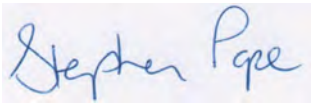
Flood Risk Assessment & Drainage Strategy

Spout Farm
Longridge,Preston

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

30429/SRG
March 2020

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

CONTENTS

APPENDICES

SPOUT FARM, LONGRIDGE
FLOOD RISK & DRAINAGE ASSESSMENT

1.0 Introduction

Create Homes intend to submit a Planning Application for a residential development at a site off Preston Road, Longridge.

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 site extends to approximately 1.757ha and is located to the east of Preston Road, Longridge. The site is at the south of the built-up area of Longridge approximately 8.0km to the north east of Preston City centre and the grid reference of the site is SD 60255 3630; the Location and Site plan are included in Appendices A and B.

Vehicular access to the site is gained directly from Preston Road on the western boundary which is tree lined; access is also provided to the existing Spout Farm, now a private house and restaurant with car park that is separated from the site by a band of trees. From the gravelled car park, access is gained to a tree care business along the eastern boundary.

Beyond the eastern boundary, there are the remains of Alston Reservoir No.3, a former United Utilities reservoir that has been drained. Alston Reservoir No.2 is located to the north of the northern boundary; the site is separated from the reservoir site by a stone wall lined with trees. An existing water main easement runs along the eastern boundary.

The main site area is open, rough grass that is surrounded by tree belts; there is a general fall from north to south across the site.

The site access off Preston Road 84.06m is at 84.89m and the southern boundary falls to 83.858m before rising to the east to 84.40m at the south east corner. Levels rise gradually along the eastern boundary to 85.58m at the north east corner. The highest point on the site, at 86.68m is at the mid-point of the northern boundary which then falls to 85.67m in the north west corner adjacent to Preston Road; along this boundary there is a shallow, dry ditch.

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 proposals for the land off Preston Road will comprise a residential development of up to 34 units with associated access, parking, and landscaping; vehicular access will be taken from Preston Road that will also serve the existing house and restaurant car park to the south 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) 2019 sets out the Government's policy on meeting the challenges of climate change, flooding and coastal change. Paragraph numbers 148 and 149 of the NPPF state that:

"The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.

Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure."

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

Based on the location of the site in Flood Zone 1 all development (including 'More Vulnerable') is deemed appropriate according to NPPF and NPPG, therefore the development is appropriately situated and the Sequential Test is not required.

4.2 Exception Test

NPPF classifies the development as 'More Vulnerable', however as the site is located within Flood Zone 1 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 is included as Appendix E.

It can be seen from the map that the site is in Flood Zone 1 with a chance of flooding of less than 0.1% (or 1 in 1000). The nearest open watercourse is a tributary of Savick Brook, some 150m to the south west of the site.

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

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 southerly direction towards the southern boundary but the Alston Reservoir No.2 is located beyond the northern boundary. There is a short embankment down from the reservoir to the northern boundary.

There is therefore some potential for run-off from this embankment onto the site.

Reference to EA Surface Water Return depth map included in Appendix J indicates very little surface water flooding on the site in all events up to the 1 in 1000-year return period event. The velocity and flow direction map indicate a slight flow in an easterly direction at low velocities and the overall 1000-year hazard rating map indicates the site to be in the low rating for potential surface water flooding.

The site is therefore not considered to be at significant risk of flooding from run-off from adjacent land but it is recommended that a land drain is installed along the northern boundary to intercept any overland flows. 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.

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. 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 previously by WML Consulting and reference should be made to their report 8517G-WML-00-XX RP-G-0001 dated March 2019 for the full details but in terms of groundwater the report confirmed:

Groundwater

6.13 Groundwater seepages were encountered during the formation of WS08 and WS17 in the central and south-eastern sections of the site at depths of 0.50m and 0.20mbgl respectively. This was observed to within the topsoil and made ground above the relatively impermeable cohesive till.

6.14 A groundwater seepage was also encountered during the formation of WS07 in the central part of the site, presumably within a more granular horizon in the glacial till at a depth of 2.50mbgl.

6.15 During the initial monitoring visit, groundwater was encountered at a depth of 0.60mbgl within WS01 with the remaining standpipes waterlogged due to a period of heavy rainfall. During the second monitoring visit groundwater was recorded at depths of between 0.58m and 2.40mbgl. However, this is likely to be due to infiltration of surface water and water perched within the saturated topsoil and therefore not representative of the true phreatic groundwater levels across the site.

6.16 It should be appreciated that the groundwater monitoring described above has been undertaken during a very short period of time. Significant variations in the long term groundwater regime may occur at other times, particularly with prolonged, extreme weather conditions, and that no account can be taken of such in this report.

Finished levels on the development site will generally be higher than at present and it is not considered to be at significant 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 are no public sewers crossing the site itself or immediately adjacent.

The site is not considered to be at significant risk of flooding from sewers but the drainage proposals for the site will need to be agreed with United Utilities and Lancashire CC 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 site is within the area at risk of flooding from reservoirs. Alston Reservoir No.2 is located immediately to the north of the site at levels above the site.

If a location is at risk, flooding from reservoirs is extremely unlikely. There has been no loss of life in the UK from reservoir flooding since 1925. As detailed previously, United Utilities maintain the reservoir and will undertake regular inspections as such the risk of failure is not considered high.

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 in Appendix G and their response is awaited. The normal requirement is to follow the hierarchy of surface water drainage.

Therefore, in relation to the surface water hierarchy:

- Ground conditions from the previous ground conditions report are as detailed in the extract below:

Stratigraphy

6.1 Ground conditions encountered during the intrusive investigation generally comprise a surface layer of topsoil and mixed cohesive and granular made ground in the north-eastern and eastern sections, these being underlain by cohesive glacial till to a maximum proven depth of 5.00 metres below ground level (mbgl).

Topsoil

6.2 Topsoil was encountered across the majority of the site (namely WS01 to WS12) from ground level to depths of between 0.30m and 0.55mbgl.

6.3 The topsoil was surfaced with turf and generally comprised dark brown, slightly silty, sandy clay with rootlets.

Made Ground

6.4 Made ground was only encountered within WS13 to WS18 located in the north-eastern and eastern sections of the site, from ground level to depths of between 0.20m and 0.45mbgl and forming the compacted granular compound of the existing storage area.

6.5 The made ground generally comprised brownish grey, variably sandy gravel with a low to medium cobble content with the exception of WS13, where the surface was noted to be reworked natural soils comprising brownish grey, slightly sandy, gravelly clay.

6.6 Gravel sized particles included brick, sandstone, concrete, asphalt and locally wood. Cobble sized fragments included brick, concrete and asphalt.

Glacial Till

6.7 Within all of the exploratory holes, glacial till was encountered beneath the topsoil or made ground at depths of between 0.20m and 0.55mbgl and extending to a maximum proven depth of 5.00mbgl.

6.8 The till generally comprised firm to stiff, brown and occasionally grey mottled, slightly sandy, slightly gravelly clay. Gravel sized particles include sandstone and siltstone.

6.9 Within WS12 in the central section of the site, a soft, light grey, slightly gravelly, sandy clay was encountered at the base of the topsoil, extending from 0.40m to 1.00mbgl.

6.10 SPT 'N' values within the cohesive glacial till ranged between 9 and 21, indicating a generally firm and locally stiff consistency.

6.11 Natural moisture contents of between 15% and 24% were recorded within the glacial till. Liquid Limits from 30% to 46% together with corresponding Plasticity Indices between 15% and 23% indicate clay of low but generally intermediate plasticity and low to medium volume change potential.

- The report therefore concluded the site is not suitable for the use of infiltration techniques:

Drainage and Soakaways

7.19 In consideration of the site being underlain by relatively impermeable cohesive glacial till at shallow depth, soakaways are not considered to be a feasible drainage option for the site.

- Previous investigations indicate an ordinary watercourse commencing within the site and running in a southerly direction through Spout Farm and crossing Preston Road approximately 100m to the south of the site. A connection to the existing 225mm dia. culverted watercourse is considered the most practical location for the discharge of surface water from the site in accordance with the hierarchy

The site is considered greenfield; the IoH 124 method has been used to predict the run-off from the development site; the existing Qbar flow has been calculated as 12.4l/s and the Q1, Q30 and Q100 flows as 10.8l/s; 21.0l/s and 25.7l/s respectively, 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. Underground attenuation has been included in the system in the form of oversized pipes and off-line cellular storage with a complex flow control introduced to limit the flows in all events up to and including the 100 year + 40% climate change allowance event to the equivalent of the Q1, Q30 and Q100 greenfield flows.

The final details of the proposed drainage system will be developed and discussed with Lancashire CC LLFA and United Utilities.

Foul drainage will be connected to a new pumping station within the site and then discharged via a rising main to the existing foul sewer at manhole 1302 in Preston Road.

7.0 Conclusions

- 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 although it is within the potential extent of flooding from a reservoir. A cut off drain should be installed along the northern boundary of the site to prevent possible run-off from the adjacent reservoir site.

- 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 in the 30-year event and no flooding to property in the 100-year event with a 40% allowance for future climate change.

- Foul drainage may be connected to the existing foul public sewer network via a new pumping station and rising main.

- Infiltration suds techniques have not been included in the drainage layout due to the underlying ground conditions.

8.0 Recommendations

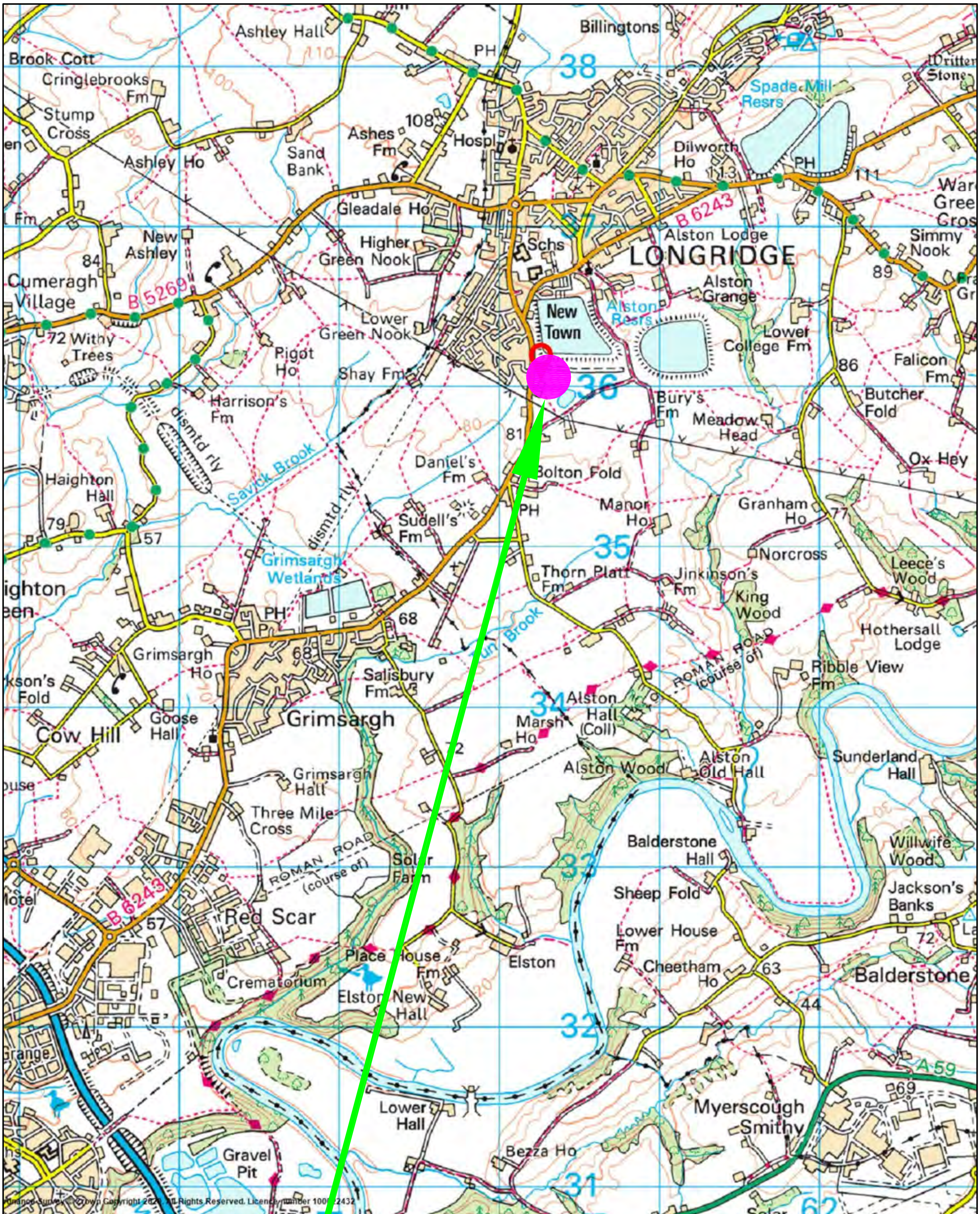
- Attenuation should be included in the proposed drainage to achieve the agreed discharge rates; the design should include all events up to and including the 100 year plus 40% climate change allowance.

