	45.612	0.996	0.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	22.7	1.451	0.620	0.3147	
15 minute winter	2	1.001	3	63.0	1.935	0.499	0.7185	
15 minute winter	3	1.002	4	91.4	3.290	0.309	0.4674	
15 minute winter	11	2.000	12	36.3	0.772	0.131	3.1596	
15 minute winter	12	2.001	4	73.5	0.651	0.286	3.0187	
15 minute winter	4	1.003	5	141.9	1.159	0.622	1.3632	
15 minute winter	5	1.004	6	159.6	1.010	0.777	7.1341	
15 minute winter	6	1.005	7	197.2	1.245	1.228	6.7689	
15 minute winter	26	3.005	27	72.6	2.050	0.488	1.3434	
15 minute winter	27	3.006	28	149.3	1.463	0.566	1.9190	
15 minute winter	28	3.007	7	143.9	1.435	0.432	2.7401	
15 minute winter	7	1.006	8	358.8	2.266	2.233	1.3553	
240 minute winter	8	1.007	9	36.6	0.231	0.238	7.5405	
60 minute summer	9	Hydro-Brake®	10	15.0				214.8

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	12	48.234	0.938	44.5	2.0746	0.0000	SURCHARGED
15 minute winter	2	12	47.343	0.993	112.8	2.8500	0.0000	SURCHARGED
15 minute winter	3	13	47.153	1.083	156.3	2.5309	0.0000	SURCHARGED
15 minute winter	11	13	47.003	1.620	122.2	13.6702	0.0000	FLOOD RISK
15 minute winter	12	13	46.995	1.761	106.2	14.1026	0.0000	SURCHARGED
15 minute winter	4	13	46.969	1.856	244.9	14.2121	0.0000	SURCHARGED
15 minute winter	5	13	46.864	1.794	262.3	13.7287	0.0000	SURCHARGED
15 minute winter	6	12	46.484	1.597	322.0	14.0863	0.0000	FLOOD RISK
15 minute winter	26	11	46.950	0.897	143.7	3.6572	0.0000	SURCHARGED
15 minute winter	27	11	46.336	1.110	273.6	5.2703	0.0000	SURCHARGED
15 minute winter	28	12	46.152	1.037	266.4	1.8330	0.0000	SURCHARGED
480 minute winter	7	464	46.050	1.275	114.0	4.3857	0.0000	SURCHARGED
480 minute winter	8	464	46.050	1.302	113.5	975.6012	0.0000	SURCHARGED
480 minute winter	9	464	46.048	1.409	16.2	2.4904	0.0000	SURCHARGED
15 minute summer	10	1	45.612	0.996	0.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	34.9	1.982	0.952	0.3960	
15 minute winter	2	1.001	3	104.1	2.001	0.825	1.5310	
15 minute summer	3	1.002	4	148.8	3.326	0.503	0.6897	
15 minute winter	11	2.000	12	-66.1	0.781	-0.239	3.2093	
15 minute winter	12	2.001	4	104.1	0.657	0.405	3.0187	
15 minute winter	4	1.003	5	240.7	1.519	1.056	1.3632	
15 minute winter	5	1.004	6	276.6	1.746	1.347	7.1341	
15 minute winter	6	1.005	7	337.1	2.128	2.099	6.7689	
15 minute winter	26	3.005	27	128.3	2.030	0.862	2.6685	
15 minute winter	27	3.006	28	266.4	1.682	1.011	2.6482	
15 minute winter	28	3.007	7	263.9	1.666	0.792	3.2072	
15 minute winter	7	1.006	8	641.7	4.051	3.995	1.3891	
15 minute winter	8	1.007	9	47.3	0.617	0.308	7.5405	
480 minute winter	9	Hydro-Brake®	10	16.2				569.3

