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Drainage Strategy

For

Rochdale Extra Care

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SUTCLIFFE

Drainage Strategy

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1. Introduction

1.1 As part of the planning process it is necessary to prepare a drainage assessment for the proposed Extra Care off Bowness Road Langley.

1.2 The site is considered a major development as it consists of more than 10 dwellings and as such requires a drainage assessment.

1.3 The drainage assessment will consider how surface water runoff from the site is to be managed throughout the lifetime of the development.

1.4 Standing advice from the Rochdale Borough Council requires that the proposed drainage systems complies with the planning framework for sustainable drainage:

1.4.1 Paragraph 103 of the National Planning Policy Framework (NPPF)
1.4.2 Paragraph 80, Section 10 of the Planning Practice Guidance (PPG)
1.4.3 Written Statement on the use of Sustainable Drainage Systems (HCWS161)
1.4.4 Non-Statutory Technical Standards for Sustainable Drainage Systems
1.4.5 Planning Practice Guidance; and
1.4.6 Relevant District Local Plan Policies.

1.5 Paragraph 103 of the NPPF seeks to ensure that development is only permitted when flood risk is not increased elsewhere and when the sequential test has been appropriately applied to development in areas at risk of flooding. If required, the sequential test should demonstrate that the most vulnerable development is situated in the areas of least flood risk on the site and that flood resilient and resistant principles are adopted.

1.6 HCWS161 makes clear the Government's expectation that sustainable drainage systems are incorporated in the development plans, where appropriate, to manage surface water runoff and that provision for the future maintenance and operation are made.

1.7 The Non-Statutory Technical Guidance Standards for Sustainable Drainage sets out the requirements for peak flow control, volume control and flood risk and states that designs should consider the 1 in 1-year and 1 in 100-year design standards as a minimum.

1.8 The Planning Practice Guidance dictates that opportunities to reduce overall flood risk be considered through the appropriate application of SuDS with particular emphasis, where reasonably practical, on the following surface water discharge hierarchy:

1.8.1 Infiltration;
1.8.2 To a surface water body or watercourse;
1.8.3 To a surface water sewer, highway drain, or other drainage system;
1.8.4 To a combined sewer.

2. Development Description and Location

2.1 The proposed development involves the construction of a 3-storey extra care building comprising of 88 self-contained apartments, 10 bungalows and associated infrastructure.

2.2 The site is located in Keswick Close off Bowness Road, Langley.

Grid Reference:	SD 85849 06649
x: 385849	y: 406649
Post Code:	M24 4FP
Site area:	12,680m^2 (1.26 ha)

2.3 The site is classified as being at low risk of flooding and is situated within Flood Zone 1 on the Environment Agency's Flood Map for planning.

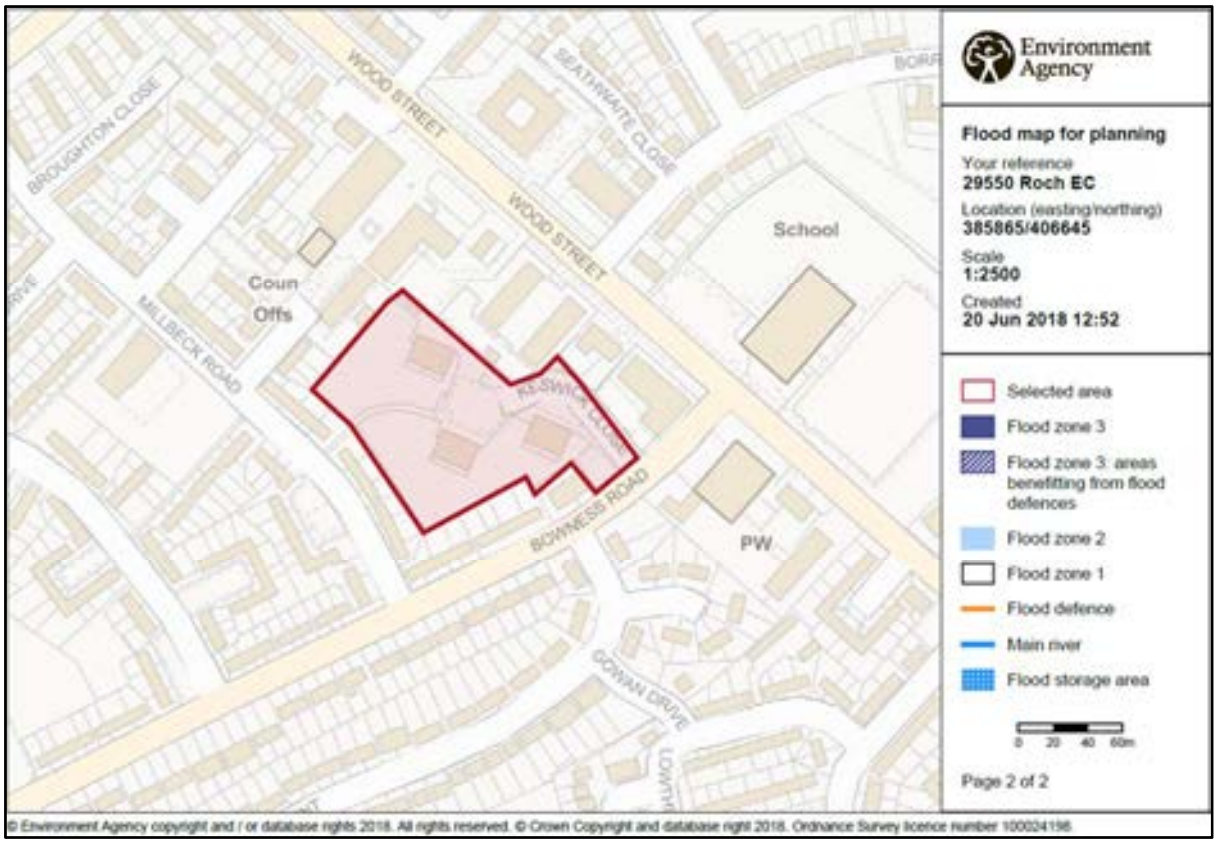


Figure 1: Environment Agency Flood Map for Planning

2.4 Although the site is in Flood Zone 1 it is greater than 1 hectare so a flood risk assessment is required.

Flood Risk

3. Development Flood Risk

3.1 A flood risk assessment was prepared by Ironside Farrar Limited to support the application. The report's conclusions are summarised as follows:

3.1.1 The site is in Flood Zone 1 with a low annual probability of flooding.

3.1.2 The site is a low risk of flooding from all other sources.

3.1.3 Surface water runoff should be discharged to the public sewer at the rate agreed with United Utilities or the reduced rates identified in the report (whichever is lesser).

3.1.4 Attenuation will be provided in the form of oversized pipes and cellular storage.

3.1.5 The proposed development must reduce the surface water runoff by at least 30% to satisfy the requirements of the SFRA.

3.1.6 Further site investigation should be carried out to confirm infiltration rates and determine if the use of infiltration SuDS techniques is possible.

3.1.7 The public sewer in the surrounding area is a combined sewer network, the site should be designed as a separate network and combined just prior to connection to the public sewer.

3.1.8 The external levels should be designed to provide overland flood routes that direct water away from buildings during exceedance events.

3.2 For full details of the Flood Risk & Drainage Strategy prepared by Ironside Farrar Limited.

Drainage Strategy

4. Lead Local Flood Authority Requirements

Rochdale Borough Council as the Lead Local Flood Authority (LLFA) require, as part of the pre-application standing advice, a drainage strategy be developed in accordance with the Written Statement on Sustainable Drainage Systems and the Non-Statutory Technical Standards for Sustainable Drainage Systems.

Rochdale Borough Council requires that the following hierarchy of drainage techniques should be used in the management of surface water:

- Prevention of runoff by good site design and the reduction of impermeable areas.
- Source control, dealing with water where and when it falls.
- Site control, management of water in the local area.
- Regional control, management of runoff from sites.

The drainage techniques adopted are influenced by the discharge hierarchy and will be considered in Section 9 following a review of the discharge hierarchy.

Current guidance is that the following surface water discharge hierarchy is considered and implemented using sustainable drainage solutions:

i. Infiltration (to ground)
ii. To a watercourse/surface water body
iii. To a surface water sewer, highway drain
iv. To a combined sewer.

The following sections review each tier in the hierarchy in more detail and comment on the suitability for use within the development.

5. Infiltration to Ground

5.1 Infiltration is the process of allowing rainwater to retained and managed on site.

5.2 The SuDS Manual (CIRIA C753) provides a definitive list of SuDS components, those that allow infiltration to occur are:

- Proprietary infiltration systems
- Filter strips
- Filter drains
- Swales
- Biorentention Systems
- Permeable pavements
- Detention basin

5.3 Infiltration systems must maintain 1m separation between the invert of the proposed system and the seasonal high-water table.

5.4 Approved Document H of the building regulations requires that soakaway structures be at least 5m away from buildings and structures.

5.5 A review of the surface geology on the British Geological Survey website (http://mapapps.bgs.ac.uk/wiyby /default.aspx) indicates that the site overlays an area of Pennine Lower Coal Measures Formation consisting of mudstone, siltstone and sandstone overlain by Hummocky (Moundy) Glacial Deposits, Devensian – Sand and Gravel.

5.6 The Soilscapes website (http://www.landis.org.uk/soilscapes/index.cfm) indicates that the general soil category is Soilscape 17 which is defined as slowly permeable seasonally wet acid loamy and clayey soils. The soil is classified as having impeded drainage, draining to stream network.

5.7 Following the recommendation of the FRA, further site investigation was carried out to determine the capacity of the soil for infiltration. Infiltration testing was carried out in accordance with BRE365. The results of the infiltration tests are located in Appendix B, the test results indicate that infiltration is not feasible as the water level in the trial pit during the test failed to fall sufficiently to all the infiltration rate to be determined.

5.8 Although the infiltration tests showed that soakaways receiving point inflows of surface water runoff are unsuitable consideration should still be given to disconnecting paths and patios from the drainage network and allowing them to free drain to surface SuDS features such as rain gardens, shallow depressions with water tolerant planting, where plant uptake and evaporation may occur. The inclusion of such features reduces the impermeable area treated through traditional drainage systems and it enables the management of surface water runoff at source with techniques that mimic natural process.

6. Discharge to Watercourse

6.1 An inspection the Environment Agency flood map confirms that there are no watercourses in the vicinity of the proposed development.



Figure 2: Extract from Environment Agency flood map indicating watercourses in the vicinity.

6.2 Discharge to a watercourse is not an option for this development.

7. Discharge to Surface Water Sewer Network

7.1 An extract of the public sewer record is provided in Figure 3.



Figure 3: Extract from Public Sewer Record

7.2 The public sewer map indicates that there are no surface water sewers within the vicinity of the site.

7.3 Discharge to a surface water sewer is not an option for this site.

8. Discharge to Combined Sewer Network

8.1 The extract of the public sewer record in the Figure 3 confirms that the public sewers in the vicinity of the site are combined sewers.

8.2 From the sewer record it can be seen that there are combined sewers in Bowness Road, Wood Street and Millbeck Road.

8.3 A drainage survey has been undertaken and it confirms there is also a public sewer in Lingmell Close.

8.4 The existing sewer in Lingmell Close is a 300mm vitrified clay pipe.

8.5 Connection to the combined sewer will require consent from United Utilities, United Utilities have been consulted with regards to discharging to the combined sewer and have indicated that they will accept unrestricted foul flows but surface water, should a connection be required, must be restricted to 6.0 l/s. United Utilities developer enquiry response is included in Appendix C.

8.6 Discharge to the combined sewer can only be considered when all preceding options in the discharge hierarchy have been investigated and proved non-viable.

9. Proposed Surface Water Management

9.1 Following the above review of the discharge hierarchy a surface water drainage strategy, following the aforementioned hierarchy of drainage techniques can be proposed.

9.2 The site area is approximately 12,680m^2. This includes the access road Keswick Close which has an impermeable area of 491m^2. The existing site was previously developed and occupied by 3 apartment blocks, the apartment blocks were demolished prior to 2015. For the purpose of the surface water strategy the site can be considered greenfield as there are no live surface water drains/sewers serving the site.

9.3 The proposed site plan has an impermeable area of 6,685m^2, excluding the existing access road. The increase does not take in to account paths adjacent to the building which will free drain to adjacent soft landscaping.

9.4 The proposed site layout minimises impermeable as much as possible while providing access in line with highways requirements and parking provision in line with Rochdale Borough Council requirements.

9.5 The increase in impermeable area over the current condition results in an increase in the surface water runoff rate and volume which will require managing in line with the aforementioned surface discharge hierarchy.

9.6 The surface water discharge rates for the proposed development have been identified in the FRA and are confirmed as:

Return Period	Existing Discharge Rate (l/s)	Proposed Discharge Rate 30% Reduction Over Existing(l/s)	Proposed Dischargere Rate Including CC Allowance(l/s)
Q1yr	29.1	20.3	20.3
Q30yr	66.7	46.6	31.5
Q100yr	81.2	56.8	41.2

Table 1; Surface Water Discharge Rates

9.7 As required by the drainage infiltration has been considered but discounted due to the soakaway tests failing to provide a suitable result.

9.8 In the absence of a watercourse a discharge the public sewer is considered the most manageable means for discharging surface water.

9.7 Based on current guidance and United Utilities requirements the surface water from the proposed development to be managed as close to greenfield rates as possible but not to exceed 6.0 l/s as stipulated in the United Utilities developer enquiry.

9.8 Uncontrolled runoff from the proposed development is in excess of the permissible rate stated by United Utilities, thus indicating the need to introduce site control (attenuation and flow controls) to manage the surface water runoff and mitigate offsite impacts should a connection to the public sewer be required.

9.9 To reduce the impermeable area contributing to the below ground drainage pavements and patios should be disconnected.

9.10 The runoff from the proposed development was modelled in Windes to ascertain the required attenuation volume for all storms up to and including the 100-year plus 30% climate change event.

9.11 United Utilities, as the statutory undertaker will adopt attenuation up to the 30 year event, for rarer events (up to the 100 year plus 30% climate change) offline storage will be provided. The adoptable storage will be provided in oversized pipes laid within the proposed road, the offline storage will be in the form of cellular attenuation located in the car park of the extra care.

9.12 To adequately manage surface water runoff an attenuation volume of 442.8m^3 will be required, based on a discharge rate of 6.0 l/s, for the 100-year plus 30% climate change event. The adopted pipe and manhole network will provide 267m^3 of attenuation while the offline storage will provide the balance, 175.5m^3.

9.10 By providing 442.8m^3 of storage there will be no flooding on site for the 100-year plus 30% climate change event.

9.11 A drainage strategy plan and supporting calculations are included in the Appendix B.

9.12 As the proposed car park has fewer than 50 spaces and an area less than 800m^2 a petrol interceptor is not required. Deep trap road gullies will serve the car park and the surface water drains will be routed through catch-pit manholes prior to connection with the soakaway.

9.13 The proposed drainage strategy adopts SuDS principles where possible and manages surface water runoff from the site in line with the LLFA requirements.

10. Management and Maintenance

10.1 The proposed drainage system has both public and private components.

10.2 The adopted network will be transferred to United Utilities following a 12-month defects period.

10.3 The land/property owner will be responsible for the management and maintenance of the private system.

10.4 As with the adopted system, following construction. there will be a 12-month defects/maintenance period during which the principal contractor will retain responsibility.

10.5 Table 2 identifies the key management and maintenance requirements for the SuDS components shown on the drainage strategy. The maintenance requirements can be grouped in to three categories: regular maintenance, occasional maintenance, and remedial maintenance.

Regular maintenance consists of the basic tasks that are carried out frequently and on a predictable schedule.

Occasional maintenance consists of tasks that are predictable but are not required a frequently as those falling under the regular maintenance.

Remedial maintenance is only required to rehabilitate the system when faults are identified during regular or occasional maintenance or pollution leads to contamination of the system.

After the initial hand-over inspection confirms the system has been constructed and installed as designed inspections should take place monthly for 12-months. The frequent initial inspections will help determine the optimum maintenance routine as well as identify performance issues such as silt build-up and poorer infiltration than expected.

The inspection checklist should cover the typical actions noted in Table 3.

Operation and Maintenance Activity	SuDS Component	
	Cellular Attenuation	Flow Control
Regular Maintenance		
Inspection	■	■
Litter and Debris Removal	☐	■
Occasional Maintenance		
Sediment Management[1]	■	■
Remedial Maintenance		
Structure rehabilitation/repair	☐	☐

Table 2: SuDS Maintenance Activities

■ will be required

☐ may be required

[1] sediment should be collected and managed upstream of the main device.

At a minimum the maintenance regime will require the following:

- An annual inspection of the drainage network to ensure that gullies, gutters and other inlets to the drainage system are not blocked.
- An annual inspection of the flow control chamber to ensure that the control is in full working order and free from blockages.
- Any deficiencies identified during the annual inspections must be rectified immediately to ensure the continued function of the system.

Inspection Date:				
	Details	Y/N	Action Required	Date Completed
General Inspection Items				
Is there evidence of poor hydraulic performance (i.e. standing water)?				
Is there any evidence of accidental spillages (oils etc.)?				
Have any H&S risks been identified?				
Is there any deterioration of permeable paving surface?				
Silt/Sediment Accumulation				
Is there any sediment accumulation in the catch-pits? (If yes remove)				
Does the flow control need maintaining to remove silt?				
System Blockages				
Is there any evidence of litter within the system? Can it cause blockages?				
Is there any evidence of blockages in gullies and gutters?				
Infrastructure				
Is there any evidence of accidental damage (i.e. broken or misplace covers, settlement in vicinity of the cellular storage?)				
Is there any evidence of cross connections or other contamination (i.e. oils)				
Other observations				
Appended information (i.e. photos)				
Suitability of current maintenance regime				
Continue as current? Increase maintenance? Decrease maintenance?				
Next inspection				
Proposed date for next inspection				

Table 3: Inspection checklist

11. Conclusion and Recommendations

11.1 The proposed site will manage the rate and volume of runoff from the site through the use of an attenuation system and a flow control.

11.2 Inclusion of attenuation will ensure that the site does not lead to increased flood risk on site or elsewhere for the design return periods.

11.3 The site investigation confirm infiltration is not possible.

11.4 The proposed drainage layout adopts SuDS principles where possible through the provision of long term storage and flow control.

11.5 Introduction of the maintenance and management plan will ensure that the proposed system remains operational and performs as designed for the life of the proposed development.

11.6 The site does is not in an area at risk of flooding and the introduction of SuDS techniques manages runoff resulting from the proposed development and ensures the development does not contribute to increased flood risk.