- Finished levels on the site will ensure there is an emergency overland flow route through the site to the southern 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.

APPENDIX A

Site Location Plan



Site Location

North Point	Project: Spout Farm Longridge, Preston	IronsideFarrar Environmental Consultants
Quality Ass. UKAS 005 Quality Assurance ISO 9001:2008 SGS Certificate GB02/54539	Client: Create Homes	Environmental Planners, Civil Engineers, Landscape Architects, Graphic Design
	Title: Site Location Plan	3 Worsley Court MANCHESTER M28 3N… Tel. 0161 703 8801 Fax. 0161 703 827… manchester@ironsidefarrar.co… EDINBURGH BELLSHILL
Original Size: A4	Copyright Acknowledgement: Ordnance Survey© ©Crown Copyright. Drawn: KD Checked By: SRG	Drawing No.: 30429/App A Revision

APPENDIX B

Existing Site Plan

FB
Valve Tower
Valve Shaft
Sloping masonry
86.5m
85.6m
Track
Straining
Chambers
Grimbledeston
Farm
Meadowcroft
B 6243
FB
Valve Tower
5300
Alston Reservoir
Number Three
83.2m
Spout
Farm
Issues
Path (um)
Charnley

KEY

SITE BOUNDARY

North Point

Quality Ass.

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

Project
Spout Farm
Longridge,Preston

Client
Create Homes

Title
Existing Site Plan

Original Size
A3

Copyright Acknowledgement
Ordnace Survey©
©Crown Copyright.
All rights reserved.
Licence No. AL100017966.

Drawn **KD**
Checked By **SRG**
Date **MAr 20**
Scale **1:750**

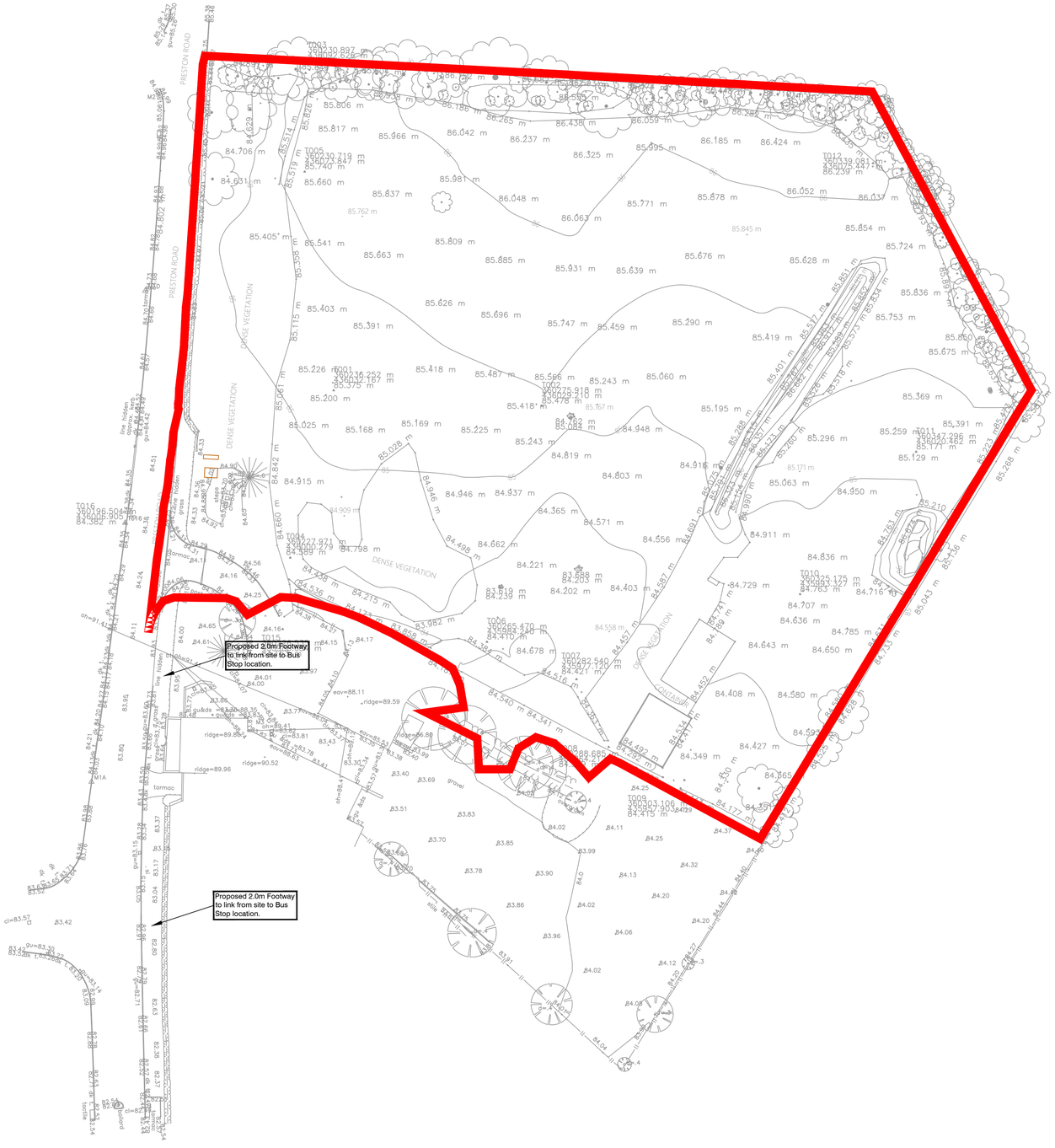
IronsideFarrar
EnvironmentalConsultants
EnvironmentalPlanners
CivilEngineers
LandscapeArchitects
GraphicDesign
3 Worsley Court **MANCHESTER** M28 3NJ
Tel. 0161 703 8801 Fax. 0161 703 8279
manchester@ironsidefarrar.com
EDINBURGH **BELLSHILL**

Drawing No.
30429/App B

Revision

APPENDIX C

Topographical Survey



North Point

Quality Ass.

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

Project
Spout Farm
Longridge, Preston

Client
Create Homes

Title
Topographical Survey

Original Size
A1

Drawn: KD
Checked By: SG
Date: Mar 20
Scale: 1:500

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.: 30429/App C
Revision:

APPENDIX D

Aerial & Site Photographs

KEY

SITE BOUNDARY

North Point

Quality Ass.

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

Project
Spout Farm
Longridge, Preston

Client
Create Homes

Title
Aerial
Photograph

Original Size
A3

Drawn
KD

Checked By
SRG

Date

Scale

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.
30429/App D

Revision

Preston Road to the North.

Preston Road to the South.

Western boundary to the North.

View South along Western boundary.

Northern boundary to the East .

General view South from Northern boundary.

Preston road North from culvert location.

APPENDIX E

Environment Agency
Flood Risk Map

Flood map for planning

Your reference	Location (easting/northing)	Created
30429	**360290/436021**	**20 Mar 2020 17:23**

Your selected location is in flood zone 1, an area with a low probability of flooding.

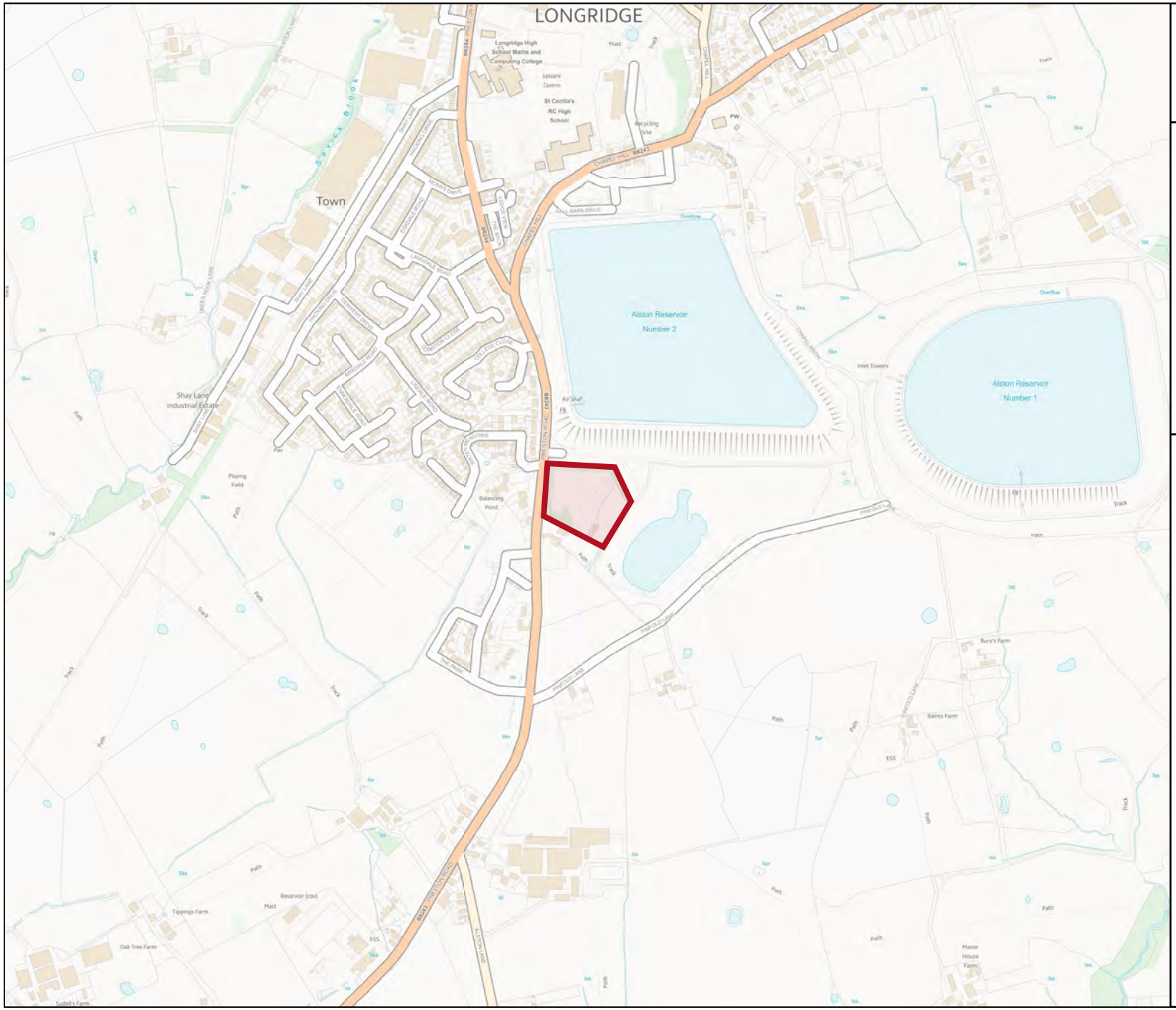
This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn’t include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
30429

