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Civil | Structural | Geo-Environmental | Transport Planning

Land West of Uttoxeter - Development Phase 1C

Flood Risk Assessment and Drainage Strategy Addendum

Prepared for
Bellway Homes West Midlands

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Document Control

Project Title: Proposed Residential Development at Land West of Uttoxeter – Phase 1C

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Revision	Date	Comments	Prepared by	Checked by
-	28 March 2017	DRAFT for Comment	N Whittaker	D Baker

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1.0 INTRODUCTION

1.1 Travis Baker have been commissioned by Bellway Homes West Midlands, to prepare a Flood Risk Assessment and Drainage Strategy Addendum in support of the proposed development of Phase 1C of the site, which forms part of the wider development area of land to the west of Uttoxeter.

1.2 An outline application for the wider development site was submitted to East Staffordshire Borough Council (ESBC) in 2013 (ref: P/2013/00882). It received conditional approval on 13 November 2015.

1.3 The *Land West of Uttoxeter Flood Risk Assessment and Drainage Strategy* report by Waterman (dated September 2013) was submitted in support of the outline application. That report has assessed the potential effects upon the wider development of tidal, fluvial, groundwater, sewer, overland, reservoir, canal and artificial sources of flooding. In line with current policy, the management of surface and foul water was also assessed, and a strategy to effectively manage surface and foul water whilst working within site specific constraints was proposed, so as not to increase and, if possible, decrease flood risk elsewhere.

1.4 In addition, a hydraulic modelling study; *Land West of Uttoxeter Hydraulic Modelling Technical Note* by Waterman (dated 5 September 2013) was undertaken to assess the flood risk from the unnamed tributaries of the River Tean in the site vicinity.

1.5 An addendum to the 2013 FRA report; Phase 1 Residential Development Land West of Uttoxeter – Flood Risk Assessment and Drainage Strategy Addendum Additional Statement, dated 21 August 2014, was submitted during the planning application period to address comments from the Flood Risk Officer at Staffordshire County Council.

1.6 This report relates to development proposals for Phase 1C of the residential development of Land to the West of Uttoxeter, and is intended as an addendum to the original 2013 *Flood Risk Assessment and Drainage Strategy* report. It is issued to support the discharge of Planning Condition 16 of the outline planning permission, which reads: *No development of any phase shall take place until a scheme for the disposal of foul and surface waters relating to that phase has been submitted to and approved in writing by the Local Planning Authority. The development shall be completed in accordance with the approved details prior to its first occupation*.

2.0 SITE DESCRIPTION

2.1 The Phase 1C Residential Area (hereafter referred to as 'the Site') is approximately 2.735 hectares in size, and is predominantly open agricultural land. A Site location plan[i] is in the Appendices.

2.1.1 A topographical survey[ii] of the wider site is also in the Appendices, and shows that there is a general fall from west to north east. The high point along the western boundary is approximately 112.5 m AOD, and the low point in the north east corner is approximately 100 m AOD.

3.0 DEVELOPMENT PROPOSALS

3.1 The approved development proposals encompassed by Phase 1A + Phase 1B are already under construction, and are situated adjacent to the south and south west of the Site.

3.2 A separate infrastructure enabling package of works has been undertaken in advance of Phase 1 A , and is covered under a separate planning consent. These works comprise a new access junction off Bramshall Road with associated drainage and earthworks.

3.3 The proposals for Phase 1B provide the drainage and highways enabling infrastructure for the Site, and will also provide the permanent outfalls for both surface and foul water from Phase 1A. The previous application for Phase 1A included the detention pond and foul water pumping station, but with a temporary connecting ditch and access track arrangement. The detailed housing layout for the school is yet to be developed will be subject to future application.

3.4 There is also an existing overland flow path which crosses the Site which has been accounted for in the infrastructure works package for which land drainage consent has been received.

3.5 The proposals for phase 1C include the construction of 119 Dwellings, estate roads and adoptable drainage which will connect to the infrastructure roads and drainage constructed by St Modwen Developments.

4.0 SOURCES OF POTENTIAL FLOODING

4.1 An assessment of flood risk from a variety of sources including fluvial, tidal, groundwater, pluvial, reservoir and artificial sources was provided in Section 2 of the *Land West of Uttoxeter Flood Risk Assessment and Drainage Strategy* report (September 2013).

