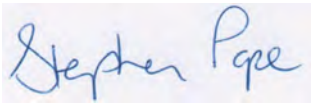
Flood Risk & Drainage Assessment

Red Bank
Newton-le-willows

Ironside Farrar Limited
3 Worsley Court
High Street
Worsley
Manchester
M28 3NJ

30488/FRA/SRG
November 2023

Prepared By: **S.R. Gough**	
Checked By: **S.A. Pope**	

CONTENTS

APPENDICES

RED BANK, NEWTON LE WILLOWS
FLOOD RISK & DRAINAGE ASSESSMENT

1.0 Introduction

Wainhomes intend to submit a Full Planning Application for a residential development at a site off Mill Lane, Newton le Willows. The application site is located to the south of a larger site for which a masterplan has been prepared.

In accordance with National Planning Policy Framework (NPPF) and the associated National Planning Practice Guidance (NPPG), flood risk must be assessed for all sources including tidal (from the sea), fluvial (from rivers), pluvial (from land), groundwater, sewer and artificial water bodies (e.g. reservoirs, canals, major water supply infrastructure etc.).

More specifically, the development of any site must be carried out in such a way as to mitigate any potential flood risk, both on and off site from all sources of flooding.

2.0 Site Description

The overall site extends to approximately 12.83ha with the proposed development occupying 5.03ha and located to the west of Mill Lane (A49), Newton le Willows. The site is at the south of the built-up area of Newton le Willows approximately 0.8km to the southeast of Newton le Willows centre and the grid reference of the site is SJ 59423 94861; the Location and Site plan are included in Appendices A and B.

Access to the site is gained from a private drive off Wayfarers Drive, adjacent to the A49 where Mill Lane meets Winwick Road; at this point, the A49 is considerably above the site level as it passes over the main west coast railway line.

The overall site is almost triangular in shape and consists of a single agricultural field; at the time of the site visit, the field was ploughed; the full application site is located at the southern point of the triangle. Along the northern boundary of the overall site there is existing residential development on Wayfarers Drive with the site extending to the west where it is bordered by Newton Brook. The brook runs along the full extent of the western boundary to a large culvert passing under the railway line in the south of the site; there are several low lying, marshy areas adjacent to the brook. The entire eastern boundary is formed by the west coast main line

that is at levels similar to the site in the north but as the site falls to the south, the railway line gradually rises above the site on an embankment.

There is a general fall on the site from northeast to southwest.

The existing site access off Wayfarers Drive in the northwest of the site is at 27.92m and the A49 is at 29.57m. The northern boundary falls gradually to the west and relatively steeply close to Newton Brook where the site level is at 16.41m and the bed level of the watercourse at 14.49m; the water level is 14.89m. At the southern end of the site, where Newton Brook passes under the railway, the bed level is 14.16m and the water level 14.26m; the site is at a level of 17.14m. Levels then rise gradually along the eastern boundary to the site access.

The topographical survey is included in Appendix C and a selection of photographs, together with an aerial photo is included in Appendix D to illustrate the site at the present day.

3.0 Proposed Development

The full application proposals for the land off Mill Lane will comprise a residential development of up to 99no. units with associated access, parking, and landscaping; vehicular access will be taken from Mill Lane and will run alongside the railway boundary to the east of the site. There will be an embankment to lead the access road down to the site levels at acceptable gradients to the highway authority.

Open spaces are provided along the corridor of Newton Brook on the west of the site and at the northeast corner of the site adjacent to Mill Lane.

Two on-line SuDS basins will be included within the development and an off-line open attenuation basin adjacent to the railway boundary in the southeast of the site.

An indicative layout of the development is shown on the Proposed Development and Drainage Layout attached at Appendix H.

4.0 Planning Policy

The National Planning Policy Framework (NPPF) 2021 sets out the Government's policy on meeting the challenges of climate change, flooding and coastal change. Paragraph 167 of the NPPF states that:

"When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment[55]. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;

b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;

c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

d) any residual risk can be safely managed; and

e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan."

This Flood Risk Assessment proposes recommendations to facilitate the proposed development so that it considers flood risk at all stages of the development.

4.1 Sequential and Exception Test

Paragraph 161 of the NPPG states:

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

a) applying the sequential test and then, if necessary, the exception test as set out below;

b) safeguarding land from development that is required, or likely to be required, for current or future flood management;

c) using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding, (making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management); and

d) where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking

opportunities to relocate development, including housing, to more sustainable locations."

The information received from the Environment Agency (Appendix E) indicates the western area of the site adjacent to Newton Brook is located in Flood Zone 3 with the majority of the site in Flood Zone 1. Development has therefore been directed away from the portion of the site in Flood Zone 3 to the areas of the site in Flood Zone 1 where all development (including 'More Vulnerable') is deemed appropriate according to NPPF and NPPG, therefore the development is appropriately situated.

4.2 Exception Test

NPPF classifies the development as 'More Vulnerable', however as the development on the site is located within Flood Zone 1 it is considered the Exception Test is not required.

5.0 Forms of Flooding

The NPPG requires all forms of flooding to be considered.

5.1 Flooding from Rivers

The Environment Agency Flood Risk map and flood levels are included as Appendix E.

It can be seen from the map that the development on the site is in Flood Zone 1 with a chance of flooding of less than 0.1% (or 1 in 1000). The nearest open named watercourse is Newton Brook, running from north to south on the west boundary; Newton Brook is classified as Main River. There is an area of the site on the western boundary within Flood Zone 3 but the development has been directed away from this area.

Flood levels provided by the Environment Agency indicate the 100-year flood levels as 18.58m at the northwest corner of the overall site, through to 17.62m at the southern corner of the full application site. These levels have been added to the topography of the site on the layout in Appendix H to determine the extent of the site in Flood Zone 3; development on the site has then been placed outside of this area.

The development on the site is therefore considered to be at low risk of flooding from rivers.

For the development, the Finished Floor Levels (FFL's) should be 600mm above the 100-year flood level plus 44% climate change allowance; the

levels provided by the Environment Agency do not include climate change allowances. Following a meeting with the Environment Agency on 15th September 2023, it was agreed that plotting the levels for the various return period flood events and extrapolating for the 100-year event plus 44% event would provide suitable flood levels to set the proposed FFLs for the development. The email and graphs are included in Appendix E and result in 100-year event plus 44% flood levels of 18.65m at Node 3 and 17.72m at Node 4.

For the development, the resulting flood levels vary from 18.36m in the north to 17.72m at the southern end of the site; the corresponding FFLs vary from 19.30m to 18.50m respectively and are transposed onto the development layout included in Appendix H. There is therefore greater than the minimum 600mm freeboard provided to the 100-year return period event plus 44% flood levels for the development.

To ensure the area of flooding is not reduced by the development and hence flood compensation required, retention will be required along the western edge of the development.

5.2 Flooding from the Sea

The site is not at risk of flooding from the sea.

5.3 Flooding from Land

Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding.

The site falls in a south westerly direction towards Newton Brook with the railway embankment on the eastern boundary and existing development on the northern boundary. Newton Brook runs along the western boundary so there is therefore limited potential for run-off from adjacent land onto the site.

Reference to the EA Surface Water Return depth map included in Appendix J indicates surface water flooding along the western boundary of the site, following the line of Newton Brook. There is a shallow area of surface water flooding (depth 0 - 0.15m) crossing the site from east to west - an existing land drain from under the railway line was noted at this point. The velocity and flow direction map indicate flow direction to the south and west at velocities of 0.5m/s to 1.0m/s; the overall 1000-year hazard rating map indicates the majority of the site to be in the low to

rating for potential surface water flooding. There is no surface water flooding of the development area in the 100-year return period EA Surface Water map.

The site is therefore considered to be at a low risk of flooding from run-off from adjacent land but it will be important to ensure the external levels are designed to convey any overland flows through the site along the highway corridor and away from the development. The land drain described previously should be investigated and diverted through the development as required.

Reference should also be made to Section 6 relating to the site drainage.

5.4 Flooding from Groundwater

Reference to the BGS Data included in Appendix J indicates the site is situated in an area that has limited potential for groundwater flooding to occur at surface. The Geo Smart Groundwater Flood Map, also included in Appendix J, indicates the site to be in an area of Negligible Risk.

A site investigation has been undertaken on the site and reference should be made to the REFA Consulting Engineers report reference 20028/GEIR dated November 2020 for the full details. With respect to groundwater, the report comments:

"Groundwater was encountered only within TP13 at 1.80m bgl within the slightly gravelly clayey sand unit. No further groundwater strikes were recorded during the investigation"

Finished levels on the development site will generally be higher than at present and it is considered to be at a low risk of flooding from groundwater.

5.5 Flooding from Sewers

The record of Public Sewers has been obtained from United Utilities and is included in Appendix F.

The sewer records indicate there is a 525mm dia. Combined Public Sewer running from north to south along the western boundary immediately adjacent to Newton Brook.

The sewer is at varying levels and in some locations the pipe was visible at ground level during the site visit. Should any flooding occur from the

sewer it would be directed to Newton Brook and away from the development area.

The site is therefore considered to be at a low risk of flooding from sewers but the drainage proposals for the site will need to be agreed with United Utilities and St. Helens MBC LLFA to ensure the risk of flooding to other areas is not exacerbated.

5.6 Flooding from Reservoirs, Canals and Other Artificial Sources

The Environment Agency flood risk map indicates the area at risk of flooding from reservoirs runs along the line of Newton Brook on the western boundary of the site. Newton Lake is located to the north at levels above the site.

As detailed, the area at risk of flooding from reservoirs runs along the line of Newton Brook with the development on the site located away from Newton Brook at levels above the watercourse.

The site is therefore not considered to be at risk of flooding from artificial sources.

6.0 Development and Drainage

United Utilities has been consulted with respect to the drainage of the site and their response is included in Appendix G. The advice is to follow the hierarchy of surface water drainage.

Therefore, in relation to the surface water hierarchy:

- A site investigation has been undertaken on the site and reference should be made to the REFA Consulting Engineers report reference 20028/GEIR dated November 2020 for the full details. With respect to ground conditions the report provides the strata encountered below the site as:

Topsoil
Topsoil has been identified within all exploratory hole positions across the site and composed dark brown slightly gravelly slightly clayey sand. The topsoil stratum has been proven to extend to depths of 0.15 – 0.30m bgl.

Made Ground
Made ground deposits were not identified within any of the exploratory hole locations during this investigation. The absence of made ground across the site indicates no landfilling has taken place within the site. No made ground has been identified adjacent to northern and eastern boundaries associated with the former garages and railway line.

Natural Strata
These investigations have identified the presence of orangish brown gravelly fine to coarse sand over much of the site from 0.15m to a maximum depth of 4.45m bgl (WS10). In situ standard penetration tests (SPTs) have recorded 'N' values ranging from 14 to 31blows/300mm. Based upon this information we can consider the sand strata to offer a safe bearing capacity in the order of 150kN/m2 at a minimum depth of 0.60m bgl.

The south east and central areas of the site recorded an area of reddish-brown mottled grey slightly gravelly slightly sandy clay to a maximum depth of 2.20m bgl (TP04). SPTs conducted within the strata recorded 'N' values ranging from 12 to 16 blows/300m. Based upon this information we can consider the sand strata to offer a safe bearing capacity in excess of 150kN/m2 at a minimum depth of 0.90m bgl

The north west corner of the site recorded reddish brown mottled grey slightly gravelly clayey fine to medium sand to a maximum depth of 2.50m bgl (TP13). A yellowish brown silty fine to medium sand was recorded as underlying most of the exploratory hole locations across the site to a maximum proven depth of 2.50m bgl (TP04).

Bedrock
This investigation has identified completely weathered sandstone bedrock, recovered as dense brown fine sand, within WS05, WS11 and WS12 at depths between 3.60m and 3.80m bgl. WS03 recorded weak becoming moderately strong reddish-brown fine-grained sandstone at 1.40m bgl. No further evidence of bedrock was recorded

during the investigation. SPTs conducted within the strata recorded 'N' values ranging from 44 blows/300m to refusal. Based upon this information we can consider the sand strata to offer a safe bearing capacity in excess of 300kN/m2 at a minimum depth of 1.40m bgl.

In relation to the use of infiltration, the report comments:

Assessment of the ground conditions present within this site in terms of sustainable urban drainage has identified potentially permeable sands and gravels. Groundwater was only recorded within TP13 at 1.80m bgl. Therefore, the site is potentially suitable for the use of a soakaway system for surface water disposal. However, soakaway testing will need to be conducted to either confirm or disprove their suitability.

- Infiltration techniques would therefore appear viable but have not been included in the surface water drainage at this stage; they cannot be ruled out until testing to BRE Digest 365 have been undertaken.

- Newton Brook, classified as Main River, runs along the western boundary of the site. A connection to the watercourse is considered the most practical location for the discharge of surface water from the site in accordance with the hierarchy at this time.

The overall site is considered greenfield; although the overall application site extends to 5.03ha, the development area occupies only 3.68ha. The IoH 124 method has been used to predict the run-off from the developed portion of the site; the existing Qbar flow has been calculated as 20.7l/s, this flow has been divided between the two outfall points to Newton Brook. The full calculations are included in Appendix I.

The Drainage Layout included in Appendix H has been prepared to demonstrate the site can be developed without increasing flood risk elsewhere. Attenuation has been included in the system in the form of two on-line SuDS basins together with oversized underground pipes, an off-line attenuation basin and off-line cellular storage with flow controls introduced to limit the flows in all events up to and including the 100 year + 45% climate change allowance event to a total of 20.7l/s for the development area. In addition, permeable driveway construction has been included in the larger areas of shared driveways. Urban creep at 10% of the domestic element of the impermeable areas has been included in the calculations.

The final details of the proposed drainage system will be developed and discussed with St. Helens MBC LLFA and United Utilities.

Foul drainage will be connected to the existing 525mm dia. Public Combined sewer running alongside Newton Brook on the western boundary.

7.0 Conclusions

- The development on the site is located within Flood Zone 1 with a low probability of flooding.
- The development site is at a low risk of flooding from other sources.
- Development on the site has been directed away from areas that are within Flood Zones 2 and 3.
- Allowance for climate change of 44% on peak river flow allowance has been made in establishing the proposed FFLs on the development; the minimum FFL to achieve the 600mm freeboard to the 100-year return period event plus 44% climate change allowance ranges from 19.30m in the north to 18.50m in the south of the development.
- Attenuation will be required within the surface water drainage system to achieve the specified flow rates. The design of the attenuation will ensure there is no flooding to property in the 100-year event with a 45% allowance for future climate change.
- Urban creep of 10% of the domestic element of the impermeable areas has been included in the calculations.
- Foul drainage will be connected to the existing 525mm dia. Public Combined sewer on the western boundary.
- Infiltration suds techniques have not been included in the drainage layout at present but cannot be ruled out until suitable tests are undertaken.

8.0 Recommendations

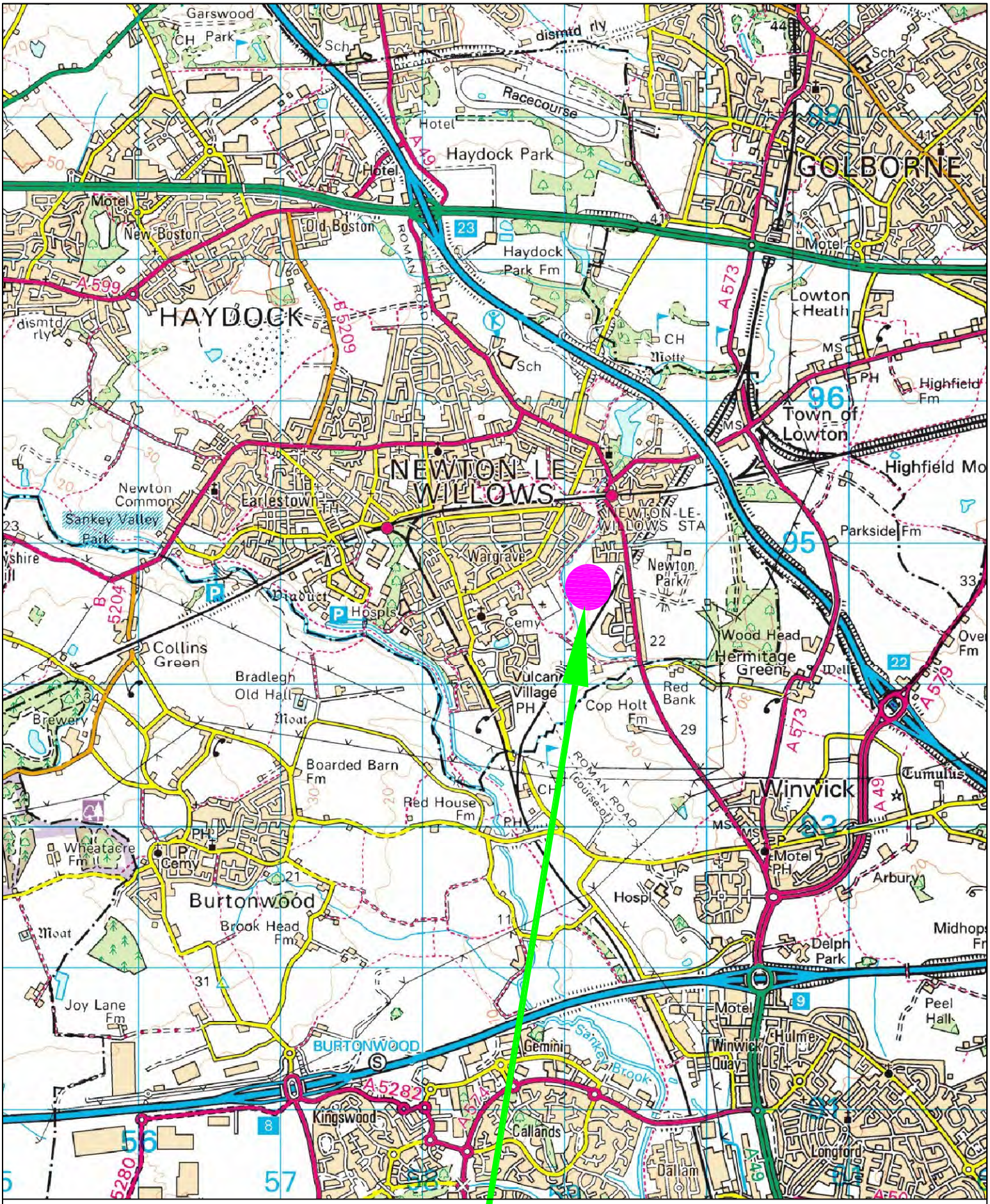
- Attenuation should be included in the proposed drainage to achieve the agreed discharge rates; the design should include all events up to and including the 100 year plus a climate change allowance.
- Finished levels on the site will ensure there is an emergency overland flow route through the site to the western boundary as appropriate.

- The finished floor levels of properties have generally been set above the adjacent road level to protect the properties against overland flows; the floor levels should also provide a minimum of 600mm freeboard to the 100-year flood levels including 44% allowance for climate change.

- Testing to BRE Digest 365 should be undertaken to determine whether the site is suitable for the use of infiltration techniques.

APPENDIX A

Site Location Plan



North Point

Project
Red Bank
Newton-le-Willows

Client
WAINHOMES

Title
Site Location Plan

Quality Ass.
UKAS 005
Quality Assurance
ISO 9001:2008
SGS Certificate GB02/54539

Original Size
A4

Copyright Acknowledgement
Ordnance Survey©
©Crown Copyright.