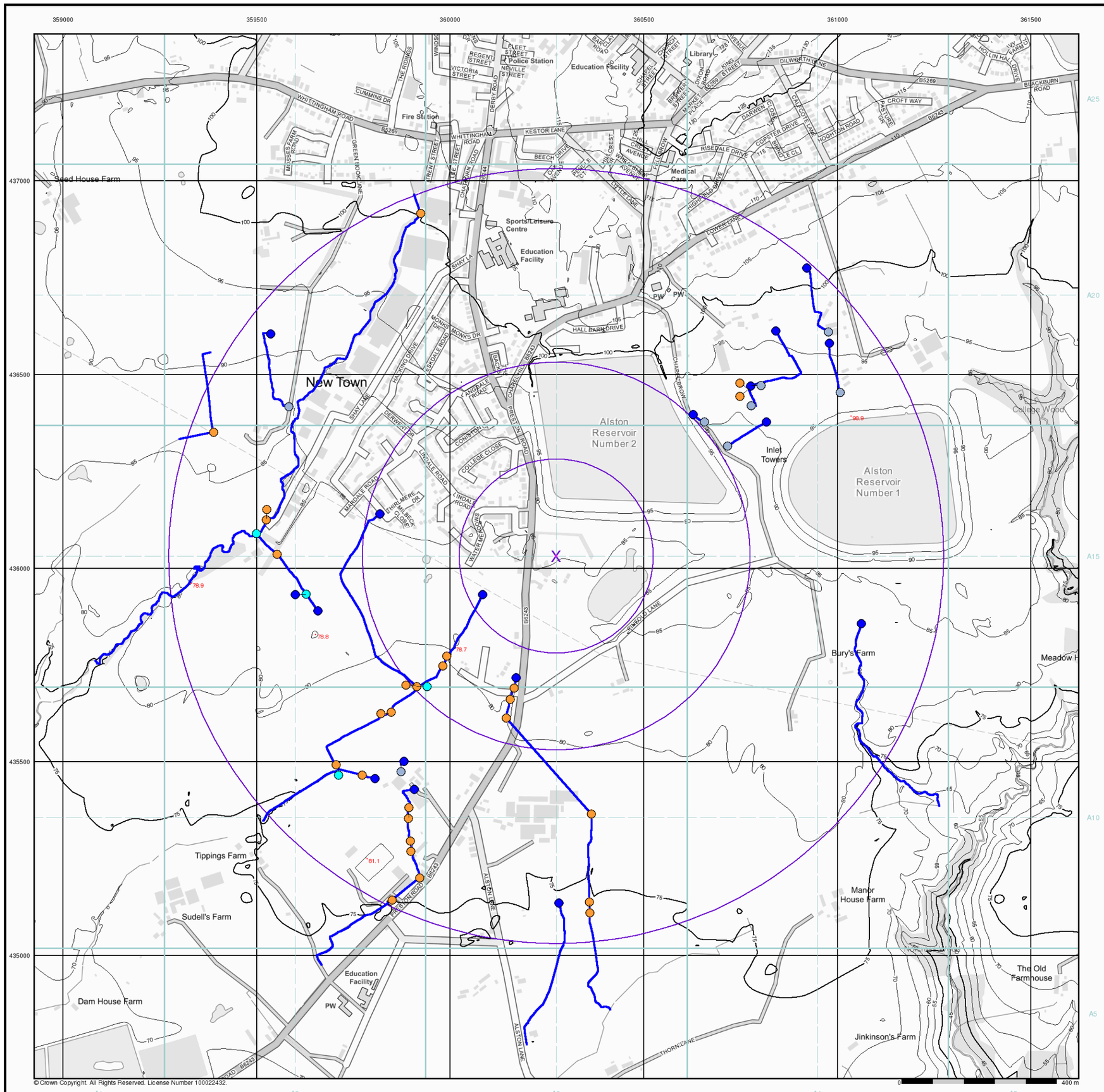
Location (easting/northing)
360290/436021

Scale
1:10000

Created
20 Mar 2020 17:23

- Selected area
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 100 200 300m



IronsideFarrar
EnvironmentalConsultants

OS Water Network Lines Map (1:10,000)

General

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

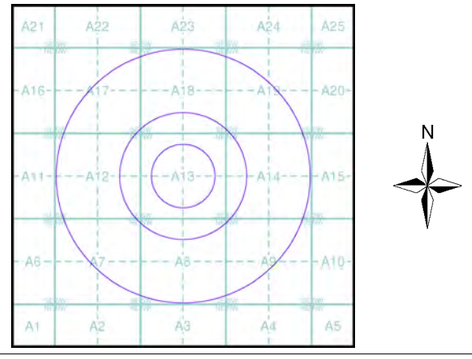
OS Water Network Data

- Canal
- Reservoir
- Foreshore
- Marsh
- Tidal River
- Inland River
- Drain
- Other
- Lake
- Transfer
- Lock Or Flight Of Locks
- Sea
- Junction
- Outlet
- Pseudo
- Source
- Other

Contours (height in meters)

Standard Contour 105
Master Contour 100 95
Spot Height 167.3
MLW Mean Low Water
MHW Mean High Water

OS Water Network Map - Slice A



Order Details

Order Number:	239051132_1_1
Customer Ref:	30429
National Grid Reference:	360270, 436030
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 360260, 436040

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

APPENDIX F

Existing Sewer Records

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
0205		SW	0	450			CO	26.86545	
9108	86.4	SW	84.39	450			CO	14.82112	1 in 148
1106	86.3	FO	84	150			VC	26.94798	1 in 79
9001	85.91	FO	84	150			VC	84.35504	1 in 121
0105	85.36	SW	82.25	375			CO	13.60467	1 in 151
0025		SW	83.9	150			UN	6.21471	1 in 7
0107	85.52	SW	82.08	375			CO	13.67405	1 in 171
9113		FO	0	150			VC	23.37187	
0002	84.29	SW	81.6	375			CO	24.74336	1 in 130
1110		FO	84.5	150			VC	12.71907	1 in 67
0012	84.18	FO	82.82	150			VC	19.60631	1 in 49
9901	83.37	SW	80.82	225			VC	80.97823	1 in 85
0101	86.48	SW	84.64	450			CO	46.0734	1 in 768
1305	89.24	FO	86.92	375			CO	50.88032	1 in 18
9110		FO	0	150			VC	19.39265	
0021		FO	84	150			VC	6.754902	1 in 10
1005		SW	84.2	150			UN	5.230168	1 in 5
0024		SW	83.25	150			UN	6.100568	1 in 5
1112		FO	84.9	150			VC	11.78971	1 in 10
1207		OV	0	150			VC	16.7375	
0113	85.24	FO	83.01	150			VC	20.3319	1 in 145
1102	85.95	SW	82.98	300			VC	17.78503	1 in 148
0110	85.38	FO	83.28	150			VC	14.74462	1 in 147
0201	86.37	FO	83.83	375			CO	93.1225	
9202	87.09	SW	83.93	450			CO	53.30708	1 in 888
9111	86.59	SW	84.47	450			CO	19.2489	1 in 275
0004	85.04	SW	83	225			VC	40.02792	1 in 45
0007	83.35	SW	81.22	225			VC	80.17077	1 in 200
0006	83.74	SW	81.31	225			VC	16.88367	1 in 188
1108	85.2	FO	83.43	150			VC	23.01965	1 in 153
0015	83.34	FO	81.86	150			VC	16.74976	1 in 93
0106	85.6	SW	82.16	375			CO	11.53571	1 in 144
0013	84.94	FO	83.3	150			VC	33.15149	1 in 69
9105	86.78	SW	84.25	450			CO	32.80775	
1115		SW	84.6	150			UN	15.5147	1 in 9
1114		FO	83.6	150			VC	9.295042	1 in 55
9109	86.21	SW	85.1	225			VC	18.13362	1 in 38
0104	85.95	SW	85.17	225			VC	10.71322	1 in 40
9204		FO		150			VC	21.87768	
9902	81.84	SW	79.87	225			VC	49.63046	1 in 146
1002	85.3	SW	83.5	225			VC	18.11159	1 in 62
0115		FO	84.6	150			VC	6.799402	1 in 5
0118		SW	82.5	150			UN	6.08203	1 in 24
0117		FO	84.3	150			VC	10.09341	1 in 16
1304	89.48	SW	84.93	300			VC	52.59959	1 in 159
0119		SW	84	150			UN	6.790212	1 in 4
1004		SW	84.2	150			UN	7.421395	1 in 11
0301	86.22	FO	83.97	375			CO	90.21049	1 in 1002
1209		CO		100			VC	20.43653	
0018		FO	82.9	150			VC	6.530794	1 in 6
0014	85.5	FO	83.67	150			VC	26.88844	1 in 73
1303	89.6	FO	87.09	375			CO	14.25272	1 in 89
9106		FO	0	150			VC	32.61232	
0108	85.29	SW	82	375			CO	17.92842	1 in 149
1109		FO		150			VC	11.57696	
9107		FO	0	150			VC	14.16037	
0001	84.67	SW	81.75	375			CO	22.05901	1 in 147
1309	88.14	SW	85.23	300			VC	36.69671	1 in 153
1104	85.76	SW	82.67	375			CO	51.09087	1 in 122
0116		FO	84.5	150			VC	11.98071	1 in 5
1103	86.31	SW	82.86	300			VC	29.33313	1 in 154
0112	85.46	FO	83.1	150			VC	12.62464	1 in 140
0202		FO	0	150			VC	40.28188	
0019		FO	82.95	150			VC	5.457321	1 in 42
0103	86.21	FO	85.53	150			VC	24.16187	
0102		FO	0	150			VC	16.63233	
0026		SW	83.25	150			UN	5.851665	1 in 23
1105	85.9	FO	84.31	150			VC	22.22536	1 in 72
9201	87.31	SW	85.85	225			VC	21.19596	1 in 68
1113		FO	84.6	150			VC	10.69422	1 in 9
0109	84.96	SW	81.88	375			CO	18.52637	1 in 143
1101	85.79	SW	83.06	300			VC	11.9929	1 in 150
9203	87.01	SW	85.49	300			CO	80.78162	1 in 119
0005	84.13	SW	82.12	300			VC	19.98736	1 in 154
0114	84.94	FO	82.87	150			VC	17.55865	1 in 160
1116		SW	84.8	150			UN	7.039237	1 in 3
1003	85.53	SW	83.2	300			VC	20.77708	1 in 148
0302	88.4	SW	84.53	375			CO	92.02291	1 in 188
1107	85.85	FO	83.66	150			VC	34.09246	1 in 148
0010	84.28	FO	82.62	150			VC	25.98903	1 in 130
9117	87.18	SW	83.86	450			CO	44.19245	1 in 884
0023		SW	82.5	150			UN	6.947159	1 in 9
0111	85.57	FO	83.18	150			VC	12.35559	1 in 154
0003	83.91	SW	0	0			UN	0.2827009	
9116	87.25	FO	84.39	375			CO	49.76725	1 in 98
1111		FO	85.5	150			VC	26.7625	1 in 18
0011	83.83	FO	82.42	150			VC	27.87177	1 in 50
1204	87.19	SW	85.35	300			VC	58.82325	1 in 535
0022		FO	84.15	150			VC	6.121156	1 in 13
0020		FO	83.5	150			VC	6.234046	1 in 12
0203	87.01	SW	85.39	225			VC	43.11715	1 in 37
9112	86.46	SW	84.56	450			CO	26.03638	1 in 289
0009	84.64	FO	82.76	150			VC	21.63017	1 in 155
1205		FO	0	150			VC	11.88768	
1201	86.95	SW	85.61	225			VC	14.70576	1 in 105
1216		FO		150			VC	4.387999	
1206	87.36	FO	85.14	150			VC	14.94152	
1203	86.94	SW	85.46	225			VC	18.50007	1 in 154
1202		FO	0	150			VC	22.74214	

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad

LEGEND

Abandoned	Foul	Surface Water	Combined	
				Public Sewer
				Private Sewer
				Section 104
				Rising Main
				Sludge Main
				Overflow
				Water Course
				Highway Drain

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

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

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

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

SEWER MATERIAL

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

Address or Site Reference:

902 741,

Scale: 1:1250 **Date:** 09/01/2020

Sheet: 1 of 1

Printed by: Property Searches

SEWER RECORDS

United Utilities
helping life flow smoothly

APPENDIX G

Consultation with United Utilities

Simon Gough

From: Simon Gough
Sent: 24 March 2020 17:46
To: 'Wastewater Developer Services'
Subject: Spout Farm, Longridge(30429)
Attachments: 30429_Longridge_predevelopment_enquiry_200321.pdf; 30429_App B.pdf; 30429_App F.pdf; 30429_Preliminary Drainage Layout.pdf

On behalf of our Client, Create Homes, please find attached a pre-development enquiry for the above site.

We require confirmation of the proposed flow rates for FOUL to the existing public sewers.

The site is greenfield and SW will be discharged to a culverted watercourse at Greenfield rates.

In relation to the SW hierarchy:

- Ground conditions are not suitable for infiltration as detailed in the extract from the Phase 2 Investigation

Ground conditions encountered during the intrusive investigation generally comprise a surface layer of topsoil and mixed
cohesive and granular made ground in the north-eastern and eastern sections, these being underlain by cohesive glacial till to a maximum proven depth of 5.00 metres below ground level (mbgl).