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.500
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.073	5.00	48.646	1200	373579.669	436076.937	1.350
2	0.131	5.00	47.857	1200	373574.622	436055.014	1.507
3	0.091	5.00	47.579	1200	373553.423	436059.839	1.509
11	0.118	5.00	47.109	3000	373522.844	436080.478	1.726
12	0.128	5.00	47.961	3000	373542.195	436074.493	2.727
4	0.069	5.00	47.458	3000	373544.597	436055.593	2.345
5	0.069	5.00	47.428	3000	373540.747	436047.898	2.358
6	0.158	5.00	46.691	3000	373531.367	436003.860	1.804
26	0.236	5.00	48.097	1500	373605.848	436047.500	2.044
27	0.253	5.00	46.923	1500	373596.676	436010.732	1.697
28	0.000	5.00	46.785	1500	373593.195	435994.385	1.670
7	0.152	5.00	46.593	1500	373572.955	435994.085	1.818
8	0.000		46.474	1500	373571.516	435985.437	1.726
9	0.000		46.474	1500	373573.098	435937.872	1.835
10			46.168	1500	373573.032	435932.522	1.552

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	22.496	0.600	47.296	46.350	0.946	23.8	150	5.18	50.0
1.001	2	3	21.741	0.600	46.350	46.070	0.280	77.6	300	5.38	50.0
1.002	3	4	9.794	0.600	46.070	45.383	0.687	14.3	300	5.42	50.0
2.000	11	12	20.255	0.600	45.383	45.234	0.149	135.9	450	5.19	50.0
2.001	12	4	19.052	0.600	45.234	45.113	0.121	157.5	450	5.39	50.0
1.003	4	5	8.604	0.600	45.113	45.070	0.043	200.1	450	5.52	50.0
1.004	5	6	45.026	0.600	45.070	44.887	0.183	246.0	450	6.10	50.0
1.005	6	7	42.721	0.600	44.887	44.780	0.107	400.0	450	6.81	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	2.073	36.6	9.9	1.200	1.357	0.073	0.0
1.001	1.786	126.2	27.6	1.207	1.209	0.204	0.0
1.002	4.185	295.8	40.0	1.209	1.775	0.295	0.0
2.000	1.742	277.0	16.0	1.276	2.277	0.118	0.0
2.001	1.617	257.2	33.3	2.277	1.895	0.246	0.0
1.003	1.433	228.0	82.7	1.895	1.908	0.610	0.0
1.004	1.291	205.4	92.0	1.908	1.354	0.679	0.0
1.005	1.010	160.7	113.4	1.354	1.363	0.837	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
3.005	26	27	37.895	0.600	46.053	45.376	0.677	56.0	300	5.30	50.0
3.006	27	28	16.714	0.600	45.226	45.115	0.111	150.0	450	5.47	50.0
3.007	28	7	20.242	0.600	45.140	44.925	0.215	94.1	450	5.63	50.0
1.006	7	8	8.767	0.600	44.775	44.753	0.022	400.0	450	6.95	50.0
1.007	8	9	47.591	0.600	44.748	44.639	0.109	436.6	450	7.77	50.0
1.008	9	10	5.350	0.600	44.639	44.616	0.023	232.6	225	7.88	50.0