Drawn
KD

Checked By
SRG

Date

Scale

IronsideFarrar
Environmental Consultant
Environmental Planner
Civil Engineer
Landscape Architect
Graphic Design

3 Worsley Court MANCHESTER M28 3N
Tel. 0161 703 8801 Fax. 0161 703 827
manchester@ironsidefarrar.com

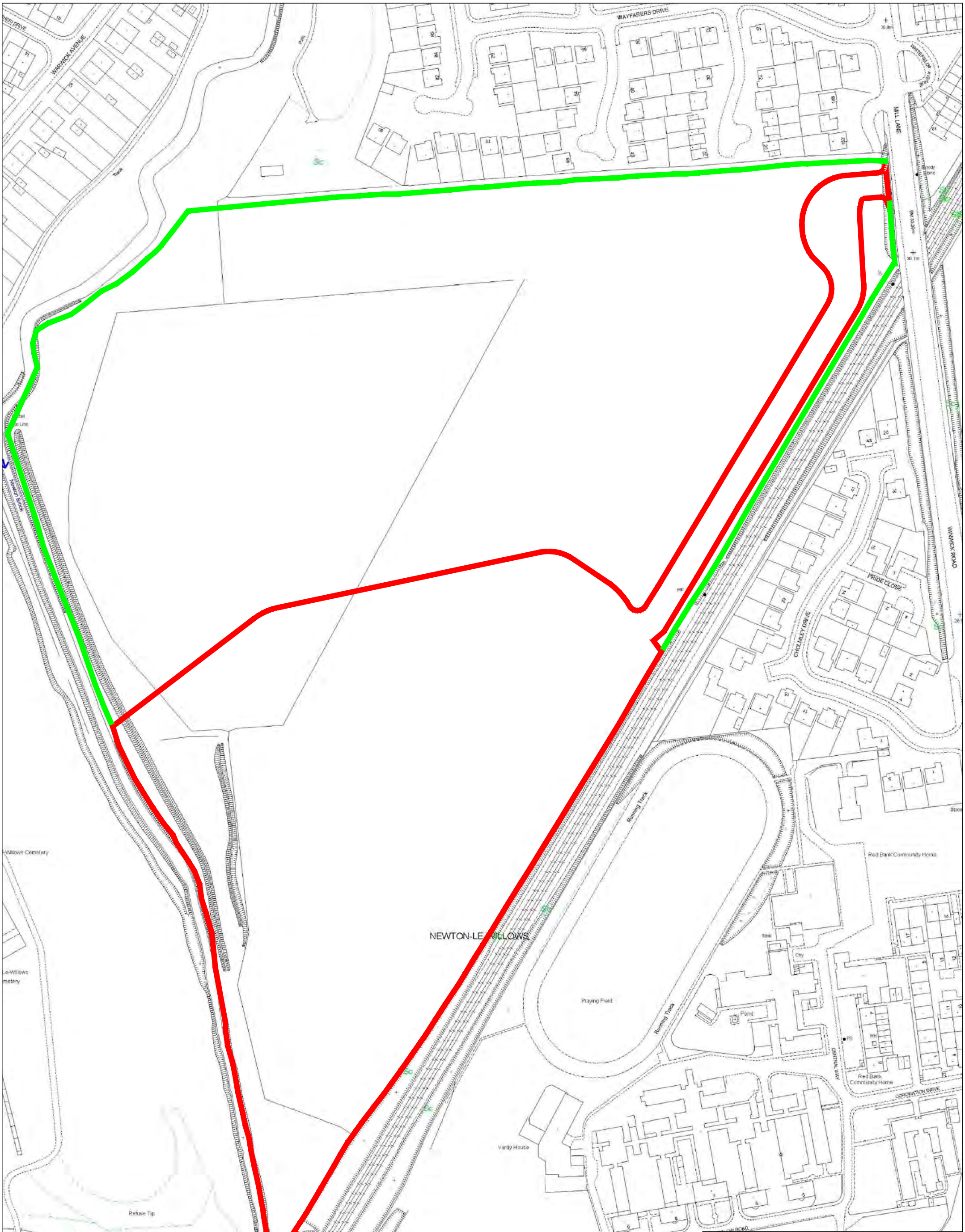
EDINBURGH BELLSHILL

Drawing No.
30488/A/DD A

Revision

APPENDIX B

Existing Site Plan



Rev	Date	Initials	Details
A	22/11/23	KF	Boundary revised to suit latest development layout

Drawing Revisions

North Point

Quality Ass.

UKAS 005 Quality Assurance ISO 9001:2008 SGS Certificate GB02/54539

Project
Red Bank
Newton-le-Willows

Client
WAINHOMES
BUILDING BRITAIN'S HERITAGE

Title
Existing Site Plan

Original Size
A3

Drawn: KD
Checked By: SRG
Date: Mar 21
Scale: 1:750

IronsideFarrar
Environmental Consultants
Environmental Planners
Civil Engineers
Landscape Architects
Graphic Design
3 Worsley Court MANCHESTER M28 3NJ
Tel. 0161 703 8801 Fax. 0161 703 8279
manchester@ironsidefarrar.com
EDINBURGH BELLSHILL

Drawing No. 30488/App B

Revision A

APPENDIX C

Topographical Survey

KEY

MASTER PLAN SITE BOUNDARY

SOUTHERN APPLICATION SITE BOUNDARY

Rev	Date	Initials	Details
A	22/11/23	KF	Boundary revised to suit latest development layout

Drawing Revisions

North Point

Quality Ass.

UKAS 005
Quality
Assurance
ISO 9001:2008
SGS Certificate
GB02/54539

Project
Red Bank
Newton-le-Willows

Client
WAINHOMES
BUILDING BRITAIN'S HERITAGE

Title
Topographical Survey

Original Size
A1

Drawn: KD
Checked By: SRG
Date: Mar 21
Scale: 1:1000

IronsideFarrar
EnvironmentalConsultants

EnvironmentalPlanners
CivilEngineers
LandscapeArchitects
GraphicDesign

3 Worsley Court MANCHESTER M28 3NJ
Tel. 0161 703 8801 Fax. 0161 703 8279
manchester@ironsidefarrar.com

EDINBURGH BELLSHILL

Drawing No.: 30488/App C

Revision: A

APPENDIX D

Aerial & Site Photographs

KEY

MASTER PLAN BOUNDARY

SOUTHERN APPLICATION BOUNDARY

Rev	Date	Initials	Details
A	22/11/23	KF	Boundary revised to suit latest development layout

Drawing Revisions

North Point

Quality Ass.

UKAS 005
Quality
Assurance
ISO 9001:2008
SGS Certificate
GB02/54539

Project
Red Bank
Newton-le-Willows

Client
WAINHOMES
BUILDING BRITAIN'S HERITAGE

Title
Aerial
Photograph

Original Size
A3

Drawn KD
Checked By SRG
Date Mar 21
Scale NTS

IronsideFarrar
Environmental**Consultants**

Environmental**Planners**
Civil**Engineers**
Landscape**Architects**
Graphic**Design**

3 Worsley Court **MANCHESTER** M28 3NJ
Tel. 0161 703 8801 Fax. 0161 703 8279
manchester@ironsidefarrar.com

EDINBURGH **BELLSHILL**

Drawing No. 30488/App D

Revision A

Winwick Road to the north

Mill Lane south to proposed site access

View west from eastern boundary

View southwest along eastern boundary

View south along Newton Brook on western boundary

View south along Newton Brook

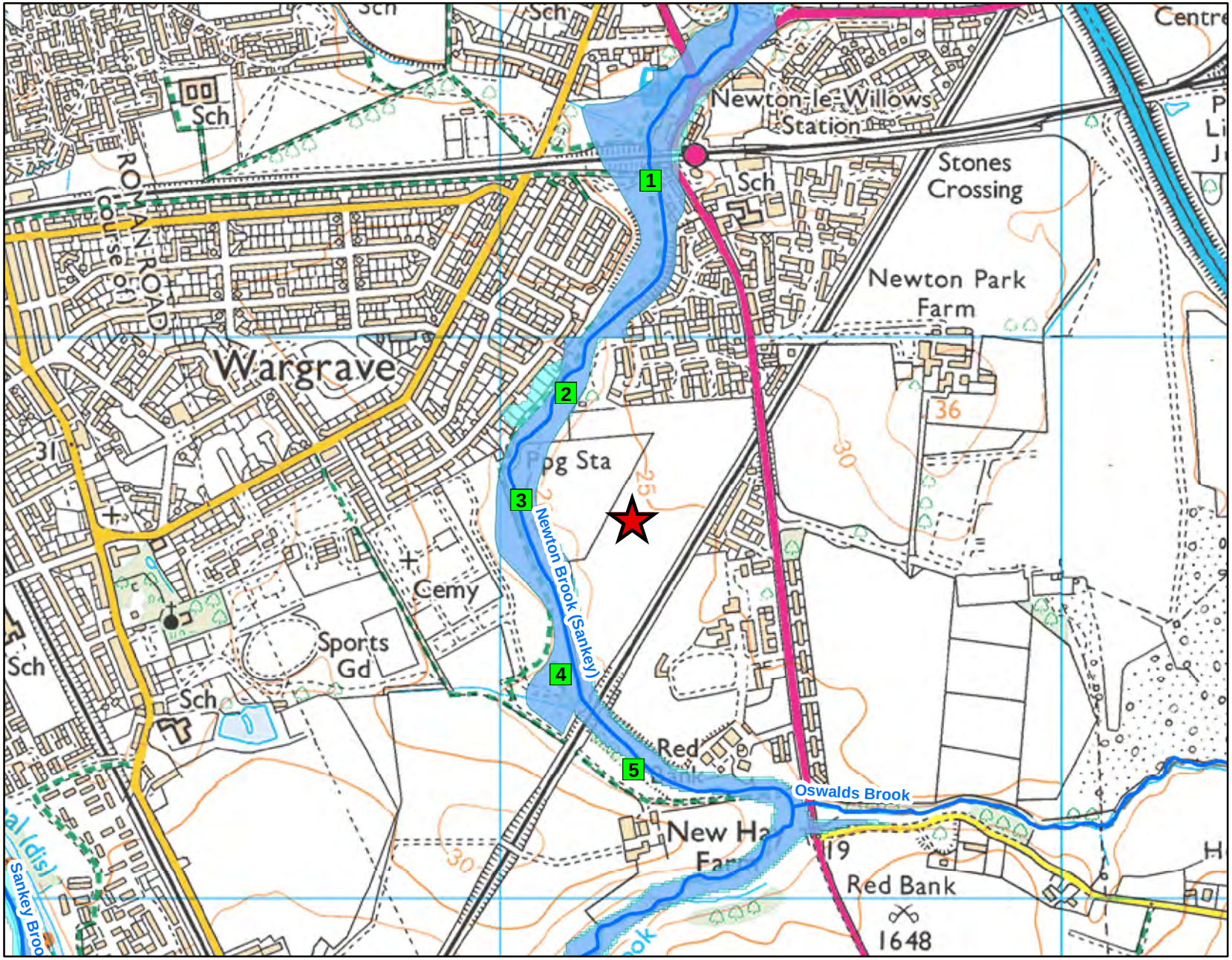
View north along Newton Brook

Newton Brook crossing under Railway

APPENDIX E

Environment Agency
Flood Risk Map

Detailed Flood Map centred on Mill Lane, Newton le Willows, WA12 8DG. Created on 01/04/2021 [GMMC211201AB]



Environment Agency

1:10,001

N

Legend

- Site Location
- Model Measurements
- Main River
- Flood Zone 3
- Flood Zone 2

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

					Undefended					
Map Reference	Model Node Reference	Easting	Northing	Data	20 % AEP (1 in 5 year)	10 % AEP (1 in 10 year)	4 % AEP (1 in 25 year)	2 % AEP (1 in 50 year)	1.33 % AEP (1 in 75 year)	1 % AEP (1 in 100 year)
1	EA01316_NEWT01_00295	359270	395280	Modelled Water Level (m aodN)	20.17	20.43	20.93	21.90	22.56	22.95
				Modelled Flow (cumecs)	12.43	14.83	19.29	26.62	30.46	32.91
2	EA01316_NEWT01_00850	359120	394900	Modelled Water Level (m aodN)	17.58	17.77	18.06	18.45	18.56	18.63
				Modelled Flow (cumecs)	12.76	15.22	19.81	26.99	31.37	33.78
3	EA01316_NEWT01_01000	359040	394710	Modelled Water Level (m aodN)	17.55	17.75	18.03	18.40	18.51	18.58
				Modelled Flow (cumecs)	13.10	15.62	20.34	27.59	31.83	34.23
4	EA01316_NEWT01_01300	359110	394400	Modelled Water Level (m aodN)	16.66	16.81	17.06	17.42	17.54	17.62
				Modelled Flow (cumecs)	13.44	16.01	20.87	28.18	31.79	34.24
5	EA01316_NEWT01_01600	359240	394230	Modelled Water Level (m aodN)	15.85	16.02	16.30	16.66	16.81	16.91
				Modelled Flow (cumecs)	13.78	16.40	21.40	28.75	32.27	34.67

Model data taken from Sankey Catchment 2003

AEP - Annual Exceedence Probability

m aodN - metres above ordnance datum Newlyn

cumecs - cubic metres per second

Notes: Climate Change Scenario - We do not hold climate change measurements at this location. For further guidance on climate change within the GMMC area please see the attachment ‘Flood risk assessments: Climate change allowances’. Particularly section 3, table B which shows the Local precautionary allowances for potential climate change impacts.

Flood risk assessments: Climate change allowances

Application of the allowances and local considerations

Greater Manchester, Merseyside & Cheshire

1) The climate change allowances

The National Planning Practice Guidance refers planners, developers and advisors to the Environment Agency guidance on considering climate change in Flood Risk Assessments (FRAs). This guidance was updated in February 2016 and is available on Gov.uk and should be read in conjunction with this document. The guidance can be used for planning applications, local plans, neighbourhood plans and other projects. It provides climate change allowances for peak river flow, peak rainfall, sea level rise, wind speed and wave height. The guidance provides a range of allowances to assess fluvial flooding, rather than a single national allowance. It advises on what allowances to use for assessment based on vulnerability classification, flood zone and development lifetime.

2) Assessment of climate change impacts on fluvial flooding

Table A below indicates the level of technical assessment of climate change impacts on fluvial flooding appropriate for new developments depending on their scale and location. This should be used as **a guide only**. Ultimately, the agreed approach should be based on expert local knowledge of flood risk conditions, local sensitivities and other influences. **For these reasons we recommend that applicants and / or their consultants should contact the Environment Agency at the pre-planning application stage to confirm the assessment approach, on a case by case basis**. **Table A** defines three possible approaches to account for flood risk impacts due to climate change, in new development proposals:

- **Basic:** Developer can add an allowance to the 'design flood' (i.e. 1% annual probability) peak levels to account for potential climate change impacts. The allowance should be derived and agreed locally by Environment Agency teams.
- **Intermediate:** Developer can use existing modelled flood and flow data to construct a stage-discharge rating curve, which can be used to interpolate a flood level based on the required peak flow allowance to apply to the 'design flood' flow.
- **Detailed:** Perform detailed hydraulic modelling, through either re-running Environment Agency hydraulic models (if available) or construction of a new model by the developer.

Table A – Indicative guide to assessment approach

VULNERABILITY CLASSIFICATION	FLOOD ZONE	DEVELOPMENT TYPE		
		MINOR	SMALL-MAJOR	LARGE-MAJOR
ESSENTIAL INFRASTRUCTURE	Zone 2	Detailed		
	Zone 3a	Detailed		
	Zone 3b	Detailed		
HIGHLY VULNERABLE	Zone 2	Intermediate/ Basic	Intermediate/ Basic	Detailed
	Zone 3a	Not appropriate development		
	Zone 3b	Not appropriate development		
MORE VULNERABLE	Zone 2	Basic	Basic	Intermediate/ Basic
	Zone 3a	Basic	Detailed	Detailed
	Zone 3b	Not appropriate development		
LESS VULNERABLE	Zone 2	Basic	Basic	Intermediate/ Basic
	Zone 3a	Basic	Basic	Detailed
	Zone 3b	Not appropriate development		
WATER COMPATIBLE	Zone 2	None		
	Zone 3a	Intermediate/ Basic		
	Zone 3b	Detailed		

NOTES:

- Minor: 1-9 dwellings/ less than 0.5 ha | Office / light industrial under 1ha | General industrial under 1 ha | Retail under 1 ha | Gypsy/traveller site between 0 and 9 pitches
- Small-Major: 10 to 30 dwellings | Office / light industrial 1ha to 5ha | General industrial 1ha to 5ha | Retail over 1ha to 5ha | Gypsy/traveller site over 10 to 30 pitches
- Large-Major: 30+ dwellings | Office / light industrial 5ha+ | General industrial 5ha+ | Retail 5ha+ | Gypsy/traveller site over 30+ pitches | any other development that creates a non residential building or development over 1000 sq m.

The assessment approach should be agreed with the Environment Agency as part of pre-planning application discussions to avoid abortive work.

3) Specific local considerations

Where the Environment Agency and the applicant and / or their consultant has agreed that a '**basic**´ level of assessment is appropriate the figures in Table B below can be used as a precautionary allowance for potential climate change impacts on peak 'design' (i.e. 1% annual probability) fluvial flood level rather than undertaking detailed modelling.

Table B – Local precautionary allowances for potential climate change impacts

Watercourse	Central	Higher Central	Upper
All	0.15m	0.24m	0.48m

Use of these allowances will only be accepted after discussion with the Environment Agency.

4) Fluvial food risk mitigation

Read the guidance on Gov.uk to find out which allowances to use to **assess** the impact of climate change on flood risk.

For planning consultations where we are a statutory consultee and our Flood risk standing advice **does not** apply we use the following benchmarks to inform flood risk **mitigation** for different vulnerability classifications. **These are a guide only**. **We strongly recommend you contact us at the pre-planning application stage to confirm this on a case by case basis. Please note you may be charged for this advice.** For planning consultations where we are not a statutory consultee or our Flood risk Standing advice applies we recommend local planning authorities and developers use these benchmarks but we do not expect to be consulted.

- For development classed as '**Essential Infrastructure**' our benchmark for flood risk mitigation is for it to be designed to the '**upper end**' climate change allowance for the epoch that most closely represents the lifetime of the development, including decommissioning.

- For **highly vulnerable** in flood zone 2, the '**higher central'** climate change allowance is our minimum benchmark for flood risk mitigation. In sensitive locations it may be necessary to use the **upper end** allowance.

- For **more vulnerable developments** in flood zone 2, the '**central**' climate change allowance is our minimum benchmark for flood risk mitigation, and in flood zone 3 the '**higher central**' climate change allowance is our minimum benchmark for flood risk

mitigation. In sensitive locations it may be necessary to use the **higher central** (in flood zone 2) and the **upper end** allowance (in flood zone 3).

- For **water compatible** or **less vulnerable** development (e.g. commercial), the '**central**' climate change allowance for the epoch that most closely represents the lifetime of the development is our minimum benchmark for flood risk mitigation. In sensitive locations it may be necessary to use the **higher central** (particularly in flood zone 3) to inform built in resilience.

There may be circumstances where local evidence supports the use of other data or allowances. Where you think this is the case we may want to check this data and how you propose to use it.

END.

From: Bryan, John <John.Bryan@environment-agency.gov.uk>
Sent: 09 November 2023 15:56
To: Simon Gough
Cc: Claire Campbell; Liam Worthington; Stephen Harris; Blythin, India
Subject: RE: Mill Lane, Newton le Willows(30488)

Good Afternoon Simon,

Thanks for that, the levels provided seem sensible, but will also require freeboard as discussed on this
call (600mm)

For confirmation we have already been reconsulted under reference - P/2023/0619/FUL – as you say
there is no FRA associated to this, so we would require this, or we have to object.

In your FRA for reference, it needs the FFL's, flood compensation if any building within flood zone's, a
updated master site plan.

John

John Bryan | Flood & Coastal Risk Advisor
FCRM - Partnerships & Strategic Overview
Greater Manchester, Merseyside and Cheshire Area
The Environment Agency
Richard Fairclough House, Knutsford Road, Warrington, WA4 1HT

Mobile: 07785459197
john.bryan@environment-agency.gov.uk

From: Simon Gough <simon.gough@ironsidefarrar.com>
Sent: 09 November 2023 14:32
To: Bryan, John <John.Bryan@environment-agency.gov.uk>
Cc: Claire Campbell <Claire.Campbell@wainhomes.co.uk>; Liam Worthington <liam.worthington@wainhomes.co.uk>; Stephen Harris <SHarris@emeryplanning.com>
Subject: Mill Lane, Newton le Willows(30488)

John, I refer to our meeting on 15th September 2023, held to discuss the EA concerns with the planning
application for the above site and in particular the adjustment of flood levels for the 100 year event to
include 44% climate change allowance.

You will recall from the meeting that the present modelled flood levels do not include the most current
climate change allowances for this particular location.
For the Central allowance the required increase in peak river flows is 44%.

As discussed, the 100 year flood levels plus 44% CC allowance have been calculated by plotting the

supplied model levels and extrapolating these for the 100 year plus 44% allowance flood level.
This exercise has been undertaken for Model Nodes 3 and 4 from the Product 4 data supplied for the
site. I will interpolate between these two points along the line of Newton Brook to determine the
proposed FFL's for the properties in this area.

The 100 year plus 44% flood level for node 3 is 18.65m and for node 4 is 17.72m

Before I review and amend where required, the FFL's on the site, please could you confirm the approach
is correct and the resulting levels are acceptable to you.

Your earliest response would be most appreciated as I need to finalise the FRA for re-submission.