4.2 In addition, the hydraulic modelling study *Land West of Uttoxeter Hydraulic Modelling Technical Note* by Waterman dated, 5 September 2013, was undertaken to assess the flood risk from the unnamed tributaries of the River Tean in the Site vicinity.

4.3 The conclusion from both studies is that the southern parts of the wider site (ie the site that is the subject of this Flood Risk and Drainage Addendum) are considered to be at low risk of flooding from all sources.

4.4 It is, however, also necessary to ensure that the Development itself will not increase flood risk elsewhere through increased surface water runoff.

5.0 CURRENT DRAINAGE REGIME

5.1 Surface runoff at the Site currently discharges via infiltration or overland flow towards the north east. With reference to the topographical survey, there is a general depression in the contours running across the site which direct flows to the head of a small ditch at the north eastern corner.

5.2 The lie of the land to the west also falls towards the Site, with the overland flow route also following the depression in the contours within the Site.

6.0 PROPOSED SURFACE WATER DRAINAGE

6.1 Surface water runoff from the impermeable areas of the proposed infrastructure roads and the future residential development areas (ie roofs, private driveways and highways) will drain to the network of proposed sewers within the Site. These sewers will also cater for the outfalls from the approved Phase 1A + Phase 1B drainage. The engineering details for the Phase 1A proposals were prepared by Rodgers Leask[iii] and copies of their drawings are in the Appendices.

6.2 The sewers will ultimately discharge to the detention basin in the north east of the Site. The proposed drainage layout is as shown on Travis Baker drawing number SK101 Drainage Strategy[iv], in the Appendices.

6.3 During the preparation of the *Land West of Uttoxeter Flood Risk Assessment and Drainage Strategy* report, the Environment Agency were approached for their views on acceptable surface water discharge rates. They confirmed that a maximum rate of 5 litres per second per hectare would be acceptable. They also confirmed that this rate should be applied to all storm events up to the critical 1 in 100 year event, with the addition of 30% to account for the potential future effects of climate change.

6.4 The required attenuation volume will be provided in the detention basin to the north east of the Site, with runoff to the adjacent ditch restricted to a maximum of 36.5 l/s by a vortex flow control device. This maximum outflow rate is based upon the development area covering both Phases 1A and 1B, including the area set aside for the proposed school. The detention basin will provide a storage volume of 2230 cubic metres, with a maximum held water depth of approximately 950 mm. A minimum freeboard of 350 mm will be maintained above this level.

6.5 A hydraulic model of the proposed network has been built using the WINDES modelling software, and the input data and simulation results[v] are in the Appendices. This model includes the networks designed previously for the Phase 1A + Phase 1B area of the development. It also includes the impermeable area for this proposed phase and a robust assessment of the catchment associated with the proposed school.

6.6 It is intended that the detention basin will be managed and maintained by an appointed management company. The proposed sewerage will be offered for adoption by Severn Trent Water which will ensure ongoing maintenance throughout the lifetime of the development.

6.7 The surface water strategy provides a robust and sustainable drainage system which would not increase runoff, while providing significant ecological, water quality, and amenity benefits, and not increase flood risk at the Site and elsewhere.

6.8 It is also proposed to formalise the existing overland flow which passes through the Site into a positive open ditch system, with nominal lengths of culverting where proposed estate roads pass over. The ditch will be a minimum of 3 m wide bank top to top, and the culverted lengths will be a minimum of 450 mm diameter, with easily accessible headwall structures. The ditch course will be kept totally separate from the surface water drainage system and detention basin.

7.0 PROPOSED FOUL WATER DRAINAGE

7.1 Severn Trent Water has confirmed that foul water from the whole of Phase 1 Site can discharge to the existing public foul sewer in Byrds Lane to the east of the Site.

7.2 A new foul pumping station will be constructed by St Modwen at the low point of the Site in the east, with a rising main from the Site along Bramshall Road to Byrds Lane providing the means of discharge.

8.0 CONCLUSIONS

8.1 Based on Environment Agency Flood Maps, the Site is shown to lie in Flood Risk Zone 1 and the risk of fluvial flooding from the unnamed water courses in the Site vicinity to the north is low. The flood risk from fluvial, groundwater, pluvial and reservoirs, canal and artificial sources is also low.