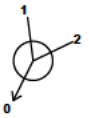
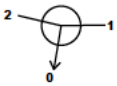
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
3.005	2.105	148.8	32.0	1.744	1.247	0.236	0.0
3.006	1.657	263.6	66.3	1.247	1.220	0.489	0.0
3.007	2.095	333.2	66.3	1.195	1.218	0.489	0.0
1.006	1.010	160.7	200.3	1.368	1.271	1.478	0.0
1.007	0.966	153.7	200.3	1.276	1.385	1.478	0.0
1.008	0.853	33.9	200.3	1.610	1.327	1.478	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	22.496	23.8	150	Circular_Default Sewer Type	48.646	47.296	1.200	47.857	46.350	1.357
1.001	21.741	77.6	300	Circular_Default Sewer Type	47.857	46.350	1.207	47.579	46.070	1.209
1.002	9.794	14.3	300	Circular_Default Sewer Type	47.579	46.070	1.209	47.458	45.383	1.775
2.000	20.255	135.9	450	Circular_Default Sewer Type	47.109	45.383	1.276	47.961	45.234	2.277
2.001	19.052	157.5	450	Circular_Default Sewer Type	47.961	45.234	2.277	47.458	45.113	1.895
1.003	8.604	200.1	450	Circular_Default Sewer Type	47.458	45.113	1.895	47.428	45.070	1.908
1.004	45.026	246.0	450	Circular_Default Sewer Type	47.428	45.070	1.908	46.691	44.887	1.354
1.005	42.721	400.0	450	Circular_Default Sewer Type	46.691	44.887	1.354	46.593	44.780	1.363
3.005	37.895	56.0	300	Circular_Default Sewer Type	48.097	46.053	1.744	46.923	45.376	1.247
3.006	16.714	150.0	450	Circular_Default Sewer Type	46.923	45.226	1.247	46.785	45.115	1.220
3.007	20.242	94.1	450	Circular_Default Sewer Type	46.785	45.140	1.195	46.593	44.925	1.218
1.006	8.767	400.0	450	Circular_Default Sewer Type	46.593	44.775	1.368	46.474	44.753	1.271
1.007	47.591	436.6	450	Circular_Default Sewer Type	46.474	44.748	1.276	46.474	44.639	1.385
1.008	5.350	232.6	225	Circular_Default Sewer Type	46.474	44.639	1.610	46.168	44.616	1.327

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	4	3000	Manhole	Adoptable
2.000	11	3000	Manhole	Adoptable	12	3000	Manhole	Adoptable
2.001	12	3000	Manhole	Adoptable	4	3000	Manhole	Adoptable
1.003	4	3000	Manhole	Adoptable	5	3000	Manhole	Adoptable
1.004	5	3000	Manhole	Adoptable	6	3000	Manhole	Adoptable
1.005	6	3000	Manhole	Adoptable	7	1500	Manhole	Adoptable
3.005	26	1500	Manhole	Adoptable	27	1500	Manhole	Adoptable
3.006	27	1500	Manhole	Adoptable	28	1500	Manhole	Adoptable
3.007	28	1500	Manhole	Adoptable	7	1500	Manhole	Adoptable
1.006	7	1500	Manhole	Adoptable	8	1500	Manhole	Adoptable
1.007	8	1500	Manhole	Adoptable	9	1500	Manhole	Adoptable
1.008	9	1500	Manhole	Adoptable	10	1500	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	373579.669	436076.937	48.646	1.350	1200		0 1.000	47.296	150
2	373574.622	436055.014	47.857	1.507	1200		1 1.000	46.350	150
							0 1.001	46.350	300
3	373553.423	436059.839	47.579	1.509	1200		1 1.001	46.070	300
							0 1.002	46.070	300
11	373522.844	436080.478	47.109	1.726	3000		0 2.000	45.383	450
12	373542.195	436074.493	47.961	2.727	3000		1 2.000	45.234	450
							0 2.001	45.234	450
4	373544.597	436055.593	47.458	2.345	3000		1 2.001	45.113	450
							2 1.002	45.383	300
							0 1.003	45.113	450
5	373540.747	436047.898	47.428	2.358	3000		1 1.003	45.070	450
							0 1.004	45.070	450
6	373531.367	436003.860	46.691	1.804	3000		1 1.004	44.887	450
							0 1.005	44.887	450
26	373605.848	436047.500	48.097	2.044	1500		0 3.005	46.053	300
27	373596.676	436010.732	46.923	1.697	1500		1 3.005	45.376	300
							0 3.006	45.226	450
28	373593.195	435994.385	46.785	1.670	1500		1 3.006	45.115	450
							0 3.007	45.140	450
7	373572.955	435994.085	46.593	1.818	1500		1 3.007	44.925	450
							2 1.005	44.780	450
							0 1.006	44.775	450
8	373571.516	435985.437	46.474	1.726	1500		1 1.006	44.753	450
							0 1.007	44.748	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
9	373573.098	435937.872	46.474	1.835	1500	1	1.007	44.639	450
						0	1.008	44.639	225
10	373573.032	435932.522	46.168	1.552	1500	1	1.008	44.616	225