In consideration of the site being underlain by relatively impermeable cohesive glacial till at shallow depth, soakaways are
not considered to be a feasible drainage option for the site.

- There is a culverted watercourse crossing Preston Road to the south of the site; previous investigations have proved
the site is already connected to the upstream section of this watercourse.

Foul will be pumped along Preston Road to manhole 1302,immediately to the north of the junction with College Close.
SW will be discharged to the existing 225mm dia. culverted watercourse crossing Preston Road to the south of the site.
A copy of the Proposed Development and existing flows calculation are attached for reference.

Please could you confirm the connection points and flow rates are acceptable to United Utilities.
Please also confirm if there have been any flooding incidents relating to the Public Sewerage system?

Regards

Simon Gough | **Director** | **Ironside Farrar** | 3 Worsley Court | Worsley | **Manchester** |M28 3NJ |
Tel: **0161 703 8801** | **Fax**: **0161 703 8279** | **Mobile**: **07717 023091** |
Web:ironsidefarrar.com

Wastewater predevelopment enquiry

This form is for all first time enquiries you may have when planning your development.

If your enquiry relates to advice on **connection points and discharge rates**, please complete all sections, providing as much information as you have available. You will notice some fields are marked as optional, all other fields are mandatory.
For **all other enquiries**, please complete Sections 1, 2, 7 and 8.

When answering the yes/no questions please mark an 'x' in the appropriate box.

All enquiries must be accompanied by a site location plan, clearly identifying the site boundary.

Once completed, please return this form by email to WastewaterDeveloperServices@uuplc.co.uk or post to United Utilities, Developer Services and Planning, Warrington North Wastewater Treatment Works, Gatewarth Industrial Estate**,** Off Liverpool Road, Warrington, WA5 1DS.

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

Section 1: About you

	Applicant	Agent (if applicable)
Name	TIM RACKHAM	SIMON GOUGH
Company name	CREATE HOMES	IRONSIDE FARRAR LIMITED
Home or company address *(including postcode)*	1 NEPTUNE COURT, HALLAM WAY, BLACKPOOL, FY4 5LZ	3 WORSLEY COURT, WORSLEY, MANCHESTER, M28 3NJ
Contact telephone number *(a mobile number is fine)*	07920 802 461	0161 703 8801
Email	Tim.Rackham@createhomes.com	Simon.gough@ironsidefarrar.com
What is your enquiry?	DISCHARGE POINTS AND RATES CONFIRMATION.	

Who should we send the enquiry response to?	Applicant		Agent		Both	X

Section 2: About your site

Site name	SPOUT FARM, LONGRIDGE							
Site address *(or nearest main road)*	PRESTON ROAD, LONGRIDGE							
Nearest postcode	PR3 3BF							
Site grid reference (mid point)	X:	360255			Y:	436030		
Approx. number of dwellings	34							
Approx. numbers of non-household units	N/A							
Total site area (hectares)	1.757							
Development area - hectares (*Optional*)	Residential	1.757	Commercial		Industrial			
Estimated onsite date *(Optional)*								
Estimated first occupation *(Optional)*								

Does the site have planning permission?									
	Full	Yes		No	X	Application submitted		Planning Ref *(if applicable)*	
	Outline	Yes	X	No		Application submitted		Planning Ref *(if appropriate)*	
Have you approached us about this site previously?		Yes		No	X	If yes, please provide Ref No. &/or contact details			

Section 3: Your site drainage strategy

Type of site	GREENFIELD (Go to Q 3.1)		BROWNFIELD (Go to Q 3.2)	
		X		

3.1 Greenfield site *(Optional)*	*Confirmed attachment:*			
Please provide full calculations to show **existing** greenfield run off rates	Yes	X	No	
3.2 Brownfield site *(Optional)*	*Confirmed attachment:*			
Please provide a plan showing **existing** foul water drainage from this site to the public sewer network (including location of existing drains, pipe sizes and points of connection)	Yes		No	X
Please provide a plan showing the **existing** surface water drainage from this site to the public sewer network, including location of existing drains, pipe sizes and points of connection	Yes		No	X
Will this development produce trade effluent?	Yes		No	X
If yes, have you applied for a trade effluent consent from United Utilities?	Yes		No	
Do you intend to discharge highways drainage to the public sewer network?	Yes	x	No	
If yes, to which sewer?	TO PROPOSED SEWERS ON DEVELOPMENT			

Section 4: Foul water connection

Are you proposing to use an existing connection to the public sewer?	Yes		No	X
If yes, please provide manhole number or grid reference number If no, please provide the proposed flow rate and connection points (litres per second)	PROPOSED CONNECTION TO Ex MH 1302 ON FOUL SEWER FOUL FLOW RATE APPROX. 1.57 L/S.			
Is the foul water discharge to be pumped?	Yes	X	No	

Section 5: Surface water connection

If you are proposing to connect surface water to a public sewer, please attach evidence that all options for Sustainable Urban Drainage Systems (SUDs) have been explored in accordance with part H of the Building Regulations 2010.
Details of SUDs can be found at http://www.ciria.com/sudsdesign_guidance.htm

How do you propose to drain surface water from the site?	SUDs *(Go to Section 6)*	X	Discharge to public sewer *(Go to Q5.1)*	

(5.1) Does the site have existing surface water connections to the public sewer?	Yes *(Go to Q5.2)*		No *(Go to Q5.3)*	X
(5.2) Proposed surface water discharging to public sewer via **existing connection** Are you proposing to use an existing connection?	Yes		No *(Go to Q5.3)*	X
If yes, please provide manhole number or grid reference number & proposed flow rates				
(5.3) Proposed surface water discharging to public sewer via a **new connection** If a new connection point is required, please provide proposed point of connection and proposed flow rates (litres per second)	PROPOSED CONNECTION TO EX CULVERT TO BE LIMITED TO GREENFIELD RATES			
Have you completed a flood risk assessment in support of your planning application?	Yes		No	X
Is the surface water to be controlled? *(Optional)*	Yes	X	No	
Is the surface water to be pumped? *(Optional)*	Yes		No	X

Section 6: Development details *(Optional)*

Is the development part of a larger site that will be developed in phases or will be subject to separate planning applications? If yes, please provide details below	Yes		No	

		Phase No.						
		1	2	3	4	5	6	7
Start date on site								
Anticipated date of first occupation								
Anticipated completion date								
No. of dwellings								
Sustainability code for dwellings								
Public houses and/or restaurants	No. of seats							
	Floor space (m^2)							
Hotels: Total No. of beds								
Schools: Total No. of pupils								
Hospitals: Total No. of beds								
Nursing homes: Total No. of beds								
Retail units: Total No. of units								
Office space: Total No. of units								
Industrial / manufacturing: Total No. of units								
Other: Foul water (litres per second)								

Section 7: Supporting information

Please confirm you have included all supporting information in relation to your enquiry

Site location plan	Yes	X	No	
Site boundary	Yes	X	No	
Proposed drainage layout plan (optional)	Yes		No	X
Indicative layout plan (optional)	Yes	X	No	
Calculations in support of proposed flow rates or run off rates (optional)	Yes	X	No	
Flood risk assessment (if appropriate)	Yes		No	X

Section 8: Declaration

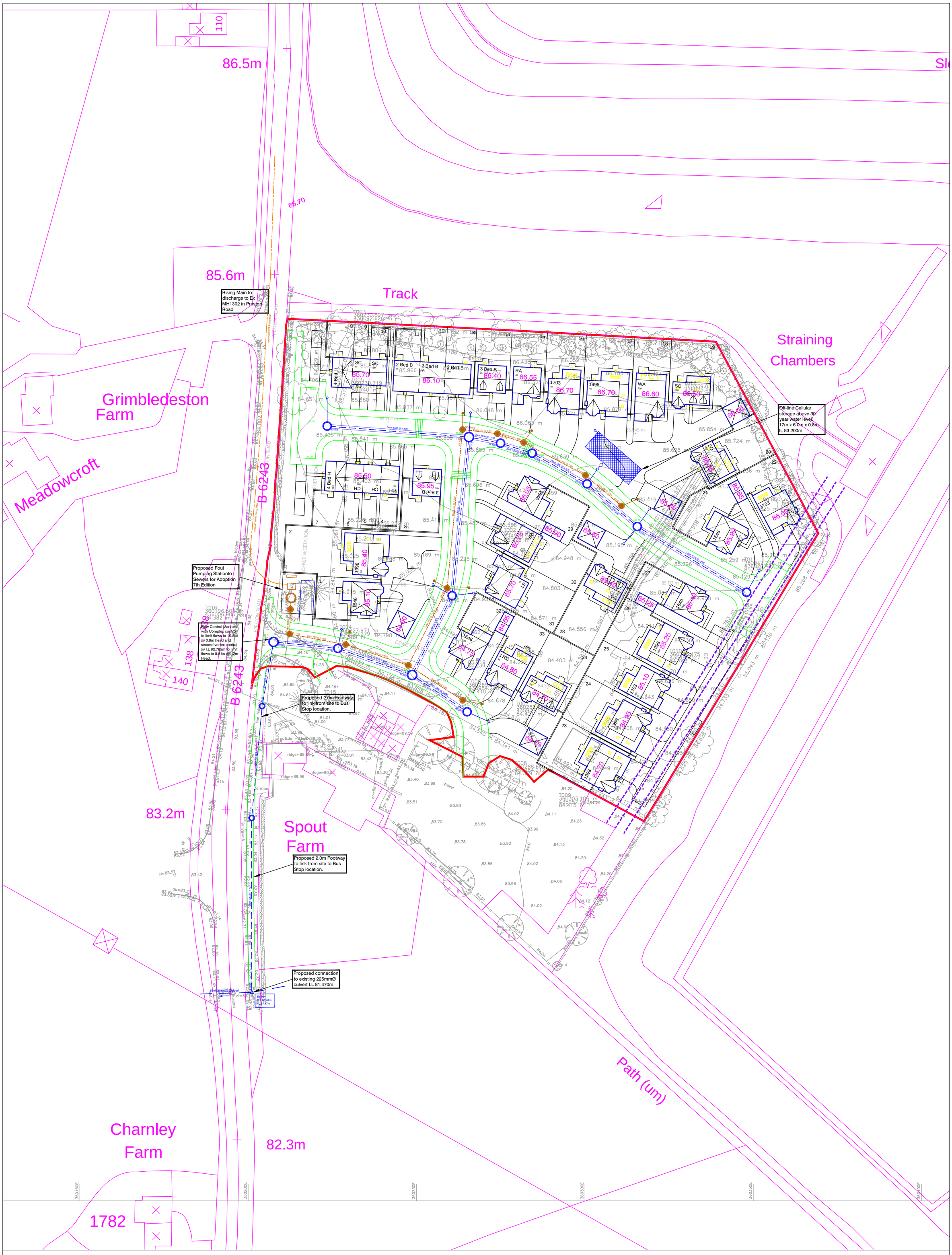
I understand that the submission of this form is to be treated as a preliminary enquiry and the information may be subject to change. In particular, I understand that the information United Utilities Water Limited provides in response is valid only in conjunction with the information provided in relation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

Name (please print)	SIMON GOUGH	Signature	
Company	IRONSIDE FARRAR LIMITED	Date	24/03/2020

For United Utilities use only			
Date received		UUW Ref No.	