8.2 The strategy for draining the Site using SuDs will ensure that the Development does not increase flood risk either on or off Site. It is proposed to maintain the existing drainage regime for the Site by discharging runoff to the existing ditch in the north east. In accordance with the requirements of the Environment Agency, discharge to the existing ditch in the north east would be limited to 36.5 l/s/ha by a flow control device for storms up to the critical 1 in 100 year (plus 30% climate change) storm event. Attenuation storage will be provided within the detention basin to the north east of the Site.

8.3 A response from Severn Trent Water confirms that foul flows from the phase 1 residential development can discharge to the existing public sewerage system in Byrds Lane within Uttoxeter to the east of the Site. There will be two on site pumping stations, one within Phase 1A (already approved) and the second in Phase 1B. The associated rising main will ultimately pass through the development, along Bramshall Road and on to the public sewer outfall in Byrds Lane.

8.4 This report demonstrates that the Development has a low risk of flooding, and has been designed so that it does not increase flood risk at the Site or elsewhere. It also confirms that surface water from the Development can be drained sustainably to ensure that flood risk is not increased elsewhere, and that foul water can be drained into the adjacent public foul water infrastructure.

9.0 APPENDICES

[i] Site Location Plan

The Contractor is to check and verify all building and site dimensions, levels and sewer invert levels at connection points before work starts.

The Contractor is to comply in all respects with current building legislation-British Standard Specifications, Building regulations etc., whether or not specifically stated on this drawing.

This drawing must be read with and checked against any structural, geotechnical or other specialist documentation provided.

This drawing is not intended to show details of foundations, ground conditions or ground contaminants. Each area of ground relied upon to support any structure depicted (including drainage) must be investigated by the Contractor. A suitable method of foundation should be provided allowing for existing ground conditions. Any suspect or fluid ground, contaminants on or within the ground, should be further investigated by a suitable expert. Any earthwork constructions shown indicate typical slopes for guidance only and should be further investigated by a suitable expert.

Where existing trees are shown to be retained they should be subject to a full Arboricultural inspection for safety.

All trees are to be planted so as to ensure they are a minimum of 5 metres from buildings and 3 metres from drainage and services. A suitable method of foundation is to be provided to accommodate the proposed tree planting.

MOSS BEDS FARM

ST MODWEN - PROPOSED PHASE 2 DEVELOPMENT

Road feature in Spine Road to be provided by St Modwen. See Section 38 Proposal

Turning head

Feature site frontage to school site to be provided by St Modwen - refer to seperate details

ATTENUATION POND

MILVERTON DRIVE

SCHOOL SITE

Entrance to school site

Road feature in Spine Road to be provided by St Modwen (See seperate proposals).

TREE & PLOT LANDSCAPING - REFER TO SEPERATE LANDSCAPE ARCHITECTS DETAILED DRAWING.

ECOLOGICAL CORRIDOR

GCN POND

2.4m x 33m Visibility Splay

33m Forward Visibility

Foul pump station & Stand-off zone

EQUIPPED PLAY AREA TO BE PROVIDED BY ST MODWEN HOMES (SEE SEPARATE PROPOSAL)

POS & PLAY AREA

5m WIDE CULVERT HEADWALL WITH 1.1m HIGH METAL RAILING (SEE SEPARATE ENGINEERS DRAWINGS FOR DETAIL)

EXISTING DITCH

3m WIDE CULVERT HEADWALL WITH 1.1m HIGH METAL RAILING (SEE SEPARATE ENGINEERS DRAWINGS FOR DETAIL)

5m WIDE CULVERT HEADWALL WITH 1.1m HIGH METAL RAILING (SEE SEPARATE ENGINEERS DRAWINGS FOR DETAIL)

TRACK

PUBLIC RIGHT OF WAY

ST MODWEN - PHASE 1 DEVELOPMENT

Allow for proposed 2m wide new hedge - see seperate details

Proposed feature to spline road subject to S7 & S38 approval.