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	✓
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.300	Check Discharge Rate(s)	✓
Summer CV	0.750	Check Discharge Volume	✓
Winter CV	0.840	100 year 360 minute (m³)	
Analysis Speed	Detailed		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	50	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m³)	

Node 9 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	44.639	Product Number	CTL-SHE-0172-1500-1200-1500
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	15.0	Min Node Diameter (mm)	1500

Node 8 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	44.748
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	525.0	0.0	1.725	1115.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	47.348	0.052	9.4	0.1140	0.0000	OK
15 minute winter	2	10	46.448	0.098	26.1	0.2806	0.0000	OK
15 minute winter	3	10	46.148	0.078	37.4	0.1820	0.0000	OK
15 minute winter	11	10	45.452	0.069	15.1	0.5840	0.0000	OK
15 minute winter	12	11	45.337	0.103	31.0	0.8220	0.0000	OK
15 minute winter	4	11	45.325	0.212	75.6	1.6210	0.0000	OK
15 minute winter	5	11	45.272	0.202	84.0	1.5445	0.0000	OK
15 minute winter	6	12	45.190	0.303	103.4	2.6748	0.0000	OK
15 minute winter	26	10	46.146	0.093	30.3	0.3790	0.0000	OK
15 minute winter	27	10	45.388	0.162	61.9	0.7709	0.0000	OK
15 minute winter	28	11	45.281	0.166	61.1	0.2926	0.0000	OK
15 minute winter	7	12	45.136	0.361	171.5	1.2428	0.0000	OK
240 minute winter	8	180	44.995	0.247	46.7	140.2840	0.0000	OK
240 minute winter	9	180	44.993	0.354	15.5	0.6260	0.0000	SURCHARGED
15 minute summer	10	1	44.616	0.000	14.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	9.3	1.061	0.253	0.1969	
15 minute winter	2	1.001	3	25.7	1.497	0.203	0.3739	
15 minute winter	3	1.002	4	37.0	2.718	0.125	0.1335	
15 minute winter	11	2.000	12	14.6	0.698	0.053	0.4303	
15 minute winter	12	2.001	4	30.3	0.619	0.118	0.9567	
15 minute winter	4	1.003	5	75.7	1.065	0.332	0.6113	
15 minute winter	5	1.004	6	84.3	0.972	0.410	4.0336	
15 minute winter	6	1.005	7	98.4	0.807	0.612	5.3036	
15 minute winter	26	3.005	27	29.5	1.630	0.198	0.6872	
15 minute winter	27	3.006	28	61.1	1.180	0.232	0.8654	
15 minute winter	28	3.007	7	61.1	1.418	0.183	1.1294	
15 minute winter	7	1.006	8	171.7	1.394	1.069	1.0749	
30 minute winter	8	1.007	9	24.4	0.503	0.159	3.8333	
240 minute winter	9	Hydro-Brake®	10	15.0				256.5