APPENDIX H

Proposed Development
&
Drainage Layout


86.5m
85.6m
83.2m
82.3m
Track
Straining Chambers
Grimbledeston Farm
Meadowcroft
Spout Farm
Charnley Farm
1782
B 6243
Rising Main to discharge to Ex MH1302 in Preston Road
Proposed Foul Pumping Stationto Sewers for Adoption 7th Edition
Flow Control Manhole with Complex control to limit flows to 10.8l/s @ 0.8m head and second vortex control @ I.L 82.785m to limit flows to 8.8 l/s @1.2m Head.
Proposed 2.0m Footway to link from site to Bus Stop location.
Proposed 2.0m Footway to link from site to Bus Stop location.
Proposed connection to existing 225mmØ culvert I.L 81.470m
Off-line Cellular storage above 30 year water level 17m x 6.0m x 0.8m IL 83.200m
Path (um)
DENSE VEGETATION
PRESTON ROAD
2 Bed B
3 Bed B
4 Bed H
RA
WA
SO
SC
CH
ST
1998
1703
1646
gravel
tarmac
KEY
S.W.
Foul
Proposed Sewer
Proposed Disconnection Manhole
23.50
Proposed Finished Floor Level
Existing Foul Sewer
Existing SW Sewer
31.25
Proposed Road Level
× 29.35
Existing Level
North Point
Quality Ass.
UKAS 005 Quality Assurance ISO 9001:2008 SGS Certificate GB02/54539
Project
Spout Farm
Longridge, Preston
Client
Create Homes
Title
Preliminary Drainage Layout
PRELIMINARY
Original Size
A1
Copyright Acknowledgement
Ordnace Survey©
©Crown Copyright.
All rights reserved.
Licence No. AL100017966.
Drawn
KD
Checked By
SRG
Date
Mar 20
Scale
1:500
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.
30429/100
Revision

APPENDIX I

Hydraulic Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	1.757	Urban	0.000
SAAR (mm)	1047	Region Number	Region 10

Results l/s

QBAR Rural	12.4
QBAR Urban	12.4
Q100 years	25.7
Q1 year	10.8
Q30 years	21.0
Q100 years	25.7

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)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.285	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	0.251	4-8	0.613

Total Area Contributing (ha) = 0.864

Total Pipe Volume (m³) = 241.167

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)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	37.875	0.095	398.7	0.081	4.00	0.0	0.600	o	1050	Pipe/Conduit	
1.001	19.563	0.049	399.2	0.158	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.002	18.678	0.047	397.4	0.017	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.003	9.840	0.025	393.6	0.010	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.004	9.572	0.024	398.8	0.000	0.00	0.0	0.600	o	1050	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	4.37	82.616	0.081	0.0	0.0	0.0	1.72	1489.1	0.0
1.001	0.00	4.56	82.521	0.239	0.0	0.0	0.0	1.72	1488.0	0.0
1.002	0.00	4.74	82.472	0.256	0.0	0.0	0.0	1.72	1491.5	0.0
1.003	0.00	4.83	82.425	0.266	0.0	0.0	0.0	1.73	1498.8	0.0
1.004	0.00	4.93	82.400	0.266	0.0	0.0	0.0	1.72	1488.8	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)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	42.223	0.106	398.3	0.078	4.00	0.0	0.600	o	1050	Pipe/Conduit	
1.005	47.360	0.118	401.4	0.131	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.006	26.363	0.066	399.4	0.110	0.00	0.0	0.600	o	1050	Pipe/Conduit	
3.000	19.622	0.049	400.4	0.176	4.00	0.0	0.600	o	1050	Pipe/Conduit	
1.007	23.424	0.059	397.0	0.033	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.008	19.197	0.048	399.9	0.070	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.009	19.342	0.114	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.010	33.373	0.196	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.011	51.781	0.305	170.0	0.000	0.00	0.0	0.600	o	225	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	4.41	82.482	0.078	0.0	0.0	0.0	1.72	1489.8	0.0
1.005	0.00	5.39	82.376	0.475	0.0	0.0	0.0	1.71	1484.1	0.0
1.006	0.00	5.64	82.258	0.585	0.0	0.0	0.0	1.72	1487.7	0.0
3.000	0.00	4.19	82.241	0.176	0.0	0.0	0.0	1.72	1485.8	0.0
1.007	0.00	5.87	82.192	0.794	0.0	0.0	0.0	1.72	1492.2	0.0
1.008	0.00	6.05	82.133	0.864	0.0	0.0	0.0	1.72	1486.7	0.0
1.009	0.00	6.38	82.085	0.864	0.0	0.0	0.0	1.00	39.8	0.0
1.010	0.00	6.93	81.971	0.864	0.0	0.0	0.0	1.00	39.8	0.0
1.011	0.00	7.80	81.775	0.864	0.0	0.0	0.0	1.00	39.8	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	1050	1	85.150	82.616	1.484	Open Manhole	1950
1.001	o	1050	2	85.700	82.521	2.129	Open Manhole	2100
1.002	o	1050	3	85.950	82.472	2.428	Open Manhole	2100
1.003	o	1050	4	86.120	82.425	2.645	Open Manhole	2100
1.004	o	1050	5	86.000	82.400	2.550	Open Manhole	2100
2.000	o	1050	6	85.240	82.482	1.708	Open Manhole	2100
1.005	o	1050	7	85.900	82.376	2.474	Open Manhole	2100
1.006	o	1050	8	85.100	82.258	1.792	Open Manhole	2100
3.000	o	1050	9	84.500	82.241	1.209	Open Manhole	2100
1.007	o	1050	10	84.300	82.192	1.058	Open Manhole	2400
1.008	o	1050	11	84.370	82.133	1.187	Open Manhole	2100
1.009	o	225	12	84.150	82.085	1.840	Open Manhole	2400
1.010	o	225	13	84.000	81.971	1.804	Open Manhole	1200
1.011	o	225	14	83.350	81.775	1.350	Open Manhole	1200

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	37.875	398.7	2	85.700	82.521	2.129	Open Manhole	2100
1.001	19.563	399.2	3	85.950	82.472	2.428	Open Manhole	2100
1.002	18.678	397.4	4	86.120	82.425	2.645	Open Manhole	2100
1.003	9.840	393.6	5	86.000	82.400	2.550	Open Manhole	2100
1.004	9.572	398.8	7	85.900	82.376	2.474	Open Manhole	2100
2.000	42.223	398.3	7	85.900	82.376	2.474	Open Manhole	2100
1.005	47.360	401.4	8	85.100	82.258	1.792	Open Manhole	2100
1.006	26.363	399.4	10	84.300	82.192	1.058	Open Manhole	2400
3.000	19.622	400.4	10	84.300	82.192	1.058	Open Manhole	2400
1.007	23.424	397.0	11	84.370	82.133	1.187	Open Manhole	2100
1.008	19.197	399.9	12	84.150	82.085	1.015	Open Manhole	2400
1.009	19.342	170.0	13	84.000	81.971	1.804	Open Manhole	1200
1.010	33.373	170.0	14	83.350	81.775	1.350	Open Manhole	1200
1.011	51.781	170.0		82.490	81.470	0.795	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)	18.800	Storm Duration (mins)	30
Ratio R	0.285		

Online Controls for Storm

Complex Manhole: 12, DS/PN: 1.009, Volume (m³): 24.0

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0154-1080-0800-1080
Design Head (m)	0.800
Design Flow (l/s)	10.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	154
Invert Level (m)	82.085
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	10.8	Kick-Flo®	0.574	9.2
Flush-Flo™	0.266	10.8	Mean Flow over Head Range	-	9.1

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	5.5	1.200	13.1	3.000	20.2	7.000	30.4
0.200	10.7	1.400	14.1	3.500	21.8	7.500	31.4
0.300	10.8	1.600	15.0	4.000	23.2	8.000	32.4
0.400	10.5	1.800	15.9	4.500	24.6	8.500	33.3
0.500	10.1	2.000	16.7	5.000	25.9	9.000	34.3
0.600	9.4	2.200	17.4	5.500	27.1	9.500	35.2
0.800	10.8	2.400	18.2	6.000	28.2		
1.000	12.0	2.600	18.9	6.500	29.3		

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0134-8800-1200-8800
Design Head (m)	1.200
Design Flow (l/s)	8.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	134
Invert Level (m)	82.785
Minimum Outlet Pipe Diameter (mm)	150

Hydro-Brake® Optimum

Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	8.8	Kick-Flo®	0.769	7.1
Flush-Flo™	0.355	8.8	Mean Flow over Head Range	-	7.6

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	4.8	1.200	8.8	3.000	13.6	7.000	20.3
0.200	8.3	1.400	9.5	3.500	14.6	7.500	21.0
0.300	8.7	1.600	10.1	4.000	15.6	8.000	21.7
0.400	8.8	1.800	10.6	4.500	16.5	8.500	22.3
0.500	8.6	2.000	11.2	5.000	17.3	9.000	22.9
0.600	8.4	2.200	11.7	5.500	18.1	9.500	23.6
0.800	7.3	2.400	12.2	6.000	18.9		
1.000	8.1	2.600	12.7	6.500	19.6		

Storage Structures for Storm

Cellular Storage Manhole: 3, DS/PN: 1.002

Invert Level (m) 83.200 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	102.0	0.0	0.801	0.0	0.0
0.800	102.0	0.0			

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	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	0.285
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.800	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	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960
Return Period(s) (years)	1, 30, 100
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%	100/60 Winter				82.690
1.001	2	120 Winter	1	+0%	100/60 Winter				82.668
1.002	3	120 Winter	1	+0%	100/60 Winter				82.668
1.003	4	120 Winter	1	+0%	100/60 Winter				82.668
1.004	5	120 Winter	1	+0%	100/60 Winter				82.668
2.000	6	120 Winter	1	+0%	100/60 Winter				82.668
1.005	7	120 Winter	1	+0%	100/60 Summer				82.668
1.006	8	120 Winter	1	+0%	100/30 Winter				82.667
3.000	9	120 Winter	1	+0%	100/30 Winter				82.666
1.007	10	120 Winter	1	+0%	100/30 Winter				82.666
1.008	11	120 Winter	1	+0%	100/30 Winter				82.665
1.009	12	120 Winter	1	+0%	1/15 Summer				82.664
1.010	13	720 Winter	1	+0%					82.053
1.011	14	720 Winter	1	+0%					81.856

1 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)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.976	0.000	0.01		9.7	OK	
1.001	2	-0.903	0.000	0.01		10.7	OK	
1.002	3	-0.854	0.000	0.01		11.2	OK	
1.003	4	-0.807	0.000	0.02		11.0	OK	
1.004	5	-0.782	0.000	0.02		10.5	OK	
2.000	6	-0.864	0.000	0.00		3.3	OK	
1.005	7	-0.758	0.000	0.01		17.0	OK	
1.006	8	-0.641	0.000	0.02		16.2	OK	
3.000	9	-0.625	0.000	0.01		7.1	OK	
1.007	10	-0.576	0.000	0.02		16.7	OK	
1.008	11	-0.518	0.000	0.02		14.7	OK	
1.009	12	0.354	0.000	0.30		10.8	SURCHARGED	
1.010	13	-0.143	0.000	0.29		10.8	OK	
1.011	14	-0.144	0.000	0.28		10.8	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	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	0.285
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.800	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	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960
Return Period(s) (years)	1, 30, 100
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	180 Winter	30	+0%	100/60 Winter				83.082
1.001	2	180 Winter	30	+0%	100/60 Winter				83.082
1.002	3	180 Winter	30	+0%	100/60 Winter				83.082
1.003	4	180 Winter	30	+0%	100/60 Winter				83.081
1.004	5	180 Winter	30	+0%	100/60 Winter				83.081
2.000	6	180 Winter	30	+0%	100/60 Winter				83.080
1.005	7	180 Winter	30	+0%	100/60 Summer				83.080
1.006	8	180 Winter	30	+0%	100/30 Winter				83.074
3.000	9	180 Winter	30	+0%	100/30 Winter				83.067
1.007	10	180 Winter	30	+0%	100/30 Winter				83.066
1.008	11	180 Winter	30	+0%	100/30 Winter				83.049
1.009	12	180 Winter	30	+0%	1/15 Summer				83.027
1.010	13	180 Winter	30	+0%					82.089
1.011	14	180 Winter	30	+0%					81.891

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)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.584	0.000	0.01		6.0	OK	
1.001	2	-0.489	0.000	0.01		13.3	OK	
1.002	3	-0.440	0.000	0.01		12.2	OK	
1.003	4	-0.394	0.000	0.02		10.9	OK	
1.004	5	-0.369	0.000	0.02		9.8	OK	
2.000	6	-0.452	0.000	0.00		5.6	OK	
1.005	7	-0.346	0.000	0.01		15.8	OK	
1.006	8	-0.234	0.000	0.01		14.3	OK	
3.000	9	-0.224	0.000	0.01		13.5	OK	
1.007	10	-0.176	0.000	0.02		19.7	OK	
1.008	11	-0.134	0.000	0.02		21.4	OK	
1.009	12	0.717	0.000	0.56		20.2	SURCHARGED	
1.010	13	-0.107	0.000	0.54		20.2	OK	
1.011	14	-0.109	0.000	0.53		20.2	OK	