BUS STOP

BRAMSHALL ROAD

HOUSETYPE SCHEDULE			
Open Market Units			
Type	No. Of Beds	SQFT	No.
SOUTHAM -Sou	2	605	6
DOVERIDGE - Dov	2	646	6
ASTLEY - Ast	2	667	6
ALMOND - Alm	3	681	13
CHERRY - Che	3	802	23
LILAC - Lil	3	1394	5
JAPONICA	3	946	9
LARCH - Lar	3	1087	12
WALNUT - Wal	4	1199	2
MAPLE - Map	4	1336	4
MAGNOLIA - Mag	4	1514	2
ACACIA - Aca	4	1550	5
ALDER - Ald	4	1589	8
		Total	Total
		98575	101
Affordable Units			
Type	No. Of Beds		No.
SO9	1	505	4
SO2+	2	799	10
SO3	3	928	3
SO17	3	1061	1
		Total	Total
		13855	18
Overall Development			
			Overall Total
			119
	AREA	Total	Coverage
Net Developable Area	7.11 Acres	112430	15812 Sq Ft

CYCLE STORES TO BE PROVIDED TO ALL PROPERTIES EITHER IN GARAGE TO DWELLINGS OR SECURE CYCLE STORE TO APARTMENTS OR TIMBER SHED TO DWELLINGS NOT HAVING A GARAGE.

Key

- △ Access Door
- Block Paving (Red brindle laid in herringbone pattern)
- Gate Position
- ✳ Garage Personnel Door
- Affordable Tenure
  - (SC) - Shared Ownership
  - (RE) - Affordable Rent
- Existing tree's to be retained
- bcp Bin Collection Point
- Denotes handed from working drawing
- Denotes sewer easement

Rev F - 29.03.17 - Additional notes regarding ditch course added. Layout amended as per comments (BWM)
Rev E - 24.03.17 - Plot 102 amended to a Cherry HT. (BWM)
Rev D - 14.03.17 - Amendments as requested by client.
Rev C - 07.03.17 - Amendments as requested by client.
Rev B - 02.03.17 - Amendments as requested by client.
Rev A - 24.02.17 - Site plan updated following re-draw from client.

Revisions

Bellway

BELLWAY HOMES WEST MIDLANDS
Bellway House, Relay Point, Relay Drive, Tamworth, B77 5PA
Tel: 01827 255755 Fax: 01827 255766

Site: BRAMSHALL ROAD, UTTOXETER

Drawing: PROPOSED SITE PLAN

Date: 24.01.17
Scale: 1:500 @ A1
Drawn By: ABA

Drg. No: UTT-LAY-01E

[ii] Topographical Survey

Survey Key:-

BO	Bollard
BB	Belisha Beacon
BT	BT Cover
CB	Telephone Control Box
CH	Coal Hole
CO	Unidentified Cover
Conc	Concrete
EP	Electricity Pole
FH	Fire Hydrant
FT	Face Profile Target
FW	Foul Water Drain Cover
GU	Drainage Gully Cover
GV	Gas Valve
Gas	Gas Cover
IC	Inspection Chamber Cover
LB	Letter Box
LP	Lamp Post
MC	Metal Drainage Channel
MH	Manhole Cover (round)
MP	Marker Post
Rwp	Rain Water Pipe
SV	Water Stop Valve
SW	Storm Water Drain Cover
TCB	Telephone Call Box
TL	Traffic Light
TP	Telegraph Pole
TV	Cable TV Cover
WM	Water Meter Cover

Some of these symbols may not appear on this drawing

STN 57.06	Survey Control Station
TP 154.67	Trial Pit
BH 154.67	Borehole
WL 154.67 21/01/10	Water Level (with date measured)
154.67	Spot Level
154.67	Tree (spread to scale)

Linetypes

	Fenceline
	Electricity Transmission Line
	Hedge
	Rock Face
	Embankment Slope
10.00	Contour Lines
	Gas Pipeline
	Water Pipeline

Building Internals - Specific Codes

Ceil 154.67	Structural Ceiling Level
F.Ce 154.67	False / Suspended Ceiling Level
154.67	Floor Level
ussb 154.67	Underside of Beam / Openings Level

Notes :-

Survey is tied to Ordnance Survey grid and level by GPS Smartnet

Contours where shown are at 0.5m intervals and highlighted at 2m intervals

BeaconLandSurveys
The Lodge
Greenhough Road
Lichfield
Staffs. WS13 7AU
Tel : 01543 417399
Mob: 07764 585084
email :- office@beaconlandsurveys.co.uk