Regards

Simon Gough
Director Emeritus
Ironside Farrar Limited
0161 703 8801
07717023091

simon.gough@ironsidefarrar.com

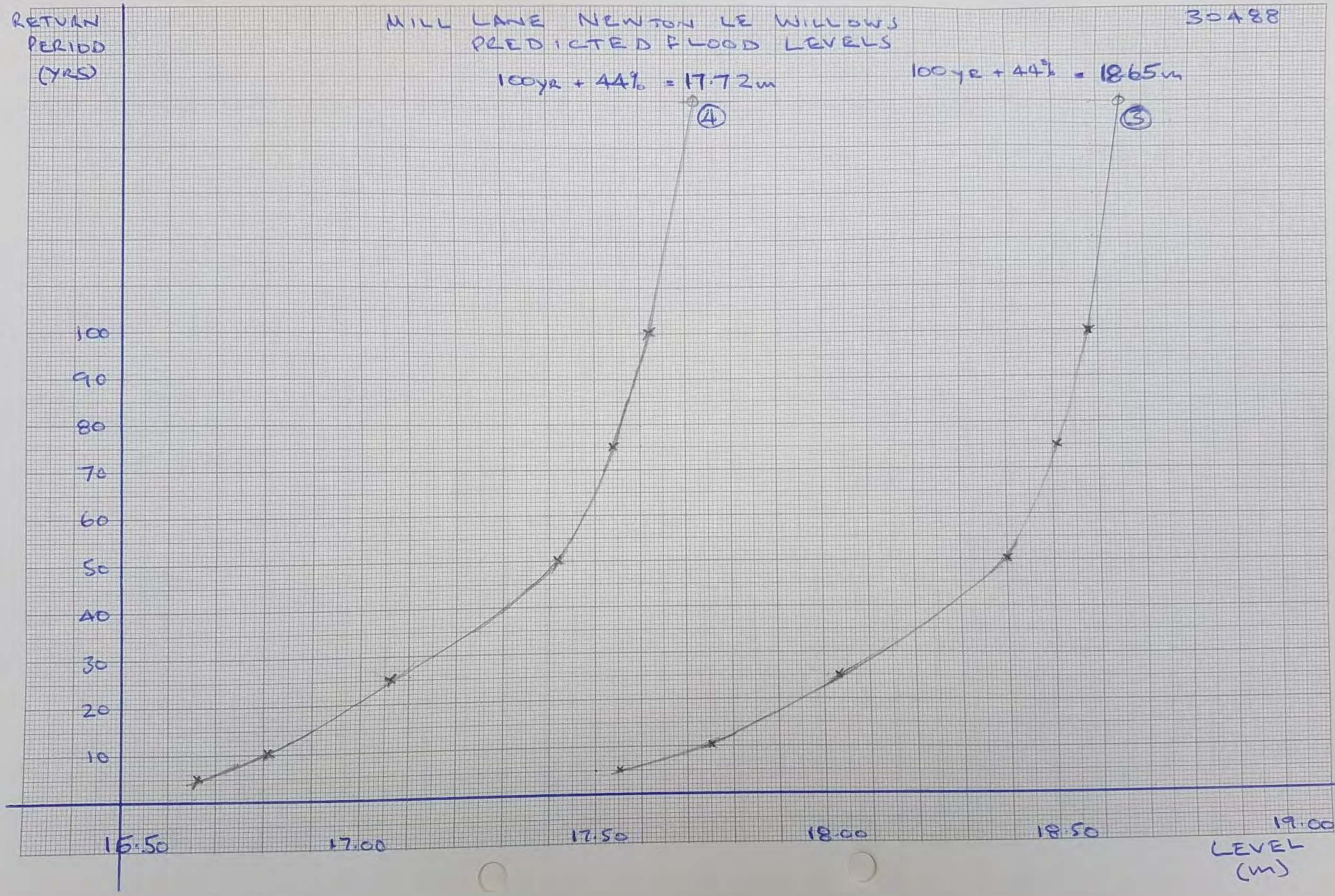
You will be aware that as from April 2021 I have been working a reduced week of Wednesday to Fridays.

From 1st January 2023 I will be taking a further step back from Ironside Farrar with a change of role from
Director of the Manchester office to a Director Emeritus.

As a client, you will still be working day to day with all of the team that you have been used to but in
addition, the Manchester staff will be supported by Gareth Roberts, a Technical Director with Ironside
Farrar. Although not working regular hours, I will still be available, behind the scenes, if the team are not
able to help with your initial query. In the first instance, please contact the Manchester office team on
0161 703 8801 to help you or direct your query to the most appropriate person.

30488

MILL LANE NEWTON LE WILLOWS
PREDICTED FLOOD LEVELS



APPENDIX F

Existing Sewer Records

NEWTON-LE-WILLOWS
WARGRAVE
SANDRA DRIVE
SHERI DRIVE
WARWICK AVENUE
WAYFARERS DRIVE
NEWTON PARK DRIVE
NEWTON PARK DR
WHITEFIELD AVENUE
MILL LANE
WINWICK ROAD
PRIDE CLOSE
CHOLMLEY DRIVE
THE CLOSE
CENTRAL WAY
CORONATION DRIVE
BUNGALOW ROAD
FARM WAY
Path
Track
Running Track
Playing Field
Refuse Tip
Newton Brook
Pipe Line
Outfall
Pumping Station
Newton-le-Willows Cemetery
Newton-Le-Willows Cemetery
Red Bank Community Home
Vardy House
Bloody Stone
Stone
Pond
Tank
Chy
MH
FS
SL
LB
MP .75
MP .5
BM 30.30m
28.8m
30.1m
26.9m
24.2m
18.0m
17.7m
Sc
RG
0001
0501
0701
0702
0703
0704
0705
0801
0802
0803
0804
0805
0806
0807
0808
0809
0810
0901
0902
0903
0904
0907
0908
0909
0911
0915
1300
1400
1500
1501
1901
1902
1904
1905
1906
1907
1908
2901
2902
2903
2904
2905
2906
2907
2908
2909
2910
2911
2912
2913
2914
2915
2916
2917
3001
3002
3003
3004
3005
3801
3802
3901
3902
3903
3904
3905
3906
3907
3908
3909
3910
3911
3912
3913
3914
3915
3916
3917
3918
3921
4901
4902
4903
4904
4905
4908
5005
225 VC
150 VC
300 VC
375 CO
300 CO
225 CO
150 CO
150 DI
100 PVC
525 CO

APPENDIX G

Consultation with United Utilities

Simon Gough

From: Bailey, Dafydd <Dafydd.Bailey@uuplc.co.uk>
Sent: 30 July 2021 17:18
To: Simon Gough
Cc: Wastewater Developer Services
Subject: Red Bank, Newton le Willows(30488) (UU Ref: 4200041988)

Hi Simon,

Many thanks for the e-mail. Please find our response below for convenience.

Pre Development Enquiry for: Proposed no. 280 dwellings on land off Winwick Road, Newton le Willows UU Reference Number: 4200041988

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 3723223 or refer to the link below:

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

Foul Water

We note foul water flows are proposed to gravitate into the 525mm public combined sewer running along the West boundary of the proposed site at several different connection points. We have no objection to the proposed foul connection point(s) in principle.

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.

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

We acknowledge surface water flows are proposed to drain into Newton Brook running along the West boundary of the proposed site. On this basis, we would advise contacting the LLFA and/ or Environment Agency to discuss and agree discharge rates (if not already done so).

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.

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 pubic sewerage network under any circumstances

Sewer Adoptions

You have indicated on your application form that you intend to put the sewers forward for adoption (including any SuDS components that can come within the meaning of a sewer).

United Utilities assess adoption applications based on the current Design & Construction Guidance and local practices which have now replaced 'Sewers For Adoption 6th Edition'.

We recommend that you submit a pre design assessment to the sewer adoption mailbox (SewerAdoptions@uuplc.co.uk) stating pre design assessment in the title

Please refer to link**s** below to obtain further guidance:

https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-adoptions/

Site drainage must be designed in accordance with Building Regulations, National Planning Policy, and local flood authority guidelines, we would recommend that you speak and make suitable agreements with the relevant statutory bodies.

If you intend to put forward your wastewater assets for adoption by United Utilities, the proposed detail design will be subject to a technical appraisal by an Adoption Engineer as we need to be sure that the proposals meets the requirements set out in the Design & Construction Guidance. The proposed design should give consideration to long term operability and give United Utilities a safe and cost effective proposal for the lifetime of the assets. In these cases, we strongly recommend that no construction commences until the detailed drainage design, submitted as part of the Section 104 application, has been assessed and accepted in writing by United Utilities. Any work carried out prior to the technical assessment being approved is done entirely at the developer's own risk and could be subject to change.

Codes For Adoption

The new Codes for Adoption are outlined on the Water UK Website. The link below takes you to their webpage:

https://www.water.org.uk/technical-guidance/developers-services/codes-for-adoption/

A free copy of the new Design & Construction Guidance can be downloaded via the link below**:**

https://www.water.org.uk/wp-content/uploads/2020/03/SSG-App-C-Des-Con-Guide-v-2-100320-C.pdf

Sustainable Drainage Systems (SuDS)

SuDS should be designed in accordance with the CIRIA SuDS manual (C753):

If you need advice on any site proposals which incorporate open SuDS features either that are to be offered for adoption or that interact with a traditional adoptable piped network you can complete the form below and we will be in touch within 2 weeks to discuss the proposals further.

Pre Design Enquiry.

Existing Wastewater Assets Crossing the Site

According to our public sewer records, a 525mm public combined sewer appears to be located within the site boundary. We will require unrestricted access to the sewer for maintenance purposes, we would ask that you maintain a minimum clearance of 6m, which is measured 3m from the centre line of the pipe unless there happens to be a formal easement agreement in place, in which case the specified easement width would apply. If you cannot achieve this then you may wish to consider diverting and or abandoning the public sewer.

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/

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/larger-developments/wastewater/sewer-connections/

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,
Dafydd

United Utilities
Water for the North West

Dafydd Bailey
Developer Engineer
Developer Services & Metering
Customer Services
M: 07464907595
unitedutilities.com

From: Simon Gough [mailto:simon.gough@ironsidefarrar.com]
Sent: 23 July 2021 16:02
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: Red Bank, Newton le Willows(30488)

Please find attached a Pre-Development enquiry for the above site.

Foul will be connected to the existing Combined Sewer running along the west boundary of the site at several different manholes.
SW will be connected to the existing Newton Brook at the Greenfield rate.

Please contact me if you need to discuss any matter further.

Regards

Simon Gough
Director
Ironside Farrar Limited

0161 703 8801
07717023091

simon.gough@ironsidefarrar.com

In response to COVID-19, Ironside Farrar have implemented our business continuity plan and are providing uninterrupted service for our clients. Our staff are now home-working with internet based access to business systems, project management and professional practice. The company has full server access including a dedicated OP-Centre internet data sharing platform and operates all standard video conference networks (Powwownow / MS Teams / Zoom / etc). Please continue to contact all staff by email and mobile telephone as noted in the above details and we will continue to provide services and professional support albeit under changed circumstances. Thank you for your continued support.

Wastewater pre-development enquiry

United Utilities
Water for the North West

Please complete this form for enquiring about drainage strategies and points of connection for new developments.

You can fill in this form, just save a copy, complete it and email it to **WastewaterDeveloperServices@uuplc.co.uk** alternatively you can print the form and post it to us at this address **United Utilities Developer Services, Second Floor, Grasmere House, Lingley Mere Business Park, Lingley Green Avenue, Great Sankey, Warrington, WA5 3LP**

All fields are required unless otherwise stated. Please note incomplete information may cause delays to your application. When answering the yes/no questions please tick in the appropriate box. Please keep a copy of the completed application for your records.

If you need any help completing the form please call us on **0345 072 6067** and we'll be happy to help.

We aim to respond to enquiries within 15 working days from receipt of your completed enquiry form.

Section 1: Your details			
Are you (please tick)	Developer ☐ Consultant ☑ Land owner ☐ Other (please state) ☐		
Name	Simon Gough		
Company Name (if applicable)	Ironside Farrar Limited		
Address (including post code)	3, Worsley Court High Street Walkden Manchester M28 3NJ		
Telephone number	07717023091		
Email address	simon.gough@ironsidefarrar.com		
Section 2: Development details			
Do you intend to offer any of the sewers for adoption by United Utilities under S104?			Yes ☑ No ☐
Please provide as much of the site address that is available. This address must contain a road name, town/city.			
Address (including nearest postcode)	Winwick Road, Vulcan Village, Newton le Willows, St. Helens WA12 8BY		
Site name	Red Bank, Newton le Willows		
The grid reference is a 12 digit grid reference split into two 6 digit numbers (X and Y).			
Grid reference number	359423, 394861		
Development type	Commercial ☐ Residential ☑		
Approx. number units	280		
Total site area (hectares)	12.5		
Does this site have planning permission?			Yes ☐ No ☑
Planning reference number			
Council area	St. Helens Council		
Have you approached us about this site previously?	Yes ☐ No ☑	If yes, please provide reference number	
Is the development part of a larger site that will be developed in phases?			Yes ☐ No ☑

Section 3: Previous land use			
Please confirm what the land was previously used for and provide the following information:			
Greenfield	☑	**Brownfield** (the site must have drained to the sewer network and incurred charges within the last 12 months)	☐

Section 4: Drainage strategy			
Foul connection: How are you proposing to drain foul flows from the site?			
Via an existing connection to the public sewer?	☐	Via a new connection to the public sewer?	☑
Do your drainage proposals involve pumping to the public sewer network?	Yes ☐ No ☑		
Surface water connection: How are you proposing to drain your site, following the surface water hierarchy, as outlined in National Planning Policy Guidance? Please indicate below and provide evidence to support your strategy			
Infiltration ☐ Surface water body ☑ Surface water sewer/Highway Drain ☐ Combined sewer ☐			
SuDS: Have SuDS features been considered in the surface water drainage strategy?	Yes ☑ No ☐		

Section 5: Supporting Information	
Please confirm that the following list of information has been provided to support with your enquiry:	
• Site location plan including site boundary and road/street names	Yes ☑ No ☐
• Preferred drainage outfall route(s) and point(s) of access etc.	Yes ☑ No ☐
• Topographical survey	Yes ☑ No ☐
• Ground investigation report	Yes ☐ No ☑
• Evidence of existing drainage connections and estimated rates of discharge (for Brownfield sites)	Yes ☐ N/A ☑
• Full calculations to show pre-development surface water rates for Greenfield sites	Yes ☐ N/A ☑

Section 6 : Declaration

I understand that the submission of this form is to be treated as a preliminary enquiry and the information may be subject to change. In particular, I understand that the information United Utilities Water Limited provides in response is only valid in conjunction with the information provided in relation to this enquiry, any changes to regulation or development layout will invalidate our response.

Signature		Date	23/07/2021
Print Name	Simon Gough	Position	Director - Ironside Farrar

APPENDIX H

Proposed Development
&
Drainage Layout

Model Node 2
100 year Level 18.63m
100 year Level +CC
18.87m

Foul & SW Connections for Future Phase of development.

Foul & SW Connections for Future Phase of development.

On-line SuDS Basin
Base Level 19.00m
Crest Level 20.50m
Max. 1:3 Side Slopes

PCC Control Manhole with Vortex Flow Control to limit flows to 5.0 l/s @ 1.3m head. Hydro brake Optimum (minimise upstream storage) or similar approved. Unit Ref: SHE-0101-5000-1300-3500

On-line SuDS Basin
Base Level 20.00m
Crest Level 20.10m
Max. 1:3 Side Slopes

PCC Control Manhole with Vortex Flow Control to limit flows to 4.0 l/s @ 0.9m head. Hydro brake Optimum (minimise upstream storage) or similar approved. Unit Ref: SHE-0096-4000-0900-4000

100 year Level +44%CC
18.36m

Proposed SW Outfall to Grass Swale to provide Treatment prior to discharge to Ex.Watercourse. Swale details / levels to be confirmed including crossing of Existing 525mm dia. Combined Sewer.

100 year Level +44%CC
18.32m

PCC Control Manhole with Vortex Flow Control to limit flows to 6.5 l/s @ 2.6m head. Hydro brake Optimum (minimise upstream storage) or similar approved. Unit Ref: SHE-0098-6500-2600-6500

100 year Level +44%CC
18.27m

Off-line Private Cellular Storage with high level overflow set above 30 yr W.L. and non-return valve on return Dimensions 3 x 25 x 1.2m I.L. 16.300m

100 year Level +44%CC
18.22m

100 year Level +44%CC
18.17m

100 year Level +44%CC
18.11m

Ex MH 1500
C.L.16.63m
I.L.15.20m

100 year Level +44%CC
18.06m

100 year Level +44%CC
18.01m

100 year Level +44%CC
17.96m

100 year Level +44%CC
17.91m

Ex MH 1400
C.L.17.32m
I.L.15.97m

100 year Level +44%CC
17.87m

100 year Level +44%CC
17.82m

100 year Level +44%CC
17.77m

Off-line Private Cellular Storage with high level overflow set above 30 yr W.L. and non-return valve on return Dimensions 3m x 52m x 1.2m I.L. 16.500m

PCC Control Manhole with Vortex Flow Control to limit flows to 14.0 l/s @ 3.0m head. Hydro brake Optimum (minimise upstream storage) or similar approved. Unit Ref: SHE-0141-1400-3000-1400

Off-line Private Cellular Storage with high level overflow set above 30 yr W.L. and non-return valve on return Dimensions 3m x 30 x 1.2m I.L. 16.500m

Off-line down basin to be set above 30 yr W.L. Base Level 20.750m, area = 172.7m²
Crest Level 21.350m, area = 359.5m²

PCC Control Manhole with Vortex Flow Control to limit flows to 7.0 l/s @ 2.2m head. Hydro brake Optimum (minimise upstream storage) or similar approved. Unit Ref: SHE-0106-7000-2200-7000

Proposed SW Outfall to Grass Swale to provide Treatment prior to discharge to Ex.Watercourse. Swale details / levels to be confirmed.

Ex MH 1300
C.L.17.37m
I.L.15.82m

Model Node 4
100 year Level 17.62m
100 year Level +44%CC
17.72m

KEY

S.W. / Foul	Proposed sewer
	Disconnection Manhole
13.50	Proposed Plot Level
MH	Existing Combined sewer
MH	Existing SW Culvert
G	Proposed highway gully
48.270	Proposed level
× 29.35	Existing Level
	Tactile Paving & Dropped Kerb
	Permeable Driveway Construction

NOTES

1. Setting out shall be undertaken using only the information given. Distances should not be scaled from this drawing.
2. All sewers and highway drainage shall be constructed in accordance with Sewers for Adoption 6th Edition and United Utilities Details & Guidelines.
3. The minimum gravity pipe diameter under adoptable highways shall be 150mm
4. It is the responsibility of the Contractor to verify all information given with regards to existing services and drainage connections etc. prior to commencing the works. The rates shall include for hand dig around services where necessary. The Contractor shall adhere to the CDM Regulations at all times
5. The outsides of all sewers shall be a minimum of 1.0m from kerb lines and the outside of manholes shall be a minimum of 0.5m from kerb lines
6. Existing flows in watercourses, sewers and land drains shall be maintained at all times
7. Only trained personnel shall be permitted to enter confined spaces
8. All materials to bear the relevant B.S. Kitemark and comply fully with the specifications. All concrete & concrete products must use Sulphate resistant cement (unless the site investigation report proves that sulphate attack from soils and groundwater will not occur to withstand a class 3 condition).
9. All opening notices etc. as required under highways acts etc. are to be obtained prior to commencement of works. All works are to be inspected by L.A., NHBC or the Network Operator as applicable.
10. Where "Ultra Rib" UPVC pipes (or similar approved) are used in adoptable drainage they shall still be handled and laid in accordance with the specification and guidance issued by the High Performance Pipe Association.
11. A Class S Bed and surround must be used for such pipes. Trench backfill in highways to within 1m of highway shall, as directed by the Highway Authority be a suitable granular material all in accordance with Sewers for Adoption cl. 4.3.4.
12. Slab levels shall not be varied without reference to the Engineer for guidance

Rev	Date	Initials	Details
B	211123	SG	Updated to latest development layout and flood levels.
A	300622	SG	Updated to latest development layout.