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	0.285
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.800	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	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960
Return Period(s) (years)	1, 30, 100
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	180 Winter	100	+40%	100/60 Winter				84.074
1.001	2	180 Winter	100	+40%	100/60 Winter				84.074
1.002	3	180 Winter	100	+40%	100/60 Winter				84.074
1.003	4	180 Winter	100	+40%	100/60 Winter				84.074
1.004	5	180 Winter	100	+40%	100/60 Winter				84.073
2.000	6	180 Winter	100	+40%	100/60 Winter				84.073
1.005	7	180 Winter	100	+40%	100/60 Summer				84.073
1.006	8	180 Winter	100	+40%	100/30 Winter				84.073
3.000	9	180 Winter	100	+40%	100/30 Winter				84.072
1.007	10	180 Winter	100	+40%	100/30 Winter				84.072
1.008	11	180 Winter	100	+40%	100/30 Winter				84.071
1.009	12	180 Winter	100	+40%	1/15 Summer				84.070
1.010	13	180 Winter	100	+40%					82.108
1.011	14	180 Winter	100	+40%					81.910

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)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.408	0.000	0.01		11.2	SURCHARGED	
1.001	2	0.503	0.000	0.03		27.6	SURCHARGED	
1.002	3	0.552	0.000	0.04		39.5	SURCHARGED	
1.003	4	0.599	0.000	0.07		43.8	SURCHARGED	
1.004	5	0.623	0.000	0.07		45.9	SURCHARGED	
2.000	6	0.541	0.000	0.01		13.1	SURCHARGED	
1.005	7	0.647	0.000	0.04		44.9	SURCHARGED	
1.006	8	0.765	0.000	0.04		43.0	SURCHARGED	
3.000	9	0.781	0.000	0.03		28.4	SURCHARGED	
1.007	10	0.830	0.000	0.04		40.2	FLOOD RISK	
1.008	11	0.888	0.000	0.04		35.5	FLOOD RISK	
1.009	12	1.760	0.000	0.71		25.5	FLOOD RISK	
1.010	13	-0.088	0.000	0.68		25.5	OK	
1.011	14	-0.090	0.000	0.67		25.5	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)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.285	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	0.251	4-8	0.613

Total Area Contributing (ha) = 0.864

Total Pipe Volume (m³) = 241.167

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)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	37.875	0.095	398.7	0.081	4.00	0.0	0.600	o	1050	Pipe/Conduit	
1.001	19.563	0.049	399.2	0.158	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.002	18.678	0.047	397.4	0.017	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.003	9.840	0.025	393.6	0.010	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.004	9.572	0.024	398.8	0.000	0.00	0.0	0.600	o	1050	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	4.37	82.616	0.081	0.0	0.0	0.0	1.72	1489.1	0.0
1.001	0.00	4.56	82.521	0.239	0.0	0.0	0.0	1.72	1488.0	0.0
1.002	0.00	4.74	82.472	0.256	0.0	0.0	0.0	1.72	1491.5	0.0
1.003	0.00	4.83	82.425	0.266	0.0	0.0	0.0	1.73	1498.8	0.0
1.004	0.00	4.93	82.400	0.266	0.0	0.0	0.0	1.72	1488.8	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)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	42.223	0.106	398.3	0.078	4.00	0.0	0.600	o	1050	Pipe/Conduit	
1.005	47.360	0.118	401.4	0.131	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.006	26.363	0.066	399.4	0.110	0.00	0.0	0.600	o	1050	Pipe/Conduit	
3.000	19.622	0.049	400.4	0.176	4.00	0.0	0.600	o	1050	Pipe/Conduit	
1.007	23.424	0.059	397.0	0.033	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.008	19.197	0.048	399.9	0.070	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.009	19.342	0.114	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.010	33.373	0.196	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.011	51.781	0.305	170.0	0.000	0.00	0.0	0.600	o	225	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	4.41	82.482	0.078	0.0	0.0	0.0	1.72	1489.8	0.0
1.005	0.00	5.39	82.376	0.475	0.0	0.0	0.0	1.71	1484.1	0.0
1.006	0.00	5.64	82.258	0.585	0.0	0.0	0.0	1.72	1487.7	0.0
3.000	0.00	4.19	82.241	0.176	0.0	0.0	0.0	1.72	1485.8	0.0
1.007	0.00	5.87	82.192	0.794	0.0	0.0	0.0	1.72	1492.2	0.0
1.008	0.00	6.05	82.133	0.864	0.0	0.0	0.0	1.72	1486.7	0.0
1.009	0.00	6.38	82.085	0.864	0.0	0.0	0.0	1.00	39.8	0.0
1.010	0.00	6.93	81.971	0.864	0.0	0.0	0.0	1.00	39.8	0.0
1.011	0.00	7.80	81.775	0.864	0.0	0.0	0.0	1.00	39.8	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	1050	1	85.150	82.616	1.484	Open Manhole	1950
1.001	o	1050	2	85.700	82.521	2.129	Open Manhole	2100
1.002	o	1050	3	85.950	82.472	2.428	Open Manhole	2100
1.003	o	1050	4	86.120	82.425	2.645	Open Manhole	2100
1.004	o	1050	5	86.000	82.400	2.550	Open Manhole	2100
2.000	o	1050	6	85.240	82.482	1.708	Open Manhole	2100
1.005	o	1050	7	85.900	82.376	2.474	Open Manhole	2100
1.006	o	1050	8	85.100	82.258	1.792	Open Manhole	2100
3.000	o	1050	9	84.500	82.241	1.209	Open Manhole	2100
1.007	o	1050	10	84.300	82.192	1.058	Open Manhole	2400
1.008	o	1050	11	84.370	82.133	1.187	Open Manhole	2100
1.009	o	225	12	84.150	82.085	1.840	Open Manhole	2400
1.010	o	225	13	84.000	81.971	1.804	Open Manhole	1200
1.011	o	225	14	83.350	81.775	1.350	Open Manhole	1200

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	37.875	398.7	2	85.700	82.521	2.129	Open Manhole	2100
1.001	19.563	399.2	3	85.950	82.472	2.428	Open Manhole	2100
1.002	18.678	397.4	4	86.120	82.425	2.645	Open Manhole	2100
1.003	9.840	393.6	5	86.000	82.400	2.550	Open Manhole	2100
1.004	9.572	398.8	7	85.900	82.376	2.474	Open Manhole	2100
2.000	42.223	398.3	7	85.900	82.376	2.474	Open Manhole	2100
1.005	47.360	401.4	8	85.100	82.258	1.792	Open Manhole	2100
1.006	26.363	399.4	10	84.300	82.192	1.058	Open Manhole	2400
3.000	19.622	400.4	10	84.300	82.192	1.058	Open Manhole	2400
1.007	23.424	397.0	11	84.370	82.133	1.187	Open Manhole	2100
1.008	19.197	399.9	12	84.150	82.085	1.015	Open Manhole	2400
1.009	19.342	170.0	13	84.000	81.971	1.804	Open Manhole	1200
1.010	33.373	170.0	14	83.350	81.775	1.350	Open Manhole	1200
1.011	51.781	170.0		82.490	81.470	0.795	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)	18.800	Storm Duration (mins)	30
Ratio R	0.285		

Online Controls for Storm

Complex Manhole: 12, DS/PN: 1.009, Volume (m³): 24.0

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0154-1080-0800-1080
Design Head (m)	0.800
Design Flow (l/s)	10.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	154
Invert Level (m)	82.085
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	10.8	Kick-Flo®	0.574	9.2
Flush-Flo™	0.266	10.8	Mean Flow over Head Range	-	9.1

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	5.5	1.200	13.1	3.000	20.2	7.000	30.4
0.200	10.7	1.400	14.1	3.500	21.8	7.500	31.4
0.300	10.8	1.600	15.0	4.000	23.2	8.000	32.4
0.400	10.5	1.800	15.9	4.500	24.6	8.500	33.3
0.500	10.1	2.000	16.7	5.000	25.9	9.000	34.3
0.600	9.4	2.200	17.4	5.500	27.1	9.500	35.2
0.800	10.8	2.400	18.2	6.000	28.2		
1.000	12.0	2.600	18.9	6.500	29.3		

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0134-8800-1200-8800
Design Head (m)	1.200
Design Flow (l/s)	8.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	134
Invert Level (m)	82.785
Minimum Outlet Pipe Diameter (mm)	150

Hydro-Brake® Optimum

Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	8.8	Kick-Flo®	0.769	7.1
Flush-Flo™	0.355	8.8	Mean Flow over Head Range	-	7.6

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	4.8	1.200	8.8	3.000	13.6	7.000	20.3
0.200	8.3	1.400	9.5	3.500	14.6	7.500	21.0
0.300	8.7	1.600	10.1	4.000	15.6	8.000	21.7
0.400	8.8	1.800	10.6	4.500	16.5	8.500	22.3
0.500	8.6	2.000	11.2	5.000	17.3	9.000	22.9
0.600	8.4	2.200	11.7	5.500	18.1	9.500	23.6
0.800	7.3	2.400	12.2	6.000	18.9		
1.000	8.1	2.600	12.7	6.500	19.6		

Storage Structures for Storm

Cellular Storage Manhole: 3, DS/PN: 1.002

Invert Level (m) 83.200 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	102.0	0.0	0.801	0.0	0.0
0.800	102.0	0.0			

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	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	0.285
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.800	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	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960
Return Period(s) (years)	1, 30, 100
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%	100/60 Winter				82.690
1.001	2	120 Winter	1	+0%	100/60 Winter				82.668
1.002	3	120 Winter	1	+0%	100/60 Winter				82.668
1.003	4	120 Winter	1	+0%	100/60 Winter				82.668
1.004	5	120 Winter	1	+0%	100/60 Winter				82.668
2.000	6	120 Winter	1	+0%	100/60 Winter				82.668
1.005	7	120 Winter	1	+0%	100/60 Summer				82.668
1.006	8	120 Winter	1	+0%	100/30 Winter				82.667
3.000	9	120 Winter	1	+0%	100/30 Winter				82.666
1.007	10	120 Winter	1	+0%	100/30 Winter				82.666
1.008	11	120 Winter	1	+0%	100/30 Winter				82.665
1.009	12	120 Winter	1	+0%	1/15 Summer				82.664
1.010	13	720 Winter	1	+0%					82.053
1.011	14	720 Winter	1	+0%					81.856

1 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)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.976	0.000	0.01		9.7	OK	
1.001	2	-0.903	0.000	0.01		10.7	OK	
1.002	3	-0.854	0.000	0.01		11.2	OK	
1.003	4	-0.807	0.000	0.02		11.0	OK	
1.004	5	-0.782	0.000	0.02		10.5	OK	
2.000	6	-0.864	0.000	0.00		3.3	OK	
1.005	7	-0.758	0.000	0.01		17.0	OK	
1.006	8	-0.641	0.000	0.02		16.2	OK	
3.000	9	-0.625	0.000	0.01		7.1	OK	
1.007	10	-0.576	0.000	0.02		16.7	OK	
1.008	11	-0.518	0.000	0.02		14.7	OK	
1.009	12	0.354	0.000	0.30		10.8	SURCHARGED	
1.010	13	-0.143	0.000	0.29		10.8	OK	
1.011	14	-0.144	0.000	0.28		10.8	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	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	0.285
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.800	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	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960
Return Period(s) (years)	1, 30, 100
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	180 Winter	30	+0%	100/60 Winter				83.082
1.001	2	180 Winter	30	+0%	100/60 Winter				83.082
1.002	3	180 Winter	30	+0%	100/60 Winter				83.082
1.003	4	180 Winter	30	+0%	100/60 Winter				83.081
1.004	5	180 Winter	30	+0%	100/60 Winter				83.081
2.000	6	180 Winter	30	+0%	100/60 Winter				83.080
1.005	7	180 Winter	30	+0%	100/60 Summer				83.080
1.006	8	180 Winter	30	+0%	100/30 Winter				83.074
3.000	9	180 Winter	30	+0%	100/30 Winter				83.067
1.007	10	180 Winter	30	+0%	100/30 Winter				83.066
1.008	11	180 Winter	30	+0%	100/30 Winter				83.049
1.009	12	180 Winter	30	+0%	1/15 Summer				83.027
1.010	13	180 Winter	30	+0%					82.089
1.011	14	180 Winter	30	+0%					81.891

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)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.584	0.000	0.01		6.0	OK	
1.001	2	-0.489	0.000	0.01		13.3	OK	
1.002	3	-0.440	0.000	0.01		12.2	OK	
1.003	4	-0.394	0.000	0.02		10.9	OK	
1.004	5	-0.369	0.000	0.02		9.8	OK	
2.000	6	-0.452	0.000	0.00		5.6	OK	
1.005	7	-0.346	0.000	0.01		15.8	OK	
1.006	8	-0.234	0.000	0.01		14.3	OK	
3.000	9	-0.224	0.000	0.01		13.5	OK	
1.007	10	-0.176	0.000	0.02		19.7	OK	
1.008	11	-0.134	0.000	0.02		21.4	OK	
1.009	12	0.717	0.000	0.56		20.2	SURCHARGED	
1.010	13	-0.107	0.000	0.54		20.2	OK	
1.011	14	-0.109	0.000	0.53		20.2	OK	