Project: Land West of Uttoxeter

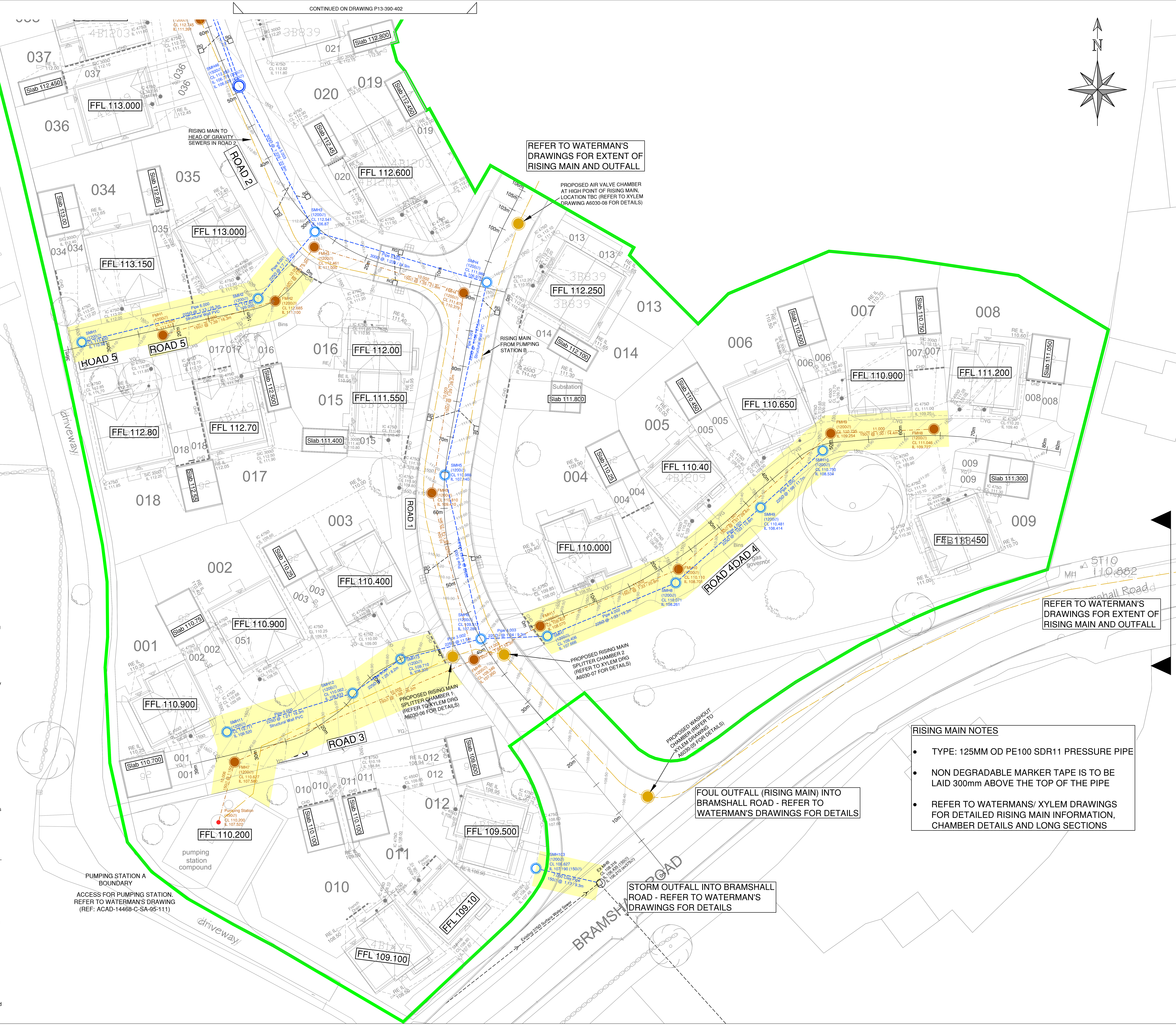
Drawing: Bramshall Road Site Area Survey

Scales:	*Drawn/Sheet Size:*
1:500	mjs/A0
Date: Feb 2016	*Drawing No:* 13-015-16-01