Drawing Revisions

North Point

Quality Ass.
UKAS 005
Quality Assurance
ISO 9001:2008
SGS Certificate
GB02/54539

Project
Red Bank
Newton le Willows

Client
Wainhomes (North West) Limited

Title
Preliminary Drainage Layout

IronsideFarrar
Environmental Consultants
Environmental Planners
Civil Engineers
Landscape Architects
Graphic Design
3 Wolseley Court MANCHESTER M28 3NJ
Tel. 0161 703 8801 Fax. 0161 703 8279
manchester@ironsidefarrar.com
EDINBURGH BELLSHILL

PRELIMINARY

Original Size A0

Drawn KD | Checked By RDE | Date July 21 | Scale 1:500

Drawing No. 30488/100 | Revision B

APPENDIX I

Hydraulic Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	3.680	Urban	0.000
SAAR (mm)	863	Region Number	Region 10

Results l/s

QBAR Rural	20.7
QBAR Urban	20.7
Q100 years	43.0
Q1 year	18.0
Q30 years	35.0
Q100 years	43.0

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.300	Add Flow / Climate Change (%)	0
Ratio R	0.378	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.280	4-8	0.223

Total Area Contributing (ha) = 0.503

Total Pipe Volume (m³) = 205.237

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	13.868	0.139	100.0	0.044	4.00	0.0	0.600		o	225	Pipe/Conduit	
1.001	19.093	0.191	100.0	0.068	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.002	11.715	0.117	100.3	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.003	21.007	0.263	80.0	0.119	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.004	52.598	0.131	401.5	0.091	0.00	0.0	0.600		o	1350	Pipe/Conduit	
1.005	21.785	0.054	403.4	0.102	0.00	0.0	0.600		o	1500	Pipe/Conduit	
1.006	16.311	0.041	397.8	0.043	0.00	0.0	0.600		o	1500	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	4.18	19.143	0.044	0.0	0.0	0.0	1.31	52.0	0.0
1.001	0.00	4.42	19.004	0.112	0.0	0.0	0.0	1.31	52.0	0.0
1.002	0.00	4.57	18.813	0.112	0.0	0.0	0.0	1.31	51.9	0.0
1.003	0.00	4.81	18.697	0.231	0.0	0.0	0.0	1.46	58.2	0.0
1.004	0.00	5.25	16.500	0.322	0.0	0.0	0.0	2.00	2863.9	0.0
1.005	0.00	5.42	16.219	0.424	0.0	0.0	0.0	2.13	3762.9	0.0
1.006	0.00	5.54	16.165	0.467	0.0	0.0	0.0	2.14	3789.5	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.007	36.245	0.286	126.7	0.036	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.008	42.378	0.283	149.7	0.000	0.00	0.0		0.027	\/	-1	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.007	0.00	6.07	16.124	0.503	0.0	0.0	0.0	1.16	46.1	0.0
1.008	0.00	6.56	15.463	0.503	0.0	0.0	0.0	1.42	1962.4	0.0

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	1	20.600	19.143	1.232	Open Manhole	1200
1.001	o	225	2	20.850	19.004	1.621	Open Manhole	1200
1.002	o	225	3	20.600	18.813	1.562	Open Manhole	1200
1.003	o	225	4	20.400	18.697	1.478	Open Manhole	1200
1.004	o	1350	6	20.250	16.500	2.400	Open Manhole	2700
1.005	o	1500	7	19.600	16.219	1.881	Open Manhole	2700
1.006	o	1500	8	19.150	16.165	1.485	Open Manhole	2700
1.007	o	225	21	18.900	16.124	2.551	Open Manhole	2700
1.008	\/	-1	Swale	17.500	15.463	1.437	Open Manhole	250

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	13.868	100.0	2	20.850	19.004	1.621	Open Manhole	1200
1.001	19.093	100.0	3	20.600	18.813	1.562	Open Manhole	1200
1.002	11.715	100.3	4	20.400	18.697	1.478	Open Manhole	1200
1.003	21.007	80.0	6	20.250	18.434	1.591	Open Manhole	2700
1.004	52.598	401.5	7	19.600	16.369	1.881	Open Manhole	2700
1.005	21.785	403.4	8	19.150	16.165	1.485	Open Manhole	2700
1.006	16.311	397.8	21	18.900	16.124	1.276	Open Manhole	2700
1.007	36.245	126.7	Swale	17.500	15.838	1.437	Open Manhole	250
1.008	42.378	149.7		15.600	15.180	-0.180	Open Manhole	1050

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.300	Storm Duration (mins)	30
Ratio R	0.378		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 21, DS/PN: 1.007, Volume (m³): 39.9

Unit Reference	MD-SHE-0098-6500-2600-6500
Design Head (m)	2.600
Design Flow (l/s)	6.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	98
Invert Level (m)	16.124
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.600	6.5
Flush-Flo™	0.429	4.9
Kick-Flo®	0.879	3.9
Mean Flow over Head Range	-	5.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.2	1.200	4.5	3.000	7.0	7.000	10.4
0.200	4.5	1.400	4.9	3.500	7.5	7.500	10.7
0.300	4.8	1.600	5.2	4.000	8.0	8.000	11.1
0.400	4.9	1.800	5.5	4.500	8.4	8.500	11.4
0.500	4.9	2.000	5.7	5.000	8.8	9.000	11.7
0.600	4.8	2.200	6.0	5.500	9.3	9.500	12.0
0.800	4.3	2.400	6.3	6.000	9.6		
1.000	4.2	2.600	6.5	6.500	10.0		

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.378
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.300	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960
Return Period(s) (years)	1, 2, 30
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Summer	1	+0%	30/15 Summer				19.198
1.001	2	15 Winter	1	+0%	30/15 Summer				19.088
1.002	3	15 Winter	1	+0%	30/15 Summer				18.900
1.003	4	15 Winter	1	+0%	30/15 Summer				18.812
1.004	6	120 Winter	1	+0%	30/120 Winter				16.768
1.005	7	120 Winter	1	+0%	30/60 Winter				16.768
1.006	8	120 Winter	1	+0%	30/60 Winter				16.768
1.007	21	120 Winter	1	+0%	1/15 Summer				16.768
1.008	Swale	720 Winter	1	+0%					15.482

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.170	0.000	0.14			6.2	OK	
1.001	2	-0.142	0.000	0.29			13.8	OK	
1.002	3	-0.139	0.000	0.31			13.7	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.003	4	-0.110	0.000	0.51			27.0	OK	
1.004	6	-1.082	0.000	0.01			13.5	OK	
1.005	7	-0.951	0.000	0.01			12.5	OK	
1.006	8	-0.897	0.000	0.00			8.3	OK	
1.007	21	0.419	0.000	0.11			4.9	SURCHARGED	
1.008	Swale	-0.581	0.000	0.00			4.9	OK	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.378
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.300	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960
Return Period(s) (years)	1, 2, 30
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Summer	2	+0%	30/15 Summer				19.206
1.001	2	15 Winter	2	+0%	30/15 Summer				19.101
1.002	3	15 Winter	2	+0%	30/15 Summer				18.913
1.003	4	15 Winter	2	+0%	30/15 Summer				18.832
1.004	6	120 Winter	2	+0%	30/120 Winter				16.884
1.005	7	120 Winter	2	+0%	30/60 Winter				16.883
1.006	8	120 Winter	2	+0%	30/60 Winter				16.883
1.007	21	120 Winter	2	+0%	1/15 Summer				16.883
1.008	Swale	960 Summer	2	+0%					15.482

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.162	0.000	0.18			8.0	OK	
1.001	2	-0.129	0.000	0.38			17.8	OK	
1.002	3	-0.125	0.000	0.40			17.7	OK	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.003	4	-0.090	0.000	0.66			34.9	OK	
1.004	6	-0.966	0.000	0.01			16.8	OK	
1.005	7	-0.836	0.000	0.01			13.3	OK	
1.006	8	-0.782	0.000	0.00			8.5	OK	
1.007	21	0.534	0.000	0.11			4.9	SURCHARGED	
1.008	Swale	-0.581	0.000	0.00			4.9	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.378
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.300	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960
Return Period(s) (years)	1, 2, 30
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	30	+40%	30/15 Summer				19.790
1.001	2	15 Winter	30	+40%	30/15 Summer				19.759
1.002	3	15 Winter	30	+40%	30/15 Summer				19.582
1.003	4	15 Winter	30	+40%	30/15 Summer				19.462
1.004	6	240 Winter	30	+40%	30/120 Winter				18.576
1.005	7	240 Winter	30	+40%	30/60 Winter				18.576
1.006	8	240 Winter	30	+40%	30/60 Winter				18.576
1.007	21	240 Winter	30	+40%	1/15 Summer				18.576
1.008	Swale	240 Winter	30	+40%					15.487

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.422	0.000	0.40			18.1	SURCHARGED	
1.001	2	0.530	0.000	0.95			44.4	SURCHARGED	
1.002	3	0.543	0.000	1.05			46.6	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.003	4	0.540	0.000	1.75			92.4	SURCHARGED	
1.004	6	0.726	0.000	0.01			26.9	SURCHARGED	
1.005	7	0.857	0.000	0.01			18.0	SURCHARGED	
1.006	8	0.911	0.000	0.01			10.0	SURCHARGED	
1.007	21	2.227	0.000	0.15			6.3	SURCHARGED	
1.008	Swale	-0.576	0.000	0.00			6.3	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.300	Add Flow / Climate Change (%)	0
Ratio R	0.378	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.280	4-8	0.223

Total Area Contributing (ha) = 0.503

Total Pipe Volume (m³) = 205.237

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	13.868	0.139	100.0	0.044	4.00	0.0	0.600		o	225	Pipe/Conduit	
1.001	19.093	0.191	100.0	0.068	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.002	11.715	0.117	100.3	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.003	21.007	0.263	80.0	0.119	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.004	52.598	0.131	401.5	0.091	0.00	0.0	0.600		o	1350	Pipe/Conduit	
1.005	21.785	0.054	403.4	0.102	0.00	0.0	0.600		o	1500	Pipe/Conduit	
1.006	16.311	0.041	397.8	0.043	0.00	0.0	0.600		o	1500	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	4.18	19.143	0.044	0.0	0.0	0.0	1.31	52.0	0.0
1.001	0.00	4.42	19.004	0.112	0.0	0.0	0.0	1.31	52.0	0.0
1.002	0.00	4.57	18.813	0.112	0.0	0.0	0.0	1.31	51.9	0.0
1.003	0.00	4.81	18.697	0.231	0.0	0.0	0.0	1.46	58.2	0.0
1.004	0.00	5.25	16.500	0.322	0.0	0.0	0.0	2.00	2863.9	0.0
1.005	0.00	5.42	16.219	0.424	0.0	0.0	0.0	2.13	3762.9	0.0
1.006	0.00	5.54	16.165	0.467	0.0	0.0	0.0	2.14	3789.5	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.007	36.245	0.286	126.7	0.036	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.008	42.378	0.283	149.7	0.000	0.00	0.0		0.027	\/	-1	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.007	0.00	6.07	16.124	0.503	0.0	0.0	0.0	1.16	46.1	0.0
1.008	0.00	6.56	15.463	0.503	0.0	0.0	0.0	1.42	1962.4	0.0

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	1	20.600	19.143	1.232	Open Manhole	1200
1.001	o	225	2	20.850	19.004	1.621	Open Manhole	1200
1.002	o	225	3	20.600	18.813	1.562	Open Manhole	1200
1.003	o	225	4	20.400	18.697	1.478	Open Manhole	1200
1.004	o	1350	6	20.250	16.500	2.400	Open Manhole	2700
1.005	o	1500	7	19.600	16.219	1.881	Open Manhole	2700
1.006	o	1500	8	19.150	16.165	1.485	Open Manhole	2700
1.007	o	225	21	18.900	16.124	2.551	Open Manhole	2700
1.008	\/	-1	Swale	17.500	15.463	1.437	Open Manhole	250

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	13.868	100.0	2	20.850	19.004	1.621	Open Manhole	1200
1.001	19.093	100.0	3	20.600	18.813	1.562	Open Manhole	1200
1.002	11.715	100.3	4	20.400	18.697	1.478	Open Manhole	1200
1.003	21.007	80.0	6	20.250	18.434	1.591	Open Manhole	2700
1.004	52.598	401.5	7	19.600	16.369	1.881	Open Manhole	2700
1.005	21.785	403.4	8	19.150	16.165	1.485	Open Manhole	2700
1.006	16.311	397.8	21	18.900	16.124	1.276	Open Manhole	2700
1.007	36.245	126.7	Swale	17.500	15.838	1.437	Open Manhole	250
1.008	42.378	149.7		15.600	15.180	-0.180	Open Manhole	1050

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.300	Storm Duration (mins)	30
Ratio R	0.378		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 21, DS/PN: 1.007, Volume (m³): 39.9

Unit Reference	MD-SHE-0098-6500-2600-6500
Design Head (m)	2.600
Design Flow (l/s)	6.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	98
Invert Level (m)	16.124
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.600	6.5
Flush-Flo™	0.429	4.9
Kick-Flo®	0.879	3.9
Mean Flow over Head Range	-	5.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.2	1.200	4.5	3.000	7.0	7.000	10.4
0.200	4.5	1.400	4.9	3.500	7.5	7.500	10.7
0.300	4.8	1.600	5.2	4.000	8.0	8.000	11.1
0.400	4.9	1.800	5.5	4.500	8.4	8.500	11.4
0.500	4.9	2.000	5.7	5.000	8.8	9.000	11.7
0.600	4.8	2.200	6.0	5.500	9.3	9.500	12.0
0.800	4.3	2.400	6.3	6.000	9.6		
1.000	4.2	2.600	6.5	6.500	10.0		

Storage Structures for Storm

Cellular Storage Manhole: 21, DS/PN: 1.007

Invert Level (m) 16.300 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	75.0	0.0	1.201	0.0	0.0
1.200	75.0	0.0			

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.378
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.300	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960
Return Period(s) (years)	100
Climate Change (%)	45

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+45%	100/15 Summer				20.498
1.001	2	15 Winter	100	+45%	100/15 Summer				20.439
1.002	3	15 Winter	100	+45%	100/15 Summer				20.156
1.003	4	15 Winter	100	+45%	100/15 Summer				19.971
1.004	6	240 Winter	100	+45%	100/120 Winter				18.737
1.005	7	240 Winter	100	+45%	100/120 Winter				18.737
1.006	8	240 Winter	100	+45%	100/120 Winter				18.737
1.007	21	240 Winter	100	+45%	100/15 Summer				18.737
1.008	Swale	240 Winter	100	+45%					15.488

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	1.130	0.000	0.51			22.9	FLOOD RISK	
1.001	2	1.210	0.000	1.20			56.2	SURCHARGED	
1.002	3	1.117	0.000	1.34			59.3	SURCHARGED	
1.003	4	1.049	0.000	2.21			117.1	SURCHARGED	
1.004	6	0.887	0.000	0.02			37.2	SURCHARGED	
1.005	7	1.018	0.000	0.01			29.8	SURCHARGED	
1.006	8	1.072	0.000	0.01			25.8	SURCHARGED	
1.007	21	2.388	0.000	0.15			6.5	FLOOD RISK	
1.008	Swale	-0.575	0.000	0.00			6.5	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.300	Add Flow / Climate Change (%)	0
Ratio R	0.378	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.679	4-8	1.666	8-12	0.072

Total Area Contributing (ha) = 2.416

Total Pipe Volume (m³) = 956.125

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	31.658	0.905	35.0	0.038	4.00	0.0	0.600		o	225	Pipe/Conduit	
1.001	25.239	0.721	35.0	0.061	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.002	27.865	0.420	66.3	0.101	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.003	9.503	0.079	120.0	0.069	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.004	8.815	0.088	100.2	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.005	7.949	0.079	100.6	0.032	0.00	0.0	0.600		o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	4.24	21.500	0.038	0.0	0.0	0.0	2.22	88.2	0.0
1.001	0.00	4.43	20.595	0.099	0.0	0.0	0.0	2.22	88.2	0.0
1.002	0.00	4.67	19.799	0.200	0.0	0.0	0.0	1.93	136.6	0.0
1.003	0.00	4.78	19.379	0.269	0.0	0.0	0.0	1.43	101.4	0.0
1.004	0.00	4.87	19.200	0.269	0.0	0.0	0.0	1.57	111.0	0.0
1.005	0.00	4.96	19.112	0.301	0.0	0.0	0.0	1.57	110.8	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	23.463	0.587	40.0	0.059	4.00	0.0	0.600		o	225	Pipe/Conduit	
2.001	15.043	0.501	30.0	0.061	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.006	36.925	0.092	401.4	0.024	0.00	0.0	0.600		o	1200	Pipe/Conduit	
1.007	46.608	0.117	398.4	0.108	0.00	0.0	0.600		o	1200	Pipe/Conduit	
3.000	19.091	0.048	397.7	0.165	4.00	0.0	0.600		o	1200	Pipe/Conduit	
3.001	11.532	0.029	397.7	0.000	0.00	0.0	0.600		o	1200	Pipe/Conduit	
1.008	23.970	0.060	399.5	0.129	0.00	0.0	0.600		o	1200	Pipe/Conduit	
1.009	14.926	0.037	403.4	0.015	0.00	0.0	0.600		o	1200	Pipe/Conduit	
1.010	12.635	0.032	394.8	0.000	0.00	0.0	0.600		o	1200	Pipe/Conduit	
1.011	13.438	0.034	395.2	0.083	0.00	0.0	0.600		o	1200	Pipe/Conduit	
4.000	22.423	0.056	400.4	0.043	4.00	0.0	0.600		o	1200	Pipe/Conduit	
1.012	21.296	0.053	401.8	0.117	0.00	0.0	0.600		o	1350	Pipe/Conduit	
1.013	35.020	0.088	398.0	0.031	0.00	0.0	0.600		o	1350	Pipe/Conduit	
1.014	10.116	0.025	404.6	0.086	0.00	0.0	0.600		o	1350	Pipe/Conduit	
1.015	12.320	0.031	397.4	0.024	0.00	0.0	0.600		o	1350	Pipe/Conduit	
1.016	14.971	0.037	404.6	0.000	0.00	0.0	0.600		o	1350	Pipe/Conduit	
1.017	19.366	0.048	403.5	0.078	0.00	0.0	0.600		o	1350	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	0.00	4.19	20.200	0.059	0.0	0.0	0.0	2.08	82.5	0.0
2.001	0.00	4.29	19.613	0.120	0.0	0.0	0.0	2.40	95.3	0.0
1.006	0.00	5.29	16.050	0.445	0.0	0.0	0.0	1.86	2105.0	0.0
1.007	0.00	5.70	15.958	0.553	0.0	0.0	0.0	1.87	2113.0	0.0
3.000	0.00	4.17	15.918	0.165	0.0	0.0	0.0	1.87	2114.6	0.0
3.001	0.00	4.27	15.870	0.165	0.0	0.0	0.0	1.87	2114.8	0.0
1.008	0.00	5.92	15.841	0.847	0.0	0.0	0.0	1.87	2109.9	0.0
1.009	0.00	6.05	15.781	0.862	0.0	0.0	0.0	1.86	2099.6	0.0
1.010	0.00	6.16	15.744	0.862	0.0	0.0	0.0	1.88	2122.4	0.0
1.011	0.00	6.28	15.712	0.945	0.0	0.0	0.0	1.88	2121.3	0.0
4.000	0.00	4.20	15.735	0.043	0.0	0.0	0.0	1.86	2107.5	0.0
1.012	0.00	6.46	15.528	1.105	0.0	0.0	0.0	2.00	2862.8	0.0
1.013	0.00	6.75	15.475	1.136	0.0	0.0	0.0	2.01	2876.8	0.0
1.014	0.00	6.83	15.387	1.222	0.0	0.0	0.0	1.99	2852.7	0.0
1.015	0.00	6.94	15.362	1.246	0.0	0.0	0.0	2.01	2878.7	0.0
1.016	0.00	7.06	15.331	1.246	0.0	0.0	0.0	1.99	2852.8	0.0
1.017	0.00	7.22	15.294	1.324	0.0	0.0	0.0	2.00	2856.9	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.018	9.088	0.022	413.1	0.000	0.00	0.0	0.600		o	1350	Pipe/Conduit	
5.000	16.218	0.705	23.0	0.026	4.00	0.0	0.600		o	150	Pipe/Conduit	
5.001	19.707	0.985	20.0	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.002	16.396	0.410	40.0	0.049	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.003	14.408	0.320	45.0	0.018	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.004	7.453	0.124	60.0	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.005	5.100	0.051	100.0	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.006	6.299	0.063	100.0	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.007	38.069	0.501	76.0	0.054	0.00	0.0	0.600		o	225	Pipe/Conduit	
5.008	60.801	0.869	70.0	0.078	0.00	0.0	0.600		o	225	Pipe/Conduit	
5.009	71.532	0.179	399.6	0.165	0.00	0.0	0.600		o	1200	Pipe/Conduit	
5.010	12.980	0.032	405.6	0.000	0.00	0.0	0.600		o	1200	Pipe/Conduit	
6.000	19.080	0.048	397.5	0.153	4.00	0.0	0.600		o	1200	Pipe/Conduit	
6.001	15.228	0.038	400.7	0.000	0.00	0.0	0.600		o	1200	Pipe/Conduit	
5.011	17.304	0.043	402.4	0.094	0.00	0.0	0.600		o	1200	Pipe/Conduit	
5.012	29.535	0.074	399.1	0.020	0.00	0.0	0.600		o	1200	Pipe/Conduit	
5.013	55.799	0.139	401.4	0.082	0.00	0.0	0.600		o	1200	Pipe/Conduit	
5.014	14.416	0.036	400.4	0.114	0.00	0.0	0.600		o	1200	Pipe/Conduit	
5.015	50.099	0.125	400.8	0.019	0.00	0.0	0.600		o	1350	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.018	0.00	7.30	15.246	1.324	0.0	0.0	0.0	1.97	2823.2	0.0
5.000	0.00	4.13	27.600	0.026	0.0	0.0	0.0	2.11	37.3	0.0
5.001	0.00	4.27	26.895	0.026	0.0	0.0	0.0	2.26	40.0	0.0
5.002	0.00	4.44	25.910	0.075	0.0	0.0	0.0	1.60	28.2	0.0
5.003	0.00	4.60	25.500	0.093	0.0	0.0	0.0	1.50	26.6	0.0
5.004	0.00	4.70	25.180	0.093	0.0	0.0	0.0	1.30	23.0	0.0
5.005	0.00	4.78	25.000	0.093	0.0	0.0	0.0	1.00	17.8	0.0
5.006	0.00	4.89	24.949	0.093	0.0	0.0	0.0	1.00	17.8	0.0
5.007	0.00	5.31	24.811	0.147	0.0	0.0	0.0	1.50	59.7	0.0
5.008	0.00	5.96	24.310	0.225	0.0	0.0	0.0	1.57	62.2	0.0
5.009	0.00	6.60	19.400	0.390	0.0	0.0	0.0	1.87	2109.6	0.0
5.010	0.00	6.71	19.221	0.390	0.0	0.0	0.0	1.85	2093.8	0.0
6.000	0.00	4.17	19.275	0.153	0.0	0.0	0.0	1.87	2115.3	0.0
6.001	0.00	4.31	19.227	0.153	0.0	0.0	0.0	1.86	2106.6	0.0
5.011	0.00	6.87	19.189	0.637	0.0	0.0	0.0	1.86	2102.2	0.0
5.012	0.00	7.13	19.146	0.657	0.0	0.0	0.0	1.87	2110.9	0.0
5.013	0.00	7.63	19.072	0.739	0.0	0.0	0.0	1.86	2104.8	0.0
5.014	0.00	7.76	18.933	0.853	0.0	0.0	0.0	1.86	2107.4	0.0
5.015	0.00	8.18	18.747	0.872	0.0	0.0	0.0	2.00	2866.5	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
5.016	10.838	0.027	401.4	0.071	0.00	0.0	0.600		o	1350	Pipe/Conduit	
5.017	12.384	0.206	60.1	0.006	0.00	0.0	0.600		o	225	Pipe/Conduit	
5.018	67.129	0.168	400.0	0.000	0.00	0.0	0.600		o	1350	Pipe/Conduit	
1.019	32.074	0.080	400.0	0.092	0.00	0.0	0.600		o	1500	Pipe/Conduit	
1.020	23.468	0.098	239.5	0.051	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.021	22.662	0.076	300.0	0.000	0.00	0.0		0.027	\/	-1	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
5.016	0.00	8.27	18.622	0.943	0.0	0.0	0.0	2.00	2864.3	0.0
5.017	0.00	8.39	18.595	0.949	0.0	0.0	0.0	1.69	67.2	0.0
5.018	0.00	8.95	15.392	0.949	0.0	0.0	0.0	2.00	2869.3	0.0
1.019	0.00	9.20	15.074	2.365	0.0	0.0	0.0	2.14	3779.1	0.0
1.020	0.00	9.59	14.994	2.416	0.0	0.0	0.0	1.01	71.5	0.0
1.021	0.00	9.96	14.596	2.416	0.0	0.0	0.0	1.00	1386.5	0.0