12. Appendices

12.1. Appendix A

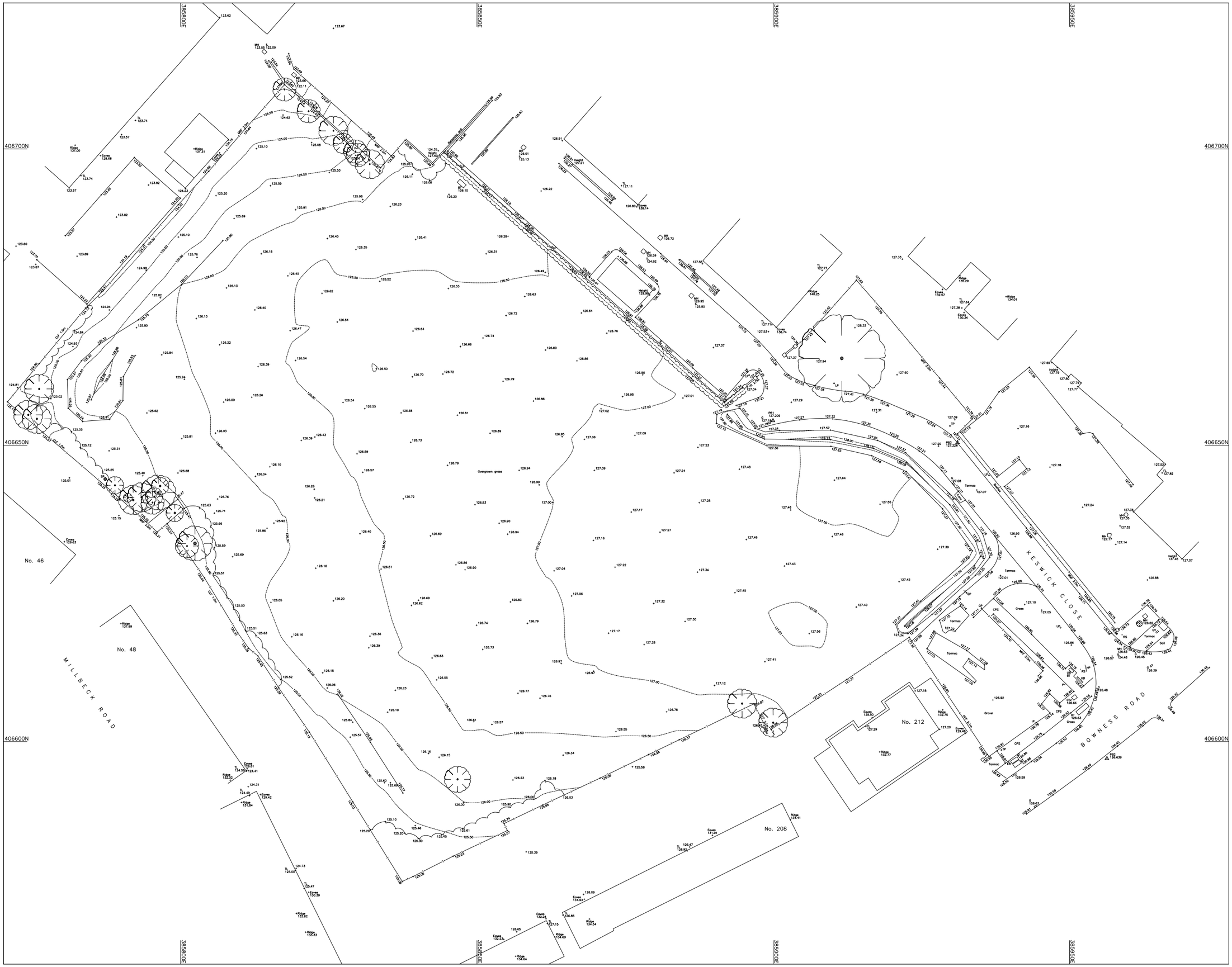
Drawings:

Existing Site Plan

Proposed Site Plan

Surface Water Drainage Plan

United Utilities Sewer Records


385800E
385850E
385900E
385950E
406700N
406650N
406600N
No. 46
No. 48
No. 212
No. 208
MILLBECK ROAD
KESWICK CLOSE
BOWNESS ROAD
Overgrown grass
Tarmac
Grass
Gravel
Soil
OPS
Ridge 137.00
Ridge 137.31
Eaves 128.68
Ridge 137.99
Eaves 129.63
Ridge 132.50
Eaves 129.61
Ridge 137.54
Eaves 129.42
Ridge 132.82
Ridge 133.33
Eaves 132.24
Ridge 134.64
Eaves 131.91
Ridge 134.41
Ridge 134.34
Eaves 132.24
Ridge 134.69
Ridge 135.29
Eaves 132.57
Eaves 130.34
Ridge 134.01
Eaves 129.50
Ridge 132.75
Eaves 129.48
Ridge 137.79
Ridge 134.61
Eaves 131.38
Ridge 137.45
Eaves 134.14
Ridge 142.25
Eaves 138.74
Ridge 137.21
Eaves 132.57
Ridge 135.29
Eaves 130.34
Ridge 134.01

1 Car park - 38 spaces including 7 accessible and 2 in a drop off zone
2 Smoking area
3 Drop off bay
4 Private gardens to ground floor apartments
5 Bicycle parking
6 Cafe seating area
7 Cafe bin store
8 Car park - 26 spaces including 2 accessible
9 Site signage
10 Garden with dementia path
11 Garden with seating area
12 Garden with greenhouse
13 Greenhouse
14 Buggy store
15 Care office
16 Management office
17 Reception
18 Lobby
19 Stretcher lift
20 Standard lift
21 Store
22 Main stair
23 Accessible WC
24 Multi-purpose room
25 Male WC
26 Female WC
27 Main lounge
28 Stair
29 Bin store
30 Memory corner
31 Laundry
32 Hairdresser
33 Treatment room
34 Cafe WCs
35 Kitchen store
36 Kitchen
37 Servery
38 Cafe
39 Plant
40 Store
41 Staff room
42 Communal lounge
43 Seating area
44 Void over lobby
45 Therapy room
46 Guest bedroom
47 Assisted bathroom
48 Bathroom

Bungalows

1	2b3p bungalow	65.7m²/708ft²	10
2	2b3p bungalow	65.8m²/708ft²	
3	2b3p bungalow	65.2m²/702ft²	
4	2b3p bungalow	65.4m²/703ft²	
5	2b3p bungalow	65.8m²/708ft²	
6	2b3p bungalow	65.4m²/703ft²	
7	2b3p bungalow	65.8m²/708ft²	
8	2b3p bungalow	65.2m²/702ft²	
9	2b3p bungalow	65.8m²/708ft²	
10	2b3p bungalow	66.5m²/716ft²	
	Total	579m²/6232ft²	10

Extra care housing scheme based on HAPPI principles

	Communal rooms	
	Commercial rooms	
	1b2p apartment	23
	2b3p apartment	65
	Total	88
	Grand total	98

Site area
1.27ha/3.13 acres

ECU gross internal floor area
8,549.4m²/92,025ft²

Total residential area
8,442.3m²/58,581ft²

Total communal area
1,438.9m²/15,488ft²

Total circulation area
1,468.1m²/16,018ft²

Total commercial area
180.1m²/1,938ft²

Footpath link to Woodside Medical Centre

4 houses by Woodside Medical Centre

24 houses including 2 wheelchair

38 spaces including 7 accessible and 2 in drop off zone

KESWICK CLOSE

BOWNESS ROAD

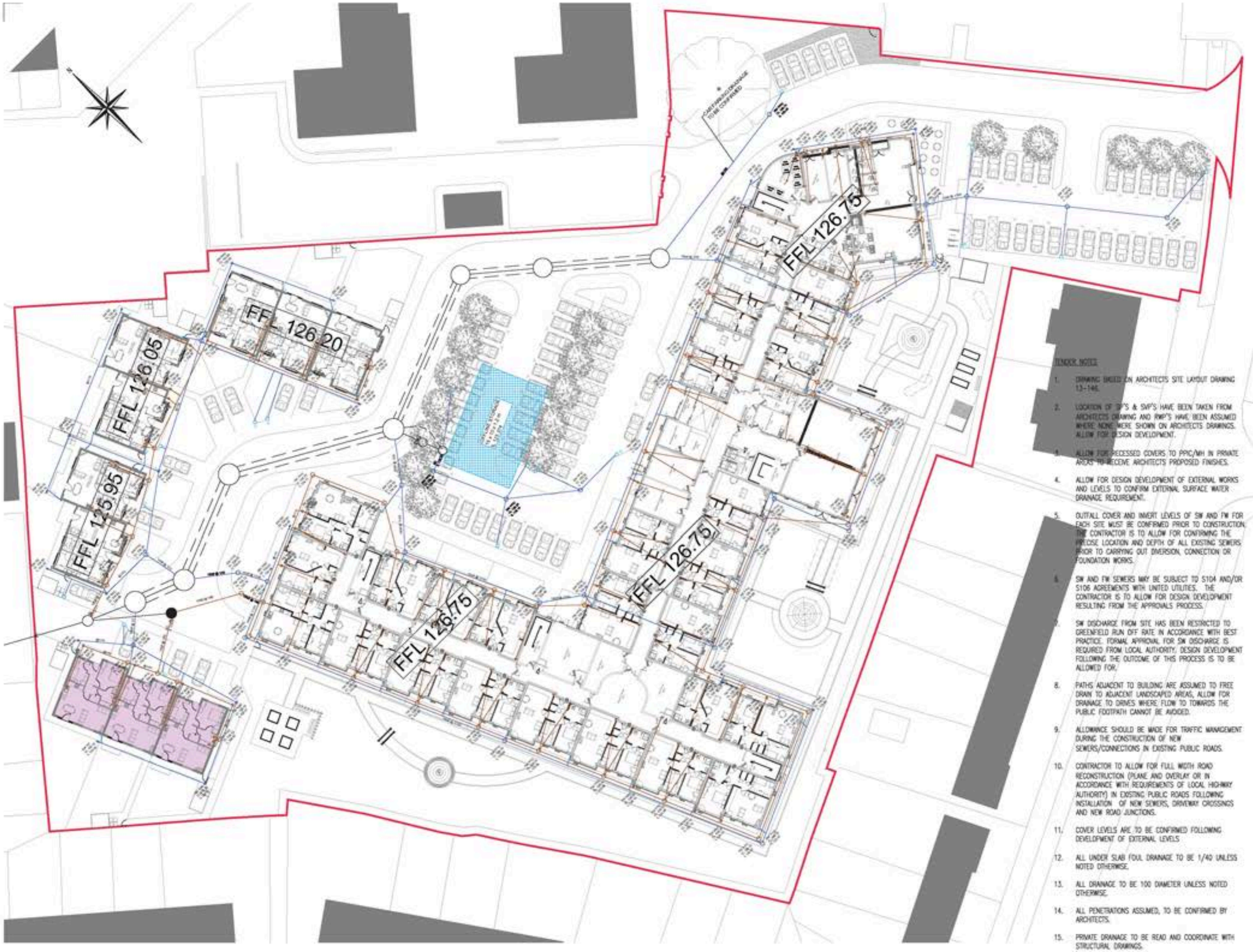
MILLBECK ROAD

N

Rochdale Extra Care Bowness Drive, Rochdale	Status Planning	Date 29/06/15	
Proposed Site and Ground Floor Plan	Scale 1:250 at A1	Drawn by CJB	
	Drawing no 13-148-P02-I	Checked by APS	

eden BUILDING DESIGN

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DO NOT SCALE OFF THIS DRAWING

GENERAL NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT STRUCTURAL AND ARCHITECTURAL DRAWINGS AND SPECIFICATIONS.
2. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR / FABRICATOR PRIOR TO COMMENCEMENT OF WORKS.
3. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS STATED OTHERWISE.
4. ALL WORKS TO BE CARRIED OUT IN STRICT ACCORDANCE WITH THE ENGINEER'S SPECIFICATIONS, RELEVANT BRITISH STANDARDS AND WHERE APPLICABLE LOCAL AUTHORITIES REQUIREMENTS.
5. FOR FINAL SETTING OUT INFORMATION RELATING TO KERB LINES AND WALL POSITIONS REFER TO THE ARCHITECT'S DRAWINGS.
6. ALL FLOOR LEVELS TO BE CONFIRMED BY ARCHITECT PRIOR TO CONSTRUCTION
7. ALL COVER LEVELS TO BE CONFIRMED BY ARCHITECT PRIOR TO CONSTRUCTION
8. ALL DRAINAGE PENETRATING THROUGH FLOOR SLABS AND WARRANTED PIPE LOCATIONS SHOWN FROM ARCHITECTS DRAWINGS. ARCHITECT TO CONFIRM LOCATIONS PRIOR TO CONSTRUCTION.

PROPOSED DRAINAGE

9. ADOPTABLE SEWERS SHOULD BE A MINIMUM OF 1m AND MANHOLES 0.5m FROM KERB FACES AND SERVICE MARKERS.
10. PRIOR TO CONSTRUCTION THE CONTRACTOR IS TO ENSURE THAT THE PROPOSED DRAINAGE DOES NOT CLASH WITH THE EXISTING SERVICES. THE CONTRACTOR IS TO ALLOW FOR THIS PROVISION WITHIN THE TENDER SUM.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ATTAINING ALL NECESSARY APPROVALS FOR ANY SERVICE DIVERSIONS REQUIRED TO FACILITATE THE PROPOSED WORKS

SURFACE WATER DRAINAGE

12. ALL PRIVATE SURFACE WATER DRAINAGE TO BE 150mm ø AT 1:100 GRADIENT UNLESS NOTED OTHERWISE.
13. 6M ALLOWANCE TO BE MADE FOR DRIVEWAY GULLIES AND ASSOCIATED DRAIN RUNS WHERE APPLICABLE
14. ALL FLOWS FROM PRIVATE CELLULAR SW STORAGE TO BE DISCHARGED THROUGH A SILT TRAP MANHOLE PRIOR TO BEING DISCHARGED INTO ANY PUBLIC SEWERS.

FOUL WATER / COMBINED DRAINAGE

15. ALL PRIVATE FOUL WATER DRAINAGE TO BE 150mm ø AT 1:80 GRADIENT UNLESS NOTED OTHERWISE
16. INTERNAL WORKING OF DRAINAGE SYSTEM TO ARCHITECTS DETAILS

TENDER NOTES

1. DRAWING BASED ON ARCHITECTS SITE LAYOUT DRAWING 13-146.
2. LOCATION OF SP'S & SWP'S HAVE BEEN TAKEN FROM ARCHITECTS DRAWING AND RWP'S HAVE BEEN ASSUMED WHERE NONE WERE SHOWN ON ARCHITECTS DRAWINGS. ALLOW FOR DESIGN DEVELOPMENT.
3. ALLOW FOR RECESSED COVERS TO PPC/MH IN PRIVATE AREAS TO RECEIVE ARCHITECTS PROPOSED FINISHES.
4. ALLOW FOR DESIGN DEVELOPMENT OF EXTERNAL WORKS AND LEVELS TO CONFIRM EXTERNAL SURFACE WATER DRAINAGE REQUIREMENT.
5. OUTFALL COVER AND INVERT LEVELS OF SW AND FW FOR EACH SITE MUST BE CONFIRMED PRIOR TO CONSTRUCTION. THE CONTRACTOR IS TO ALLOW FOR CONFIRMING THE PRECISE LOCATION AND DEPTH OF ALL EXISTING SEWERS PRIOR TO CARRYING OUT DIVERSION, CONNECTION OR FOUNDATION WORKS.
6. SW AND FW SEWERS MAY BE SUBJECT TO S104 AND/OR S106 AGREEMENTS WITH UNITED UTILITIES. THE CONTRACTOR IS TO ALLOW FOR DESIGN DEVELOPMENT RESULTING FROM THE APPROVALS PROCESS.
7. SW DISCHARGE FROM SITE HAS BEEN RESTRICTED TO GREENFIELD RUN OFF RATE IN ACCORDANCE WITH BEST PRACTICE. FORMAL APPROVAL FOR SW DISCHARGE IS REQUIRED FROM LOCAL AUTHORITY, DESIGN DEVELOPMENT FOLLOWING THE OUTCOME OF THIS PROCESS IS TO BE ALLOWED FOR.
8. PATHS ADJACENT TO BUILDING ARE ASSUMED TO FREE DRAIN TO ADJACENT LANDSCAPED AREAS, ALLOW FOR DRAINAGE TO DRAIN WHERE FLOW TO TOWARDS THE PUBLIC FOOTPATH CANNOT BE AVOIDED.
9. ALLOWANCE SHOULD BE MADE FOR TRAFFIC MANAGEMENT DURING THE CONSTRUCTION OF NEW SEWERS/CONNECTIONS IN EXISTING PUBLIC ROADS.
10. CONTRACTOR TO ALLOW FOR FULL WIDTH ROAD RECONSTRUCTION (PLANE AND OVERLAY OR IN ACCORDANCE WITH REQUIREMENTS OF LOCAL HIGHWAY AUTHORITY) IN EXISTING PUBLIC ROADS FOLLOWING INSTALLATION OF NEW SEWERS, DRIVEWAY CROSSINGS AND NEW ROAD JUNCTIONS.
11. COVER LEVELS ARE TO BE CONFIRMED FOLLOWING DEVELOPMENT OF EXTERNAL LEVELS
12. ALL UNDER SLAB FOUL DRAINAGE TO BE 1/40 UNLESS NOTED OTHERWISE.
13. ALL DRAINAGE TO BE 100 DIAMETER UNLESS NOTED OTHERWISE.
14. ALL PENETRATIONS ASSUMED, TO BE CONFIRMED BY ARCHITECTS.
15. PRIVATE DRAINAGE TO BE READ AND COORDINATE WITH STRUCTURAL DRAWINGS.

PRIVATE DRAINAGE KEY

- SITE BOUNDARY
- EXISTING SURFACE WATER SEWER / MH
- EXISTING FOUL WATER SEWER / MH
- PRIVATE SURFACE WATER SEWER / MH
- PRIVATE FOUL WATER SEWER / MH
- ADOPTED SURFACE WATER SEWER / MH
- ADOPTED FOUL WATER SEWER / MH

} REFER TO DEVELOPMENT AGREEMENT PLANS

- EASEMENTS (AS DIMENSIONED ON PLAN)
- CHANNEL DRAIN
- PRIVATE GULLY
- ROAD GULLY WITH 150 ø CONNECTOR
- SHOE INLET GULLY
- SOIL PIPE CONNECTION
- RAIN WATER PIPE & ACCESS GULLY CONNECTION
- MH ACCESS CHAMBER
- POLYPROPYLENE INSPECTION CHAMBER
- KERBING ETC

} ARCHITECT TO CONFIRM LOCATIONS PRIOR TO CONSTRUCTION.
THIS DRAWING ONLY INDICATES BELOW GROUND CONNECTIONS, RENTING OF DRAINAGE SYSTEM TO ARCHITECTS DETAILS.

Rev	Date	Checked	Description	By
T3	20.06.18	SB	BIN STORE GULLY ADDED	JG
T2	24.05.18	SB	SVP'S POSITION UPDATED	JG
T1	27.04.18	SB	TENDER ISSUE	JG

TENDER DRAWING

Sutcliffe
18-20 Hanington Street, Liverpool L2 9QA
t: 0151 227 3155 f: 0151 227 3156
e: sutcliffe@sutcliffe.co.uk w: www.sutcliffe.co.uk

Client: RIVERSIDE

Project: ROCHDALE EXTRA CARE
BOWNESS ROAD
LANGLEY

Drawing title: PRIVATE DRAINAGE LAYOUT

Scale at A1	1:250	Drawing number	29550-620
Drawn by	JG	Revision suffix	T3
Date	APR. 2018		

PRIOR TO CONSTRUCTION THE CONTRACTOR IS TO ENSURE THAT THE PROPOSED DRAINAGE DOES NOT CLASH WITH THE EXISTING SERVICES. THE CONTRACTOR IS TO ALLOW FOR THIS PROVISION WITHIN THE TENDER SUM. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ATTAINING ALL NECESSARY APPROVALS FOR ANY SERVICE DIVERSIONS REQUIRED TO FACILITATE THE PROPOSED WORKS

ALL FLOWS FROM PRIVATE CELLULAR SW STORARGE TO BE DISCHARGED THROUGH A SILT TRAP MANHOLE PRIOR TO BEING DISCHARGED INTO ANY PUBLIC SEWERS.

HYDROBRAKE DETAILS	
MANHOLE REFERENCE	S5
HYDROBRAKE TYPE	OPTIMUM
HYDROBRAKE REFERENCE	225-300-HOV-DS/SW/005
DISCHARGE RATE	5.0 l/s
DESIGN HEAD	2.1m
ORIFICE SIZE (mm)	69mm

FFL 126.20

FFL 126.05

FFL 125.95

FFL 126.75

FFL 126.75

FFL 126.75

FFL 126.25

OFF-SITE SEWER CONNECTION

DO NOT SCALE OFF THIS DRAWING

GENERAL NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT STRUCTURAL AND ARCHITECTURAL DRAWINGS AND SPECIFICATIONS.
2. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR / FABRICATOR PRIOR TO COMMENCEMENT OF WORKS.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
4. ALL WORKS TO BE CARRIED OUT IN STRICT ACCORDANCE WITH THE ENGINEER'S SPECIFICATIONS, RELEVANT BRITISH STANDARDS AND WHERE APPLICABLE LOCAL AUTHORITIES REQUIREMENTS.

SEWERS FOR ADOPTION

5. ALL MAIN SEWERS TO BE CONSTRUCTED IN ACCORDANCE WITH "SEWERS FOR ADOPTION" 7TH EDITION AND WATER UTILITIES STANDARD DETAILS.
6. ALL MATERIALS TO BE AGREED WITH SEI SITE MAIN WHERE APPLICABLE.
7. ALL DRAINAGE UNDER ROADS WITH LESS THAN 900MM OF COVER AND DRAINAGE UNDER THE HIGHWAY WITH LESS THAN 1200MM OF COVER WILL REQUIRE 150MM THICK CONCRETE BED AND SURROUND.
8. ALL 150MM Ø & 225MM DIA PIPES TO BE CLAY TO COMPLY WITH THE RELEVANT REQUIREMENTS OF BS EN 295-1: 1991.
9. ALL PIPES 300MM DIA AND ABOVE TO BE CONCRETE PIPES TO COMPLY WITH THE RELEVANT PROVISIONS OF BS 5911, STRENGTH CLASS AS INDICATED ON LONGITUDINAL SECTIONS.
10. MINIMUM PIPE CRUSHING STRENGTH TO BE: 150MM Ø = 40KN/M, 225 Ø = 45KN/M, 300 Ø = 72KN/M.
11. ALL PIPES TO HAVE CLASS 'Z' GRANULAR SURROUND WITH BEDDING FACTOR OF 2.2 UNLESS STATED OTHERWISE ON THE LONGITUDINAL SECTIONS AND TO BE CLASS 2 SULPHATE RESISTANT. GRANULAR MATERIAL FOR SURROUNDS TO BE STONE TO, 14 OR 20MM NOMINAL SINGLE SIZED.
12. STONE BACKFILL IS REQUIRED TO ALL SEWER TRENCHES UNDER HIGHWAY AREAS. AS DUG MATERIAL MAY BE USED ON STATED AREAS SUBJECT TO THE WRITTEN APPROVAL OF THE DRAINAGE AUTHORITY.
13. ALL CONCRETE PRODUCTS MANUFACTURED OR CAST INSITU TO BE SULPHATE RESISTANT UNLESS PROVED OTHERWISE BY SITE INVESTIGATION OR SUBSEQUENT TESTING.
14. SEWERS MUST HAVE 3 METRES CLEARANCE FROM TREES AND HEDGES, WHERE IT IS NOT POSSIBLE TO ACHIEVE THIS CLEARANCE CONCRETE BED AND SURROUND IS REQUIRED.
15. THE CONSENT SIZE OF MANHOLES WITH MORE THAN ONE CONNECTION MAY NEED TO BE INCREASED IN ACCORDANCE TO ACCOMMODATE THE CONNECTIONS AND BENDS.
16. MANHOLE COVERS MUST HAVE A MINIMUM CLEAR OPENING OF 600MM AND SHALL BE CLASS D400 TO BS EN 124 WITH 150MM DEEP FRAMES IN HIGHWAYS. SOME MANHOLES MAY REQUIRE DOUBLE SEALED COVER ACCESS, REFER TO MANHOLE SCHEDULES TO CONFIRM SIZES.
17. FILLED GROUND MUST BE FILLED AND CONSOLIDATED UNDER THE SUPERVISION AND TO THE SATISFACTION OF UNITED UTILITIES BEFORE ANY SEWER WORKS ARE CARRIED OUT.
18. ADOPTABLE SEWERS SHOULD BE A MINIMUM OF 1M AND MANHOLES 3.5M FROM HOUSE FACES AND SEWERS AVOIDED.
19. ANY LAND DRAIN OR WATERCOURSE ON SITE TO BE DIVERTED SO AS NOT TO PASS UNDER PROPOSED BUILDING.
20. DIVERSION TO BE INSPECTED ON SITE BY LOCAL AUTHORITY.
21. ALL EXISTING TO BE PROTECTED FROM SILT DURING THE CONSTRUCTION PROCESS WITH A LAYER OF HESSIAN SHEETING PLACED UNDER THE GULLY GRATING. THE HESSIAN SHALL BE CLEANED AND MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD.
22. ALL LIVE CONNECTIONS IDENTIFIED IDENTIFIED IN THE CCTV SURVEY, MUST BE RE-PIPED TO THE UNITED SEWER.
23. ALL SEWER ABANDONMENTS MUST BE WITNESSED BY A UNITED UTILITIES REPRESENTATIVE.
24. METHOD OF SEWER ABANDONMENT SHALL BE BY GRUBBING UP AND REPLACING PIPE TRENCHES WITH APPROVED SUITABLY COMPACTED BACKFILL.
25. CONNECTIONS OF SEWERS TO BE ABANDONED TO THE LIVE SEWERS SHALL BE CARRIED TO THE APPROVAL OF THE UNITED UTILITIES REPRESENTATIVE.