[iii] Phase 1A Drainage Proposals by Rodgers Leask

A1

CONTINUED ON DRAWING P13-390-402



NOTES:

1. Before work commences, the contractor shall liaise with all Statutory Authorities to determine the exact location of all apparatus and take all precautions deemed necessary to locate, protect and where necessary divert such equipment.
2. All works to comply with relevant specifications.
3. This drawing is subject to approval by Local Authority, Building Control, Sewerage Undertaker and the Environment Agency. Any works undertaken prior to the granting of these approvals is carried out at at risk to others.
4. Prior to commencing work on the drainage, all existing drains, sewers manholes and outfalls to remain shall be located, identified and a CCTV condition survey carried out. Where necessary, protection to the existing drainage infrastructure shall be provided.
5. All existing sewers and manholes abandoned due to the proposed works are to be either removed, and suitably backfilled or grouted up.
6. Any existing details which are shown on this drawing are for guidance only and are to be checked on site by the contractor. Any variations are to be recorded and reported to the engineer immediately.
7. Cover levels for manholes are approximate only and should be adjusted to match surrounding levels.
8. All manhole and drainage covers shall comply with BS.EN124. Manhole covers within block paved area and buildings shall be recessed. Cover strengths to be:-
   Class E600 in areas of heavy loading.
   Class D400 in heavy trafficked areas (roads, services yards).
   Class C250 Lightly trafficked areas (car parks).
   Drainage pipes 100mm Ø unless stated otherwise.
9. Pipes to be :-
   Vitrified clay to BS EN 295 or Concrete to BS 5911 (Load Class M, unless stated otherwise) or UPVC pipes to BS EN 1452 or Thermoplastic Structured wall pipes complying with WIS 4-35-01. BSi kitemarked.
   Class 8kM/m^2 nominal short term ring stiffness.
10. All sewer pipes 300mm diameter or larger, to be Class M concrete pipes, to BS.5911, unless noted otherwise
11. All pipes to be laid with soffits level, unless noted otherwise.
12. Where cover to pipes is less than 1200mm under carriageway - concrete bed and surround or concrete protection slab is required.
13. All concrete to drainage, manholes bases, surrounds etc to be in accordance with the BRE special digest 1 - Concrete in aggressive ground. Refer to site investigation report for sulphate requirements.
14. All manholes, pipe trenches etc. to be backfilled with imported granular fill to Class 6F1-6F5 (Capping material) to (SHW) Table 6/1 & compacted in accordance with Table 6/4.
15. All pipelines shall be tested both before and after backfilling, using either air test or water test, in accordance with BS EN 1610.
16. Upon completion of the drainage works all drains shall be flushed out and CCTV surveyed and shown to be free of all silt and debris and to have no joint displacements or other defects. A copy of the written report and video is to be forwarded to the Engineers for comment. Any defects shall be attributable to the contractor for rectification unless indicated otherwise by the CCTV report and agreed with the Engineers.
17. Demarcation manholes and lateral drains need to be constructed in accordance with the Water UK/WRc "Sewers For Adoption 6th Edition".
18. All works to sewers/ manholes being offered for adoption or on existing public sewers should be in accordance with "Sewers for Adoption 6th Edition" and the Adopting Water Authority's recommendations

RISING MAIN NOTES

- TYPE: 125MM OD PE100 SDR11 PRESSURE PIPE
- NON DEGRADABLE MARKER TAPE IS TO BE LAID 300mm ABOVE THE TOP OF THE PIPE
- REFER TO WATERMANS/ XYLEM DRAWINGS FOR DETAILED RISING MAIN INFORMATION, CHAMBER DETAILS AND LONG SECTIONS

All adoptable drainage must be laid in accordance with Sewers for Adoption 6th Edition, together with the Sewerage Undertaker's requirements

ANY WORKS UNDERTAKEN PRIOR TO RECEIPT OF TECHNICAL APPROVAL FOR THEIR RESPECTIVE PROPOSALS IS DONE AT THE CONTRACTOR'S OWN RISK.

Any changes to pipe materials indicated within the Approved Drawings will be subject to a Design Amendment Fee of 1% of the estimated construction costs.