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	47.382	0.086	22.9	0.1892	0.0000	OK
15 minute winter	2	10	46.514	0.164	63.8	0.4709	0.0000	OK
15 minute winter	3	9	46.195	0.125	91.6	0.2912	0.0000	OK
15 minute winter	11	12	45.801	0.418	50.7	3.5271	0.0000	OK
15 minute winter	12	12	45.779	0.545	70.7	4.3649	0.0000	SURCHARGED
15 minute winter	4	12	45.770	0.657	175.9	5.0279	0.0000	SURCHARGED
15 minute winter	5	12	45.738	0.668	158.9	5.1161	0.0000	SURCHARGED
15 minute winter	6	12	45.609	0.722	188.6	6.3647	0.0000	SURCHARGED
15 minute winter	26	10	46.208	0.155	74.1	0.6328	0.0000	OK
15 minute winter	27	11	45.519	0.293	152.0	1.3904	0.0000	OK
15 minute winter	28	12	45.440	0.325	149.3	0.5744	0.0000	OK
15 minute winter	7	12	45.416	0.641	357.7	2.2059	0.0000	SURCHARGED
240 minute winter	8	232	45.375	0.627	99.3	397.5330	0.0000	SURCHARGED
240 minute winter	9	232	45.374	0.735	16.3	1.2988	0.0000	SURCHARGED
15 minute summer	10	1	44.616	0.000	15.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	22.7	1.451	0.620	0.3147	
15 minute winter	2	1.001	3	63.0	1.935	0.499	0.7185	
15 minute winter	3	1.002	4	91.4	3.290	0.309	0.4674	
15 minute winter	11	2.000	12	36.3	0.772	0.131	3.1596	
15 minute winter	12	2.001	4	73.5	0.651	0.286	3.0187	
15 minute winter	4	1.003	5	141.9	1.159	0.622	1.3632	
15 minute winter	5	1.004	6	159.6	1.010	0.777	7.1341	
15 minute winter	6	1.005	7	197.2	1.245	1.228	6.7689	
15 minute winter	26	3.005	27	72.6	2.050	0.488	1.3434	
15 minute winter	27	3.006	28	149.3	1.463	0.566	1.9190	
15 minute winter	28	3.007	7	143.9	1.435	0.432	2.7401	
15 minute winter	7	1.006	8	358.8	2.266	2.233	1.3553	
15 minute winter	8	1.007	9	44.6	0.647	0.290	6.6342	
15 minute summer	9	Hydro-Brake®	10	15.0				169.8

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	12	48.234	0.938	44.5	2.0746	0.0000	SURCHARGED
15 minute winter	2	12	47.343	0.993	112.8	2.8500	0.0000	SURCHARGED
15 minute winter	3	13	47.153	1.083	156.3	2.5309	0.0000	SURCHARGED
15 minute winter	11	13	47.003	1.620	122.2	13.6702	0.0000	FLOOD RISK
15 minute winter	12	13	46.995	1.761	106.2	14.1026	0.0000	SURCHARGED
15 minute winter	4	13	46.969	1.856	244.9	14.2121	0.0000	SURCHARGED
15 minute winter	5	13	46.864	1.794	262.3	13.7287	0.0000	SURCHARGED
15 minute winter	6	12	46.484	1.597	322.0	14.0863	0.0000	FLOOD RISK
15 minute winter	26	11	46.950	0.897	143.7	3.6572	0.0000	SURCHARGED
15 minute winter	27	11	46.336	1.110	273.6	5.2703	0.0000	SURCHARGED
15 minute winter	28	12	46.152	1.037	266.4	1.8330	0.0000	SURCHARGED
480 minute winter	7	464	46.019	1.244	113.1	4.2777	0.0000	SURCHARGED
480 minute winter	8	464	46.018	1.270	112.7	945.1942	0.0000	SURCHARGED
480 minute winter	9	464	46.017	1.378	16.0	2.4348	0.0000	SURCHARGED
15 minute summer	10	1	44.616	0.000	15.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	34.9	1.982	0.952	0.3960	
15 minute winter	2	1.001	3	104.1	2.001	0.825	1.5310	
15 minute summer	3	1.002	4	148.8	3.326	0.503	0.6897	
15 minute winter	11	2.000	12	-66.1	0.781	-0.239	3.2093	
15 minute winter	12	2.001	4	104.1	0.657	0.405	3.0187	
15 minute winter	4	1.003	5	240.7	1.519	1.056	1.3632	
15 minute winter	5	1.004	6	276.6	1.746	1.347	7.1341	
15 minute winter	6	1.005	7	337.1	2.128	2.099	6.7689	
15 minute winter	26	3.005	27	128.3	2.030	0.862	2.6685	
15 minute winter	27	3.006	28	266.4	1.682	1.011	2.6482	
15 minute winter	28	3.007	7	263.9	1.666	0.792	3.2072	
15 minute winter	7	1.006	8	641.7	4.051	3.995	1.3891	
15 minute summer	8	1.007	9	59.2	0.694	0.385	7.5405	
480 minute winter	9	Hydro-Brake®	10	16.0				598.8