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	1	23.300	21.500	1.575	Open Manhole	1200
1.001	o	225	2	22.100	20.595	1.280	Open Manhole	1200
1.002	o	300	3	21.200	19.799	1.101	Open Manhole	1200
1.003	o	300	4	20.600	19.379	0.921	Open Manhole	1200
1.004	o	300	5	20.500	19.200	1.000	Open Manhole	250
1.005	o	300	6	20.700	19.112	1.288	Open Manhole	1800
2.000	o	225	6	21.800	20.200	1.375	Open Manhole	1200
2.001	o	225	7	21.250	19.613	1.412	Open Manhole	1200
1.006	o	1200	7	20.600	16.050	3.350	Open Manhole	2400
1.007	o	1200	8	20.950	15.958	3.792	Open Manhole	2400
3.000	o	1200	10	19.800	15.918	2.682	Open Manhole	2400
3.001	o	1200	11	20.600	15.870	3.530	Open Manhole	2400
1.008	o	1200	9	20.800	15.841	3.759	Open Manhole	2700
1.009	o	1200	14	20.800	15.781	3.819	Open Manhole	2400
1.010	o	1200	15	20.400	15.744	3.456	Open Manhole	2400
1.011	o	1200	16	20.250	15.712	3.338	Open Manhole	2400

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	31.658	35.0	2	22.100	20.595	1.280	Open Manhole	1200
1.001	25.239	35.0	3	21.200	19.874	1.101	Open Manhole	1200
1.002	27.865	66.3	4	20.600	19.379	0.921	Open Manhole	1200
1.003	9.503	120.0	5	20.500	19.300	0.900	Open Manhole	250
1.004	8.815	100.2	6	20.700	19.112	1.288	Open Manhole	1800
1.005	7.949	100.6	7	20.600	19.033	1.267	Open Manhole	2400
2.000	23.463	40.0	7	21.250	19.613	1.412	Open Manhole	1200
2.001	15.043	30.0	7	20.600	19.112	1.263	Open Manhole	2400
1.006	36.925	401.4	8	20.950	15.958	3.792	Open Manhole	2400
1.007	46.608	398.4	9	20.800	15.841	3.759	Open Manhole	2700
3.000	19.091	397.7	11	20.600	15.870	3.530	Open Manhole	2400
3.001	11.532	397.7	9	20.800	15.841	3.759	Open Manhole	2700
1.008	23.970	399.5	14	20.800	15.781	3.819	Open Manhole	2400
1.009	14.926	403.4	15	20.400	15.744	3.456	Open Manhole	2400
1.010	12.635	394.8	16	20.250	15.712	3.338	Open Manhole	2400
1.011	13.438	395.2	17	20.100	15.678	3.222	Open Manhole	2700

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.000	o	1200	16	20.750	15.735	3.815	Open Manhole	2400
1.012	o	1350	17	20.100	15.528	3.222	Open Manhole	2700
1.013	o	1350	18	19.500	15.475	2.675	Open Manhole	2400
1.014	o	1350	19	18.700	15.387	1.963	Open Manhole	2400
1.015	o	1350	20	18.800	15.362	2.088	Open Manhole	2400
1.016	o	1350	21	18.950	15.331	2.269	Open Manhole	2400
1.017	o	1350	22	19.100	15.294	2.456	Open Manhole	2400
1.018	o	1350	23	19.300	15.246	2.704	Open Manhole	2400
5.000	o	150	24	29.100	27.600	1.350	Open Manhole	1200
5.001	o	150	25	28.350	26.895	1.305	Open Manhole	1200
5.002	o	150	26	27.400	25.910	1.340	Open Manhole	1200
5.003	o	150	27	27.000	25.500	1.350	Open Manhole	1200
5.004	o	150	28	26.400	25.180	1.070	Open Manhole	1200
5.005	o	150	29	26.100	25.000	0.950	Open Manhole	1200
5.006	o	150	30	26.100	24.949	1.001	Open Manhole	1200
5.007	o	225	31	25.950	24.811	0.914	Open Manhole	1200
5.008	o	225	32	25.500	24.310	0.965	Open Manhole	1200
5.009	o	1200	33	24.600	19.400	4.000	Open Manhole	2400
5.010	o	1200	34	22.250	19.221	1.829	Open Manhole	2400

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.000	22.423	400.4	17	20.100	15.679	3.221	Open Manhole	2700
1.012	21.296	401.8	18	19.500	15.475	2.675	Open Manhole	2400
1.013	35.020	398.0	19	18.700	15.387	1.963	Open Manhole	2400
1.014	10.116	404.6	20	18.800	15.362	2.088	Open Manhole	2400
1.015	12.320	397.4	21	18.950	15.331	2.269	Open Manhole	2400
1.016	14.971	404.6	22	19.100	15.294	2.456	Open Manhole	2400
1.017	19.366	403.5	23	19.300	15.246	2.704	Open Manhole	2400
1.018	9.088	413.1	45	19.200	15.224	2.626	Open Manhole	2700
5.000	16.218	23.0	25	28.350	26.895	1.305	Open Manhole	1200
5.001	19.707	20.0	26	27.400	25.910	1.340	Open Manhole	1200
5.002	16.396	40.0	27	27.000	25.500	1.350	Open Manhole	1200
5.003	14.408	45.0	28	26.400	25.180	1.070	Open Manhole	1200
5.004	7.453	60.0	29	26.100	25.055	0.895	Open Manhole	1200
5.005	5.100	100.0	30	26.100	24.949	1.001	Open Manhole	1200
5.006	6.299	100.0	31	25.950	24.886	0.914	Open Manhole	1200
5.007	38.069	76.0	32	25.500	24.310	0.965	Open Manhole	1200
5.008	60.801	70.0	33	24.600	23.441	0.934	Open Manhole	2400
5.009	71.532	399.6	34	22.250	19.221	1.829	Open Manhole	2400
5.010	12.980	405.6	37	22.100	19.189	1.711	Open Manhole	2700

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
6.000	o	1200	35	22.000	19.275	1.525	Open Manhole	2400
6.001	o	1200	36	22.250	19.227	1.823	Open Manhole	2400
5.011	o	1200	37	22.100	19.189	1.711	Open Manhole	2700
5.012	o	1200	38	22.500	19.146	2.154	Open Manhole	2400
5.013	o	1200	39	22.300	19.072	2.028	Open Manhole	2400
5.014	o	1200	40	21.900	18.933	1.767	Open Manhole	2400
5.015	o	1350	41	21.750	18.747	1.653	Open Manhole	2400
5.016	o	1350	42	21.450	18.622	1.478	Open Manhole	2400
5.017	o	225	43	21.350	18.595	2.530	Open Manhole	2400
5.018	o	1350	44	21.000	15.392	4.258	Open Manhole	2400
1.019	o	1500	45	19.200	15.074	2.626	Open Manhole	2700
1.020	o	300	19	18.300	14.994	3.006	Open Manhole	2700
1.021	\/	-1	Swale	17.000	14.596	1.804	Open Manhole	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
6.000	19.080	397.5	36	22.250	19.227	1.823	Open Manhole	2400
6.001	15.228	400.7	37	22.100	19.189	1.711	Open Manhole	2700
5.011	17.304	402.4	38	22.500	19.146	2.154	Open Manhole	2400
5.012	29.535	399.1	39	22.300	19.072	2.028	Open Manhole	2400
5.013	55.799	401.4	40	21.900	18.933	1.767	Open Manhole	2400
5.014	14.416	400.4	41	21.750	18.897	1.653	Open Manhole	2400
5.015	50.099	400.8	42	21.450	18.622	1.478	Open Manhole	2400
5.016	10.838	401.4	43	21.350	18.595	1.405	Open Manhole	2400
5.017	12.384	60.1	44	21.000	18.389	2.386	Open Manhole	2400
5.018	67.129	400.0	45	19.200	15.224	2.626	Open Manhole	2700
1.019	32.074	400.0	19	18.300	14.994	1.806	Open Manhole	2700
1.020	23.468	239.5	Swale	17.000	14.896	1.804	Open Manhole	1050
1.021	22.662	300.0		15.650	14.520	0.530	Open Manhole	1050

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.300	Storm Duration (mins)	30
Ratio R	0.378		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 6, DS/PN: 1.005, Volume (m³): 4.6

Unit Reference	MD-SHE-0101-5000-1300-5000
Design Head (m)	1.300
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	19.112
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.300	5.0
Flush-Flo™	0.384	5.0
Kick-Flo®	0.798	4.0
Mean Flow over Head Range	-	4.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	1.200	4.8	3.000	7.4	7.000	11.0
0.200	4.7	1.400	5.2	3.500	7.9	7.500	11.4
0.300	4.9	1.600	5.5	4.000	8.5	8.000	11.8
0.400	5.0	1.800	5.8	4.500	9.0	8.500	12.1
0.500	4.9	2.000	6.1	5.000	9.4	9.000	12.5
0.600	4.8	2.200	6.4	5.500	9.8	9.500	12.8
0.800	4.0	2.400	6.7	6.000	10.3		
1.000	4.4	2.600	6.9	6.500	10.7		

Hydro-Brake® Optimum Manhole: 30, DS/PN: 5.006, Volume (m³): 1.4

Unit Reference	MD-SHE-0096-4000-0900-4000
Design Head (m)	0.900
Design Flow (l/s)	4.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	96
Invert Level (m)	24.949
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Hydro-Brake® Optimum Manhole: 30, DS/PN: 5.006, Volume (m³): 1.4

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	4.0
Flush-Flo™	0.266	4.0
Kick-Flo®	0.578	3.3
Mean Flow over Head Range	-	3.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	1.200	4.6	3.000	7.0	7.000	10.5
0.200	3.9	1.400	4.9	3.500	7.5	7.500	10.8
0.300	4.0	1.600	5.2	4.000	8.0	8.000	11.2
0.400	3.9	1.800	5.5	4.500	8.5	8.500	11.5
0.500	3.7	2.000	5.8	5.000	8.9	9.000	11.8
0.600	3.3	2.200	6.1	5.500	9.3	9.500	12.1
0.800	3.8	2.400	6.3	6.000	9.7		
1.000	4.2	2.600	6.6	6.500	10.1		

Hydro-Brake® Optimum Manhole: 43, DS/PN: 5.017, Volume (m³): 24.5

Unit Reference	MD-SHE-0106-7000-2200-7000
Design Head (m)	2.200
Design Flow (l/s)	7.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	106
Invert Level (m)	18.595
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.200	7.0
Flush-Flo™	0.465	5.9
Kick-Flo®	0.952	4.7
Mean Flow over Head Range	-	5.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	0.300	5.8	0.500	5.9	0.800	5.5
0.200	5.3	0.400	5.9	0.600	5.9	1.000	4.8

Hydro-Brake® Optimum Manhole: 43, DS/PN: 5.017, Volume (m³): 24.5

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
1.200	5.3	2.400	7.3	5.000	10.3	8.000	12.9
1.400	5.7	2.600	7.6	5.500	10.8	8.500	13.3
1.600	6.0	3.000	8.1	6.000	11.2	9.000	13.6
1.800	6.4	3.500	8.7	6.500	11.7	9.500	14.0
2.000	6.7	4.000	9.3	7.000	12.1		
2.200	7.0	4.500	9.8	7.500	12.5		

Hydro-Brake® Optimum Manhole: 19, DS/PN: 1.020, Volume (m³): 70.8

Unit Reference	MD-SHE-0141-1400-3000-1400
Design Head (m)	3.000
Design Flow (l/s)	14.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	141
Invert Level (m)	14.994
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	3.000	14.0
Flush-Flo™	0.620	11.7
Kick-Flo®	1.262	9.3
Mean Flow over Head Range	-	11.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.1	1.200	9.9	3.000	14.0	7.000	21.0
0.200	9.6	1.400	9.8	3.500	15.1	7.500	21.7
0.300	10.8	1.600	10.4	4.000	16.1	8.000	22.4
0.400	11.4	1.800	11.0	4.500	17.0	8.500	23.0
0.500	11.6	2.000	11.5	5.000	17.9	9.000	23.7
0.600	11.7	2.200	12.1	5.500	18.7	9.500	24.3
0.800	11.6	2.400	12.6	6.000	19.5		
1.000	11.1	2.600	13.1	6.500	20.2		

Storage Structures for Storm

Tank or Pond Manhole: 5, DS/PN: 1.004

Invert Level (m) 19.200

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	38.0	1.300	194.3

Tank or Pond Manhole: 29, DS/PN: 5.005

Invert Level (m) 25.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	56.0	1.100	194.0

Tank or Pond Manhole: 42, DS/PN: 5.016

Invert Level (m) 20.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	172.7	0.600	359.5

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.378
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.300	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 2, 30
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	1	+0%					21.537
1.001	2	15 Winter	1	+0%					20.653
1.002	3	15 Winter	1	+0%	30/15 Summer				19.888
1.003	4	15 Winter	1	+0%	30/15 Summer				19.519
1.004	5	60 Winter	1	+0%	1/60 Winter				19.511
1.005	6	60 Winter	1	+0%	1/15 Summer				19.508
2.000	6	15 Winter	1	+0%					20.249
2.001	7	15 Winter	1	+0%					19.677
1.006	7	15 Winter	1	+0%	30/480 Winter				16.162
1.007	8	15 Winter	1	+0%	30/480 Winter				16.097
3.000	10	15 Winter	1	+0%	30/480 Winter				16.055
3.001	11	15 Winter	1	+0%	30/360 Winter				16.037
1.008	9	15 Winter	1	+0%	30/360 Winter				16.033
1.009	14	15 Winter	1	+0%	30/360 Winter				15.990
1.010	15	15 Winter	1	+0%	30/360 Winter				15.953
1.011	16	240 Winter	1	+0%	30/360 Winter				15.952
4.000	16	240 Winter	1	+0%	30/360 Winter				15.952
1.012	17	240 Winter	1	+0%	30/360 Winter				15.952

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.188	0.000	0.06			5.4	OK	
1.001	2	-0.167	0.000	0.15			12.2	OK	
1.002	3	-0.211	0.000	0.19			23.4	OK	
1.003	4	-0.160	0.000	0.44			31.1	OK	
1.004	5	0.011	0.000	0.06			4.8	SURCHARGED	
1.005	6	0.096	0.000	0.07			5.0	SURCHARGED	
2.000	6	-0.176	0.000	0.11			8.3	OK	
2.001	7	-0.161	0.000	0.18			15.2	OK	
1.006	7	-1.088	0.000	0.01			22.0	OK	
1.007	8	-1.061	0.000	0.02			32.4	OK	
3.000	10	-1.063	0.000	0.02			22.6	OK	
3.001	11	-1.033	0.000	0.02			20.0	OK	
1.008	9	-1.008	0.000	0.05			61.2	OK	
1.009	14	-0.991	0.000	0.06			60.6	OK	
1.010	15	-0.991	0.000	0.06			60.3	OK	
1.011	16	-0.960	0.000	0.02			22.7	OK	
4.000	16	-0.983	0.000	0.00			1.2	OK	
1.012	17	-0.926	0.000	0.02			26.4	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.013	18	240 Winter	1	+0%	30/240 Winter				15.951
1.014	19	240 Winter	1	+0%	30/180 Winter				15.951
1.015	20	240 Winter	1	+0%	30/180 Winter				15.951
1.016	21	240 Winter	1	+0%	30/180 Winter				15.951
1.017	22	240 Winter	1	+0%	30/180 Winter				15.950
1.018	23	240 Winter	1	+0%	30/120 Winter				15.950
5.000	24	15 Winter	1	+0%					27.632
5.001	25	15 Summer	1	+0%					26.926
5.002	26	15 Winter	1	+0%	30/15 Summer				25.971
5.003	27	15 Winter	1	+0%	30/15 Summer				25.571
5.004	28	15 Winter	1	+0%	30/15 Summer				25.261
5.005	29	30 Winter	1	+0%	30/15 Summer				25.072
5.006	30	30 Winter	1	+0%	30/15 Summer				25.065
5.007	31	30 Winter	1	+0%					24.867
5.008	32	15 Winter	1	+0%	30/15 Summer				24.388
5.009	33	15 Winter	1	+0%	30/360 Winter				19.523
5.010	34	180 Winter	1	+0%	30/240 Winter				19.412
6.000	35	180 Winter	1	+0%	30/240 Winter				19.413
6.001	36	180 Winter	1	+0%	30/240 Winter				19.413
5.011	37	180 Winter	1	+0%	30/240 Winter				19.413
5.012	38	180 Winter	1	+0%	30/240 Winter				19.413
5.013	39	180 Winter	1	+0%	30/180 Winter				19.413
5.014	40	180 Winter	1	+0%	30/120 Winter				19.413
5.015	41	180 Winter	1	+0%	30/120 Winter				19.412
5.016	42	180 Winter	1	+0%	30/60 Winter				19.411
5.017	43	180 Winter	1	+0%	1/15 Summer				19.411
5.018	44	240 Winter	1	+0%	30/180 Winter				15.950
1.019	45	240 Winter	1	+0%	30/120 Winter				15.950
1.020	19	240 Winter	1	+0%	1/15 Summer				15.948
1.021	Swale	480 Summer	1	+0%					14.657