Screen / Grill to be installed in the last manhole prior to connection into existing sewers (foul and storm) to prevent construction debris entering existing sewer network

Foul sewers installed higher than adjacent storm sewers are to incorporate 2000 Gauge impermeable membrane to the trench base and sides (min 300mm from base) to prevent foul water leaching into storm sewer network.

Pipe material / manufacturer to be confirmed by contractors. Pipe deformation calculations to be obtained from manufacturer and submitted to Severn Trent Water for approval. Technical Approval will only be granted once pipe materials / manufacturer is confirmed.

KEY□

- Site Boundary
- Storm sewers offered for adoption
- Storm manholes offered for adoption
- Private Storm Sewers
- Foul sewers offered for adoption
- Foul manholes offered for adoption
- Private Foul Sewers
- Foul Rising Main
- 5m Easement

Rev.	Date	Amendments	By	Chk
J	25.08.15	Revised to STW Comments. Gullies now uncoloured	JF	DMcC
H	30.07.15	Updated to suit revised layout	JF	RB
G	17.07.15	Minor amendments to avoid drainage clashes	JF	RB
F	14.05.15	Rising Main Added, road drainage revised to avoid clashes	JF	RB
E	18.02.15	Updated to suit latest layout	AT	RM
D	19.01.15	Road Layout updated, road gullys revised to suit	JF	RB
C	12.12.14	S104 Updated to STW Comments.	JF	RB
B	04.11.14	Amendments to drainage network.	RM	DMcC
A	09.10.14	Site Plan Updated, 5m Easement added & FWS greyed out	RM	DMcC

RODGERS LEASK
Consulting Civil & Structural Engineers

Client
St Modwen

Project
Residential
Uttoxeter

Drawing Title
Section 104 Agreement Plan
Sheet 1

Status
Approval

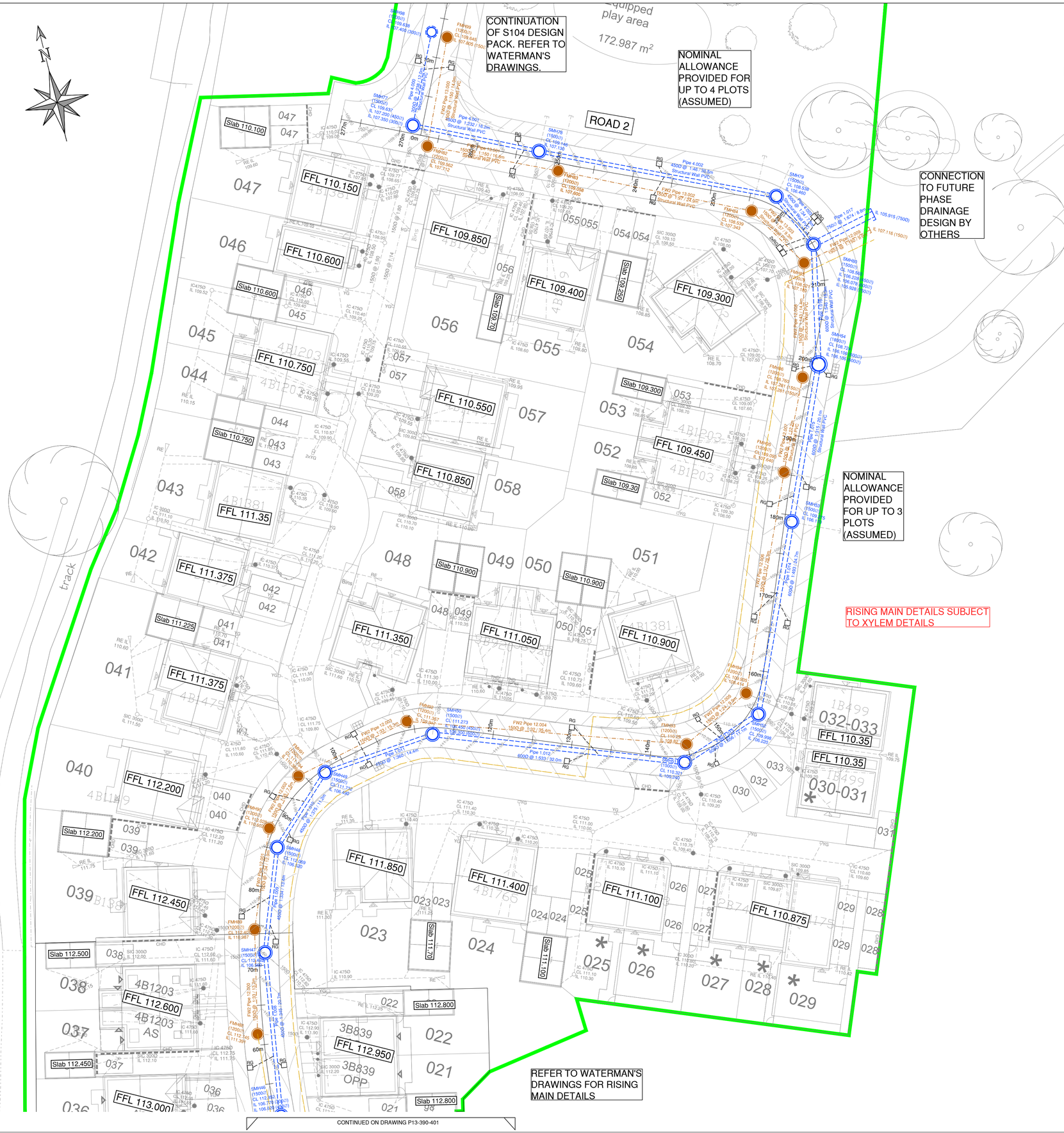
Scale	Drawn	Checked	Date
A1@ 1:250	RM	CJ	18.08.14