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	0.285
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.800	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	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

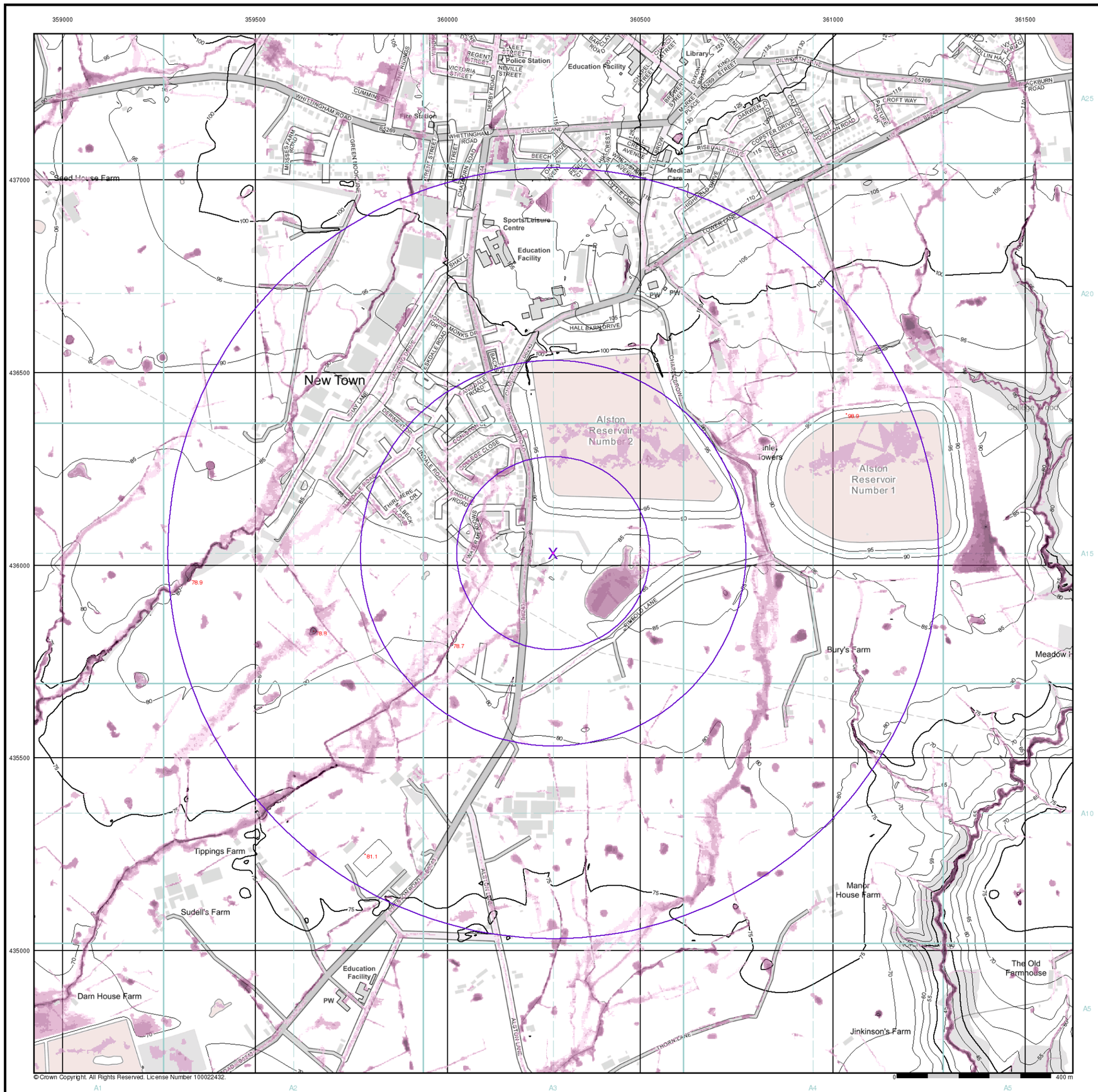
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	180 Winter	100	+40%	100/60 Winter				84.074
1.001	2	180 Winter	100	+40%	100/60 Winter				84.074
1.002	3	180 Winter	100	+40%	100/60 Winter				84.074
1.003	4	180 Winter	100	+40%	100/60 Winter				84.074
1.004	5	180 Winter	100	+40%	100/60 Winter				84.073
2.000	6	180 Winter	100	+40%	100/60 Winter				84.073
1.005	7	180 Winter	100	+40%	100/60 Summer				84.073
1.006	8	180 Winter	100	+40%	100/30 Winter				84.073
3.000	9	180 Winter	100	+40%	100/30 Winter				84.072
1.007	10	180 Winter	100	+40%	100/30 Winter				84.072
1.008	11	180 Winter	100	+40%	100/30 Winter				84.071
1.009	12	180 Winter	100	+40%	1/15 Summer				84.070
1.010	13	180 Winter	100	+40%					82.108
1.011	14	180 Winter	100	+40%					81.910

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)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.408	0.000	0.01		11.2	SURCHARGED	
1.001	2	0.503	0.000	0.03		27.6	SURCHARGED	
1.002	3	0.552	0.000	0.04		39.5	SURCHARGED	
1.003	4	0.599	0.000	0.07		43.8	SURCHARGED	
1.004	5	0.623	0.000	0.07		45.9	SURCHARGED	
2.000	6	0.541	0.000	0.01		13.1	SURCHARGED	
1.005	7	0.647	0.000	0.04		44.9	SURCHARGED	
1.006	8	0.765	0.000	0.04		43.0	SURCHARGED	
3.000	9	0.781	0.000	0.03		28.4	SURCHARGED	
1.007	10	0.830	0.000	0.04		40.2	FLOOD RISK	
1.008	11	0.888	0.000	0.04		35.5	FLOOD RISK	
1.009	12	1.760	0.000	0.71		25.5	FLOOD RISK	
1.010	13	-0.088	0.000	0.68		25.5	OK	
1.011	14	-0.090	0.000	0.67		25.5	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 105 | Master Contour 100 95 | Spot Height *167.8

MLW Mean Low Water

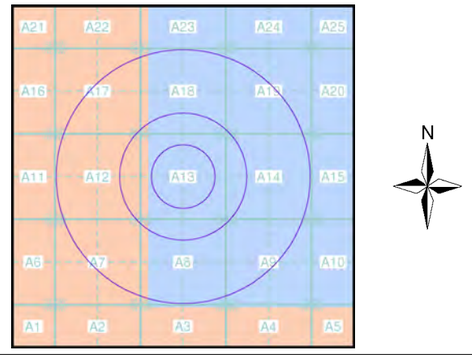
MHW Mean High Water

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

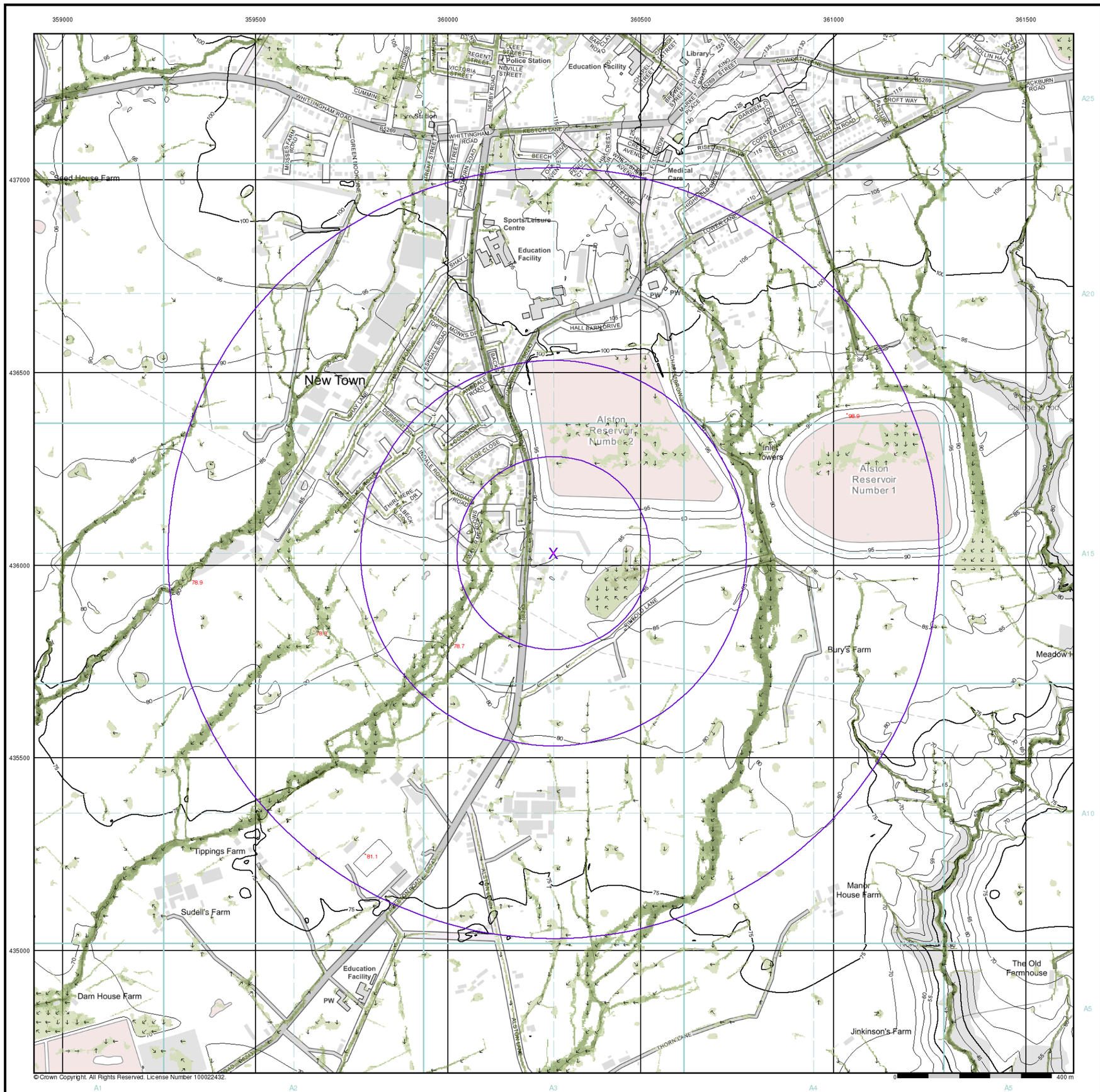


Order Details

Order Number:	239051132_1_1
Customer Ref:	30429
National Grid Reference:	360270, 436030
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 360260, 436040



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

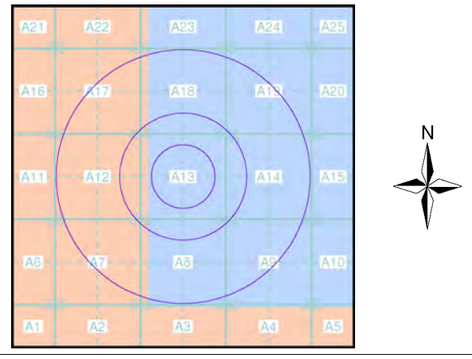
Contours (height in metres)
Standard Contour | Master Contour | Spot Height *167.8