DRAINAGE KEY

- SITE BOUNDARY
- EXTG SURFACE WATER DRAINAGE
- EXTG FOUL WATER DRAINAGE
- EXTG COMBINED DRAINAGE
- PRIVATE FOUL WATER DRAINAGE
- PRIVATE SURFACE WATER DRAINAGE
- PRIVATE COMBINED DRAINAGE
- FOUL WATER SEWER DIVERSION
- SURFACE WATER SEWER DIVERSION
- COMBINED SEWER DIVERSION
- NEW FOUL WATER SEWER (NOT PART OF S104 AGREEMENT)
- NEW SURFACE WATER SEWER (NOT PART OF S104 AGREEMENT)
- NEW COMBINED SEWER (NOT PART OF S104 AGREEMENT)
- SEWER EASEMENT (AS DIMENSIONED)

Rev	Date	Checked	Description	By
T1	27.04.18	SB	TENDER ISSUE	JG

TENDER DRAWING

PRIOR TO CONSTRUCTION THE CONTRACTOR IS TO ENSURE THAT THE PROPOSED DRAINAGE DOES NOT CLASH WITH THE EXISTING SERVICES. THE CONTRACTOR IS TO ALLOW FOR THIS PROVISION WITHIN THE TENDER SUM. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ATTAINING ALL NECESSARY APPROVALS FOR ANY SERVICE DIVERSIONS REQUIRED TO FACILITATE THE PROPOSED WORKS.

ALL FLOWS FROM PRIVATE CELLULAR SW STORARGE TO BE DISCHARGED THROUGH A SILT TRAP MANHOLE PRIOR TO BEING DISCHARGED INTO ANY PUBLIC SEWERS.

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Client: RIVERSIDE

Project: ROCHDALE EXTRA CARE
BOWNESS ROAD
LANGLEY

Drawing title: ADOPTABLE DRAINAGE LAYOUT

Scale at A1	1:250
Drawn by	JG
Date	APR. 2018

Drawing number: 29550-655
Revision suffix: T1

UU Maps for Safe Dig

Centre :	X : 385905	Y : 406669	Date : 13/01/2014 11:48:29	Scale Approx : 2500



Extract from maps of United Utilities' Underground Assets

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private service pipes may be shown by a blue broken line. United Utilities Water will not accept liability for any damage caused by the actual position being different from those shown.

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United Utilities

12.2. Appendix B

Calculations

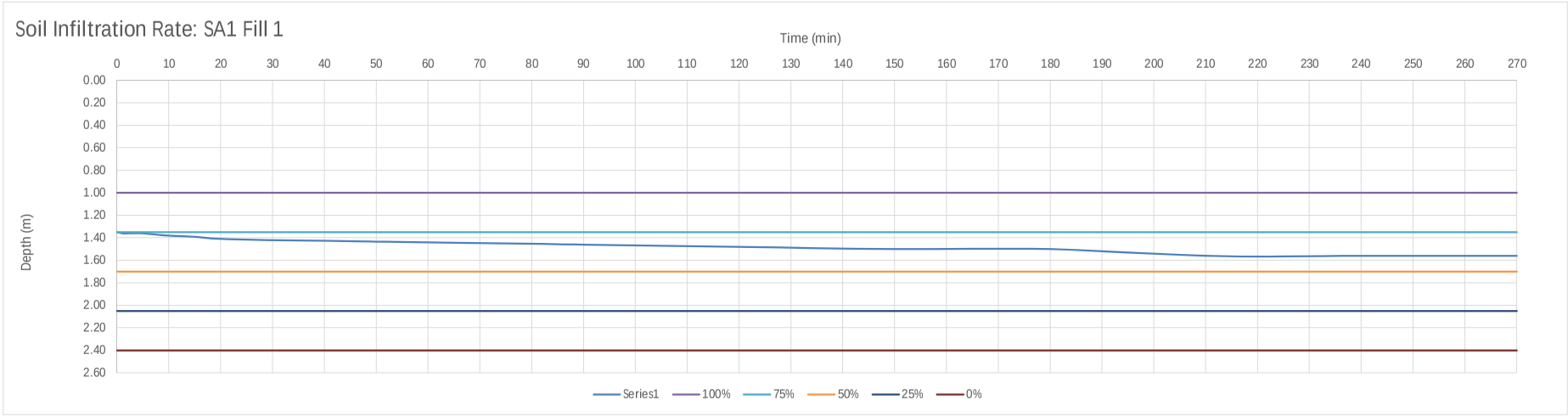
Bowness Road, Middleton
29550LG
BRE 365 SOIL INFILTRATION TEST "Soakaway Test"
SA1 - Fill 1

Pit Dimensions:	
Depth	2.40
Width	0.90
Length	4.20

Volume Outflowing between 75% and 25% of effective depth:						
V_{p75-25}	=	**L**	x	**B**	x	D_{75-25}
	=	4.20	x	0.90	x	1.20
	=	4.54 m^3				

Mean surface area through which outflow occurs, taken to be pit sides to 50% effective depth and including the base of the pit:						
a_{p50}	=	L_{side} **Area**	+	B_{side} **Area**	+	**Base Area**
	=	10.08	+	2.16	+	3.78
	=	16.02 m^2				

Time (mins)	**0**	**1**	**2**	**3**	**4**	**5**	**10**	**15**	**20**	**30**	**45**	**60**	**90**	**120**	**150**	**180**	**210**	**240**	**270**
Depth (m)	1.35	1.36	1.36	1.36	1.36	1.36	1.38	1.39	1.41	1.42	1.43	1.44	1.46	1.48	1.50	1.50	1.56	1.56	1.56



t_{p75-25} = 0.00 - 0 = 0

Soil infiltration rate = V_{p75-25} / (a_{p50}*t_{p75-25}*60)
= **#DIV/0!** **m/s** = **#DIV/0!** **mm/hr** (Test terminated, water level had not reach 75% level after 4 1/2 hrs)

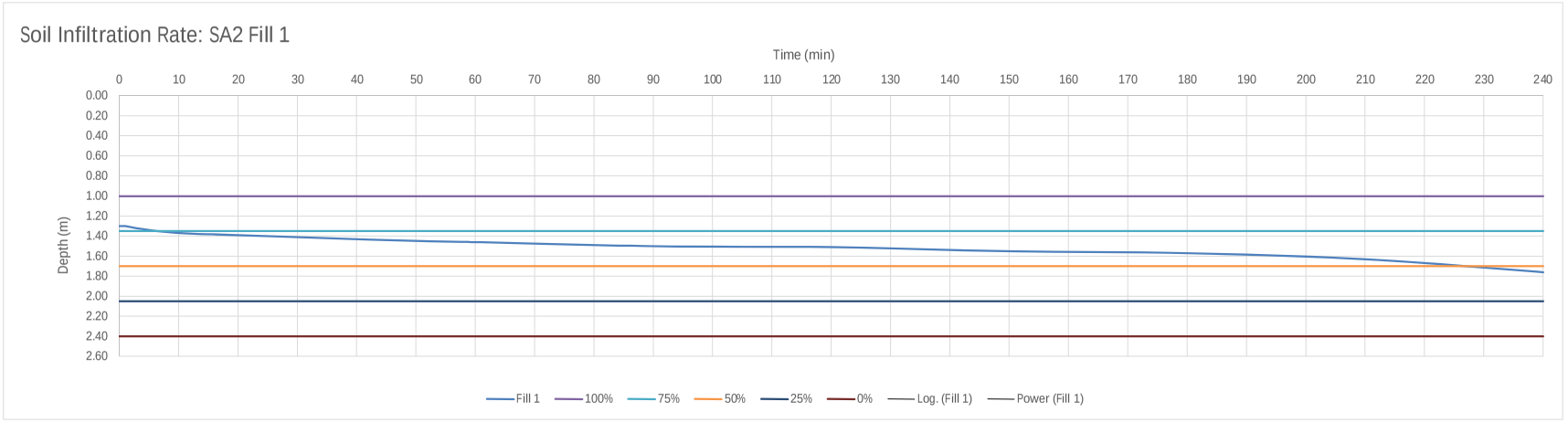
Bowness Road, Middleton
29550LG
BRE 365 SOIL INFILTRATION TEST "Soakaway Test"
SA2 - Fill 1

Pit Dimensions:	
Depth	2.40
Width	0.90
Length	4.20

Volume Outflowing between 75% and 25% of effective depth:						
V_{p75-25}	=	L	x	B	x	D_{75-25}
	=	4.20	x	0.90	x	1.20
	=	4.54 m^3				

Mean surface area through which outflow occurs, taken to be pit sides to 50% effective depth and including the base of the pit:						
a_{p50}	=	L_{side} Area	+	B_{side} Area	+	Base Area
	=	10.08	+	2.16	+	3.78
	=	16.02 m^2				

Time (mins)	0	1	2	3	4	5	10	15	30	45	60	90	120	150	180	210	240
Depth (m)	1.30	1.30	1.31	1.32	1.33	1.34	1.37	1.38	1.41	1.44	1.46	1.50	1.51	1.55	1.57	1.63	1.76



t_{p75-25} = 0.00 - 0 = 0

Soil infiltration rate = V_{p75-25} / (a_{p50}*t_{p75-25}*60)
= #DIV/0! m/s = #DIV/0! mm/hr (Test terminated, water level had not reach 75% level after 4 hrs)

Bowness Road, Middleton
29550LG
BRE 365 SOIL INFILTRATION TEST "Soakaway Test"
SA3 - Fill 1

Pit Dimensions:	
Depth	2.40
Width	0.90
Length	4.20

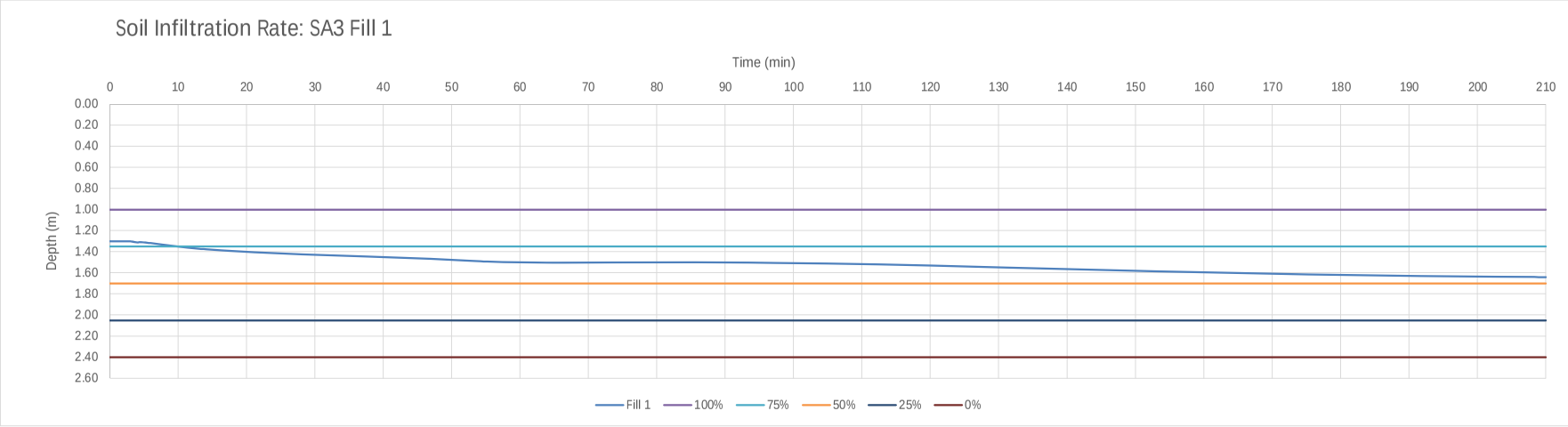
Volume Outflowing between 75% and 25% of effective depth:

V_{p75-25}	=	L	x	B	x	D_{75-25}
	=	4.20	x	0.90	x	1.20
	=	4.54 m^3				

Mean surface area through which outflow occurs, taken to be pit sides to 50% effective depth and including the base of the pit:

a_{p50}	=	L_{side} Area	+	B_{side} Area	+	Base Area
	=	10.08	+	2.16	+	3.78
	=	16.02 m^2				

Time (mins	0	1	2	3	4	5	10	15	30	45	60	90	120	150	180	210
Depth (m)	1.30	1.30	1.30	1.30	1.31	1.31	1.35	1.38	1.43	1.46	1.50	1.50	1.53	1.58	1.62	1.64



t_{p75-25} = 0.00 - 0 = 0

Soil infiltration rate = $V_{p75-25} / (a_{p50} * t_{p75-25} * 60)$
= **#DIV/0! m/s** = **#DIV/0! mm/hr** (Test terminated, water level had not reach 75% level after 3 1/2 hrs)

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW.SWS

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	0.318	Minimum Backdrop Height (m)	0.700
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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)	400

Designed with Level Soffits

Time Area Diagram for SW.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.425	4-8	0.250

Total Area Contributing (ha) = 0.675

Total Pipe Volume (m³) = 144.033

Network Design Table for SW.SWS

« - Indicates pipe capacity < flow

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
S1.000	16.574	0.041	400.3	0.185	5.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.001	11.629	0.029	399.6	0.224	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.002	23.742	0.060	398.4	0.018	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S2.000	3.008	0.030	99.9	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.001	4.561	0.046	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	24.058	0.060	400.3	0.018	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.004	16.096	0.040	400.4	0.164	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.005	7.536	0.019	400.9	0.066	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.006	7.200	0.072	100.0	0.000	0.00	0.0	0.600	o	150	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)
S1.000	50.00	5.15	123.428	0.185	0.0	0.0	0.0	1.86	2107.7	25.1
S1.001	50.00	5.25	123.387	0.409	0.0	0.0	0.0	1.87	2109.6	55.4
S1.002	50.00	5.46	123.358	0.427	0.0	0.0	0.0	1.87	2113.0	57.8
S2.000	50.00	5.05	123.374	0.000	0.0	0.0	0.0	1.01	17.8	0.0
S2.001	50.00	5.13	123.344	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S1.003	50.00	5.65	122.998	0.445	0.0	0.0	0.0	2.14	3777.7	60.3
S1.004	50.00	5.78	122.938	0.609	0.0	0.0	0.0	2.14	3777.2	82.5
S1.005	50.00	5.84	122.898	0.675	0.0	0.0	0.0	2.14	3775.0	91.4
S1.006	50.00	5.96	122.879	0.675	0.0	0.0	0.0	1.00	17.8«	91.4

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Network Design Table for SW.SWS

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
S1.007	15.468	0.155	99.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.008	26.907	0.269	100.0	0.000	0.00	0.0	0.600	o	150	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)
S1.007	50.00	6.21	122.807	0.675	0.0	0.0	0.0	1.01	17.8«	91.4
S1.008	50.00	6.66	122.652	0.675	0.0	0.0	0.0	1.00	17.8«	91.4

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Area Summary for SW.SWS

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.185	0.185	0.185
1.001	-	-	100	0.224	0.224	0.224
1.002	-	-	100	0.018	0.018	0.018
2.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.018	0.018	0.018
1.004	-	-	100	0.164	0.164	0.164
1.005	-	-	100	0.066	0.066	0.066
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.675	0.675	0.675

Free Flowing Outfall Details for SW.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S12	123.800	122.383	0.000	1500	0

Simulation Criteria for SW.SWS

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 Offline Controls 1 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 1 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	0.318		

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Online Controls for SW.SWS

Non Return Valve Manhole: S5, DS/PN: S2.001, Volume (m³): 3.9

Hydro-Brake® Optimum Manhole: S9, DS/PN: S1.006, Volume (m³): 29.3

Unit Reference	MD-SHE-0099-6000-2100-6000
Design Head (m)	2.100
Design Flow (l/s)	6.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	99
Invert Level (m)	122.879
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.100	6.0	Kick-Flo®	0.888	4.0
Flush-Flo™	0.432	5.1	Mean Flow over Head Range	-	4.8

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)	Depth (m)	Flow (l/s)
0.100	3.3	0.800	4.5	2.000	5.9	4.000	8.1	7.000	10.6
0.200	4.6	1.000	4.2	2.200	6.1	4.500	8.6	7.500	10.9
0.300	4.9	1.200	4.6	2.400	6.4	5.000	9.0	8.000	11.3
0.400	5.1	1.400	5.0	2.600	6.6	5.500	9.4	8.500	11.6
0.500	5.0	1.600	5.3	3.000	7.1	6.000	9.8	9.000	11.9
0.600	5.0	1.800	5.6	3.500	7.6	6.500	10.2	9.500	12.2

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Offline Controls for SW.SWS

Pipe Manhole: S6, DS/PN: S1.003, Loop to PN: S2.000

Diameter (m)	0.300	Roughness k (mm)	0.600
Section Type	Pipe/Conduit	Entry Loss Coefficient	0.500
Slope (1:X)	220.0	Coefficient of Contraction	0.600
Length (m)	7.570	Upstream Invert Level (m)	124.578

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Storage Structures for SW.SWS

Cellular Storage Manhole: S4, DS/PN: S2.000

Invert Level (m) 123.374 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)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	150.0	150.0	1.200	150.0	210.0	1.300	0.0	210.0

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Summary of Critical Results by Maximum Level (Rank 1) for SW.SWS

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 Offline Controls 1 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.800
Region	England and Wales	Ratio R	0.314
Cv (Summer)	0.750		
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, 1440
Return Period(s) (years)	1
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	180 Winter	1	+0%					123.669	-0.959	0.000
S1.001	S2	180 Winter	1	+0%					123.669	-0.918	0.000
S1.002	S3	180 Winter	1	+0%					123.669	-0.889	0.000
S2.000	S4	120 Winter	1	+0%					123.374	-0.150	0.000
S2.001	S5	120 Winter	1	+0%					123.344	-0.150	0.000
S1.003	S6	180 Winter	1	+0%				0	123.669	-0.829	0.000
S1.004	S7	180 Winter	1	+0%					123.669	-0.769	0.000
S1.005	S8	180 Winter	1	+0%					123.669	-0.729	0.000
S1.006	S9	180 Winter	1	+0%	1/15 Summer				123.669	0.640	0.000
S1.007	S10	15 Winter	1	+0%					122.864	-0.093	0.000
S1.008	S11	480 Winter	1	+0%					122.708	-0.094	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.01		6.3	OK	
S1.001	S2	0.02		13.7	OK	
S1.002	S3	0.01		13.7	OK	
S2.000	S4	0.00		0.0	OK	
S2.001	S5	0.00		0.0	OK	
S1.003	S6	0.01	0.0	12.3	OK	
S1.004	S7	0.01		10.7	OK	
S1.005	S8	0.01		7.8	OK	
S1.006	S9	0.33		5.0	SURCHARGED	
S1.007	S10	0.31		5.0	OK	
S1.008	S11	0.30		5.0	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW.SWS

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	0.318	Minimum Backdrop Height (m)	0.700
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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)	400

Designed with Level Soffits

Time Area Diagram for SW.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.425	4-8	0.250

Total Area Contributing (ha) = 0.675

Total Pipe Volume (m³) = 144.033

Network Design Table for SW.SWS

« - Indicates pipe capacity < flow

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
S1.000	16.574	0.041	400.3	0.185	5.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.001	11.629	0.029	399.6	0.224	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.002	23.742	0.060	398.4	0.018	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S2.000	3.008	0.030	99.9	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.001	4.561	0.046	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	24.058	0.060	400.3	0.018	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.004	16.096	0.040	400.4	0.164	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.005	7.536	0.019	400.9	0.066	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.006	7.200	0.072	100.0	0.000	0.00	0.0	0.600	o	150	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)
S1.000	50.00	5.15	123.428	0.185	0.0	0.0	0.0	1.86	2107.7	25.1
S1.001	50.00	5.25	123.387	0.409	0.0	0.0	0.0	1.87	2109.6	55.4
S1.002	50.00	5.46	123.358	0.427	0.0	0.0	0.0	1.87	2113.0	57.8
S2.000	50.00	5.05	123.374	0.000	0.0	0.0	0.0	1.01	17.8	0.0
S2.001	50.00	5.13	123.344	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S1.003	50.00	5.65	122.998	0.445	0.0	0.0	0.0	2.14	3777.7	60.3
S1.004	50.00	5.78	122.938	0.609	0.0	0.0	0.0	2.14	3777.2	82.5
S1.005	50.00	5.84	122.898	0.675	0.0	0.0	0.0	2.14	3775.0	91.4
S1.006	50.00	5.96	122.879	0.675	0.0	0.0	0.0	1.00	17.8«	91.4