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.013	18	-0.874	0.000	0.01			25.5	OK	
1.014	19	-0.786	0.000	0.02			24.4	OK	
1.015	20	-0.761	0.000	0.02			23.8	OK	
1.016	21	-0.730	0.000	0.02			21.9	OK	
1.017	22	-0.694	0.000	0.01			21.9	OK	
1.018	23	-0.646	0.000	0.02			18.9	OK	
5.000	24	-0.118	0.000	0.11			3.7	OK	
5.001	25	-0.119	0.000	0.10			3.7	OK	
5.002	26	-0.089	0.000	0.35			9.1	OK	
5.003	27	-0.079	0.000	0.45			11.1	OK	
5.004	28	-0.069	0.000	0.57			11.2	OK	
5.005	29	-0.078	0.000	0.25			3.6	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
5.006	30	-0.034	0.000	0.24			3.6	OK	
5.007	31	-0.169	0.000	0.14			7.8	OK	
5.008	32	-0.147	0.000	0.26			15.4	OK	
5.009	33	-1.077	0.000	0.02			32.3	OK	
5.010	34	-1.009	0.000	0.01			12.3	OK	
6.000	35	-1.062	0.000	0.00			5.2	OK	
6.001	36	-1.014	0.000	0.00			5.0	OK	
5.011	37	-0.976	0.000	0.02			20.2	OK	
5.012	38	-0.933	0.000	0.01			20.4	OK	
5.013	39	-0.859	0.000	0.01			21.6	OK	
5.014	40	-0.720	0.000	0.02			19.3	OK	
5.015	41	-0.685	0.000	0.01			17.8	OK	
5.016	42	-0.561	0.000	0.01			15.1	OK	
5.017	43	0.591	0.000	0.10			5.9	SURCHARGED	
5.018	44	-0.792	0.000	0.00			6.0	OK	
1.019	45	-0.624	0.000	0.01			16.4	OK	
1.020	19	0.654	0.000	0.18			11.7	SURCHARGED	
1.021	Swale	-0.539	0.000	0.01			11.7	OK	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.378
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.300	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 2, 30
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	2	+0%					21.543
1.001	2	15 Winter	2	+0%					20.662
1.002	3	15 Winter	2	+0%	30/15 Summer				19.900
1.003	4	60 Winter	2	+0%	30/15 Summer				19.604
1.004	5	60 Winter	2	+0%	1/60 Winter				19.601
1.005	6	60 Winter	2	+0%	1/15 Summer				19.600
2.000	6	15 Winter	2	+0%					20.256
2.001	7	15 Winter	2	+0%					19.687
1.006	7	15 Winter	2	+0%	30/480 Winter				16.177
1.007	8	15 Winter	2	+0%	30/480 Winter				16.116
3.000	10	15 Winter	2	+0%	30/480 Winter				16.078
3.001	11	360 Winter	2	+0%	30/360 Winter				16.071
1.008	9	360 Winter	2	+0%	30/360 Winter				16.071
1.009	14	360 Winter	2	+0%	30/360 Winter				16.071
1.010	15	360 Winter	2	+0%	30/360 Winter				16.071
1.011	16	360 Winter	2	+0%	30/360 Winter				16.071
4.000	16	360 Winter	2	+0%	30/360 Winter				16.071
1.012	17	360 Winter	2	+0%	30/360 Winter				16.071

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.182	0.000	0.08			6.9	OK	
1.001	2	-0.158	0.000	0.19			15.8	OK	
1.002	3	-0.199	0.000	0.25			30.2	OK	
1.003	4	-0.075	0.000	0.33			23.5	OK	
1.004	5	0.101	0.000	0.07			5.3	SURCHARGED	
1.005	6	0.188	0.000	0.07			5.0	SURCHARGED	
2.000	6	-0.169	0.000	0.14			10.8	OK	
2.001	7	-0.151	0.000	0.23			19.6	OK	
1.006	7	-1.073	0.000	0.02			27.4	OK	
1.007	8	-1.042	0.000	0.03			40.5	OK	
3.000	10	-1.040	0.000	0.02			29.0	OK	
3.001	11	-0.999	0.000	0.00			4.2	OK	
1.008	9	-0.970	0.000	0.01			18.9	OK	
1.009	14	-0.910	0.000	0.02			19.2	OK	
1.010	15	-0.873	0.000	0.02			19.2	OK	
1.011	16	-0.841	0.000	0.02			21.3	OK	
4.000	16	-0.864	0.000	0.00			1.0	OK	
1.012	17	-0.807	0.000	0.01			23.7	OK	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.013	18	360 Winter	2	+0%	30/240 Winter				16.071
1.014	19	360 Winter	2	+0%	30/180 Winter				16.071
1.015	20	360 Winter	2	+0%	30/180 Winter				16.071
1.016	21	360 Winter	2	+0%	30/180 Winter				16.071
1.017	22	360 Winter	2	+0%	30/180 Winter				16.070
1.018	23	360 Winter	2	+0%	30/120 Winter				16.070
5.000	24	15 Winter	2	+0%					27.637
5.001	25	15 Summer	2	+0%					26.930
5.002	26	15 Winter	2	+0%	30/15 Summer				25.980
5.003	27	15 Winter	2	+0%	30/15 Summer				25.583
5.004	28	15 Winter	2	+0%	30/15 Summer				25.276
5.005	29	30 Winter	2	+0%	30/15 Summer				25.096
5.006	30	30 Winter	2	+0%	30/15 Summer				25.088
5.007	31	15 Winter	2	+0%					24.876
5.008	32	15 Winter	2	+0%	30/15 Summer				24.401
5.009	33	15 Winter	2	+0%	30/360 Winter				19.538
5.010	34	180 Winter	2	+0%	30/240 Winter				19.515
6.000	35	180 Winter	2	+0%	30/240 Winter				19.515
6.001	36	180 Winter	2	+0%	30/240 Winter				19.515
5.011	37	180 Winter	2	+0%	30/240 Winter				19.515
5.012	38	180 Winter	2	+0%	30/240 Winter				19.515
5.013	39	180 Winter	2	+0%	30/180 Winter				19.514
5.014	40	180 Winter	2	+0%	30/120 Winter				19.514
5.015	41	180 Winter	2	+0%	30/120 Winter				19.516
5.016	42	180 Winter	2	+0%	30/60 Winter				19.516
5.017	43	180 Winter	2	+0%	1/15 Summer				19.520
5.018	44	360 Winter	2	+0%	30/180 Winter				16.071
1.019	45	360 Winter	2	+0%	30/120 Winter				16.070
1.020	19	360 Winter	2	+0%	1/15 Summer				16.068
1.021	Swale	1440 Summer	2	+0%					14.657

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.013	18	-0.754	0.000	0.01			22.5	OK	
1.014	19	-0.666	0.000	0.02			21.0	OK	
1.015	20	-0.641	0.000	0.02			20.4	OK	
1.016	21	-0.610	0.000	0.01			18.9	OK	
1.017	22	-0.574	0.000	0.01			19.0	OK	
1.018	23	-0.526	0.000	0.02			16.6	OK	
5.000	24	-0.113	0.000	0.14			4.7	OK	
5.001	25	-0.115	0.000	0.13			4.8	OK	
5.002	26	-0.079	0.000	0.45			11.8	OK	
5.003	27	-0.067	0.000	0.59			14.3	OK	
5.004	28	-0.054	0.000	0.73			14.5	OK	
5.005	29	-0.054	0.000	0.27			3.8	OK	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
5.006	30	-0.011	0.000	0.25			3.7	OK	
5.007	31	-0.160	0.000	0.18			10.0	OK	
5.008	32	-0.134	0.000	0.34			20.4	OK	
5.009	33	-1.062	0.000	0.02			42.1	OK	
5.010	34	-0.906	0.000	0.02			14.7	OK	
6.000	35	-0.960	0.000	0.01			6.4	OK	
6.001	36	-0.912	0.000	0.01			6.1	OK	
5.011	37	-0.874	0.000	0.02			24.2	OK	
5.012	38	-0.831	0.000	0.02			24.2	OK	
5.013	39	-0.758	0.000	0.02			25.3	OK	
5.014	40	-0.619	0.000	0.02			20.9	OK	
5.015	41	-0.581	0.000	0.01			18.7	OK	
5.016	42	-0.456	0.000	0.01			11.1	OK	
5.017	43	0.700	0.000	0.10			5.9	SURCHARGED	
5.018	44	-0.671	0.000	0.00			6.0	OK	
1.019	45	-0.504	0.000	0.01			15.5	OK	
1.020	19	0.774	0.000	0.18			11.7	SURCHARGED	
1.021	Swale	-0.539	0.000	0.01			11.7	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.378
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.300	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 2, 30
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	30	+40%					21.572
1.001	2	15 Winter	30	+40%					20.719
1.002	3	120 Winter	30	+40%	30/15 Summer				20.218
1.003	4	120 Winter	30	+40%	30/15 Summer				20.213
1.004	5	120 Winter	30	+40%	1/60 Winter				20.210
1.005	6	180 Winter	30	+40%	1/15 Summer				20.217
2.000	6	15 Winter	30	+40%					20.295
2.001	7	15 Summer	30	+40%					19.751
1.006	7	960 Winter	30	+40%	30/480 Winter				17.784
1.007	8	960 Winter	30	+40%	30/480 Winter				17.784
3.000	10	960 Winter	30	+40%	30/480 Winter				17.784
3.001	11	960 Winter	30	+40%	30/360 Winter				17.784
1.008	9	960 Winter	30	+40%	30/360 Winter				17.784
1.009	14	960 Winter	30	+40%	30/360 Winter				17.785
1.010	15	960 Winter	30	+40%	30/360 Winter				17.785
1.011	16	960 Winter	30	+40%	30/360 Winter				17.785
4.000	16	960 Winter	30	+40%	30/360 Winter				17.785
1.012	17	960 Winter	30	+40%	30/360 Winter				17.785

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.153	0.000	0.22			18.4	OK	
1.001	2	-0.101	0.000	0.59			47.9	OK	
1.002	3	0.119	0.000	0.23			28.6	SURCHARGED	
1.003	4	0.534	0.000	0.53			37.0	SURCHARGED	
1.004	5	0.710	0.000	0.09			7.0	FLOOD RISK	
1.005	6	0.805	0.000	0.07			5.0	SURCHARGED	
2.000	6	-0.130	0.000	0.38			28.6	OK	
2.001	7	-0.087	0.000	0.69			58.1	OK	
1.006	7	0.534	0.000	0.01			9.1	SURCHARGED	
1.007	8	0.626	0.000	0.01			10.9	SURCHARGED	
3.000	10	0.666	0.000	0.00			4.7	SURCHARGED	
3.001	11	0.714	0.000	0.01			4.5	SURCHARGED	
1.008	9	0.743	0.000	0.01			15.9	SURCHARGED	
1.009	14	0.804	0.000	0.02			15.5	SURCHARGED	
1.010	15	0.841	0.000	0.02			14.8	SURCHARGED	
1.011	16	0.873	0.000	0.02			16.0	SURCHARGED	
4.000	16	0.850	0.000	0.00			2.0	SURCHARGED	
1.012	17	0.907	0.000	0.01			17.6	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.013	18	960 Winter	30	+40%	30/240 Winter				17.785
1.014	19	960 Winter	30	+40%	30/180 Winter				17.785
1.015	20	960 Winter	30	+40%	30/180 Winter				17.786
1.016	21	960 Winter	30	+40%	30/180 Winter				17.786
1.017	22	960 Winter	30	+40%	30/180 Winter				17.786
1.018	23	960 Winter	30	+40%	30/120 Winter				17.786
5.000	24	15 Winter	30	+40%					27.662
5.001	25	15 Summer	30	+40%					26.955
5.002	26	15 Winter	30	+40%	30/15 Summer				26.717
5.003	27	15 Winter	30	+40%	30/15 Summer				26.222
5.004	28	15 Winter	30	+40%	30/15 Summer				25.575
5.005	29	60 Winter	30	+40%	30/15 Summer				25.298
5.006	30	60 Winter	30	+40%	30/15 Summer				25.290
5.007	31	15 Winter	30	+40%					24.927
5.008	32	15 Winter	30	+40%	30/15 Summer				24.598
5.009	33	360 Winter	30	+40%	30/360 Winter				20.689
5.010	34	360 Winter	30	+40%	30/240 Winter				20.689
6.000	35	360 Winter	30	+40%	30/240 Winter				20.688
6.001	36	360 Winter	30	+40%	30/240 Winter				20.689
5.011	37	360 Winter	30	+40%	30/240 Winter				20.689
5.012	38	360 Winter	30	+40%	30/240 Winter				20.692
5.013	39	360 Winter	30	+40%	30/180 Winter				20.698
5.014	40	360 Winter	30	+40%	30/120 Winter				20.707
5.015	41	360 Winter	30	+40%	30/120 Winter				20.711
5.016	42	360 Winter	30	+40%	30/60 Winter				20.713
5.017	43	360 Winter	30	+40%	1/15 Summer				20.713
5.018	44	960 Winter	30	+40%	30/180 Winter				17.786
1.019	45	960 Winter	30	+40%	30/120 Winter				17.786
1.020	19	960 Winter	30	+40%	1/15 Summer				17.786
1.021	Swale	960 Winter	30	+40%					14.661

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.013	18	0.960	0.000	0.01			16.6	SURCHARGED	
1.014	19	1.048	0.000	0.01			15.7	SURCHARGED	
1.015	20	1.074	0.000	0.01			15.3	SURCHARGED	
1.016	21	1.105	0.000	0.01			14.3	SURCHARGED	
1.017	22	1.142	0.000	0.01			14.6	SURCHARGED	
1.018	23	1.190	0.000	0.01			12.9	SURCHARGED	
5.000	24	-0.088	0.000	0.36			12.6	OK	
5.001	25	-0.090	0.000	0.34			12.6	OK	
5.002	26	0.658	0.000	1.10			28.9	SURCHARGED	
5.003	27	0.572	0.000	1.41			34.6	SURCHARGED	
5.004	28	0.245	0.000	1.73			34.2	SURCHARGED	
5.005	29	0.148	0.000	0.30			4.3	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
5.006	30	0.191	0.000	0.27			4.0	SURCHARGED	
5.007	31	-0.109	0.000	0.52			29.5	OK	
5.008	32	0.063	0.000	1.04			62.2	SURCHARGED	
5.009	33	0.089	0.000	0.01			22.6	SURCHARGED	
5.010	34	0.268	0.000	0.04			39.9	SURCHARGED	
6.000	35	0.213	0.000	0.01			15.0	SURCHARGED	
6.001	36	0.262	0.000	0.04			35.6	SURCHARGED	
5.011	37	0.300	0.000	0.09			102.7	SURCHARGED	
5.012	38	0.346	0.000	0.07			105.7	SURCHARGED	
5.013	39	0.426	0.000	0.05			81.3	SURCHARGED	
5.014	40	0.574	0.000	0.07			66.0	SURCHARGED	
5.015	41	0.614	0.000	0.02			43.1	SURCHARGED	
5.016	42	0.741	0.000	0.02			23.6	SURCHARGED	
5.017	43	1.893	0.000	0.12			6.8	SURCHARGED	
5.018	44	1.044	0.000	0.00			8.3	SURCHARGED	
1.019	45	1.212	0.000	0.01			16.0	SURCHARGED	
1.020	19	2.492	0.000	0.21			13.5	SURCHARGED	
1.021	Swale	-0.535	0.000	0.01			13.5	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.300	Add Flow / Climate Change (%)	0
Ratio R	0.378	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.679	4-8	1.666	8-12	0.072

Total Area Contributing (ha) = 2.416

Total Pipe Volume (m³) = 956.125

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	31.658	0.905	35.0	0.038	4.00	0.0	0.600		o	225	Pipe/Conduit	
1.001	25.239	0.721	35.0	0.061	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.002	27.865	0.420	66.3	0.101	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.003	9.503	0.079	120.0	0.069	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.004	8.815	0.088	100.2	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.005	7.949	0.079	100.6	0.032	0.00	0.0	0.600		o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	4.24	21.500	0.038	0.0	0.0	0.0	2.22	88.2	0.0
1.001	0.00	4.43	20.595	0.099	0.0	0.0	0.0	2.22	88.2	0.0
1.002	0.00	4.67	19.799	0.200	0.0	0.0	0.0	1.93	136.6	0.0
1.003	0.00	4.78	19.379	0.269	0.0	0.0	0.0	1.43	101.4	0.0
1.004	0.00	4.87	19.200	0.269	0.0	0.0	0.0	1.57	111.0	0.0
1.005	0.00	4.96	19.112	0.301	0.0	0.0	0.0	1.57	110.8	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	23.463	0.587	40.0	0.059	4.00	0.0	0.600		o	225	Pipe/Conduit	
2.001	15.043	0.501	30.0	0.061	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.006	36.925	0.092	401.4	0.024	0.00	0.0	0.600		o	1200	Pipe/Conduit	
1.007	46.608	0.117	398.4	0.108	0.00	0.0	0.600		o	1200	Pipe/Conduit	
3.000	19.091	0.048	397.7	0.165	4.00	0.0	0.600		o	1200	Pipe/Conduit	
3.001	11.532	0.029	397.7	0.000	0.00	0.0	0.600		o	1200	Pipe/Conduit	
1.008	23.970	0.060	399.5	0.129	0.00	0.0	0.600		o	1200	Pipe/Conduit	
1.009	14.926	0.037	403.4	0.015	0.00	0.0	0.600		o	1200	Pipe/Conduit	
1.010	12.635	0.032	394.8	0.000	0.00	0.0	0.600		o	1200	Pipe/Conduit	
1.011	13.438	0.034	395.2	0.083	0.00	0.0	0.600		o	1200	Pipe/Conduit	
4.000	22.423	0.056	400.4	0.043	4.00	0.0	0.600		o	1200	Pipe/Conduit	
1.012	21.296	0.053	401.8	0.117	0.00	0.0	0.600		o	1350	Pipe/Conduit	
1.013	35.020	0.088	398.0	0.031	0.00	0.0	0.600		o	1350	Pipe/Conduit	
1.014	10.116	0.025	404.6	0.086	0.00	0.0	0.600		o	1350	Pipe/Conduit	
1.015	12.320	0.031	397.4	0.024	0.00	0.0	0.600		o	1350	Pipe/Conduit	
1.016	14.971	0.037	404.6	0.000	0.00	0.0	0.600		o	1350	Pipe/Conduit	
1.017	19.366	0.048	403.5	0.078	0.00	0.0	0.600		o	1350	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	0.00	4.19	20.200	0.059	0.0	0.0	0.0	2.08	82.5	0.0
2.001	0.00	4.29	19.613	0.120	0.0	0.0	0.0	2.40	95.3	0.0
1.006	0.00	5.29	16.050	0.445	0.0	0.0	0.0	1.86	2105.0	0.0
1.007	0.00	5.70	15.958	0.553	0.0	0.0	0.0	1.87	2113.0	0.0
3.000	0.00	4.17	15.918	0.165	0.0	0.0	0.0	1.87	2114.6	0.0
3.001	0.00	4.27	15.870	0.165	0.0	0.0	0.0	1.87	2114.8	0.0
1.008	0.00	5.92	15.841	0.847	0.0	0.0	0.0	1.87	2109.9	0.0
1.009	0.00	6.05	15.781	0.862	0.0	0.0	0.0	1.86	2099.6	0.0
1.010	0.00	6.16	15.744	0.862	0.0	0.0	0.0	1.88	2122.4	0.0
1.011	0.00	6.28	15.712	0.945	0.0	0.0	0.0	1.88	2121.3	0.0
4.000	0.00	4.20	15.735	0.043	0.0	0.0	0.0	1.86	2107.5	0.0
1.012	0.00	6.46	15.528	1.105	0.0	0.0	0.0	2.00	2862.8	0.0
1.013	0.00	6.75	15.475	1.136	0.0	0.0	0.0	2.01	2876.8	0.0
1.014	0.00	6.83	15.387	1.222	0.0	0.0	0.0	1.99	2852.7	0.0
1.015	0.00	6.94	15.362	1.246	0.0	0.0	0.0	2.01	2878.7	0.0
1.016	0.00	7.06	15.331	1.246	0.0	0.0	0.0	1.99	2852.8	0.0
1.017	0.00	7.22	15.294	1.324	0.0	0.0	0.0	2.00	2856.9	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.018	9.088	0.022	413.1	0.000	0.00	0.0	0.600		o	1350	Pipe/Conduit	
5.000	16.218	0.705	23.0	0.026	4.00	0.0	0.600		o	150	Pipe/Conduit	
5.001	19.707	0.985	20.0	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.002	16.396	0.410	40.0	0.049	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.003	14.408	0.320	45.0	0.018	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.004	7.453	0.124	60.0	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.005	5.100	0.051	100.0	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.006	6.299	0.063	100.0	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.007	38.069	0.501	76.0	0.054	0.00	0.0	0.600		o	225	Pipe/Conduit	
5.008	60.801	0.869	70.0	0.078	0.00	0.0	0.600		o	225	Pipe/Conduit	
5.009	71.532	0.179	399.6	0.165	0.00	0.0	0.600		o	1200	Pipe/Conduit	
5.010	12.980	0.032	405.6	0.000	0.00	0.0	0.600		o	1200	Pipe/Conduit	
6.000	19.080	0.048	397.5	0.153	4.00	0.0	0.600		o	1200	Pipe/Conduit	
6.001	15.228	0.038	400.7	0.000	0.00	0.0	0.600		o	1200	Pipe/Conduit	
5.011	17.304	0.043	402.4	0.094	0.00	0.0	0.600		o	1200	Pipe/Conduit	
5.012	29.535	0.074	399.1	0.020	0.00	0.0	0.600		o	1200	Pipe/Conduit	
5.013	55.799	0.139	401.4	0.082	0.00	0.0	0.600		o	1200	Pipe/Conduit	
5.014	14.416	0.036	400.4	0.114	0.00	0.0	0.600		o	1200	Pipe/Conduit	
5.015	50.099	0.125	400.8	0.019	0.00	0.0	0.600		o	1350	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.018	0.00	7.30	15.246	1.324	0.0	0.0	0.0	1.97	2823.2	0.0
5.000	0.00	4.13	27.600	0.026	0.0	0.0	0.0	2.11	37.3	0.0
5.001	0.00	4.27	26.895	0.026	0.0	0.0	0.0	2.26	40.0	0.0
5.002	0.00	4.44	25.910	0.075	0.0	0.0	0.0	1.60	28.2	0.0
5.003	0.00	4.60	25.500	0.093	0.0	0.0	0.0	1.50	26.6	0.0
5.004	0.00	4.70	25.180	0.093	0.0	0.0	0.0	1.30	23.0	0.0
5.005	0.00	4.78	25.000	0.093	0.0	0.0	0.0	1.00	17.8	0.0
5.006	0.00	4.89	24.949	0.093	0.0	0.0	0.0	1.00	17.8	0.0
5.007	0.00	5.31	24.811	0.147	0.0	0.0	0.0	1.50	59.7	0.0
5.008	0.00	5.96	24.310	0.225	0.0	0.0	0.0	1.57	62.2	0.0
5.009	0.00	6.60	19.400	0.390	0.0	0.0	0.0	1.87	2109.6	0.0
5.010	0.00	6.71	19.221	0.390	0.0	0.0	0.0	1.85	2093.8	0.0
6.000	0.00	4.17	19.275	0.153	0.0	0.0	0.0	1.87	2115.3	0.0
6.001	0.00	4.31	19.227	0.153	0.0	0.0	0.0	1.86	2106.6	0.0
5.011	0.00	6.87	19.189	0.637	0.0	0.0	0.0	1.86	2102.2	0.0
5.012	0.00	7.13	19.146	0.657	0.0	0.0	0.0	1.87	2110.9	0.0
5.013	0.00	7.63	19.072	0.739	0.0	0.0	0.0	1.86	2104.8	0.0
5.014	0.00	7.76	18.933	0.853	0.0	0.0	0.0	1.86	2107.4	0.0
5.015	0.00	8.18	18.747	0.872	0.0	0.0	0.0	2.00	2866.5	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
5.016	10.838	0.027	401.4	0.071	0.00	0.0	0.600		o	1350	Pipe/Conduit	
5.017	12.384	0.206	60.1	0.006	0.00	0.0	0.600		o	225	Pipe/Conduit	
5.018	67.129	0.168	400.0	0.000	0.00	0.0	0.600		o	1350	Pipe/Conduit	
1.019	32.074	0.080	400.0	0.092	0.00	0.0	0.600		o	1500	Pipe/Conduit	
1.020	23.468	0.098	239.5	0.051	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.021	22.662	0.076	300.0	0.000	0.00	0.0		0.027	\/	-1	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
5.016	0.00	8.27	18.622	0.943	0.0	0.0	0.0	2.00	2864.3	0.0
5.017	0.00	8.39	18.595	0.949	0.0	0.0	0.0	1.69	67.2	0.0
5.018	0.00	8.95	15.392	0.949	0.0	0.0	0.0	2.00	2869.3	0.0
1.019	0.00	9.20	15.074	2.365	0.0	0.0	0.0	2.14	3779.1	0.0
1.020	0.00	9.59	14.994	2.416	0.0	0.0	0.0	1.01	71.5	0.0
1.021	0.00	9.96	14.596	2.416	0.0	0.0	0.0	1.00	1386.5	0.0