Appendix E

Unit 20
Meetings Industrial Estate
Park Road
Barrow-in-Furness
Cumbria
LA14 4TL

M & P Gadsden
Consulting Engineers Ltd

Sustainable Drainage Maintenance & Management Plan

Housing Development Accrington Road, Whalley

1.0 Introduction

Sustainable drainage systems or SuDS are an environmentally friendly approach to managing rainfall that uses the landscape. SuDS aim to: -

- Control the flow, volume and frequency of water leaving a development site
- Prevent pollution by intercepting silt and cleaning runoff from hard surfaces
- Provide attractive surroundings for the community
- Create opportunities for wildlife

2.0 SuDS at Accrington Road, Whalley

Management and maintenance of the elements outlined in this document will be the responsibility of the management company. The management company that will be responsible until the development is complete are as follows:

Oakmere Homes (Northwest) Ltd
Helm Bank,
Natland, Kendal,
Cumbria. LA9 7PS

Upon completion of the development, the management and maintenance responsibilities will be passed over to a further management company, the details of which are as follows:

Trinity Property Group

Vantage Point

23 Mark Road

Hemel Hempstead

Hertfordshire

HP2 7DN

The management company will provide financial management through service charges paid by residents of the development. This will cover the routine maintenance outlined in this document, along with ensuring funding is available to replace major components when they reach the end of their design life.

The SuDS are designed to prevent flooding of the housing development and control the flow of water from the site. This site utilises attenuation in the form of an attenuation basin, along with a vortex flow control unit to slowly discharge surface water into the existing watercourse. The maintenance of the drainage network and attenuation features will be the responsibility of the management company once it has been handed over from the developer post construction.

The highway serving the site is constructed using a mixture of bituminous macadam and impermeable paviours. The maintenance of the main carriageways will be the responsibility of the management company.

Private shared access driveways are also constructed using impermeable paviours. The maintenance of these private shared access driveways will be the responsibility of the management company.

3.0 Managing the SuDS

The day-to-day surface water drainage and SuDS requiring management and maintenance for this site are summarised in Table 1 with the basin management in Table 2 and the compensatory storage in Table 3: -

Table 1 – Maintenance Schedule

	Maintenance Item	Action	Regularity
1	Monitoring Generally	Initial inspection of everything below to ensure the system is working effectively	After large storms and quarterly during first year
2	Impermeable Pavements	Brushing/sweeping of surface area to clear litter, grass cuttings, leaves and other debris	Once per year after Autumn leaf fall and as required
3	Impermeable Pavements	Removal of weeds using glyphosphate applied directly into weeds using an applicator	Annually and/or as required
4	Impermeable Pavements	Remedial work to depressions and cracked or broken block pavers. Replace blocks and replace jointing material	As required
5	Manholes, Geocellular Tanks, Pipes etc	Lift manhole covers, visual inspection. If debris/silt has built up arrange jetting. Arrange CCTV survey if performance deteriorates.	Annually and/or as required
6	Flow Control (Hydro-Brake)	Lift manhole cover, clear silt from silt trap, inspect Hydro-brake for blockages	Annually
8	Inlets and Outlets	Inspect and remove silt, litter and debris. Strim for 1m around	Monthly