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Network Design Table for SW.SWS

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
S1.007	15.468	0.155	99.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.008	26.907	0.269	100.0	0.000	0.00	0.0	0.600	o	150	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)
S1.007	50.00	6.21	122.807	0.675	0.0	0.0	0.0	1.01	17.8«	91.4
S1.008	50.00	6.66	122.652	0.675	0.0	0.0	0.0	1.00	17.8«	91.4

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Area Summary for SW.SWS

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.185	0.185	0.185
1.001	-	-	100	0.224	0.224	0.224
1.002	-	-	100	0.018	0.018	0.018
2.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.018	0.018	0.018
1.004	-	-	100	0.164	0.164	0.164
1.005	-	-	100	0.066	0.066	0.066
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.675	0.675	0.675

Free Flowing Outfall Details for SW.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S12	123.800	122.383	0.000	1500	0

Simulation Criteria for SW.SWS

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 Offline Controls 1 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 1 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	0.318		

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Online Controls for SW.SWS

Non Return Valve Manhole: S5, DS/PN: S2.001, Volume (m³): 3.9

Hydro-Brake® Optimum Manhole: S9, DS/PN: S1.006, Volume (m³): 29.3

Unit Reference	MD-SHE-0099-6000-2100-6000
Design Head (m)	2.100
Design Flow (l/s)	6.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	99
Invert Level (m)	122.879
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.100	6.0	Kick-Flo®	0.888	4.0
Flush-Flo™	0.432	5.1	Mean Flow over Head Range	-	4.8

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)	Depth (m)	Flow (l/s)
0.100	3.3	0.800	4.5	2.000	5.9	4.000	8.1	7.000	10.6
0.200	4.6	1.000	4.2	2.200	6.1	4.500	8.6	7.500	10.9
0.300	4.9	1.200	4.6	2.400	6.4	5.000	9.0	8.000	11.3
0.400	5.1	1.400	5.0	2.600	6.6	5.500	9.4	8.500	11.6
0.500	5.0	1.600	5.3	3.000	7.1	6.000	9.8	9.000	11.9
0.600	5.0	1.800	5.6	3.500	7.6	6.500	10.2	9.500	12.2

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Offline Controls for SW.SWS

Pipe Manhole: S6, DS/PN: S1.003, Loop to PN: S2.000

Diameter (m)	0.300	Roughness k (mm)	0.600
Section Type	Pipe/Conduit	Entry Loss Coefficient	0.500
Slope (1:X)	220.0	Coefficient of Contraction	0.600
Length (m)	7.570	Upstream Invert Level (m)	124.578

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Storage Structures for SW.SWS

Cellular Storage Manhole: S4, DS/PN: S2.000

Invert Level (m) 123.374 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)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	150.0	150.0	1.200	150.0	210.0	1.300	0.0	210.0

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Summary of Critical Results by Maximum Level (Rank 1) for SW.SWS

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 Offline Controls 1 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.800
Region	England and Wales	Ratio R	0.314
Cv (Summer)	0.750		
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, 1440
Return Period(s) (years)	2
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	180 Winter	2	+0%					123.825	-0.803	0.000
S1.001	S2	180 Winter	2	+0%					123.825	-0.761	0.000
S1.002	S3	180 Winter	2	+0%					123.825	-0.732	0.000
S2.000	S4	120 Winter	2	+0%					123.374	-0.150	0.000
S2.001	S5	120 Winter	2	+0%					123.344	-0.150	0.000
S1.003	S6	180 Winter	2	+0%					123.825	-0.673	0.000
S1.004	S7	180 Winter	2	+0%					123.825	-0.613	0.000
S1.005	S8	180 Winter	2	+0%					123.825	-0.573	0.000
S1.006	S9	180 Winter	2	+0%	2/15 Summer				123.825	0.796	0.000
S1.007	S10	15 Winter	2	+0%					122.864	-0.093	0.000
S1.008	S11	1440 Winter	2	+0%					122.708	-0.094	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.01		7.4	OK	
S1.001	S2	0.02		15.8	OK	
S1.002	S3	0.01		15.1	OK	
S2.000	S4	0.00		0.0	OK	
S2.001	S5	0.00		0.0	OK	
S1.003	S6	0.01	0.0	13.3	OK	
S1.004	S7	0.01		11.4	OK	
S1.005	S8	0.01		8.1	OK	
S1.006	S9	0.33		5.0	SURCHARGED	
S1.007	S10	0.31		5.0	OK	
S1.008	S11	0.30		5.0	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW.SWS

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	0.318	Minimum Backdrop Height (m)	0.700
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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)	400

Designed with Level Soffits

Time Area Diagram for SW.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.425	4-8	0.250

Total Area Contributing (ha) = 0.675

Total Pipe Volume (m³) = 144.033

Network Design Table for SW.SWS

« - Indicates pipe capacity < flow

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
S1.000	16.574	0.041	400.3	0.185	5.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.001	11.629	0.029	399.6	0.224	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.002	23.742	0.060	398.4	0.018	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S2.000	3.008	0.030	99.9	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.001	4.561	0.046	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	24.058	0.060	400.3	0.018	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.004	16.096	0.040	400.4	0.164	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.005	7.536	0.019	400.9	0.066	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.006	7.200	0.072	100.0	0.000	0.00	0.0	0.600	o	150	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)
S1.000	50.00	5.15	123.428	0.185	0.0	0.0	0.0	1.86	2107.7	25.1
S1.001	50.00	5.25	123.387	0.409	0.0	0.0	0.0	1.87	2109.6	55.4
S1.002	50.00	5.46	123.358	0.427	0.0	0.0	0.0	1.87	2113.0	57.8
S2.000	50.00	5.05	123.374	0.000	0.0	0.0	0.0	1.01	17.8	0.0
S2.001	50.00	5.13	123.344	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S1.003	50.00	5.65	122.998	0.445	0.0	0.0	0.0	2.14	3777.7	60.3
S1.004	50.00	5.78	122.938	0.609	0.0	0.0	0.0	2.14	3777.2	82.5
S1.005	50.00	5.84	122.898	0.675	0.0	0.0	0.0	2.14	3775.0	91.4
S1.006	50.00	5.96	122.879	0.675	0.0	0.0	0.0	1.00	17.8«	91.4

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Network Design Table for SW.SWS

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
S1.007	15.468	0.155	99.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.008	26.907	0.269	100.0	0.000	0.00	0.0	0.600	o	150	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)
S1.007	50.00	6.21	122.807	0.675	0.0	0.0	0.0	1.01	17.8«	91.4
S1.008	50.00	6.66	122.652	0.675	0.0	0.0	0.0	1.00	17.8«	91.4

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Area Summary for SW.SWS

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.185	0.185	0.185
1.001	-	-	100	0.224	0.224	0.224
1.002	-	-	100	0.018	0.018	0.018
2.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.018	0.018	0.018
1.004	-	-	100	0.164	0.164	0.164
1.005	-	-	100	0.066	0.066	0.066
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.675	0.675	0.675

Free Flowing Outfall Details for SW.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S12	123.800	122.383	0.000	1500	0

Simulation Criteria for SW.SWS

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 Offline Controls 1 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 1 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	0.318		

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Online Controls for SW.SWS

Non Return Valve Manhole: S5, DS/PN: S2.001, Volume (m³): 3.9

Hydro-Brake® Optimum Manhole: S9, DS/PN: S1.006, Volume (m³): 29.3

Unit Reference	MD-SHE-0099-6000-2100-6000
Design Head (m)	2.100
Design Flow (l/s)	6.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	99
Invert Level (m)	122.879
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.100	6.0	Kick-Flo®	0.888	4.0
Flush-Flo™	0.432	5.1	Mean Flow over Head Range	-	4.8

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)	Depth (m)	Flow (l/s)
0.100	3.3	0.800	4.5	2.000	5.9	4.000	8.1	7.000	10.6
0.200	4.6	1.000	4.2	2.200	6.1	4.500	8.6	7.500	10.9
0.300	4.9	1.200	4.6	2.400	6.4	5.000	9.0	8.000	11.3
0.400	5.1	1.400	5.0	2.600	6.6	5.500	9.4	8.500	11.6
0.500	5.0	1.600	5.3	3.000	7.1	6.000	9.8	9.000	11.9
0.600	5.0	1.800	5.6	3.500	7.6	6.500	10.2	9.500	12.2

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Offline Controls for SW.SWS

Pipe Manhole: S6, DS/PN: S1.003, Loop to PN: S2.000

Diameter (m)	0.300	Roughness k (mm)	0.600
Section Type	Pipe/Conduit	Entry Loss Coefficient	0.500
Slope (1:X)	220.0	Coefficient of Contraction	0.600
Length (m)	7.570	Upstream Invert Level (m)	124.578

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Storage Structures for SW.SWS

Cellular Storage Manhole: S4, DS/PN: S2.000

Invert Level (m) 123.374 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)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	150.0	150.0	1.200	150.0	210.0	1.300	0.0	210.0

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Summary of Critical Results by Maximum Level (Rank 1) for SW.SWS

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 Offline Controls 1 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.800
Region	England and Wales	Ratio R	0.314
Cv (Summer)	0.750		
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, 1440
Return Period(s) (years)	30
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	240 Winter	30	+0%					124.571	-0.057	0.000
S1.001	S2	240 Winter	30	+0%					124.571	-0.016	0.000
S1.002	S3	240 Winter	30	+0%	30/240 Winter				124.568	0.011	0.000
S2.000	S4	120 Winter	30	+0%					123.374	-0.150	0.000
S2.001	S5	120 Winter	30	+0%					123.344	-0.150	0.000
S1.003	S6	240 Winter	30	+0%	30/180 Winter			0	124.568	0.070	0.000
S1.004	S7	240 Winter	30	+0%	30/180 Winter				124.568	0.130	0.000
S1.005	S8	240 Winter	30	+0%	30/120 Winter				124.568	0.171	0.000
S1.006	S9	240 Winter	30	+0%	30/15 Summer				124.568	1.539	0.000
S1.007	S10	240 Winter	30	+0%					122.866	-0.091	0.000
S1.008	S11	240 Winter	30	+0%					122.710	-0.092	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.01		10.4	OK	
S1.001	S2	0.02		19.2	OK	
S1.002	S3	0.01		16.3	SURCHARGED	
S2.000	S4	0.00		0.0	OK	
S2.001	S5	0.00		0.0	OK	
S1.003	S6	0.01	0.0	11.7	SURCHARGED	
S1.004	S7	0.01		10.7	SURCHARGED	
S1.005	S8	0.01		7.9	SURCHARGED	
S1.006	S9	0.36		5.4	SURCHARGED	
S1.007	S10	0.33		5.4	OK	
S1.008	S11	0.32		5.4	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW.SWS

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	0.318	Minimum Backdrop Height (m)	0.700
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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)	400

Designed with Level Soffits

Time Area Diagram for SW.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.425	4-8	0.250

Total Area Contributing (ha) = 0.675

Total Pipe Volume (m³) = 144.033

Network Design Table for SW.SWS

« - Indicates pipe capacity < flow

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
S1.000	16.574	0.041	400.3	0.185	5.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.001	11.629	0.029	399.6	0.224	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.002	23.742	0.060	398.4	0.018	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S2.000	3.008	0.030	99.9	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.001	4.561	0.046	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	24.058	0.060	400.3	0.018	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.004	16.096	0.040	400.4	0.164	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.005	7.536	0.019	400.9	0.066	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.006	7.200	0.072	100.0	0.000	0.00	0.0	0.600	o	150	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)
S1.000	50.00	5.15	123.428	0.185	0.0	0.0	0.0	1.86	2107.7	25.1
S1.001	50.00	5.25	123.387	0.409	0.0	0.0	0.0	1.87	2109.6	55.4
S1.002	50.00	5.46	123.358	0.427	0.0	0.0	0.0	1.87	2113.0	57.8
S2.000	50.00	5.05	123.374	0.000	0.0	0.0	0.0	1.01	17.8	0.0
S2.001	50.00	5.13	123.344	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S1.003	50.00	5.65	122.998	0.445	0.0	0.0	0.0	2.14	3777.7	60.3
S1.004	50.00	5.78	122.938	0.609	0.0	0.0	0.0	2.14	3777.2	82.5
S1.005	50.00	5.84	122.898	0.675	0.0	0.0	0.0	2.14	3775.0	91.4
S1.006	50.00	5.96	122.879	0.675	0.0	0.0	0.0	1.00	17.8«	91.4

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Network Design Table for SW.SWS

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
S1.007	15.468	0.155	99.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.008	26.907	0.269	100.0	0.000	0.00	0.0	0.600	o	150	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)
S1.007	50.00	6.21	122.807	0.675	0.0	0.0	0.0	1.01	17.8«	91.4
S1.008	50.00	6.66	122.652	0.675	0.0	0.0	0.0	1.00	17.8«	91.4

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Area Summary for SW.SWS

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.185	0.185	0.185
1.001	-	-	100	0.224	0.224	0.224
1.002	-	-	100	0.018	0.018	0.018
2.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.018	0.018	0.018
1.004	-	-	100	0.164	0.164	0.164
1.005	-	-	100	0.066	0.066	0.066
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.675	0.675	0.675

Free Flowing Outfall Details for SW.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S12	123.800	122.383	0.000	1500	0

Simulation Criteria for SW.SWS

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 Offline Controls 1 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 1 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	0.318		

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Online Controls for SW.SWS

Non Return Valve Manhole: S5, DS/PN: S2.001, Volume (m³): 3.9

Hydro-Brake® Optimum Manhole: S9, DS/PN: S1.006, Volume (m³): 29.3

Unit Reference	MD-SHE-0099-6000-2100-6000
Design Head (m)	2.100
Design Flow (l/s)	6.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	99
Invert Level (m)	122.879
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.100	6.0	Kick-Flo®	0.888	4.0
Flush-Flo™	0.432	5.1	Mean Flow over Head Range	-	4.8

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)	Depth (m)	Flow (l/s)
0.100	3.3	0.800	4.5	2.000	5.9	4.000	8.1	7.000	10.6
0.200	4.6	1.000	4.2	2.200	6.1	4.500	8.6	7.500	10.9
0.300	4.9	1.200	4.6	2.400	6.4	5.000	9.0	8.000	11.3
0.400	5.1	1.400	5.0	2.600	6.6	5.500	9.4	8.500	11.6
0.500	5.0	1.600	5.3	3.000	7.1	6.000	9.8	9.000	11.9
0.600	5.0	1.800	5.6	3.500	7.6	6.500	10.2	9.500	12.2

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Offline Controls for SW.SWS

Pipe Manhole: S6, DS/PN: S1.003, Loop to PN: S2.000

Diameter (m)	0.300	Roughness k (mm)	0.600
Section Type	Pipe/Conduit	Entry Loss Coefficient	0.500
Slope (1:X)	220.0	Coefficient of Contraction	0.600
Length (m)	7.570	Upstream Invert Level (m)	124.578

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Storage Structures for SW.SWS

Cellular Storage Manhole: S4, DS/PN: S2.000

Invert Level (m) 123.374 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)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	150.0	150.0	1.200	150.0	210.0	1.300	0.0	210.0

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Summary of Critical Results by Maximum Level (Rank 1) for SW.SWS

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 Offline Controls 1 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 18.800	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.314	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, 1440
Return Period(s) (years)	100
Climate Change (%)	30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	180 Winter	100	+30%	100/30 Winter				124.913	0.285	0.000
S1.001	S2	180 Winter	100	+30%	100/30 Winter				124.911	0.324	0.000
S1.002	S3	180 Winter	100	+30%	100/30 Winter				124.909	0.351	0.000
S2.000	S4	600 Winter	100	+30%	100/60 Summer				125.023	1.499	0.000
S2.001	S5	600 Winter	100	+30%	100/60 Summer				124.818	1.324	0.000
S1.003	S6	180 Winter	100	+30%	100/30 Summer		100/30 Winter	21	124.907	0.409	0.000
S1.004	S7	180 Winter	100	+30%	100/30 Summer				124.913	0.475	0.000
S1.005	S8	180 Winter	100	+30%	100/30 Summer				124.919	0.521	0.000
S1.006	S9	180 Winter	100	+30%	100/15 Summer				124.920	1.891	0.000
S1.007	S10	120 Winter	100	+30%					122.869	-0.088	0.000
S1.008	S11	120 Winter	100	+30%					122.713	-0.089	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.02		24.9	SURCHARGED	
S1.001	S2	0.06		54.3	SURCHARGED	
S1.002	S3	0.04		56.9	SURCHARGED	
S2.000	S4	0.39		4.2	SURCHARGED	
S2.001	S5	0.26		3.5	SURCHARGED	
S1.003	S6	0.01	89.1	24.2	SURCHARGED	
S1.004	S7	0.01		22.7	SURCHARGED	
S1.005	S8	0.01		16.7	SURCHARGED	
S1.006	S9	0.39		5.9	SURCHARGED	
S1.007	S10	0.36		5.9	OK	
S1.008	S11	0.35		5.9	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW.SWS

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	0.318	Minimum Backdrop Height (m)	0.700
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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)	400

Designed with Level Soffits

Time Area Diagram for SW.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.425	4-8	0.250

Total Area Contributing (ha) = 0.675

Total Pipe Volume (m³) = 144.033

Network Design Table for SW.SWS

« - Indicates pipe capacity < flow

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
S1.000	16.574	0.041	400.3	0.185	5.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.001	11.629	0.029	399.6	0.224	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.002	23.742	0.060	398.4	0.018	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S2.000	3.008	0.030	99.9	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.001	4.561	0.046	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	24.058	0.060	400.3	0.018	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.004	16.096	0.040	400.4	0.164	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.005	7.536	0.019	400.9	0.066	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.006	7.200	0.072	100.0	0.000	0.00	0.0	0.600	o	150	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)
S1.000	50.00	5.15	123.428	0.185	0.0	0.0	0.0	1.86	2107.7	25.1
S1.001	50.00	5.25	123.387	0.409	0.0	0.0	0.0	1.87	2109.6	55.4
S1.002	50.00	5.46	123.358	0.427	0.0	0.0	0.0	1.87	2113.0	57.8
S2.000	50.00	5.05	123.374	0.000	0.0	0.0	0.0	1.01	17.8	0.0
S2.001	50.00	5.13	123.344	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S1.003	50.00	5.65	122.998	0.445	0.0	0.0	0.0	2.14	3777.7	60.3
S1.004	50.00	5.78	122.938	0.609	0.0	0.0	0.0	2.14	3777.2	82.5
S1.005	50.00	5.84	122.898	0.675	0.0	0.0	0.0	2.14	3775.0	91.4
S1.006	50.00	5.96	122.879	0.675	0.0	0.0	0.0	1.00	17.8«	91.4

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Network Design Table for SW.SWS

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
S1.007	15.468	0.155	99.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.008	26.907	0.269	100.0	0.000	0.00	0.0	0.600	o	150	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)
S1.007	50.00	6.21	122.807	0.675	0.0	0.0	0.0	1.01	17.8«	91.4
S1.008	50.00	6.66	122.652	0.675	0.0	0.0	0.0	1.00	17.8«	91.4

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Area Summary for SW.SWS

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.185	0.185	0.185
1.001	-	-	100	0.224	0.224	0.224
1.002	-	-	100	0.018	0.018	0.018
2.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.018	0.018	0.018
1.004	-	-	100	0.164	0.164	0.164
1.005	-	-	100	0.066	0.066	0.066
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.675	0.675	0.675

Free Flowing Outfall Details for SW.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S12	123.800	122.383	0.000	1500	0

Simulation Criteria for SW.SWS

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 Offline Controls 1 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 1 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	0.318		

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Online Controls for SW.SWS

Non Return Valve Manhole: S5, DS/PN: S2.001, Volume (m³): 3.9

Hydro-Brake® Optimum Manhole: S9, DS/PN: S1.006, Volume (m³): 29.3

Unit Reference	MD-SHE-0099-6000-2100-6000
Design Head (m)	2.100
Design Flow (l/s)	6.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	99
Invert Level (m)	122.879
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.100	6.0	Kick-Flo®	0.888	4.0
Flush-Flo™	0.432	5.1	Mean Flow over Head Range	-	4.8

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)	Depth (m)	Flow (l/s)
0.100	3.3	0.800	4.5	2.000	5.9	4.000	8.1	7.000	10.6
0.200	4.6	1.000	4.2	2.200	6.1	4.500	8.6	7.500	10.9
0.300	4.9	1.200	4.6	2.400	6.4	5.000	9.0	8.000	11.3
0.400	5.1	1.400	5.0	2.600	6.6	5.500	9.4	8.500	11.6
0.500	5.0	1.600	5.3	3.000	7.1	6.000	9.8	9.000	11.9
0.600	5.0	1.800	5.6	3.500	7.6	6.500	10.2	9.500	12.2