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	1	23.300	21.500	1.575	Open Manhole	1200
1.001	o	225	2	22.100	20.595	1.280	Open Manhole	1200
1.002	o	300	3	21.200	19.799	1.101	Open Manhole	1200
1.003	o	300	4	20.600	19.379	0.921	Open Manhole	1200
1.004	o	300	5	20.500	19.200	1.000	Open Manhole	250
1.005	o	300	6	20.700	19.112	1.288	Open Manhole	1800
2.000	o	225	6	21.800	20.200	1.375	Open Manhole	1200
2.001	o	225	7	21.250	19.613	1.412	Open Manhole	1200
1.006	o	1200	7	20.600	16.050	3.350	Open Manhole	2400
1.007	o	1200	8	20.950	15.958	3.792	Open Manhole	2400
3.000	o	1200	10	19.800	15.918	2.682	Open Manhole	2400
3.001	o	1200	11	20.600	15.870	3.530	Open Manhole	2400
1.008	o	1200	9	20.800	15.841	3.759	Open Manhole	2700
1.009	o	1200	14	20.800	15.781	3.819	Open Manhole	2400
1.010	o	1200	15	20.400	15.744	3.456	Open Manhole	2400
1.011	o	1200	16	20.250	15.712	3.338	Open Manhole	2400

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	31.658	35.0	2	22.100	20.595	1.280	Open Manhole	1200
1.001	25.239	35.0	3	21.200	19.874	1.101	Open Manhole	1200
1.002	27.865	66.3	4	20.600	19.379	0.921	Open Manhole	1200
1.003	9.503	120.0	5	20.500	19.300	0.900	Open Manhole	250
1.004	8.815	100.2	6	20.700	19.112	1.288	Open Manhole	1800
1.005	7.949	100.6	7	20.600	19.033	1.267	Open Manhole	2400
2.000	23.463	40.0	7	21.250	19.613	1.412	Open Manhole	1200
2.001	15.043	30.0	7	20.600	19.112	1.263	Open Manhole	2400
1.006	36.925	401.4	8	20.950	15.958	3.792	Open Manhole	2400
1.007	46.608	398.4	9	20.800	15.841	3.759	Open Manhole	2700
3.000	19.091	397.7	11	20.600	15.870	3.530	Open Manhole	2400
3.001	11.532	397.7	9	20.800	15.841	3.759	Open Manhole	2700
1.008	23.970	399.5	14	20.800	15.781	3.819	Open Manhole	2400
1.009	14.926	403.4	15	20.400	15.744	3.456	Open Manhole	2400
1.010	12.635	394.8	16	20.250	15.712	3.338	Open Manhole	2400
1.011	13.438	395.2	17	20.100	15.678	3.222	Open Manhole	2700

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.000	o	1200	16	20.750	15.735	3.815	Open Manhole	2400
1.012	o	1350	17	20.100	15.528	3.222	Open Manhole	2700
1.013	o	1350	18	19.500	15.475	2.675	Open Manhole	2400
1.014	o	1350	19	18.700	15.387	1.963	Open Manhole	2400
1.015	o	1350	20	18.800	15.362	2.088	Open Manhole	2400
1.016	o	1350	21	18.950	15.331	2.269	Open Manhole	2400
1.017	o	1350	22	19.100	15.294	2.456	Open Manhole	2400
1.018	o	1350	23	19.300	15.246	2.704	Open Manhole	2400
5.000	o	150	24	29.100	27.600	1.350	Open Manhole	1200
5.001	o	150	25	28.350	26.895	1.305	Open Manhole	1200
5.002	o	150	26	27.400	25.910	1.340	Open Manhole	1200
5.003	o	150	27	27.000	25.500	1.350	Open Manhole	1200
5.004	o	150	28	26.400	25.180	1.070	Open Manhole	1200
5.005	o	150	29	26.100	25.000	0.950	Open Manhole	1200
5.006	o	150	30	26.100	24.949	1.001	Open Manhole	1200
5.007	o	225	31	25.950	24.811	0.914	Open Manhole	1200
5.008	o	225	32	25.500	24.310	0.965	Open Manhole	1200
5.009	o	1200	33	24.600	19.400	4.000	Open Manhole	2400
5.010	o	1200	34	22.250	19.221	1.829	Open Manhole	2400

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.000	22.423	400.4	17	20.100	15.679	3.221	Open Manhole	2700
1.012	21.296	401.8	18	19.500	15.475	2.675	Open Manhole	2400
1.013	35.020	398.0	19	18.700	15.387	1.963	Open Manhole	2400
1.014	10.116	404.6	20	18.800	15.362	2.088	Open Manhole	2400
1.015	12.320	397.4	21	18.950	15.331	2.269	Open Manhole	2400
1.016	14.971	404.6	22	19.100	15.294	2.456	Open Manhole	2400
1.017	19.366	403.5	23	19.300	15.246	2.704	Open Manhole	2400
1.018	9.088	413.1	45	19.200	15.224	2.626	Open Manhole	2700
5.000	16.218	23.0	25	28.350	26.895	1.305	Open Manhole	1200
5.001	19.707	20.0	26	27.400	25.910	1.340	Open Manhole	1200
5.002	16.396	40.0	27	27.000	25.500	1.350	Open Manhole	1200
5.003	14.408	45.0	28	26.400	25.180	1.070	Open Manhole	1200
5.004	7.453	60.0	29	26.100	25.055	0.895	Open Manhole	1200
5.005	5.100	100.0	30	26.100	24.949	1.001	Open Manhole	1200
5.006	6.299	100.0	31	25.950	24.886	0.914	Open Manhole	1200
5.007	38.069	76.0	32	25.500	24.310	0.965	Open Manhole	1200
5.008	60.801	70.0	33	24.600	23.441	0.934	Open Manhole	2400
5.009	71.532	399.6	34	22.250	19.221	1.829	Open Manhole	2400
5.010	12.980	405.6	37	22.100	19.189	1.711	Open Manhole	2700

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
6.000	o	1200	35	22.000	19.275	1.525	Open Manhole	2400
6.001	o	1200	36	22.250	19.227	1.823	Open Manhole	2400
5.011	o	1200	37	22.100	19.189	1.711	Open Manhole	2700
5.012	o	1200	38	22.500	19.146	2.154	Open Manhole	2400
5.013	o	1200	39	22.300	19.072	2.028	Open Manhole	2400
5.014	o	1200	40	21.900	18.933	1.767	Open Manhole	2400
5.015	o	1350	41	21.750	18.747	1.653	Open Manhole	2400
5.016	o	1350	42	21.450	18.622	1.478	Open Manhole	2400
5.017	o	225	43	21.350	18.595	2.530	Open Manhole	2400
5.018	o	1350	44	21.000	15.392	4.258	Open Manhole	2400
1.019	o	1500	45	19.200	15.074	2.626	Open Manhole	2700
1.020	o	300	19	18.300	14.994	3.006	Open Manhole	2700
1.021	\/	-1	Swale	17.000	14.596	1.804	Open Manhole	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
6.000	19.080	397.5	36	22.250	19.227	1.823	Open Manhole	2400
6.001	15.228	400.7	37	22.100	19.189	1.711	Open Manhole	2700
5.011	17.304	402.4	38	22.500	19.146	2.154	Open Manhole	2400
5.012	29.535	399.1	39	22.300	19.072	2.028	Open Manhole	2400
5.013	55.799	401.4	40	21.900	18.933	1.767	Open Manhole	2400
5.014	14.416	400.4	41	21.750	18.897	1.653	Open Manhole	2400
5.015	50.099	400.8	42	21.450	18.622	1.478	Open Manhole	2400
5.016	10.838	401.4	43	21.350	18.595	1.405	Open Manhole	2400
5.017	12.384	60.1	44	21.000	18.389	2.386	Open Manhole	2400
5.018	67.129	400.0	45	19.200	15.224	2.626	Open Manhole	2700
1.019	32.074	400.0	19	18.300	14.994	1.806	Open Manhole	2700
1.020	23.468	239.5	Swale	17.000	14.896	1.804	Open Manhole	1050
1.021	22.662	300.0		15.650	14.520	0.530	Open Manhole	1050

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	5
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.300	Storm Duration (mins)	30
Ratio R	0.378		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 6, DS/PN: 1.005, Volume (m³): 4.6

Unit Reference	MD-SHE-0101-5000-1300-5000
Design Head (m)	1.300
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	19.112
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.300	5.0
Flush-Flo™	0.384	5.0
Kick-Flo®	0.798	4.0
Mean Flow over Head Range	-	4.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	1.200	4.8	3.000	7.4	7.000	11.0
0.200	4.7	1.400	5.2	3.500	7.9	7.500	11.4
0.300	4.9	1.600	5.5	4.000	8.5	8.000	11.8
0.400	5.0	1.800	5.8	4.500	9.0	8.500	12.1
0.500	4.9	2.000	6.1	5.000	9.4	9.000	12.5
0.600	4.8	2.200	6.4	5.500	9.8	9.500	12.8
0.800	4.0	2.400	6.7	6.000	10.3		
1.000	4.4	2.600	6.9	6.500	10.7		

Hydro-Brake® Optimum Manhole: 30, DS/PN: 5.006, Volume (m³): 1.4

Unit Reference	MD-SHE-0096-4000-0900-4000
Design Head (m)	0.900
Design Flow (l/s)	4.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	96
Invert Level (m)	24.949
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Hydro-Brake® Optimum Manhole: 30, DS/PN: 5.006, Volume (m³): 1.4

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	4.0
Flush-Flo™	0.266	4.0
Kick-Flo®	0.578	3.3
Mean Flow over Head Range	-	3.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	1.200	4.6	3.000	7.0	7.000	10.5
0.200	3.9	1.400	4.9	3.500	7.5	7.500	10.8
0.300	4.0	1.600	5.2	4.000	8.0	8.000	11.2
0.400	3.9	1.800	5.5	4.500	8.5	8.500	11.5
0.500	3.7	2.000	5.8	5.000	8.9	9.000	11.8
0.600	3.3	2.200	6.1	5.500	9.3	9.500	12.1
0.800	3.8	2.400	6.3	6.000	9.7		
1.000	4.2	2.600	6.6	6.500	10.1		

Hydro-Brake® Optimum Manhole: 43, DS/PN: 5.017, Volume (m³): 24.5

Unit Reference	MD-SHE-0106-7000-2200-7000
Design Head (m)	2.200
Design Flow (l/s)	7.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	106
Invert Level (m)	18.595
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.200	7.0
Flush-Flo™	0.465	5.9
Kick-Flo®	0.952	4.7
Mean Flow over Head Range	-	5.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	0.300	5.8	0.500	5.9	0.800	5.5
0.200	5.3	0.400	5.9	0.600	5.9	1.000	4.8

Hydro-Brake® Optimum Manhole: 43, DS/PN: 5.017, Volume (m³): 24.5

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
1.200	5.3	2.400	7.3	5.000	10.3	8.000	12.9
1.400	5.7	2.600	7.6	5.500	10.8	8.500	13.3
1.600	6.0	3.000	8.1	6.000	11.2	9.000	13.6
1.800	6.4	3.500	8.7	6.500	11.7	9.500	14.0
2.000	6.7	4.000	9.3	7.000	12.1		
2.200	7.0	4.500	9.8	7.500	12.5		

Hydro-Brake® Optimum Manhole: 19, DS/PN: 1.020, Volume (m³): 70.8

Unit Reference	MD-SHE-0141-1400-3000-1400
Design Head (m)	3.000
Design Flow (l/s)	14.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	141
Invert Level (m)	14.994
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	3.000	14.0
Flush-Flo™	0.620	11.7
Kick-Flo®	1.262	9.3
Mean Flow over Head Range	-	11.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.1	1.200	9.9	3.000	14.0	7.000	21.0
0.200	9.6	1.400	9.8	3.500	15.1	7.500	21.7
0.300	10.8	1.600	10.4	4.000	16.1	8.000	22.4
0.400	11.4	1.800	11.0	4.500	17.0	8.500	23.0
0.500	11.6	2.000	11.5	5.000	17.9	9.000	23.7
0.600	11.7	2.200	12.1	5.500	18.7	9.500	24.3
0.800	11.6	2.400	12.6	6.000	19.5		
1.000	11.1	2.600	13.1	6.500	20.2		

Storage Structures for Storm

Tank or Pond Manhole: 5, DS/PN: 1.004

Invert Level (m) 19.200

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	38.0	1.300	194.3

Tank or Pond Manhole: 29, DS/PN: 5.005

Invert Level (m) 25.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	56.0	1.100	194.0

Tank or Pond Manhole: 42, DS/PN: 5.016

Invert Level (m) 20.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	163.7	0.600	357.9

Cellular Storage Manhole: 45, DS/PN: 1.019

Invert Level (m) 16.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	156.0	0.0	1.201	0.0	0.0
1.200	156.0	0.0			

Cellular Storage Manhole: 19, DS/PN: 1.020

Invert Level (m) 16.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	90.0	0.0	1.201	0.0	0.0
1.200	90.0	0.0			

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	5
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.378
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.300	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880
Return Period(s) (years)	100
Climate Change (%)	45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+45%					21.584
1.001	2	15 Winter	100	+45%	100/15 Summer				20.888
1.002	3	15 Winter	100	+45%	100/15 Summer				20.548
1.003	4	180 Winter	100	+45%	100/15 Summer				20.479
1.004	5	180 Winter	100	+45%	100/15 Summer				20.476
1.005	6	180 Winter	100	+45%	100/15 Summer				20.473
2.000	6	15 Winter	100	+45%					20.313
2.001	7	15 Summer	100	+45%					19.784
1.006	7	1440 Winter	100	+45%	100/360 Winter				18.081
1.007	8	1440 Winter	100	+45%	100/240 Winter				18.081
3.000	10	1440 Winter	100	+45%	100/240 Winter				18.081
3.001	11	1440 Winter	100	+45%	100/240 Winter				18.081
1.008	9	1440 Winter	100	+45%	100/180 Winter				18.082
1.009	14	1440 Winter	100	+45%	100/180 Winter				18.082
1.010	15	1440 Winter	100	+45%	100/180 Winter				18.082
1.011	16	1440 Winter	100	+45%	100/180 Winter				18.082
4.000	16	1440 Winter	100	+45%	100/180 Winter				18.082
1.012	17	1440 Winter	100	+45%	100/120 Winter				18.082