Table 2 – Attenuation Basin Maintenance Schedule

	Maintenance Item	Action	Regularity
1	Litter Management	Pick up all litter in SuDS and landscape areas and remove from site	Monthly
2	Grass Maintenance	Cut grass to side slopes and surrounding areas at 100mm	As required or monthly
3	Basin Vegetation Maintenance	Monitor basin vegetation and cut 30% of edge at 100mm each year if necessary in September-November	Annually
4	Inlet & Outlets	Inspect and remove silt, litter and debris. Strim for 1m around	Monthly
5	Silt Management	a)Inspect base of basin for silt accumulation	Annually
		b)Excavate silt taking care not to damage basin integrity. Set a side silt and allow to dry within 10m of SuDS feature. Spread, rake and overseed.	As necessary
6	Basin Monitoring	Check and reinstate design levels. Check for ponding and inspect for structural issues, repairing as required.	Within first 12 months and then as necessary
7	Outlets	Inspect and remove silt, litter and debris. Strim for 1m around	Monthly

Table 3 – Compensatory Storage Maintenance Schedule

	Maintenance Item	Action	Regularity
1	Litter Management	Pick up all litter in SuDS and landscape areas and remove from site	Monthly
2	Grass Maintenance	Cut grass to side slopes and surrounding areas at 100mm	As required or monthly
3	Basin Vegetation Maintenance	Monitor basin vegetation and cut 30% of edge at 100mm each year if necessary in September-November	Annually
4	Inlet & Outlets	Inspect and remove silt, litter and debris. Strim for 1m around	Monthly
5	Silt Management	a)Inspect base of basin for silt accumulation	Annually
		b)Excavate silt taking care not to damage basin integrity. Set a side silt and allow to dry within 10m of SuDS feature. Spread, rake and overseed.	As necessary
6	Compensatory Storage Area Monitoring	Check and reinstate design levels. Check for ponding and inspect for structural issues, repairing as required.	Within first 12 months and then as necessary
7	Outlets	Inspect and remove silt, litter and debris. Strim for 1m around	Monthly

A record of all inspections and maintenance undertaken at the site should be recorded. This should be kept as part of the health and safety file. A template to record the items listed above can be seen on the next page of this document. Access to the maintenance file will be available upon request and electronically forwarded to the Local Planning Authority.

Appendix F

Table 1: SuDS Maintenance Inspection Checklist

GENERAL INFORMATION			
Site ID			
Site Location and co-ordinates (GIS if appropriate)			
Elements forming the SuDS scheme		Approved Drawing Reference(s)	
Inspection frequency		Approved Specification Reference	
Type of development		Specific purpose of any parts of the scheme (e.g. biodiversity, wildlife and visual aspects)	

	Inspection date				**Inspection date**			
	Details	**Y/N**	**Action required**	**Date Completed**	**Details**	**Y/N**	**Action required**	**Date Completed**
GENERAL INSPECTION ITEMS								
Is there any evidence of erosion, channelling, ponding (where not desirable) or other poor hydraulic performance?								
Is there any evidence of accidental spillages, oils, poor water quality, odours, nuisance insects?								
Have any health and safety risks been identified to either the public or maintenance operatives?								
Is there any deterioration in the surface of permeable or porous surfaces (e.g. rutting, spreading of blocks or signs of ponding water)?								

	Inspection date				Inspection date			
	Details	**Y/N**	**Action required**	**Date Completed**	**Details**	**Y/N**	**Action required**	**Date Completed**
SILT/SEDIMENT ACCUMULATION								
Is there any sediment accumulation at inlets (or other defined accumulation zones such as the surface of filter drains or infiltration basins and within proprietary devices)? If yes, state depth (mm) and extent Is removal required? If yes, state waste disposal requirements and confirm all waste management requirements have been complied with (consult Environment Agency or SEPA).								
Is surface clogging visible (potentially problematic where water has to soak into the underlying construction or ground (e.g. under-drained swale or infiltration basin)?								
Does permeable or porous surfacing require sweeping to remove silt?								
SYSTEM BLOCKAGES / LITTER BUILD UP								
Is there evidence of litter accumulation in the system? If yes, is this a blockage risk?								
Is there any evidence of any other clogging/blockage of outlets or drainage paths?								
VEGETATION								