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Offline Controls for SW.SWS

Pipe Manhole: S6, DS/PN: S1.003, Loop to PN: S2.000

Diameter (m)	0.300	Roughness k (mm)	0.600
Section Type	Pipe/Conduit	Entry Loss Coefficient	0.500
Slope (1:X)	220.0	Coefficient of Contraction	0.600
Length (m)	7.570	Upstream Invert Level (m)	124.578

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Storage Structures for SW.SWS

Cellular Storage Manhole: S4, DS/PN: S2.000

Invert Level (m) 123.374 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)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	150.0	150.0	1.200	150.0	210.0	1.300	0.0	210.0

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Summary of Critical Results by Maximum Level (Rank 1) for SW.SWS

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 Offline Controls 1 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.800
Region	England and Wales	Ratio R	0.314
Cv (Summer)	0.750		
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, 1440
Return Period(s) (years)	100
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	180 Winter	100	+0%	100/60 Winter				124.770	0.142
S1.001	S2	180 Winter	100	+0%	100/60 Winter				124.769	0.183
S1.002	S3	180 Winter	100	+0%	100/60 Winter				124.768	0.211
S2.000	S4	360 Winter	100	+0%	100/120 Winter				123.953	0.429
S2.001	S5	360 Winter	100	+0%	100/120 Winter				123.954	0.460
S1.003	S6	180 Winter	100	+0%	100/60 Winter		100/60 Winter	18	124.768	0.270
S1.004	S7	180 Winter	100	+0%	100/60 Summer				124.768	0.330
S1.005	S8	180 Winter	100	+0%	100/60 Summer				124.768	0.370
S1.006	S9	180 Winter	100	+0%	100/15 Summer				124.768	1.739
S1.007	S10	180 Winter	100	+0%					122.868	-0.089
S1.008	S11	180 Winter	100	+0%					122.712	-0.090

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.02		16.4	SURCHARGED	
S1.001	S2	0.000	0.03		31.0	SURCHARGED	
S1.002	S3	0.000	0.02		28.3	SURCHARGED	
S2.000	S4	0.000	0.19		2.1	SURCHARGED	
S2.001	S5	0.000	0.16		2.1	SURCHARGED	
S1.003	S6	0.000	0.01	33.0	13.7	SURCHARGED	
S1.004	S7	0.000	0.01		17.4	SURCHARGED	
S1.005	S8	0.000	0.01		12.3	SURCHARGED	
S1.006	S9	0.000	0.37		5.7	SURCHARGED	
S1.007	S10	0.000	0.35		5.7	OK	
S1.008	S11	0.000	0.34		5.7	OK	

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12.3. Appendix C

Correspondence

Simon Brady

From: O'Brien, Neil <Neil.O'Brien@uuplc.co.uk>
Sent: 23 February 2018 13:43
To: Wastewater Developer Services; Michael Greensmith
Subject: RE: PDE 4200019858 due 22.02.18 : Discharge Rates - Keswick Close Manchester - 29550

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Customer

We have carried out an assessment of your application which is based on the information provided; this pre development advice will be valid for 12 months

Foul will be allowed to drain to the public combined sewer network at an unrestricted rate. The connection(s) to the public sewer can be at a point(s) convenient to yourself

Surface water from this site must drain to an infiltration system or some other form of SUDS system but if ground conditions confirm that this is not a viable solution surface water can drain to the public sewer network at a maximum pass forward flow of 6l/s.

If you require any further guidance please follow http://www.unitedutilities.com/builders-developers.aspx

If you need a make further enquiry relating to this matter please send your enquiry to WastewaterDeveloperServices@uuplc.co.uk Please quote your DEXXXX/42XXXXXXX/GEXXXX reference number

Please Note:- enquiries sent to any other United Utilities e-mail address will be deleted.

Connection Application

Although we may discuss and agree discharge points & 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 ultimatley 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

http://www.unitedutilities.com/connecting-public-sewer.aspx

Please be aware that on site drainage must be designed in accordance with Building Regulations, National Planning Policy, Planning Conditions and local flood authority guidelines, we would recommend that you laise and make suitable agreements with the relevant statutory bodies.

Regards

Neil O'Brien

Developer Engineer
Developer Services and Planning

From: Michael Greensmith [mailto:Michael.Greensmith@sutcliffe.co.uk]
Sent: 08 February 2018 15:23
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: Discharge Rates - Keswick Close Manchester - 29550



Dear Sir/Madam

Please find attached an FRA from Ironside Farrar for Keswick Close, Manchester.

We have now been appointed by the contractor to carry out the drainage design works.

Within the FRA report Ironside Farrar have submitted a predevelopment enquiry. However, it does not state in the report, nor anywhere else in the documentation that we have received, that there has been a response to the enquiry from United Utilities at the time of writing.

Could you please confirm whether the enquiry was responded to, if so, could you please forward that response on us as we have no confirmation of discharge rates for the site to enable to carry out the design in accordance with your requiremnets.

Unfortunately we do not have a UU reference that would have been assigned to an emailed enquiry, only the predevelopment form itself.

We trust you are able to help with this matter, should you need any further information please do not hesitate to contact this office.

Regards
Michael Greensmith

SUTCLIFFE
18-20 HARRINGTON STREET
LIVERPOOL
L2 9QA

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12.4. Appendix D

Ironside Farrar Limited Flood Risk Assessment

MULBURY HOMES

Flood Risk Assessment & Drainage Strategy



Keswick Close
Langley, Rochdale

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

30150/RDE
July 2015

Prepared By: **R.D. Eastaff**	
Checked By: **S.A. Pope**	

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2. Site Description

3. Proposed Development

4. Planning Policy

5. Forms of Flooding

6. Development and Drainage

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8. Recommendations

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DEVELOPMENT AT KESWICK CLOSE LANGLEY, ROCHDALE FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

1.0 Introduction

This Flood Risk Assessment and Drainage Strategy have been prepared by Ironside Farrar Limited on behalf of Mulbury Homes Limited in connection with a planning application for a residential development of land at Keswick Close, Langley.

In accordance with National Planning Policy Framework (NPPF) and the associated Technical Guidance document, 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 application site comprises a parcel of land, measuring approximately 1.24ha in area. It is situated to the North of Bowness Road and is accessed via Keswick Close (grid reference SD 85852 06643). The extent of the area to which the application relates is shown on the enclosed site location plan (see Appendix A and B) and is identified by the redline boundary.

The site was recently occupied by three high rise tower blocks; Millbeck Court, Keswick Court and Bowness Court which have since been demolished. Associated with the demolished tower blocks there was previously a large car park area which has since been removed. At present, the site is largely overgrown grass and rough ground.

The main access is located at the end of Keswick Close where there are two large blocks of concrete preventing access from the highway to the site. Metal railings adjacent to the north western boundary separates the site and properties on Lingmell Close. Existing fences and properties form

the boundaries of the western and southern sides of the site. The Millbeck Gardens residential development forms the north eastern boundary of the site. Two footway accesses exist from the site to Millbeck Road and Lingmell Close, the former access restricted by a padlocked metal gate.

Topographically, the site has a general fall to the north west, the lowest point of the site being along the north western boundary. The site falls away sharply along the north western boundary from 26.00m to 24.37m within approximately 8m of the boundary.

The site falls from an approximate high point opposite the access to the Millbeck Gardens development towards the north western boundary or towards Bowness Road.

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 in the recent past.

3.0 Proposed Development

The proposals for the site comprise the erection of up to 101 dwelling units comprising 91 extra care housing scheme apartments and 10 bungalows. There are also associated areas of car parking and landscaping, private gardens and access roads. 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) sets out the Government's policy on meeting the challenges of climate change, flooding and coastal change. The NPPF states that:

"Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impact of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development.

Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change taking full account of flood risk, coastal change and water supply and demand consideration."

This Flood Risk Assessment proposes recommendations to facilitate the proposed development so that it takes into account 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, therefore the development is appropriately situated and the Sequential Test is not required.

4.2 Exception Test

NPPF classifies the majority of 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 Technical Guidance to the National Planning Policy Framework 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 located in Flood Zone 1 with a chance of flooding of less than 0.1% (or 1 in 1000). The nearest watercourse is the Langley Brook, located some 0.75km to the north west.

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

5.2 Flooding from the Sea

See 5.1 above.

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.

Reference should be made to the Envirocheck Flood Data included in Appendix J. The JBA flood maps indicate only the existing junction of Keswick Close and Bowness Road to be at any potential risk of very minor surface flooding in the 75 to 1000 year return periods. The proposed development site is not shown to be at risk of surface flooding in any return period.

As described above, the site is generally at levels similar or above the surrounding ground and existing properties and is therefore considered to be at low risk of flooding from run-off from adjacent land.

The finished floor levels of the development will ensure any overland flows are directed away from the development through the site.

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

5.4 Flooding from Groundwater

During the walkover survey there was some evidence of localised areas of standing water within the rough ground of the site.

An intrusive site investigation has been undertaken which incorporated 15 trial pits and 6 boreholes. No groundwater was encountered in the trial pits which were excavated to a depth of 1.6 - 3.4m below ground.

The BGS (British Geological Society) data included in Appendix J show the site to be located in an area with limited potential for groundwater flooding to occur at the surface or for groundwater flooding to property situated below ground to occur. The ESI Groundwater Flood Map indicates the site to be in an area with negligible risk.

Site levels will ensure where possible finished floor levels are set above existing ground levels.

The site is therefore not considered to be at 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 records indicate there are no public sewers crossing the site or in the immediate vicinity of the site. There is a 225mm dia. combined sewer running northwards in Millbeck Road and also a 225mm dia. combined sewer running westwards in Hevellyn Drive meeting Millbeck Road. There is a 375mm dia. combined sewer running westwards in Bowness Road and also a 375mm dia. combined sewer running northwards in Wood Street. The 375mm dia. combined sewer in Bowness Road has been discounted as a potential drainage connection point due to existing site levels of the site in relation to the invert level. Following topographical

levels, the most logical connection points are the 225mm dia. combined sewers in Millbeck Road or Hevellyn Drive. There are also manholes evident in Lingmell Close which should be investigated for potential connection points from the site to this possible sewer.

United Utilities have been consulted with regards to flooding from the public sewerage system in Appendix G and the response is awaited. The existing sewerage system and the topography of the site is such that the site is at low risk of flooding from sewers.

The site itself is therefore considered to be at very low risk of flooding from sewers but the final drainage proposals for the site will need to be agreed with United Utilities.

5.6 Flooding from Reservoirs, Canals and Other Artificial Sources

There are a series of reservoirs located approximately 0.6km to the south of the site. Due to the topography of the area draining away from the site towards the River Irk they do not pose a risk to the development.

There are no other artificial sources of flooding within the vicinity of the site.

6.0 Development and Drainage

In line with common practice, it is proposed the surface water discharge from the development should mimic that from the existing site. United Utilities have been consulted with a view to connecting foul and surface water from the development to the existing combined sewer at Millbeck Road. The intention is to connect to this sewer at the junction of Millbeck Road and Lingmell Close or to the possible sewers in Lingmell Close.

As the site has been developed previously but now demolished, the flows from the site have been assessed using the previous roof areas of the tower blocks and the shared car park area. The previous roof areas of the tower blocks on the site totalled approximately 0.135ha and the shared car park totalled approximately 0.150ha. A simple network was compiled and hydraulic calculations undertaken as detailed in Appendix I. These calculations result in existing flow rates of 29.1, 66.7 and 81.2l/s in the 1, 30 and 100 year events. In accordance with the Strategic Flood Risk Assessment, Rochdale MBC wishes to see flow rates reduced by a minimum of 30%.

A connection to a potential sewer in Lingmell Close or the combined sewer in Millbeck Road is possible and a Sketch Drainage Layout included in Appendix H has been prepared to demonstrate the site can be developed without increasing flood risk elsewhere. Separate surface water and foul systems are proposed to combine just before exiting the site. Attenuation will be included in the system in the form of oversized pipes and a flow control introduced to limit the flows. Off-line cellular storage will also be incorporated to accommodate the 100 year return period event including 30% allowance for climate change. There is a small volume of flooding ($0.6m^3$) from the system in the extreme event but this will be adequately accommodated on the proposed highways or private shared car park. The flows from the proposed development are 20.3, 31.5 and 41.2l/s in the 1, 30 and 100 year (plus 30% climate change) events which are within the theoretical reduced flow rates of 20.3, 46.6 and 56.8l/s. Whilst matching the 30% reduced 1 year flow, the type of flow control selected has provided a betterment of 47 and 51% respectively in the 30 and 100 year events.

Further details of the proposed drainage system will need to be agreed with United Utilities.

Wherever possible, the opportunity to include SUDS techniques within the development should be taken to reduce the run-off. As described above there has been a substantial reduction of run-off rate due to the development. Trial pit logs undertaken on the site show varying underlying ground conditions and the presence of made ground across the site. Underlying ground conditions vary from stiff clay to some sands. Further testing and investigation may be required to confirm the suitability for the use of infiltration techniques. The proposed drainage layout does not currently take into account of the use of infiltration techniques.

7.0 Conclusions

- The site is located within Flood Zone 1 with a low probability of flooding.
- The site is at a low risk of flooding from other sources.
- Flows from the site should be discharged to the public sewer at the flow rates highlighted (to be agreed with United Utilities).
- Attenuation will be provided in the form of oversized underground pipes and cellular storage.

- The development will reduce run-off from the previously developed tower blocks by at least 30% and therefore the requirements of the SFRA to reduce flow rates from brownfield sites is satisfied by the development.

- Further testing and investigation may be required to confirm the suitability for the use of infiltration SUDS techniques.

- Proposed separate surface water and foul sewers are proposed to combine just prior to exiting the site and connect to an existing combined sewer at a location to be agreed with United Utilities.

8.0 Recommendations

- Following initial consultation, further discussions should take place with United Utilities with regard to connecting the development to the existing combined sewers.

- Attenuation will need to be incorporated into the surface water drainage to ensure flows are limited to the specified discharge rate and should include an allowance for climate change of 30%.

- The external levels shall be adjusted locally to ensure overland flood routes exist through the development for use in exceptional circumstances.

APPENDIX A

Site Location Plan



North Point

Project
Keswick Close
Langley, Rochdale

Client
Mulbury
Homes

Title
Site Location
Plan

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

Original Size
A4

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Drawn
NB

Checked By
SRG

Date
May 15

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1:50 000

Drawing No.
30150/App A

Revision

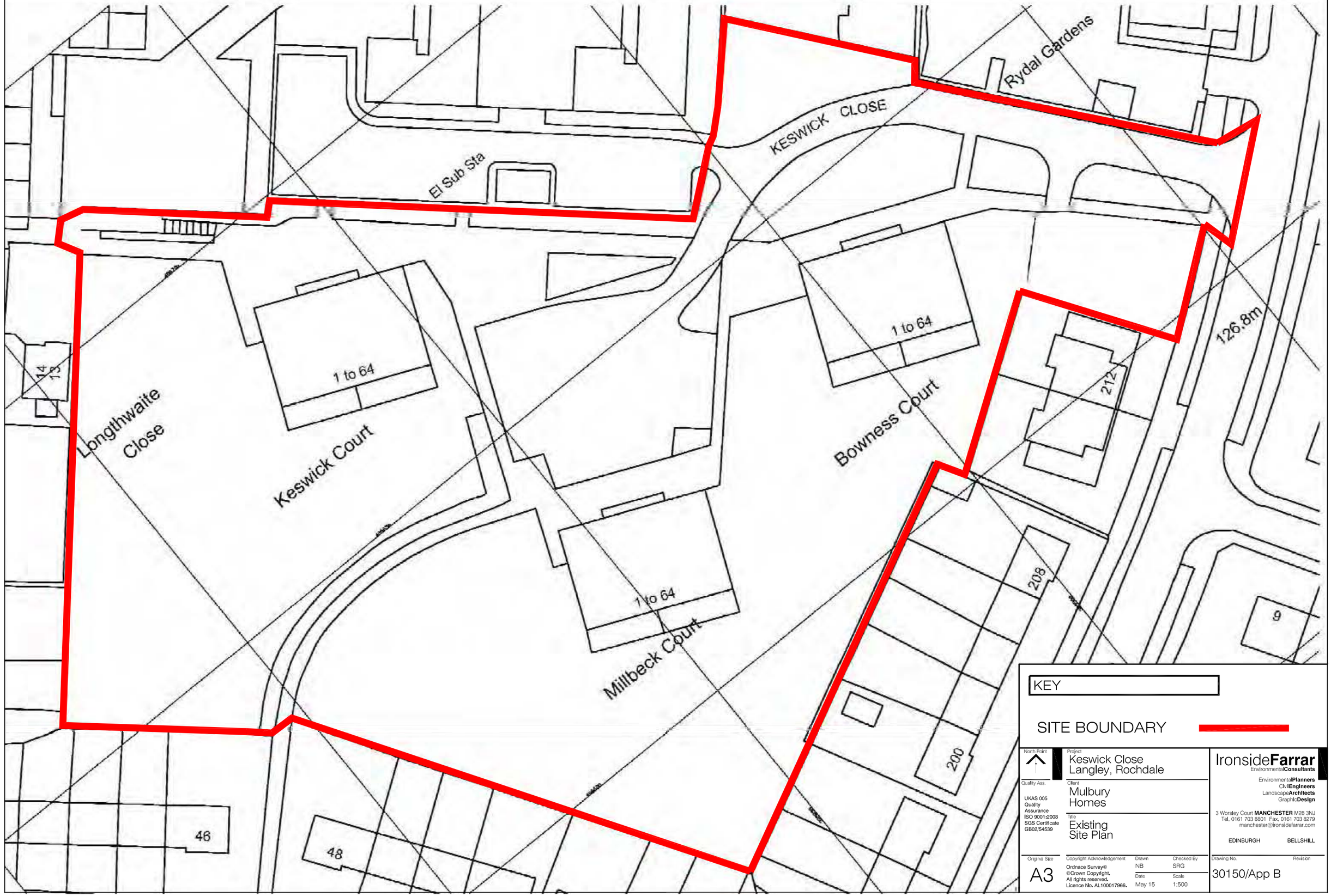
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manchester@ironsidefarrar.com

EDINBURGH BELLSHILL

APPENDIX B

Existing Site Plan



KEY

SITE BOUNDARY

North Point

Quality Ass.

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

Project
Keswick Close
Langley, Rochdale

Client
Mulbury Homes

Title
Existing Site Plan

Original Size
A3

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Date: May 15
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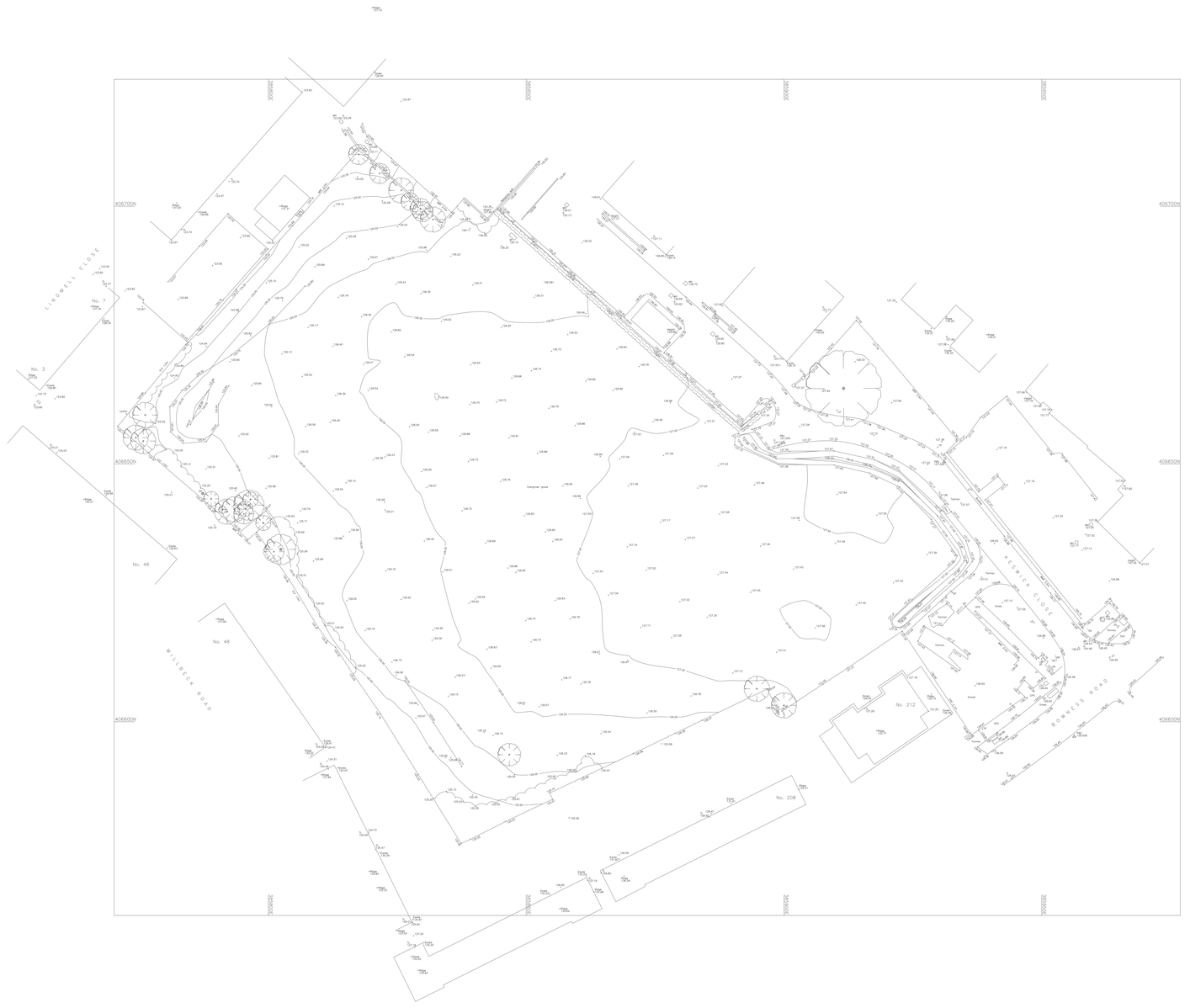
3 Worsley Court MANCHESTER M28 3NJ
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manchester@ironsidefarrar.com

EDINBURGH BELLSHILL

Drawing No.: 30150/App B
Revision:

APPENDIX C

Topographical Survey



SURVEY STATIONS			
Name	Easting	Northing	Height
PB1	385900.96	406655.14	128.21
PB2	385957.31	406598.15	127.64
PB3	385932.10	406651.45	128.23

North Point

Quality Ass.