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

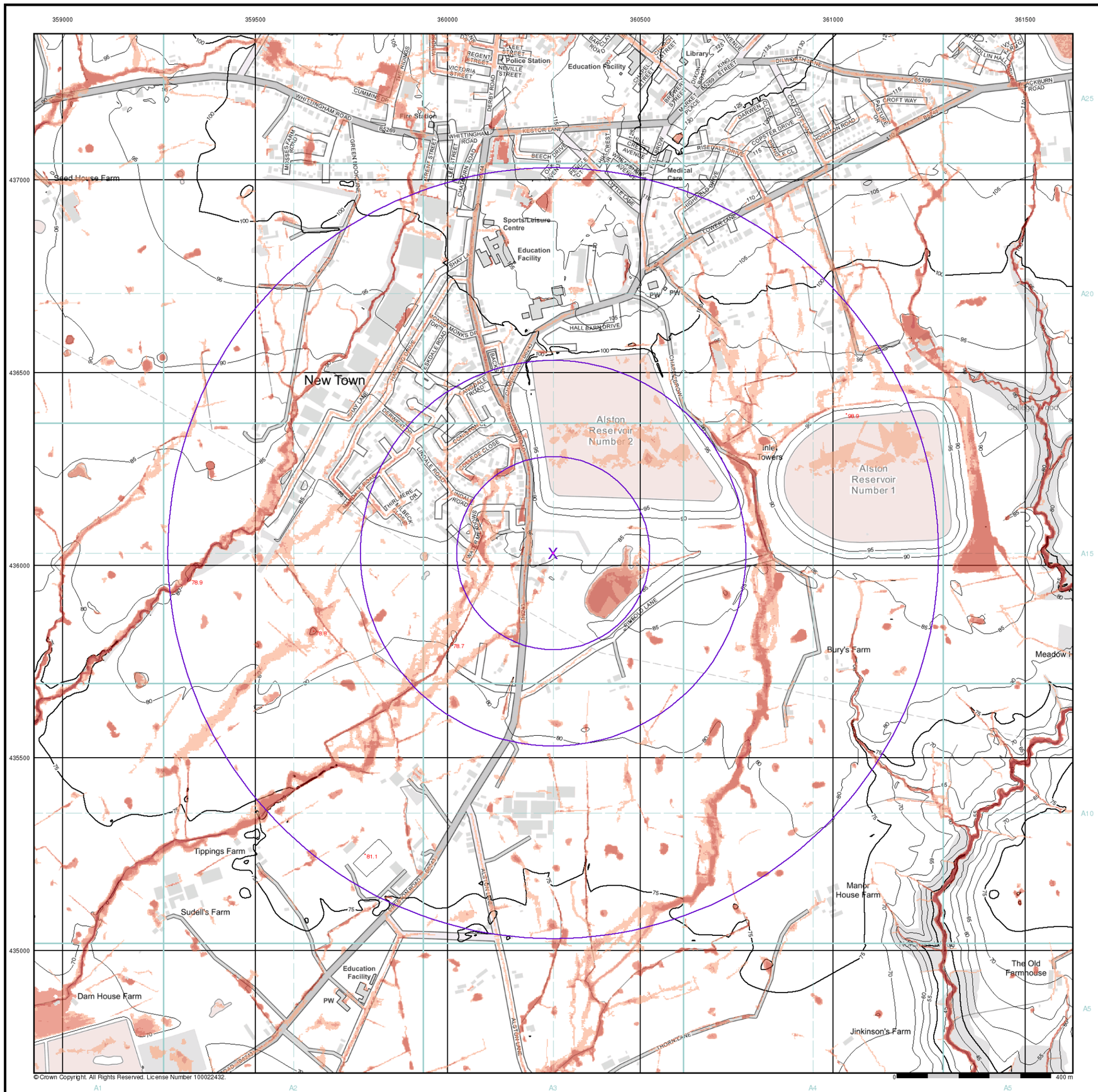


Order Details

Order Number:	239051132_1_1
Customer Ref:	30429
National Grid Reference:	360270, 436030
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details
Site at 360260, 436040

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

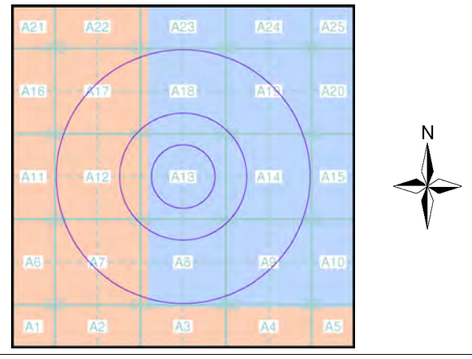
MHW Mean High Water

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



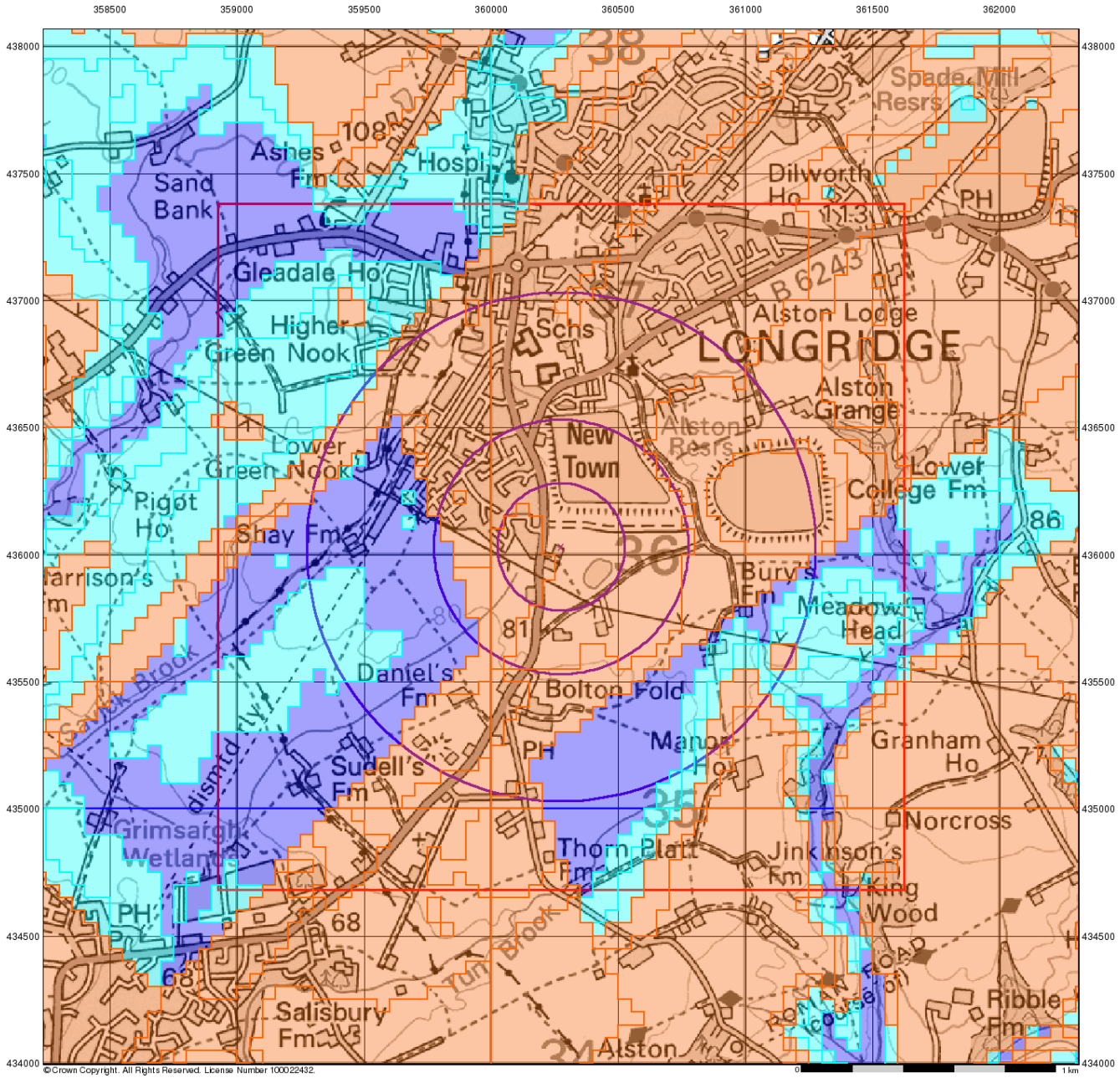
Order Details

Order Number:	239051132_1_1
Customer Ref:	30429
National Grid Reference:	360270, 436030
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 360260, 436040

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



IronsideFarrar
EnvironmentalConsultants

BGS Flood Data (1:50,000)

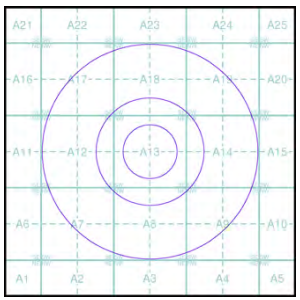
General

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



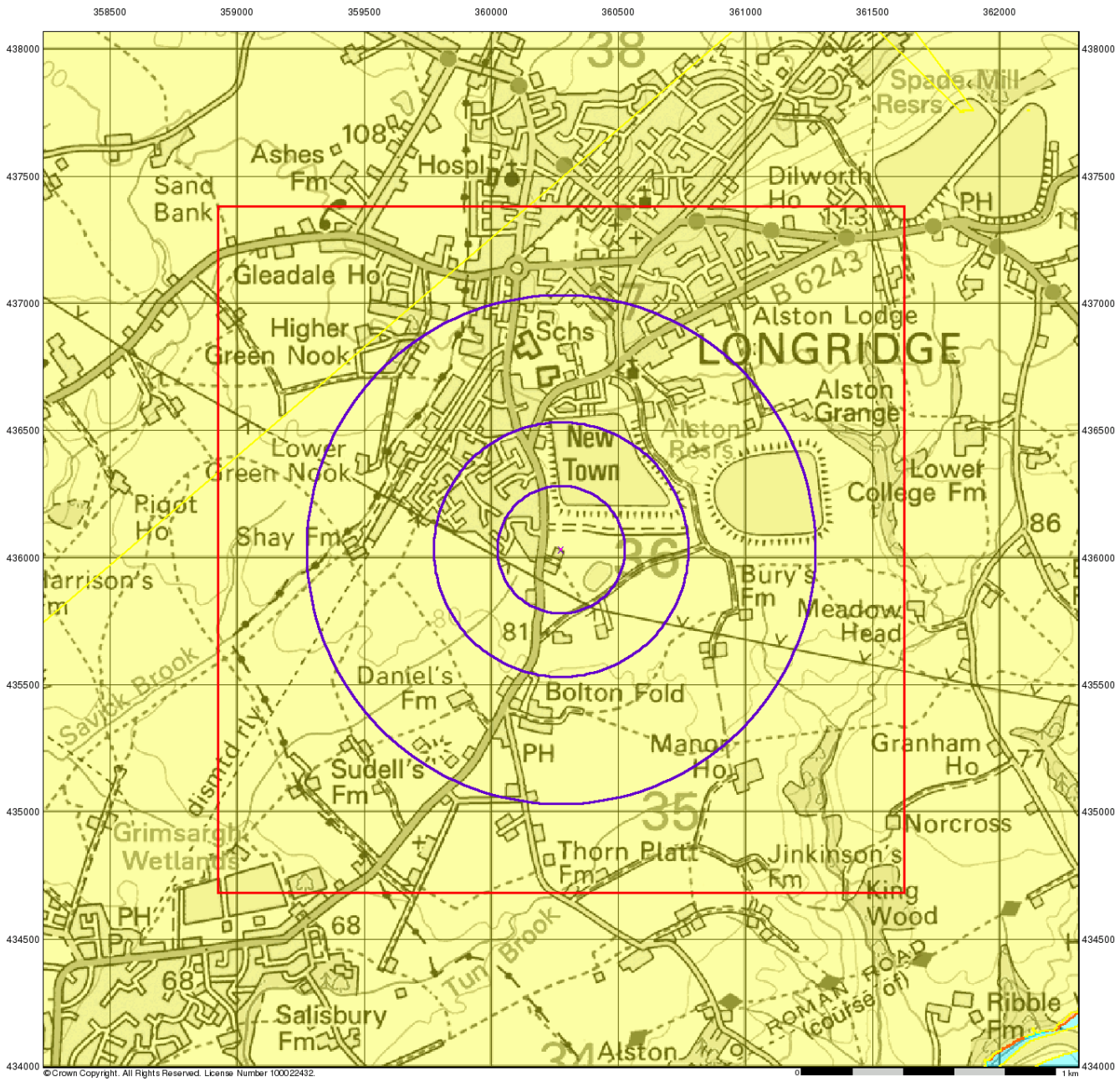
Order Details

Order Number:	239051132_1_1
Customer Ref:	30429
National Grid Reference:	360270, 436030
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 360260, 436040

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)

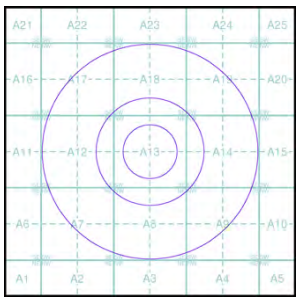
General

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:	239051132_1_1
Customer Ref:	30429
National Grid Reference:	360270, 436030
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 360260, 436040

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