	Inspection date				Inspection date			
	Details	**Y/N**	**Action required**	**Date Completed**	**Details**	**Y/N**	**Action required**	**Date Completed**
Is the vegetation condition satisfactory (density, weed growth, coverage etc.)? (Check against approved planting regime.)								
Does any part of the system require weeding / pruning / mowing? (Check against maintenance frequency stated in approved design.)								
Is there any evidence of invasive species becoming established? If yes, state action required.								
INFRASTRUCTURE								
Are any check dams or weirs in good condition?								
Is there evidence of any accidental damage to the system (e.g. wheel ruts?)								
Is there any evidence of cross connections or other unauthorised inflows?								
Is there any evidence of tampering with the flow controls?								
Are there any other matters that could affect the performance of the system in relation to the design objectives for hydraulic, water quality, biodiversity and visual aspects? (Specify.)								
OTHER OBSERVATIONS								
Information appended (e.g. photos)								

	Inspection date				Inspection date			
	Details	**Y/N**	**Action required**	**Date Completed**	**Details**	**Y/N**	**Action required**	**Date Completed**
SUITABILITY OF CURRENT MAINTENANCE REGIME								
Continue as current Increase maintenance Decrease maintenance								
NEXT INSPECTION								
Proposed date for next inspection								

Appendix G

Unit 20
Meetings Industrial Estate
Park Road
Barrow-in-Furness
Cumbria
LA14 4TL

M & P Gadsden
Consulting Engineers Ltd

Householder Sustainable Drainage Maintenance Plan

Housing Development Accrington Road, Whalley

1.0 Introduction

Sustainable drainage systems or SuDS are aimed to: -

- Control the flow, volume and frequency of water leaving a development site
- Prevent pollution by intercepting silt and cleaning runoff from hard surfaces

2.0 Surface water drainage & SuDS serving this property

House roof and impermeable driveway surfaces are served by an attenuation basin. A management company is responsible for the maintenance and upkeep of this basin.

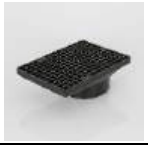
As the property owner you are responsible for maintenance and upkeep of the system serving your house and impermeable driveways until it discharges into the public sewer. Silt traps and trapped gullies protect the system from silting and blocking up as well as enhancing water quality. These features are key to ensuring the systems longevity.

SuDS features should not be interfered with in any fashion without the prior approval of the Lead Local Flood Authority (Lancashire County Council).

3.0 Management & Maintenance

The surface water drainage and SuDs requiring management and maintenance for this property are summarised in Table 1 below: -

Table 1 – Householder Maintenance Schedule

Maintenance Item	Regularity	Action	Purpose	Diagram
ACO or similar channel to driveway	Monthly	Remove litter, grass cuttings and other vegetation from the surface of the grills	Prevent grills becoming blocked allowing water to get away	
ACO or similar channel to driveway	Annually	Remove debris, grass cuttings etc from inside the channel itself. This can be easily done by lifting the lid to the corner unit and cleaning out the sump by hand wearing a suitable pair of gloves	Prevent the silt trap filling up and debris entering the tank	
Gullies to downspouts	Monthly	Remove litter, grass cuttings and other vegetation from the gulley grate	Prevent grate/cover becoming blocked allowing water to get away	
Gullies to downspouts	Annually	Remove debris, grass cuttings etc from inside the gulley itself. This can be easily done by lifting the cover and cleaning out the gulley by hand wearing a suitable pair of gloves	Prevent the trap filling up and debris entering the tank	
Inspection Chambers	Annually	-Remove silt from base of silt trap manhole	Prevent inspection chamber blocking up and affecting the performance of the system