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

Original Size: A1

Project: Keswick Close Langley, Rochdale

Client: Mulbury Homes

Title: Topographical Survey

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manchester@ironsidefarrar.com
EDINBURGH BELLSHILL

Drawing No.: 30150/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
Keswick Close
Langley, Rochdale

Client
Mulbury
Homes

Title
Aerial
Photograph

Original Size
A3

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EDINBURGH BELLSHILL

Drawing No. 30150/App D
Revision



View at Keswick Close junction with Bowness Road.



General Site view West.



General Site view East.



North Western Site boundary.



Footway Access to Lingmell Close.



Footway Access to Millbeck Road.



Keswick Close Extent.



Northern Site boundary.

APPENDIX E

Environment Agency
Flood Risk Map



North Point

Quality Ass.

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

Project
Keswick Close
Langley, Rochdale

Client
Mulbury
Homes

Title
Environment Agency
Flood Risk Map

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Drawn NB
Checked By SRG
Date May 15
Scale NTS

Original Size
A4

Drawing No.
30150/App E

Revision

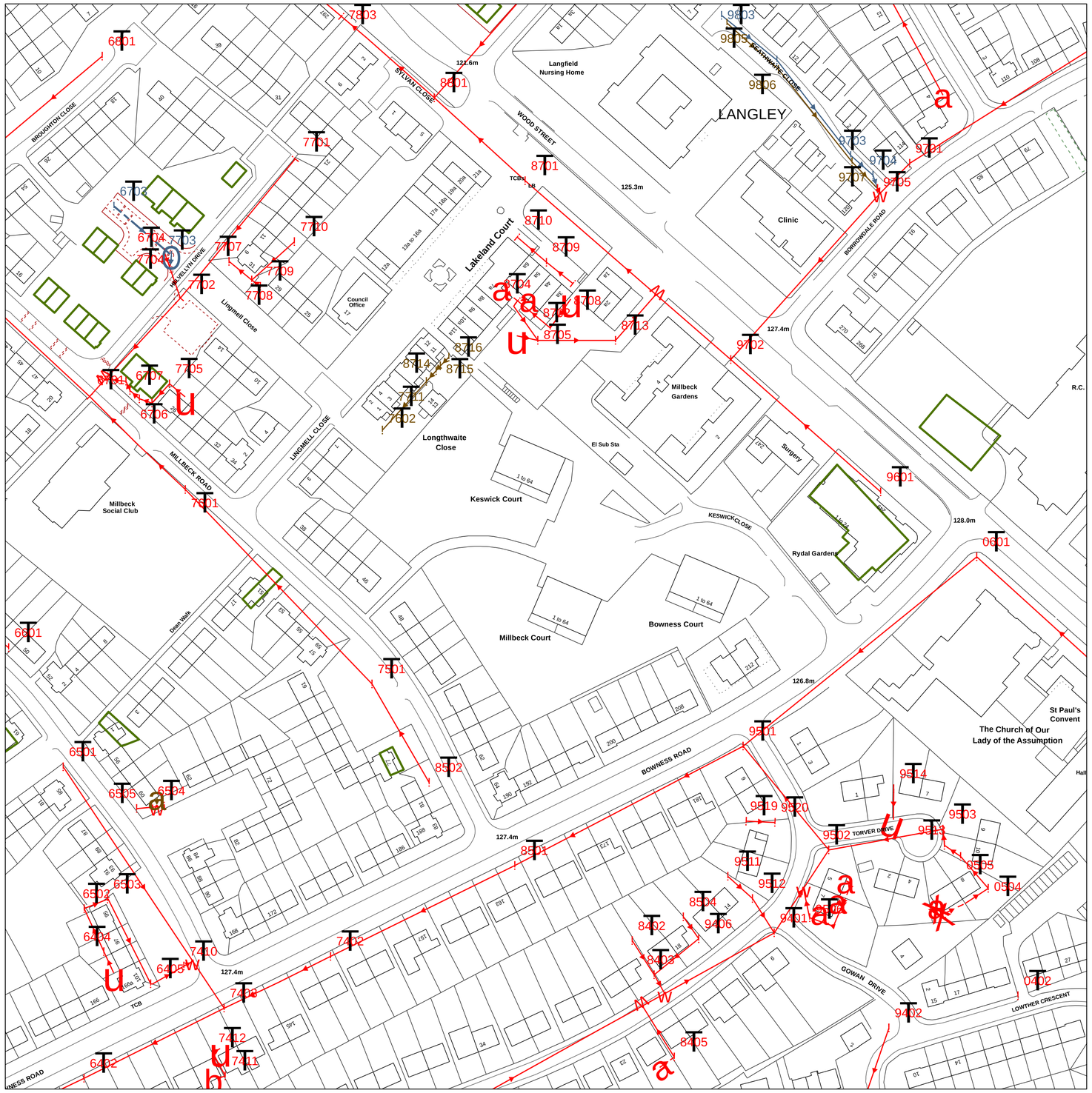
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APPENDIX F

Sewer Records



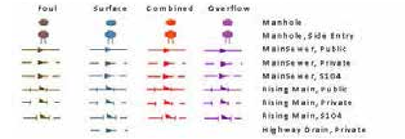
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6504		CO							
6505		CO							
6601	123.39	CO	118.97	225		CI	VC	21.4	0
6701	122.07	CO	117.82	375		CI	CO	98.58	75
6704	121.12	CO							
6705	122.36	CO							
6706		CO							
6707		CO							
6708	122.14	CO							
7501		CO							
7601		CO							
7602		FO							
7702	121.37	CO							
7703	120.97	SW							
7704	121.2	CO							
7705	122.21	CO							
7707		CO							
7708		CO							
7709		CO							
7710		CO							
7711		FO							
8502		CO	0	225		CI	VC	43.91	
8702		CO							
8704		CO							
8705		CO							
8708		CO							
8709		CO							
8713		CO							
8714		FO							
8715		FO							
8716	0	FO							
9501	127.31	CO							
9502	129.01	CO	124.56	225		CI	VC	51.86	64
9503	129.65	CO	126.49	225		CI	VC	44.72	23
9513		CO		100		CI	VC	6.22	
9514		CO							
9519		CO							
9520		CO							
9801		CO	0	225		CI	VC	77.1	
9702	127.32	CO	123.19	375		CI	CO	105.03	63
0601	127.99	CO	124	375		CI	CO	115.88	331
6506		FO							
6604		CO	0	375		CI	CO	25.23	
8503		CO	123.27	525		CI	VC	49.65	709
8711		CO							
8712		CO							
6507		CO							
6709		CO							
8707		CO							

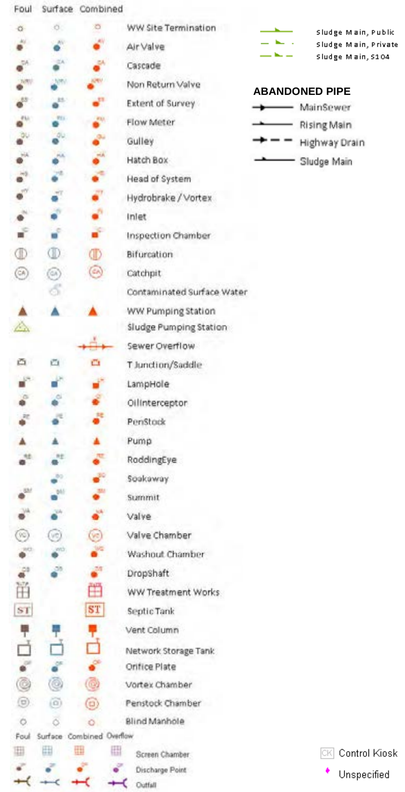
Printed By: Property Searches

OS Sheet No:

Approximately Scale: 1: 1250 Date: 07/07/2015

WASTE WATER SYMBOLOGY





LEGEND

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

The position of underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available.
The actual positions may be different from those shown on
the plan and private pipes, sewers or drains may not be recorded.
United Utilities will not accept any liability for any damage caused by the actual positions being different from those shown.
United Utilities Water Limited 2014. The plan is based upon the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office.Crown and United Utilities copyrights are reserved. Unauthorised reproduction will infringe these copyrights.

OS Sheet No:

Scale: 1: 1250 Date: 07/07/2015

50 Nodes

Sheet 1 of 1

United Utilities
helping life flow smoothly

SEWER RECORDS

APPENDIX G

Consultation with United Utilities

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	Glyn Barrett	Robert Eastaff
Company name	Mulbury Homes	Ironside Farrar Limited
Home or company address *(including postcode)*	Great Oak Farm, Mag Lane, Lymm, Cheshire WA13 0TF	3 Worsley Court, Worsley, Manchester, M28 3NJ
Contact telephone number *(a mobile number is fine)*	01925 748530	0161 703 8801
Email	Glyn@mulburyhomes.com	robert.eastaff@ironsidefarrar.com
What is your enquiry?	Surface water and foul connection points / discharge rates for proposed residential development.	

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

Section 2: About your site

Site name	Keswick Close, Langley, Rochdale								
Site address *(or nearest main road)*	Keswick Close, Langley, Rochdale								
Nearest postcode	M24 5QL								
Site grid reference (mid point)	X:	385852			Y:	406643			
Approx. number of dwellings	101 (10 bungalows, 91 extra care housing scheme apartments)								
Approx. numbers of non-household units	N/A								
Total site area (hectares)	1.27								
Development area - hectares (*Optional*)	Residential		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		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		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	X
Do you intend to discharge highways drainage to the public sewer network?	Yes	X	No	
If yes, to which sewer?	TBC			

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)				
Is the foul water discharge to be pumped?	Yes		No	X

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)*		Discharge to public sewer *(Go to Q5.1)*	X

(5.1) Does the site have existing surface water connections to the public sewer?	Yes *(Go to Q5.2)*		No *(Go to Q5.3)*	TBC
(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)	Possible sewer in Lingmell Close, or 225mm dia. combined sewer in Millbeck Road. Proposed flow rates 20.3, 46.6 and 56.8 l/s in 1, 30 & 100 year (+30% CC) events.			
Have you completed a flood risk assessment in support of your planning application?	Yes	X	No	
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	X

		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	X	No	
Indicative layout plan (optional)	Yes		No	X
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

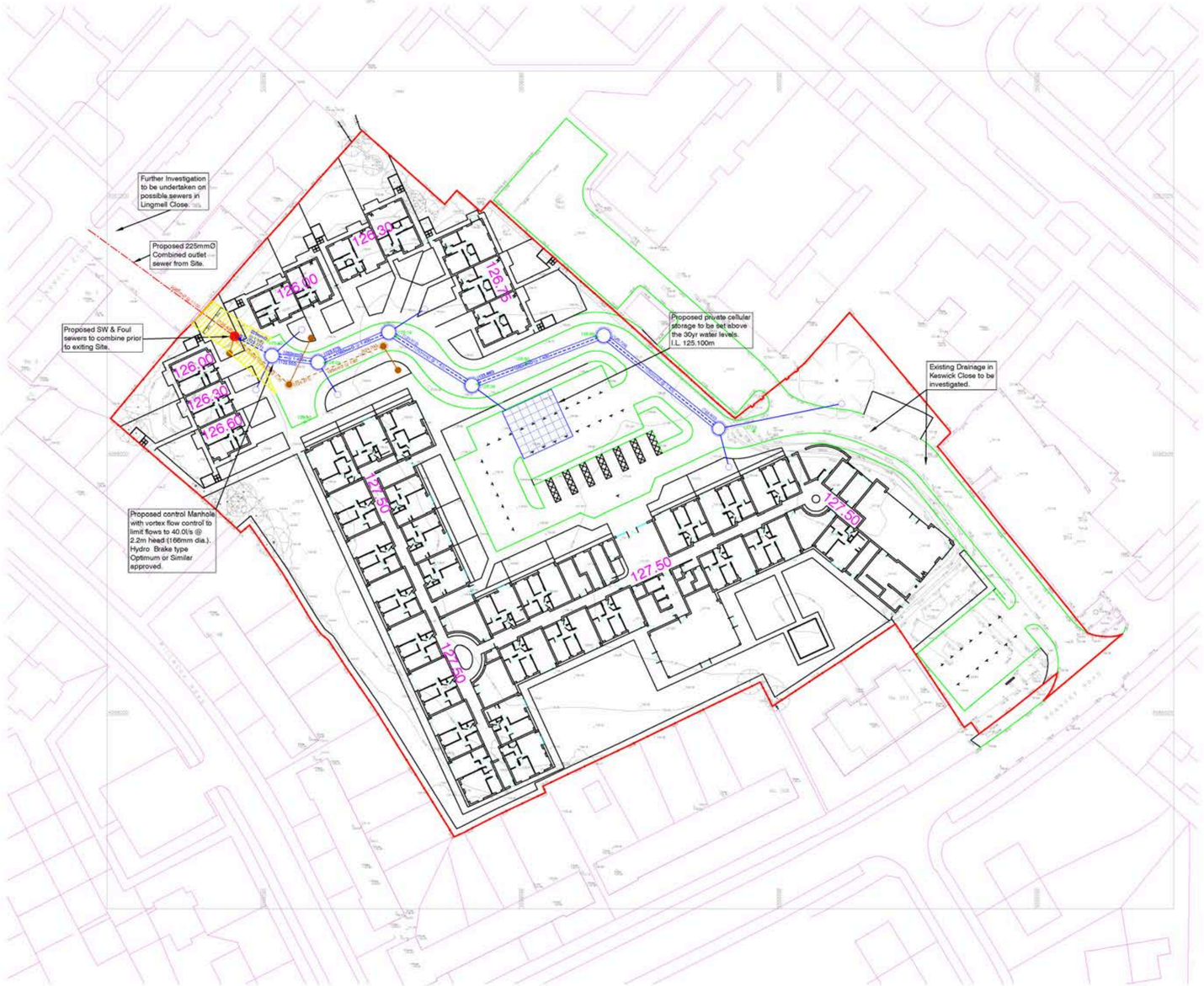
I understand that the submission of this form is to be treated as a preliminary enquiry and the information may be subject to change. In particular, I understand that the information United Utilities Water Limited provides in response is valid only in conjunction with the information provided in relation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

Name (please print)	ROBERT EASTAFF	Signature	
Company	IRONSIDE FARRAR LIMITED	Date	09/07/15

For United Utilities use only			
Date received		UUW Ref No.	

APPENDIX H

Proposed Development
&
Drainage Layout



North Point	Project	IronsideFarrar
	Keswick Close Langley, Rochdale	Environmental**Consultants**
Quality Ass UKAS 005 Quality Assurance ISO 9001:2008 SGS Certificate GB02/54539	Client Mulbury Homes	Environmental**Planners** Civil**Engineers** Landscape**Architects** Graphic**Design**
	Title Proposed Development & Drainage Layout	3 Worsley Court **MANCHESTER** M28 3NJ Tel. 0161 703 8801 Fax. 0161 703 8279 manchester@ironsidefarrar.com
Original Size A1	Copyright Acknowledgement Ordnace Survey© ©Crown Copyright. All rights reserved. Licence No. AL100017986.	Drawn: NB Checked By: RE Date: July 15 Scale: 1:500	**EDINBURGH** **BELLSHILL** Drawing No.: 30150/App H Revision

APPENDIX I

Hydraulic Calculations

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	Add Flow / Climate Change (%)	0
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.000
Ratio R	0.306	Maximum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.211	4-8	0.074

Total Area Contributing (ha) = 0.285

Total Pipe Volume (m^3) = 3.670

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)	Auto Design
1.000	41.452	0.415	100.0	0.045	5.00	0.0	0.600	o	150	
1.001	44.631	0.446	100.0	0.195	0.00	0.0	0.600	o	225	
1.002	29.260	0.293	100.0	0.045	0.00	0.0	0.600	o	225	

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	5.69	125.950	0.045	0.0	0.0	0.0	1.00	17.8	0.0
1.001	0.00	6.26	125.460	0.240	0.0	0.0	0.0	1.31	52.0	0.0
1.002	0.00	6.63	125.014	0.285	0.0	0.0	0.0	1.31	52.0	0.0

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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	150	1	127.300	125.950	1.200	Open Manhole	1200
1.001	o	225	2	126.900	125.460	1.215	Open Manhole	1200
1.002	o	225	3	126.400	125.014	1.161	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	41.452	100.0	2	126.900	125.535	1.215	Open Manhole	1200
1.001	44.631	100.0	3	126.400	125.014	1.161	Open Manhole	1200
1.002	29.260	100.0		126.400	124.722	1.453	Open Manhole	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

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%	30/15 Summer				126.008
1.001	2	15 Winter	1	+0%	30/15 Summer				125.575
1.002	3	15 Winter	1	+0%	30/15 Summer				125.141

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.092	0.000	0.31		5.3	OK	
1.001	2	-0.111	0.000	0.50		24.9	OK	
1.002	3	-0.098	0.000	0.60		29.1	OK	

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

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	+0%	30/15 Summer				126.279
1.001	2	15 Winter	30	+0%	30/15 Summer				126.126
1.002	3	15 Winter	30	+0%	30/15 Summer				125.496

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.179	0.000	0.69		11.9	SURCHARGED	
1.001	2	0.441	0.000	1.17		58.1	SURCHARGED	
1.002	3	0.257	0.000	1.38		66.7	SURCHARGED	

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

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	+0%	30/15 Summer				126.842
1.001	2	15 Winter	100	+0%	30/15 Summer				126.648
1.002	3	15 Winter	100	+0%	30/15 Summer				125.780

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.742	0.000	0.89		15.4	SURCHARGED	
1.001	2	0.963	0.000	1.38		68.4	FLOOD RISK	
1.002	3	0.541	0.000	1.68		81.2	SURCHARGED	

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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	Add Flow / Climate Change (%)	0
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.000
Ratio R	0.306	Maximum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.643	4-8	0.170

Total Area Contributing (ha) = 0.813

Total Pipe Volume (m³) = 87.470

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)	Auto Design
1.000	28.693	0.072	400.0	0.060	5.00	0.0	0.600	o	1050	
1.001	27.289	0.068	400.0	0.033	0.00	0.0	0.600	o	1050	
1.002	19.161	0.048	400.0	0.019	0.00	0.0	0.600	o	1050	
1.003	14.873	0.037	400.0	0.043	0.00	0.0	0.600	o	1050	
1.004	9.013	0.023	400.0	0.590	0.00	0.0	0.600	o	1050	
1.005	8.166	0.082	100.0	0.068	0.00	0.0	0.600	o	225	
1.006	35.118	0.351	100.0	0.000	0.00	0.0	1.500	o	225	

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	5.28	123.800	0.060	0.0	0.0	0.0	1.72	1486.6	0.0
1.001	0.00	5.54	123.728	0.093	0.0	0.0	0.0	1.72	1486.6	0.0
1.002	0.00	5.73	123.660	0.112	0.0	0.0	0.0	1.72	1486.6	0.0
1.003	0.00	5.87	123.612	0.155	0.0	0.0	0.0	1.72	1486.6	0.0
1.004	0.00	5.96	123.575	0.745	0.0	0.0	0.0	1.72	1486.6	0.0
1.005	0.00	6.07	123.552	0.813	0.0	0.0	0.0	1.31	52.0	0.0
1.006	0.00	6.58	122.408	0.813	0.0	0.0	0.0	1.15	45.6	0.0

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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	127.300	123.800	2.450	Open Manhole	2400
1.001	o	1050	2	126.680	123.728	1.902	Open Manhole	2700
1.002	o	1050	3	126.390	123.660	1.680	Open Manhole	2700
1.003	o	1050	4	126.190	123.612	1.528	Open Manhole	2700
1.004	o	1050	5	126.040	123.575	1.415	Open Manhole	2700
1.005	o	225	6	125.900	123.552	2.123	Open Manhole	2700
1.006	o	225	7	126.000	122.408	3.367	Open Manhole	1500

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	28.693	400.0	2	126.680	123.728	1.902	Open Manhole	2700
1.001	27.289	400.0	3	126.390	123.660	1.680	Open Manhole	2700
1.002	19.161	400.0	4	126.190	123.612	1.528	Open Manhole	2700
1.003	14.873	400.0	5	126.040	123.575	1.415	Open Manhole	2700
1.004	9.013	400.0	6	125.900	123.552	1.298	Open Manhole	2700
1.005	8.166	100.0	7	126.000	123.471	2.304	Open Manhole	1500
1.006	35.118	100.0		123.550	122.057	1.268	Open Manhole	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