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.141	0.000	0.30			24.7	OK	
1.001	2	0.068	0.000	0.74			60.6	SURCHARGED	
1.002	3	0.449	0.000	0.92			113.6	SURCHARGED	
1.003	4	0.800	0.000	0.55			38.5	FLOOD RISK	
1.004	5	0.976	0.000	0.07			5.0	FLOOD RISK	
1.005	6	1.061	0.000	0.07			5.1	FLOOD RISK	
2.000	6	-0.112	0.000	0.51			38.3	OK	
2.001	7	-0.054	0.000	0.93			77.9	OK	
1.006	7	0.831	0.000	0.01			8.9	SURCHARGED	
1.007	8	0.923	0.000	0.01			9.7	SURCHARGED	
3.000	10	0.963	0.000	0.00			4.6	SURCHARGED	
3.001	11	1.011	0.000	0.00			3.5	SURCHARGED	
1.008	9	1.041	0.000	0.01			15.5	SURCHARGED	
1.009	14	1.101	0.000	0.02			15.0	SURCHARGED	
1.010	15	1.138	0.000	0.02			14.4	SURCHARGED	
1.011	16	1.170	0.000	0.02			15.5	SURCHARGED	
4.000	16	1.147	0.000	0.00			3.6	SURCHARGED	
1.012	17	1.204	0.000	0.01			18.0	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.013	18	1440 Winter	100	+45%	100/120 Winter				18.082
1.014	19	1440 Winter	100	+45%	100/120 Summer				18.082
1.015	20	1440 Winter	100	+45%	100/120 Summer				18.082
1.016	21	1440 Winter	100	+45%	100/120 Summer				18.082
1.017	22	1440 Winter	100	+45%	100/60 Winter				18.082
1.018	23	1440 Winter	100	+45%	100/60 Winter				18.082
5.000	24	15 Winter	100	+45%					27.674
5.001	25	15 Winter	100	+45%	100/15 Summer				27.436
5.002	26	15 Winter	100	+45%	100/15 Summer				27.351
5.003	27	15 Winter	100	+45%	100/15 Summer				26.655
5.004	28	15 Winter	100	+45%	100/15 Summer				25.740
5.005	29	60 Winter	100	+45%	100/15 Summer				25.414
5.006	30	60 Winter	100	+45%	100/15 Summer				25.407
5.007	31	15 Winter	100	+45%	100/15 Summer				25.119
5.008	32	15 Winter	100	+45%	100/15 Summer				24.970
5.009	33	480 Winter	100	+45%	100/120 Summer				21.302
5.010	34	480 Winter	100	+45%	100/60 Winter				21.302
6.000	35	480 Winter	100	+45%	100/120 Summer				21.302
6.001	36	480 Winter	100	+45%	100/60 Winter				21.302
5.011	37	480 Winter	100	+45%	100/60 Winter				21.302
5.012	38	480 Winter	100	+45%	100/60 Winter				21.302
5.013	39	480 Winter	100	+45%	100/60 Winter				21.302
5.014	40	480 Winter	100	+45%	100/60 Summer				21.302
5.015	41	480 Winter	100	+45%	100/60 Summer				21.302
5.016	42	480 Winter	100	+45%	100/30 Winter				21.302
5.017	43	480 Winter	100	+45%	100/15 Summer				21.319
5.018	44	1440 Winter	100	+45%	100/120 Summer				18.082
1.019	45	1440 Winter	100	+45%	100/60 Summer				18.082
1.020	19	1440 Winter	100	+45%	100/15 Summer				18.082
1.021	Swale	1440 Winter	100	+45%					14.662

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.013	18	1.257	0.000	0.01			18.4	SURCHARGED	
1.014	19	1.345	0.000	0.02			20.6	SURCHARGED	
1.015	20	1.370	0.000	0.02			20.4	SURCHARGED	
1.016	21	1.401	0.000	0.02			19.5	SURCHARGED	
1.017	22	1.438	0.000	0.01			21.0	SURCHARGED	
1.018	23	1.486	0.000	0.02			20.4	SURCHARGED	
5.000	24	-0.076	0.000	0.49			16.9	OK	
5.001	25	0.391	0.000	0.41			15.3	SURCHARGED	
5.002	26	1.291	0.000	1.29			33.7	FLOOD RISK	
5.003	27	1.005	0.000	1.69			41.3	SURCHARGED	
5.004	28	0.410	0.000	2.07			41.0	SURCHARGED	
5.005	29	0.264	0.000	0.30			4.3	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
5.006	30	0.308	0.000	0.27			4.0	SURCHARGED	
5.007	31	0.083	0.000	0.62			35.3	SURCHARGED	
5.008	32	0.435	0.000	1.23			73.6	SURCHARGED	
5.009	33	0.702	0.000	0.01			23.9	SURCHARGED	
5.010	34	0.881	0.000	0.04			39.7	SURCHARGED	
6.000	35	0.827	0.000	0.01			10.4	SURCHARGED	
6.001	36	0.875	0.000	0.03			28.7	SURCHARGED	
5.011	37	0.913	0.000	0.09			94.8	SURCHARGED	
5.012	38	0.956	0.000	0.07			99.1	SURCHARGED	
5.013	39	1.030	0.000	0.05			82.3	SURCHARGED	
5.014	40	1.169	0.000	0.07			64.7	SURCHARGED	
5.015	41	1.205	0.000	0.02			39.7	SURCHARGED	
5.016	42	1.330	0.000	0.02			21.6	FLOOD RISK	
5.017	43	2.499	0.000	0.13			7.7	FLOOD RISK	
5.018	44	1.340	0.000	0.00			8.8	SURCHARGED	
1.019	45	1.508	0.000	0.01		1067	20.8	SURCHARGED	
1.020	19	2.788	0.000	0.22		1026	14.2	FLOOD RISK	
1.021	Swale	-0.534	0.000	0.01			14.2	OK	

APPENDIX J

Envirocheck
Flood Date

IronsideFarrar
EnvironmentalConsultants

EA/NRW Surface Water 1000 Year Return Depth Map (1:10,000)

General

Specified Site | Specified Buffer(s) | X Bearing Reference Point

Surface Water Depth

- 0 - 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- 0.90 - 1.20m
- > 1.20m

Contours (height in metres)

Standard Contour | Master Contour | Spot Height (e.g. 167.8)

MLW Mean Low Water

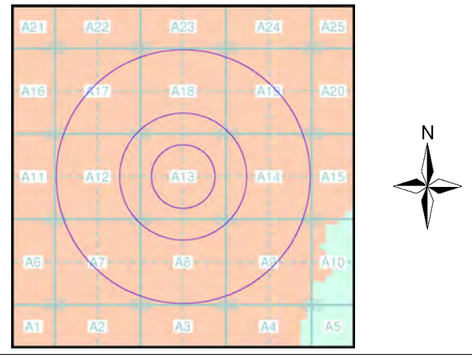
MHW Mean High Water

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



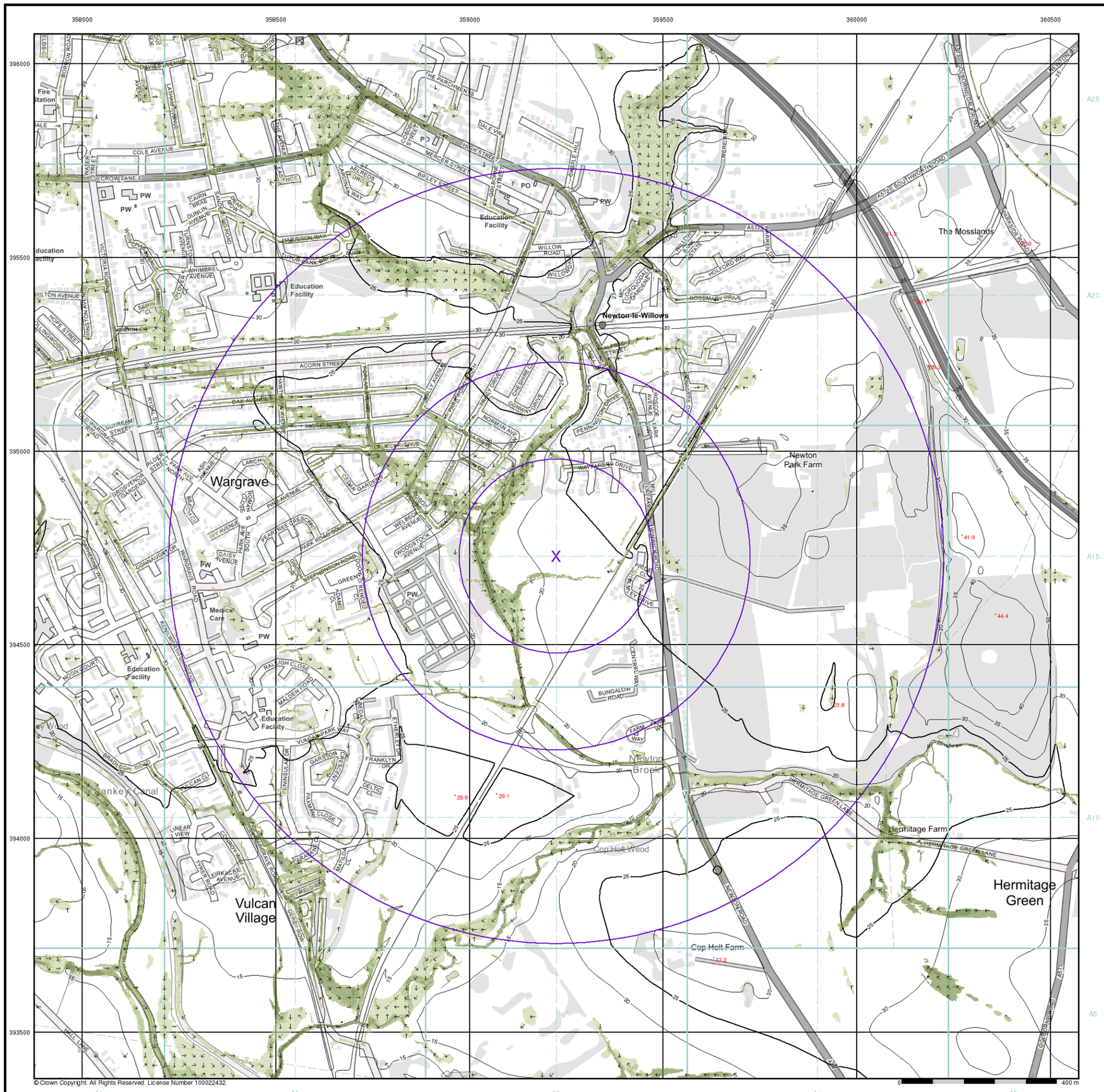
Order Details

Order Number:	275383517_1_1
Customer Ref:	30488
National Grid Reference:	359220, 394730
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 359250, 394750

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



IronsideFarrar
EnvironmentalConsultants

EA/NRW Surface Water 1000 Year Return Velocity and Flow Direction Map (1:10,000)

General

Specified Site | Specified Buffer(s) | X Bearing Reference Point

Surface Water Velocity and Direction

- 0.00 - 0.25m/s
- 0.25 - 0.50m/s
- 0.50 - 1.00m/s
- 1.00 - 2.00m/s
- > 2.00m/s

Flow Direction at maximum velocity

Contours (height in metres)

Standard Contour | Master Contour | Spot Height *167.8

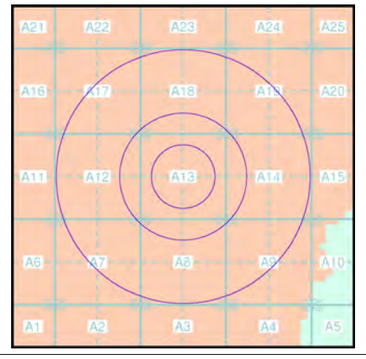
MLW Mean Low Water
MHW Mean High Water

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



Order Details

Order Number:	275383517_1_1
Customer Ref:	30488
National Grid Reference:	359220, 394730
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 359250, 394750

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

IronsideFarrar
EnvironmentalConsultants

EA/NRW Surface Water 1000 Year Return Hazard Rating Map (1:10,000)

General

Specified Site | Specified Buffer(s) | X Bearing Reference Point

Surface Water Hazard Rating

- Low (0.5 – 0.75)
- Moderate (0.75 – 1.25)
- Significant (1.25 – 2.0)
- Extreme (>2.0)

Contours (height in metres)

Standard Contour | Master Contour | Spot Height (*167.8)

MLW Mean Low Water

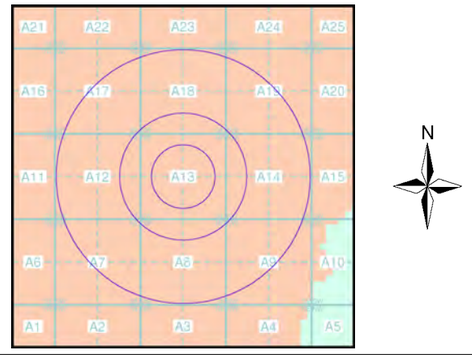
MHW Mean High Water

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



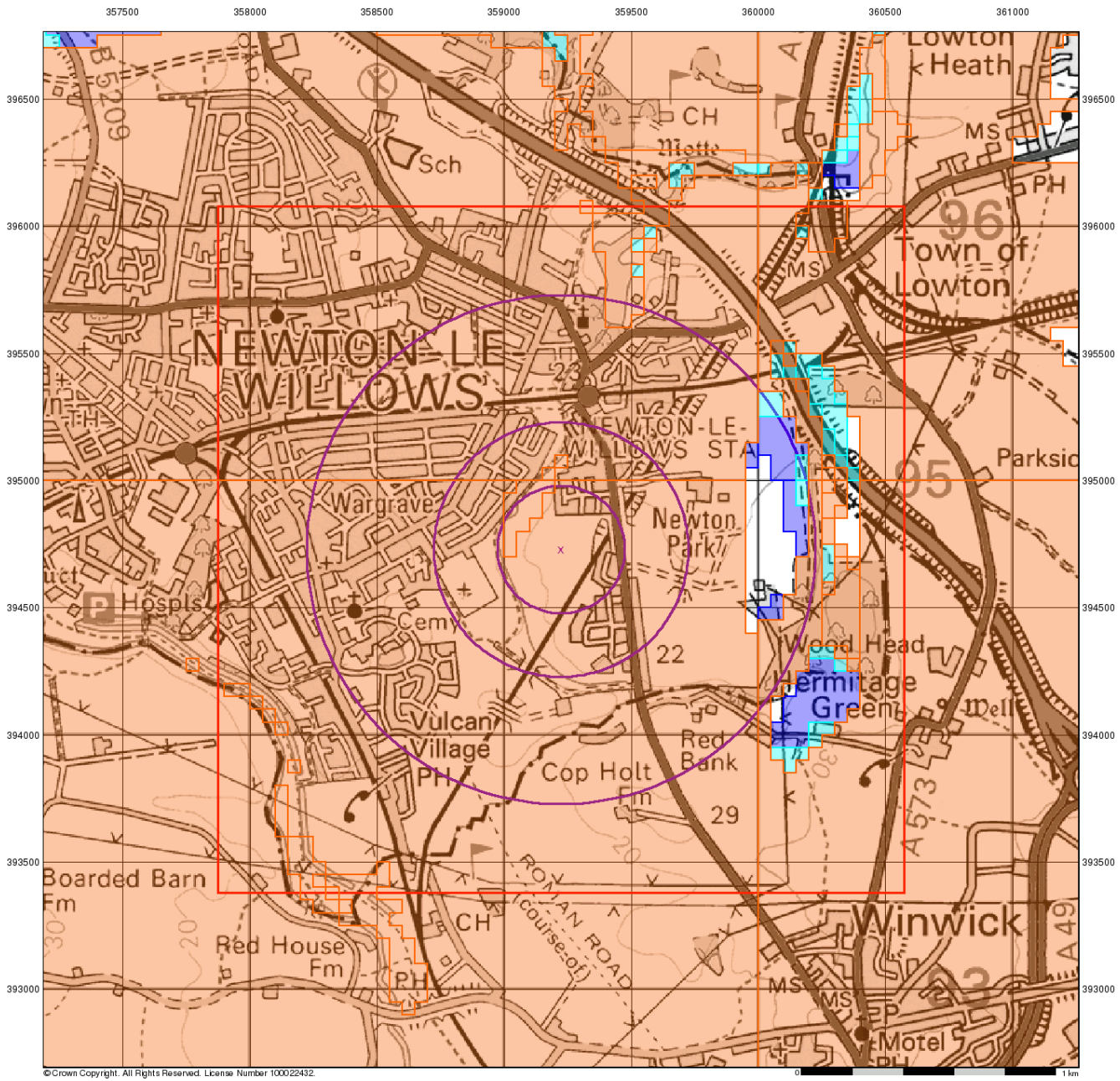
Order Details

Order Number:	275383517_1_1
Customer Ref:	30488
National Grid Reference:	359220, 394730
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 359250, 394750

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



IronsideFarrar
EnvironmentalConsultants

BGS Flood Data (1:50,000)

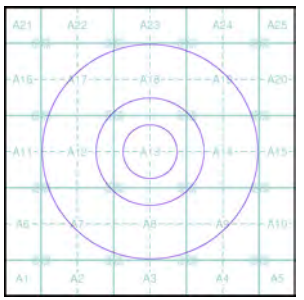
General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

BGS Groundwater Flooding Susceptibility

- Potential for Groundwater Flooding to Occur at Surface
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Limited Potential for Groundwater Flooding to Occur

BGS Flood Data Map - Slice A



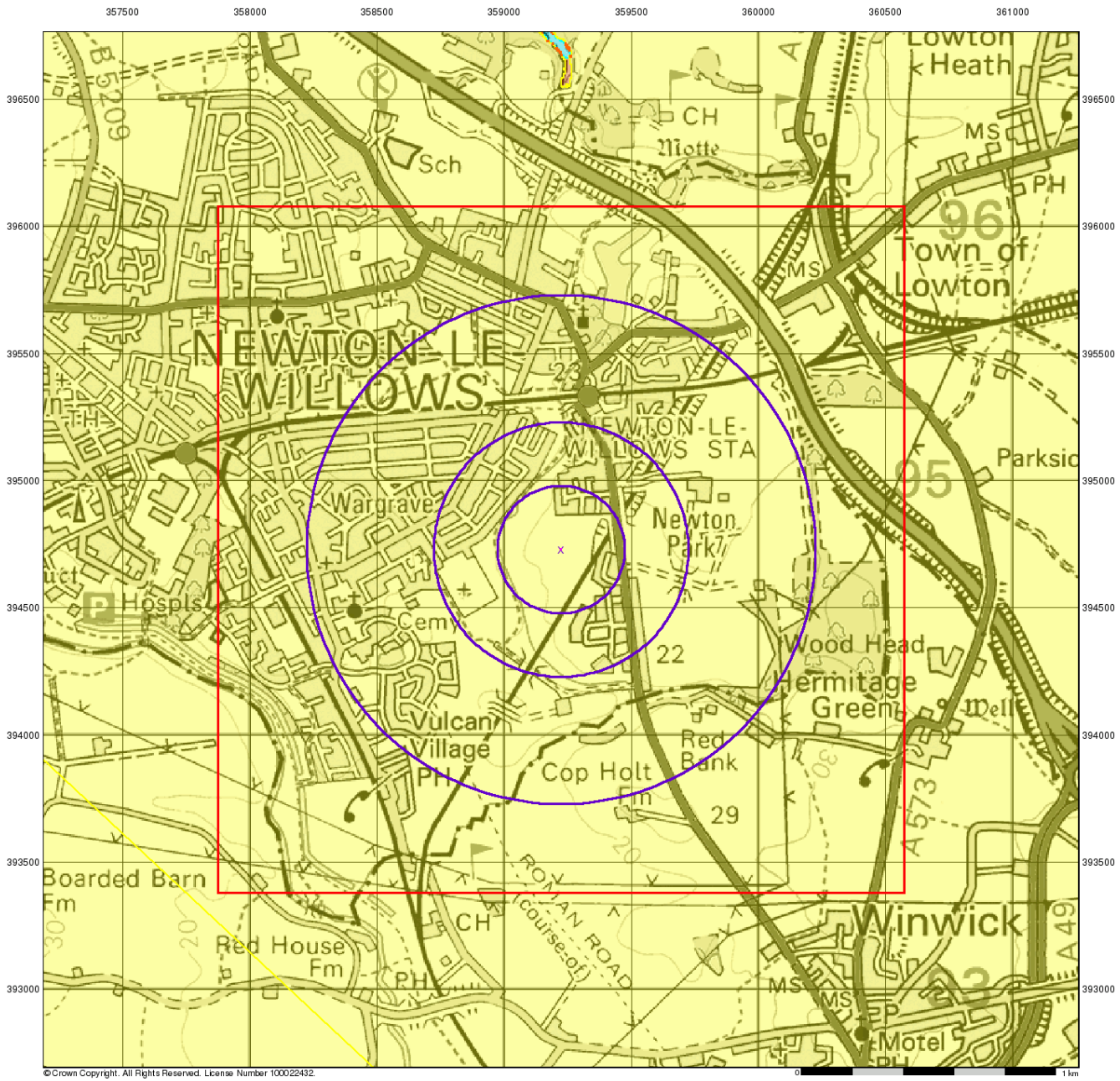
Order Details

Order Number:	275383517_1_1
Customer Ref:	30488
National Grid Reference:	359220, 394730
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 359250, 394750

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



IronsideFarrar
EnvironmentalConsultants

GeoSmart Information Groundwater Flood Map (1:50,000)

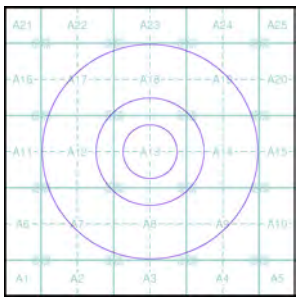
General

Specified Site
Specified Buffer(s)
Bearing Reference Point
Slice

GeoSmart Information Groundwater Flooding Risk

High Risk
Moderate Risk
Low Risk
Negligible Risk

GeoSmart Information Groundwater Flood Map - Slice A



Order Details

Order Number:	275383517_1_1
Customer Ref:	30488
National Grid Reference:	359220, 394730
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 359250, 394750

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