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Online Controls for Storm

Hydro-Brake Optimum® Manhole: 6, DS/PN: 1.005, Volume (m³): 18.9

Unit Reference	MD-SCU-0166-4000-2200-4000
Design Head (m)	2.200
Design Flow (l/s)	40.0
Flush-Flo™	Calculated
Objective	Linear discharge profile
Diameter (mm)	166
Invert Level (m)	123.552
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)	2.200	40.0	Kick-Flo®	0.249	14.2
Flush-Flo™	0.201	14.5	Mean Flow over Head Range	-	26.9

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	6.5	1.200	29.9	3.000	46.5	7.000	70.1
0.200	14.5	1.400	32.2	3.500	50.1	7.500	72.5
0.300	15.4	1.600	34.3	4.000	53.4	8.000	74.8
0.400	17.7	1.800	36.3	4.500	56.6	8.500	77.1
0.500	19.7	2.000	38.2	5.000	59.5	9.000	79.3
0.600	21.5	2.200	40.0	5.500	62.4	9.500	81.4
0.800	24.6	2.400	41.7	6.000	65.1		
1.000	27.4	2.600	43.4	6.500	67.6		

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Storage Structures for Storm

Tank or Pond Manhole: 3, DS/PN: 1.002

Invert Level (m) 125.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	105.0	2.800	0.0	5.600	0.0	8.400	0.0
0.400	105.0	3.200	0.0	6.000	0.0	8.800	0.0
0.800	105.0	3.600	0.0	6.400	0.0	9.200	0.0
0.801	0.0	4.000	0.0	6.800	0.0	9.600	0.0
1.600	0.0	4.400	0.0	7.200	0.0	10.000	0.0
2.000	0.0	4.800	0.0	7.600	0.0		
2.400	0.0	5.200	0.0	8.000	0.0		

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

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	60 Winter	1	+0%	30/60 Winter				124.086
1.001	2	60 Winter	1	+0%	30/60 Winter				124.086
1.002	3	60 Winter	1	+0%	30/30 Winter				124.086
1.003	4	60 Winter	1	+0%	30/30 Winter				124.086
1.004	5	60 Winter	1	+0%	30/30 Winter				124.086
1.005	6	60 Winter	1	+0%	1/15 Summer	100/120 Winter			124.085
1.006	7	60 Winter	1	+0%					122.516

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.764	0.000	0.00		2.7	OK	
1.001	2	-0.692	0.000	0.00		4.8	OK	
1.002	3	-0.624	0.000	0.01		9.0	OK	
1.003	4	-0.576	0.000	0.02		12.2	OK	
1.004	5	-0.539	0.000	0.03		18.7	OK	
1.005	6	0.308	0.000	0.50		20.3	SURCHARGED	1
1.006	7	-0.117	0.000	0.46		20.3	OK	

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

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	60 Winter	30	+0%	30/60 Winter				124.895
1.001	2	60 Winter	30	+0%	30/60 Winter				124.895
1.002	3	60 Winter	30	+0%	30/30 Winter				124.895
1.003	4	60 Winter	30	+0%	30/30 Winter				124.895
1.004	5	60 Winter	30	+0%	30/30 Winter				124.895
1.005	6	60 Winter	30	+0%	1/15 Summer	100/120 Winter			124.894
1.006	7	60 Winter	30	+0%					122.550

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.045	0.000	0.01		5.9	SURCHARGED	
1.001	2	0.117	0.000	0.01		12.3	SURCHARGED	
1.002	3	0.185	0.000	0.02		18.0	SURCHARGED	
1.003	4	0.233	0.000	0.03		22.1	SURCHARGED	
1.004	5	0.271	0.000	0.05		29.5	SURCHARGED	
1.005	6	1.117	0.000	0.78		31.5	SURCHARGED	1
1.006	7	-0.083	0.000	0.72		31.5	OK	

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

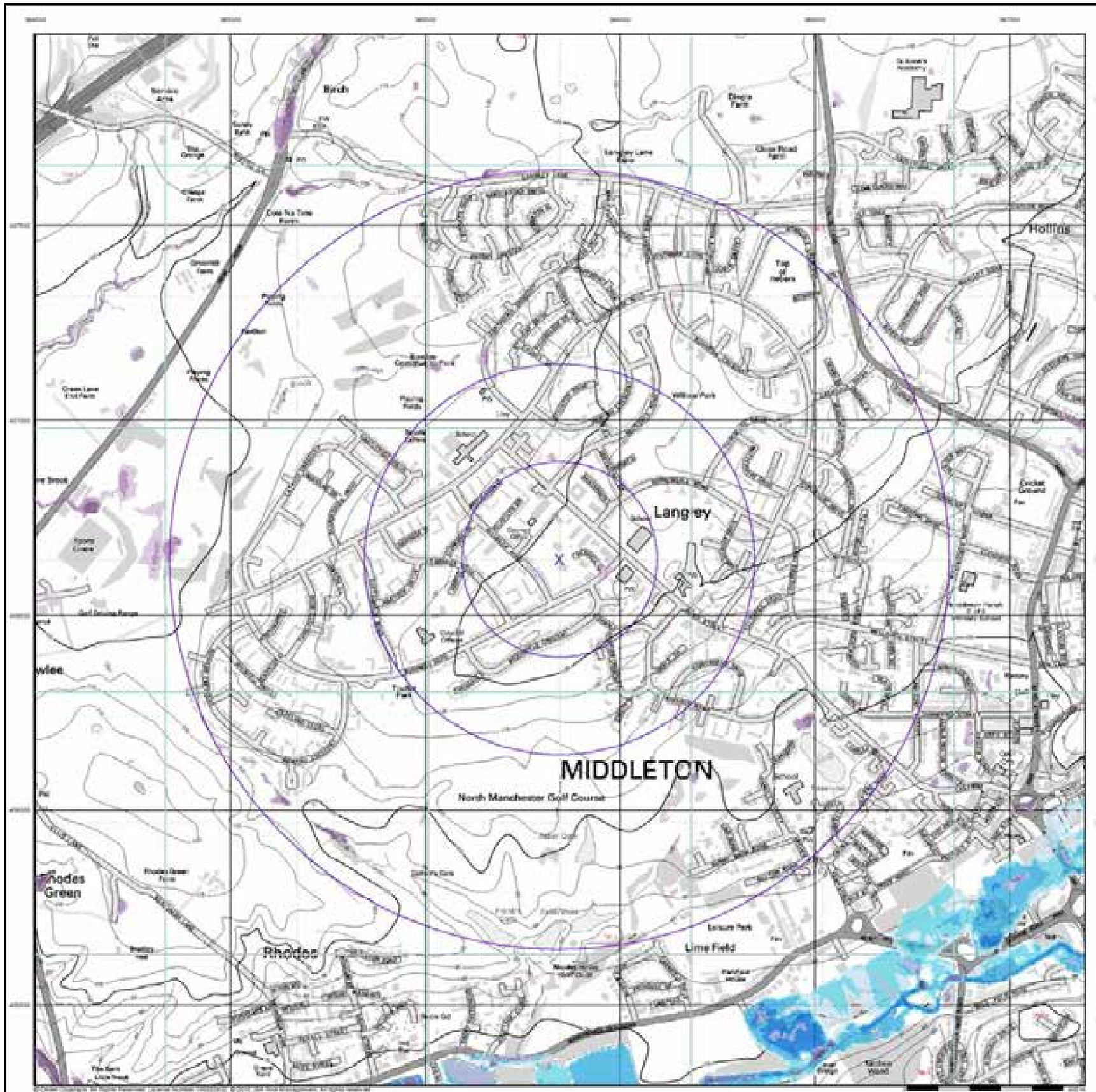
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	120 Winter	100	+30%	30/60 Winter				125.899
1.001	2	120 Winter	100	+30%	30/60 Winter				125.899
1.002	3	120 Winter	100	+30%	30/30 Winter				125.899
1.003	4	120 Winter	100	+30%	30/30 Winter				125.901
1.004	5	120 Winter	100	+30%	30/30 Winter				125.904
1.005	6	120 Winter	100	+30%	1/15 Summer	100/120 Winter			125.900
1.006	7	120 Winter	100	+30%					122.581

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	1.049	0.000	0.01		8.4	SURCHARGED	
1.001	2	1.120	0.000	0.01		13.4	SURCHARGED	
1.002	3	1.189	0.000	0.08		73.7	SURCHARGED	
1.003	4	1.239	0.000	0.08		58.6	FLOOD RISK	
1.004	5	1.279	0.000	0.09		54.1	FLOOD RISK	
1.005	6	2.123	0.601	1.02		41.2	FLOOD	1
1.006	7	-0.052	0.000	0.94		41.2	OK	

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APPENDIX J

Envirocheck
Flood Data



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JBA 75 Year Return Flood Map (Undefended) (1:10,000)

General

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

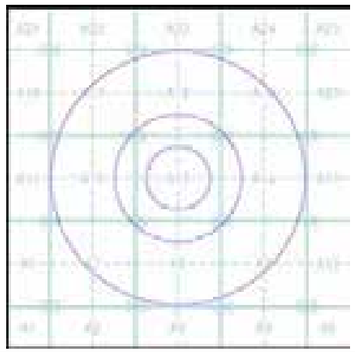
Modelled Flood Depth

Pluvial Depth	Fluvial Depth	Coastal Depth
< 1cm	0.5mm - 10cm	< 10cm
1cm - 10cm	10cm - 30cm	10cm - 30cm
10cm - 30cm	30cm - 1m	30cm - 1m
30cm - 1m	>1m	>1m
>1m		

Contours (height in meters)

- Standard Contour
- Master Contour
- Spot Height
- MLWS / MLWN Mean Low Water
- MHWS / MHWN Mean High Water

JBA 75 Year Return Flood Map (Undefended) - Slice A



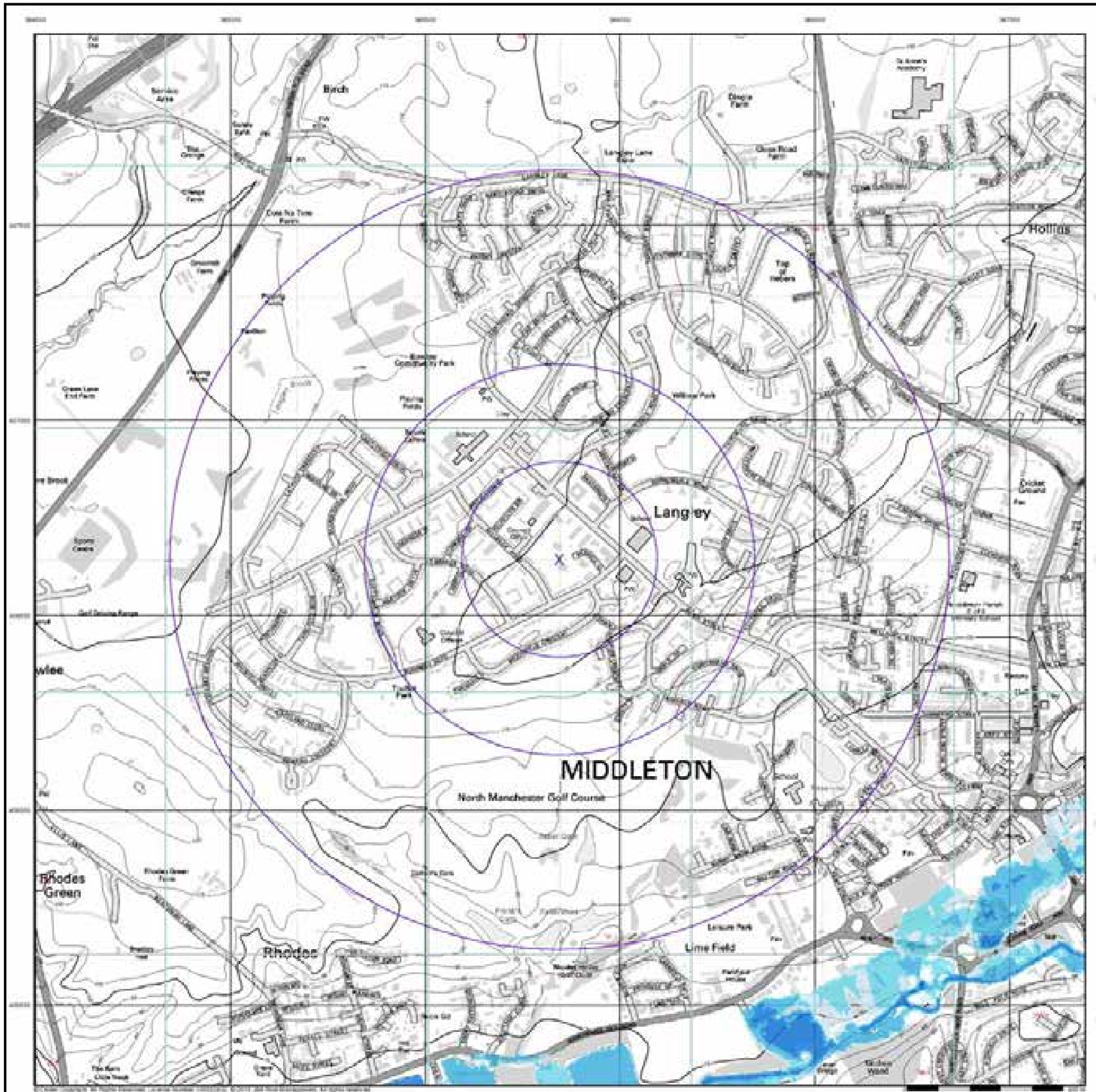
Order Details

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Customer Ref:	30150
National Grid Reference:	385840, 406640
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 385850, 406650

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



IronsideFarrar
Environmental Consultants

JBA 100 Year Return Flood Map (Undefended) (1:10,000)

General

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

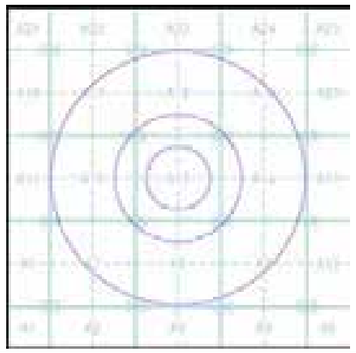
Modelled Flood Depth

Fluvial Depth	Coastal Depth
0.5mm - 10cm	< 10cm
10cm - 30cm	10cm - 30cm
30cm - 1m	30cm - 1m
>1m	>1m

Contours (height in meters)

- Standard Contour
- Master Contour
- Spot Height
- MLWV Mean Low Water
- MHWV Mean High Water

JBA 100 Year Return Flood Map (Undefended) - Slice A



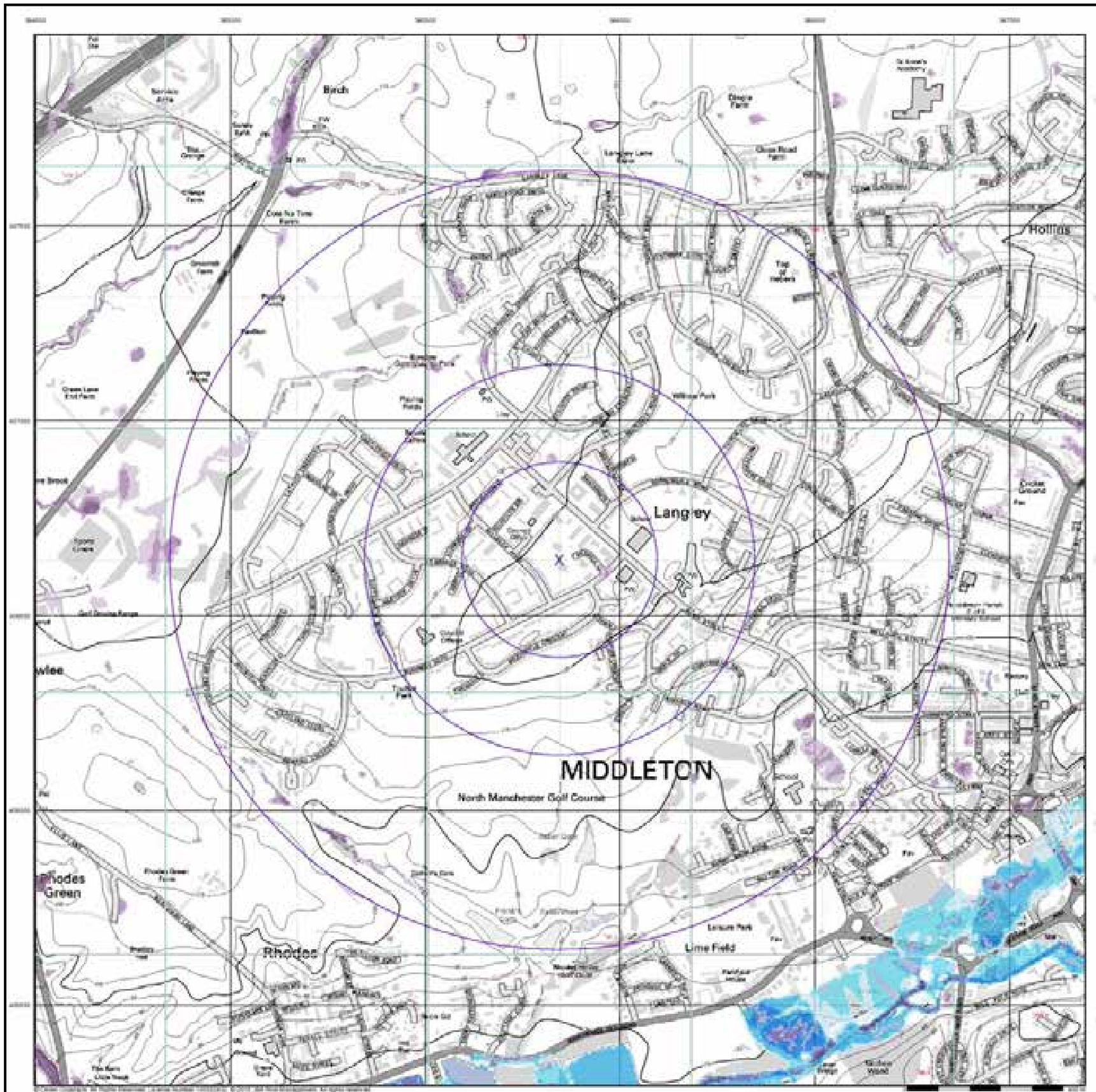
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National Grid Reference:	385840, 406640
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 385850, 406650

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



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JBA 200 Year Return Flood Map (Undefended) (1:10,000)

General

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

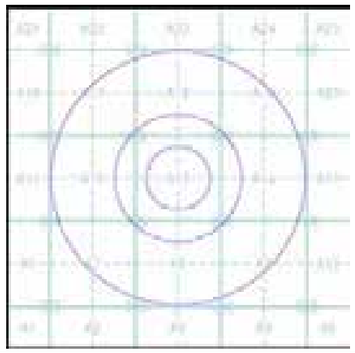
Modelled Flood Depth

Pluvial Depth	Fluvial Depth	Coastal Depth
< 1cm	0.5mm - 10cm	< 10cm
1cm - 10cm	10cm - 30cm	10cm - 30cm
10cm - 30cm	30cm - 1m	30cm - 1m
30cm - 1m	>1m	>1m
>1m		

Contours (height in meters)

- Standard Contour
- Master Contour
- Spot Height
- Mean Low Water
- Mean High Water

JBA 200 Year Return Flood Map (Undefended) - Slice A



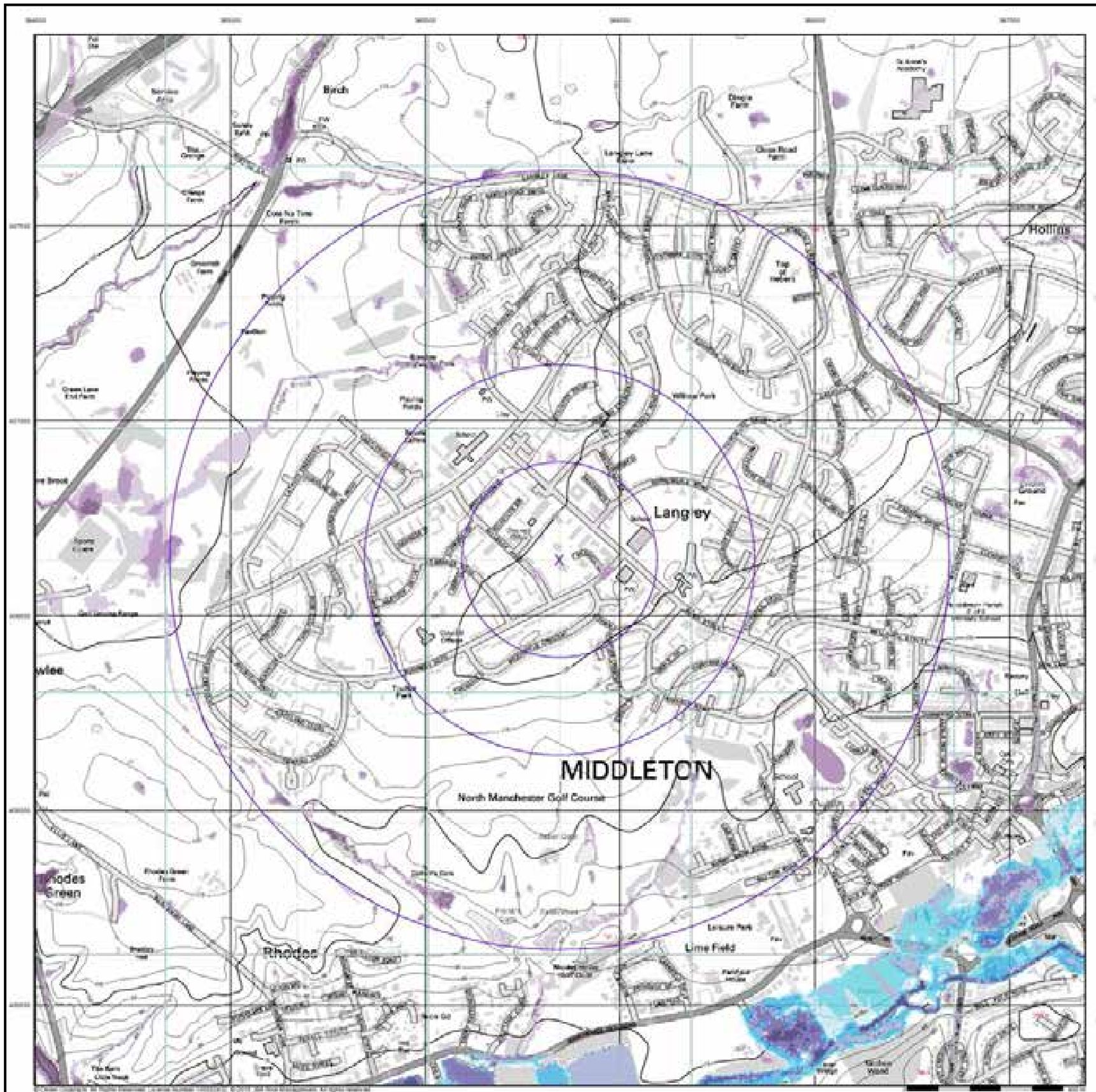
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National Grid Reference:	385840, 406640
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 385850, 406650

Landmark Information Group
Tel: 0844 844 9952
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Web: www.envirocheck.co.uk



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JBA 1000 Year Return Flood Map (Undefended) (1:10,000)

General

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

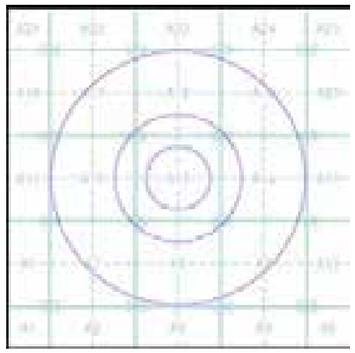
Modelled Flood Depth

Pluvial Depth	Fluvial Depth	Coastal Depth
< 1cm	0.5mm - 10cm	< 10cm
1cm - 10cm	10cm - 30cm	10cm - 30cm
10cm - 30cm	30cm - 1m	30cm - 1m
30cm - 1m	>1m	>1m
>1m		

Contours (height in meters)

- Standard Contour
- Master Contour
- Spot Height
- Mean Low Water
- Mean High Water

JBA 1000 Year Return Flood Map (Undefended) - Slice A

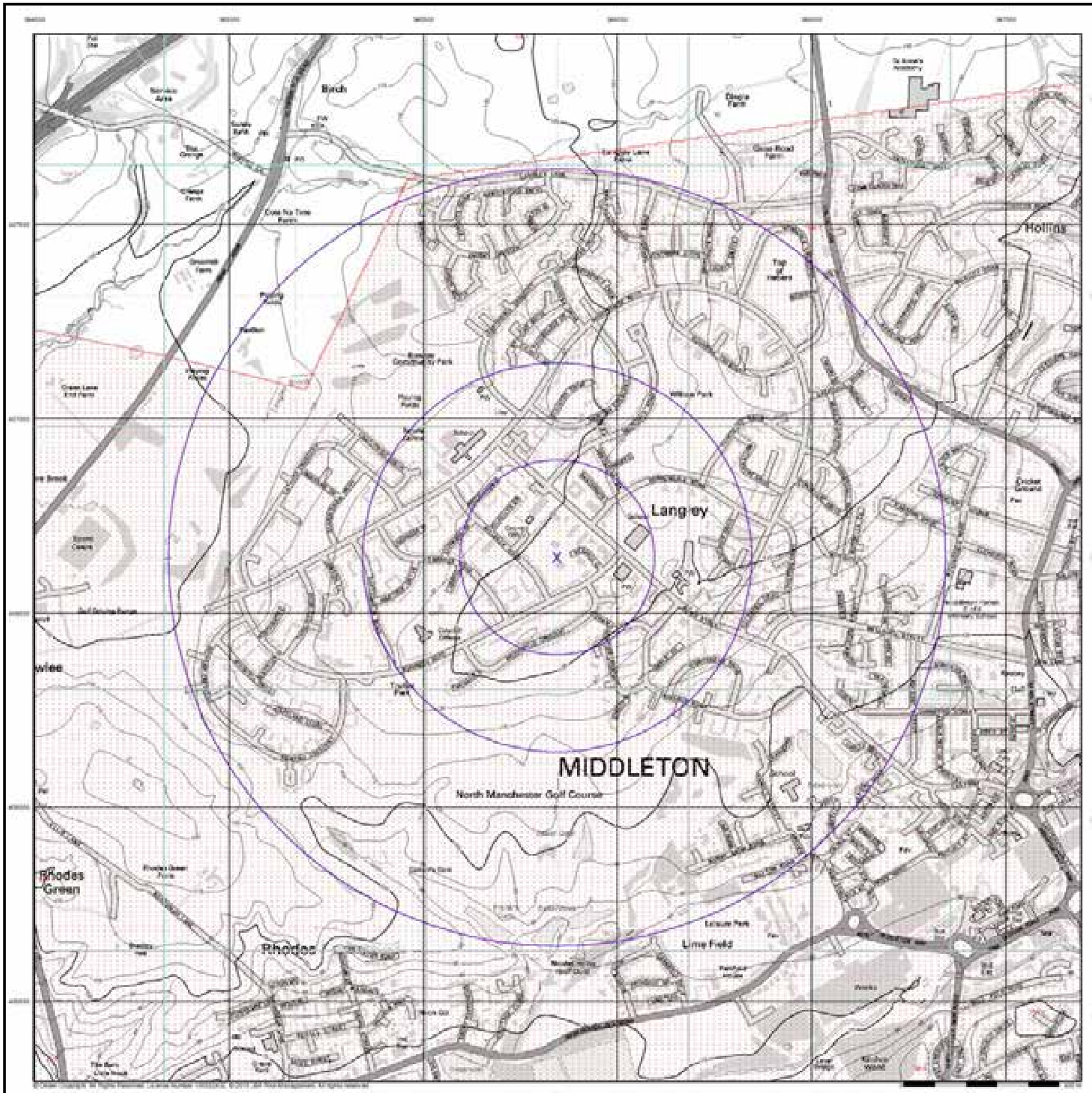


Order Details

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Customer Ref:	30150
National Grid Reference:	385840, 406640
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Search Buffer (m):	1000

Site Details

Site at 385850, 406650



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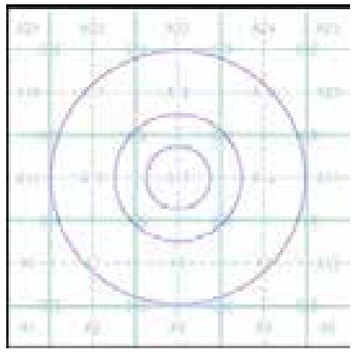
JBA Canal Failure Map (1:10,000)

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

Flood Data
- Canal Failure
- Coverage

Contours (height in meters)
- Standard Contour
- Master Contour
- Spot Height
- MLWV Mean Low Water
- MHWV Mean High Water

JBA Canal Failure Flood Map - Slice A



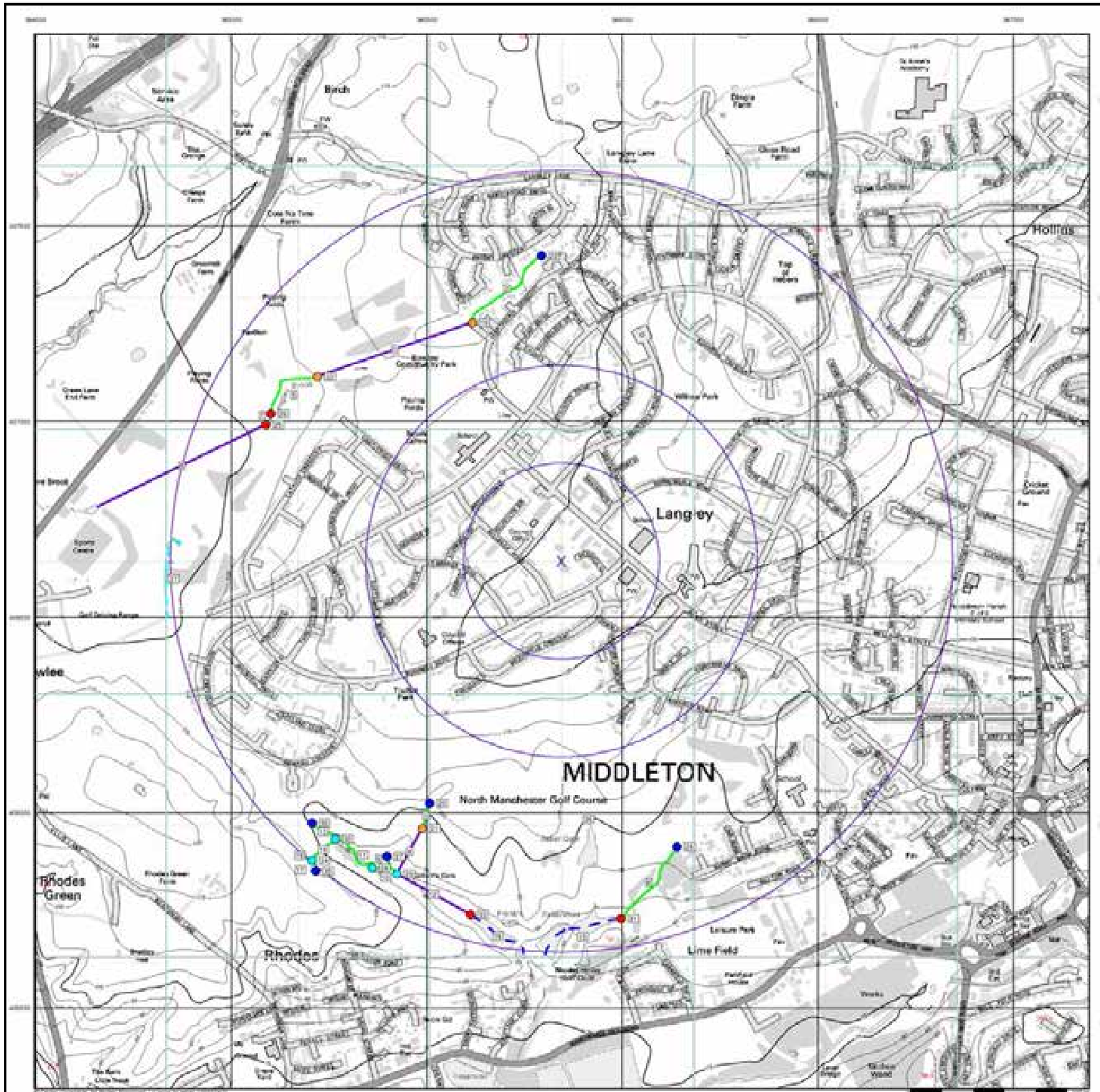
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Customer Ref:	30150
National Grid Reference:	385840, 406640
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 385850, 406650

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



IronsideFarrar
Environmental Consultants

Detailed River Network Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID

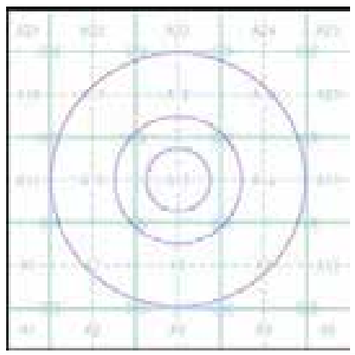
Detailed River Network Data

- Primary River
- Secondary River
- Tertiary River
- Canal
- Canal Tunnel
- Undefined River
- Lake/Reservoir
- Extended Culvert (greater than 50m)
- Underground River (inferred)
- Underground River (local knowledge)
- Downstream of High Water Mark
- Downstream of Seaward Extension
- Not assigned River feature
- Source
- Junction
- Sink
- Non-interactive Node
- Not assigned River feature
- Pseudo Node (general)
- Pseudo Node (High Water Mark)
- Pseudo Node (OS MasterMap polygon boundary)
- Offline Drainage Feature

Contours (height in meters)

- Standard Contour
- Master Contour
- Spot Height
- Mean Low Water
- Mean High Water

Detailed River Network Map - Slice A



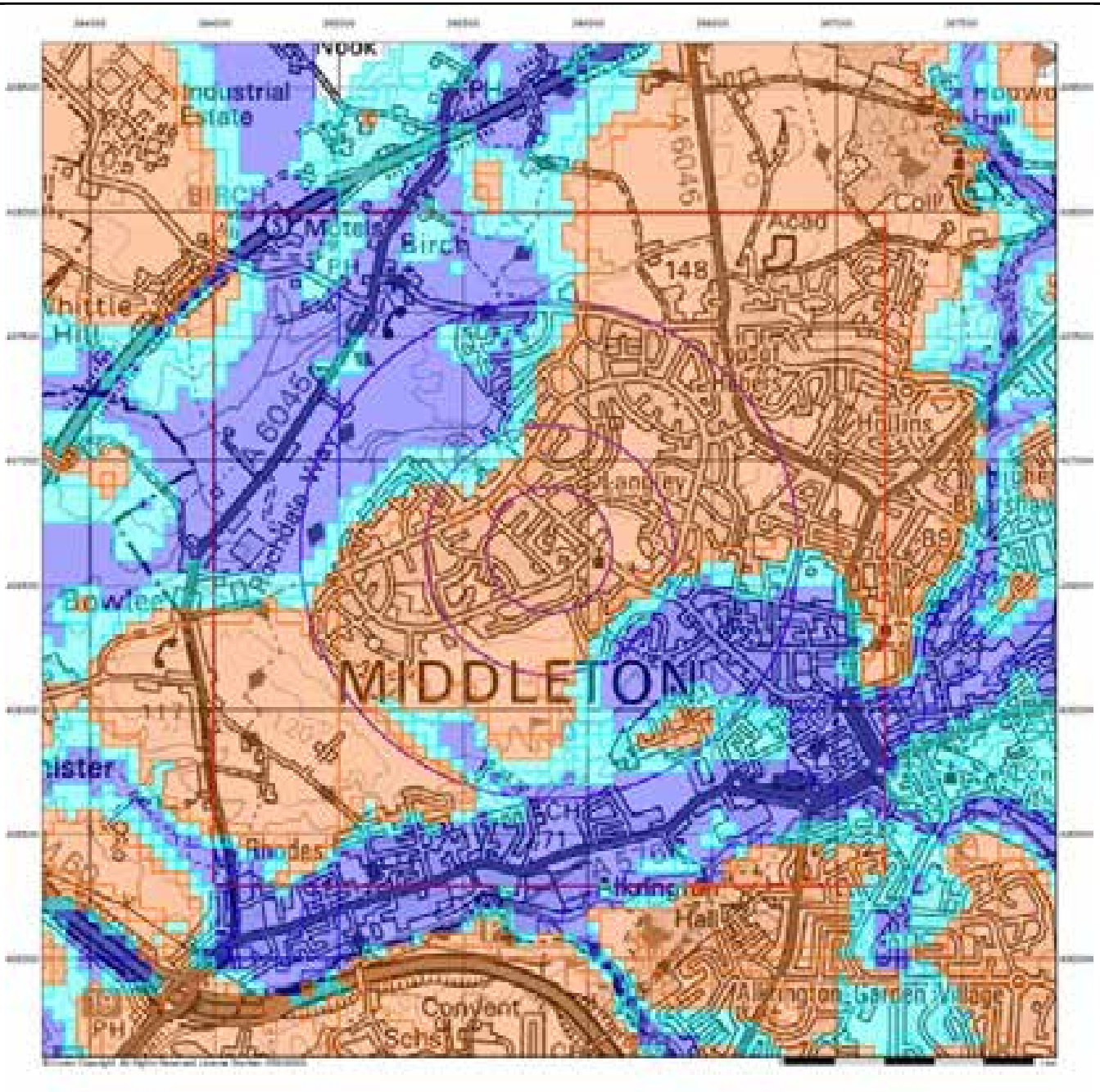
Order Details

Order Number:	67353251_1_1
Customer Ref:	30150
National Grid Reference:	385840, 406640
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 385850, 406650

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



IronsideFarrar
EnvironmentalConsultants

BGS Flood Data (1:50,000)

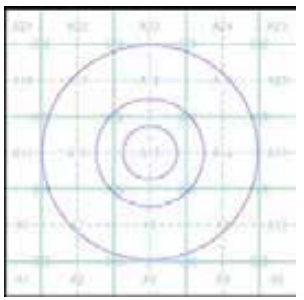
General

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



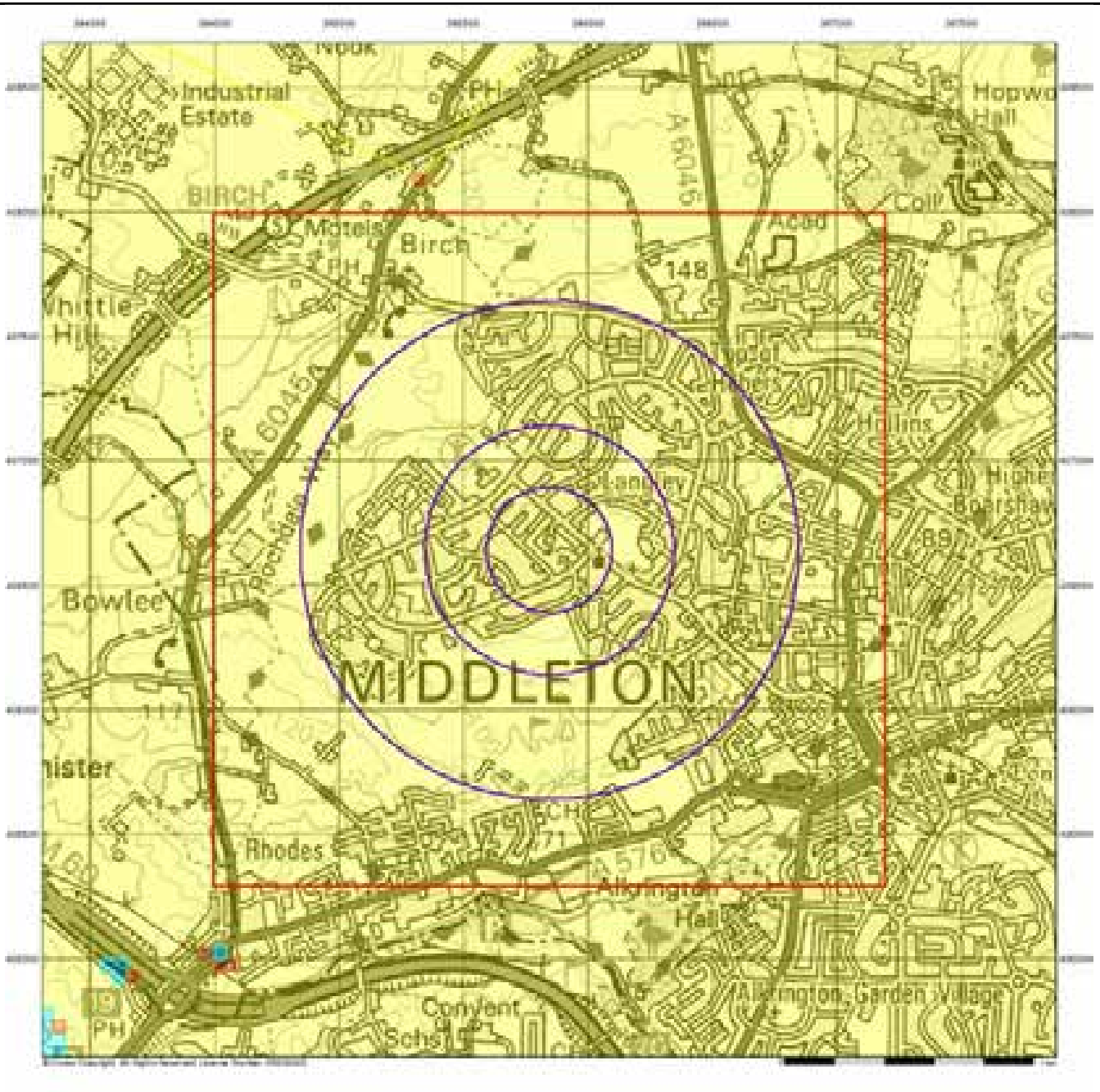
Order Details

Order Number:	67353251_1_1
Customer Ref:	30150
National Grid Reference:	385840, 406640
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 385850, 406650

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ESI Groundwater Flood Map (1:50,000)

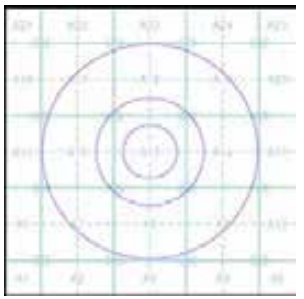
General

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

ESI Groundwater Flooding Risk

- High Risk
- Moderate Risk
- Low Risk
- Negligible Risk

ESI Groundwater Flood Map - Slice A



Order Details

Order Number:	67353251_1_1
Customer Ref:	30150
National Grid Reference:	385840, 406640
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 385850, 406650

Landmark
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