Project No.	Drawing No.	Rev.
P13-390	401	J

Scale Bar:
1:250 2 4 6 8 10 12 14 16 18

Seven House - 18 High Street - Longbridge - Birmingham - B31 2UQ - Tel: 0121 475 8426 - www.rodgersleask.co.uk

A1



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KEY

- Site Boundary
- Storm sewers offered for adoption
- Storm manholes offered for adoption
- Private Storm Sewers
- Foul sewers offered for adoption
- Foul manholes offered for adoption
- Private Foul Sewers
- Foul Rising Main
- 5m Easement

NOTES:

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2. All works to comply with relevant specifications.
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   Class D400 in heavy trafficked areas (roads, services yards).
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   Drainage pipes 100mm Ø unless stated otherwise.
9. Pipes to be :-
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10. All sewer pipes 300mm diameter or larger, to be Class M concrete pipes, to BS.5911, unless noted otherwise
11. All pipes to be laid with soffits level, unless noted otherwise.
12. Where cover to pipes is less than 1200mm under carriageway - concrete bed and surround or concrete protection slab is required.
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14. All manholes, pipe trenches etc. to be backfilled with imported granular fill to Class 6F1-6F5 (Capping material) to (SHW) Table 6/1 & compacted in accordance with Table 6/4.
15. All pipelines shall be tested both before and after backfilling, using either air test or water test, in accordance with BS EN 1610.
16. Upon completion of the drainage works all drains shall be flushed out and CCTV surveyed and shown to be free of all silt and debris and to have no joint displacements or other defects. A copy of the written report and video is to be forwarded to the Engineers for comment. Any defects shall be attributable to the contractor for rectification unless indicated otherwise by the CCTV report and agreed with the Engineers.
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18. All works to sewers/ manholes being offered for adoption or on existing public sewers should be in accordance with "Sewers for Adoption 6th Edition" and the Adopting Water Authority's recommendations

Rev.	Date	Amendments	By	Chk
N	24.08.16	Outfall amendments as per St Modwen request	RM	CJ
M	26.07.16	Revised in accordance with St Modwens comments	RM	CJ
L	20.07.16	Additional Rising main added to Road 2	RM	CJ
K	18.07.16	Revised in accordance with St Modwens comments	RM	CJ
J	25.08.15	Revised to STW Comments. Gullies now uncoloured	JF	DMcC
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D	19.01.15	Road Layout updated, road gullys revised to suit	JF	RB
C	12.12.14	S104 Updated to STW Comments.	JF	RB
B	04.11.14	Amendments to drainage network.	RM	DMcC
A	09.10.14	Notes Added & General amendments	RM	DMcC

RODGERS LEASK
Consulting Civil & Structural Engineers

Client

St Modwen

Project

Residential
Uttoxeter

Drawing Title

Section 104 Agreement Plan
Sheet 2

Status

Approval

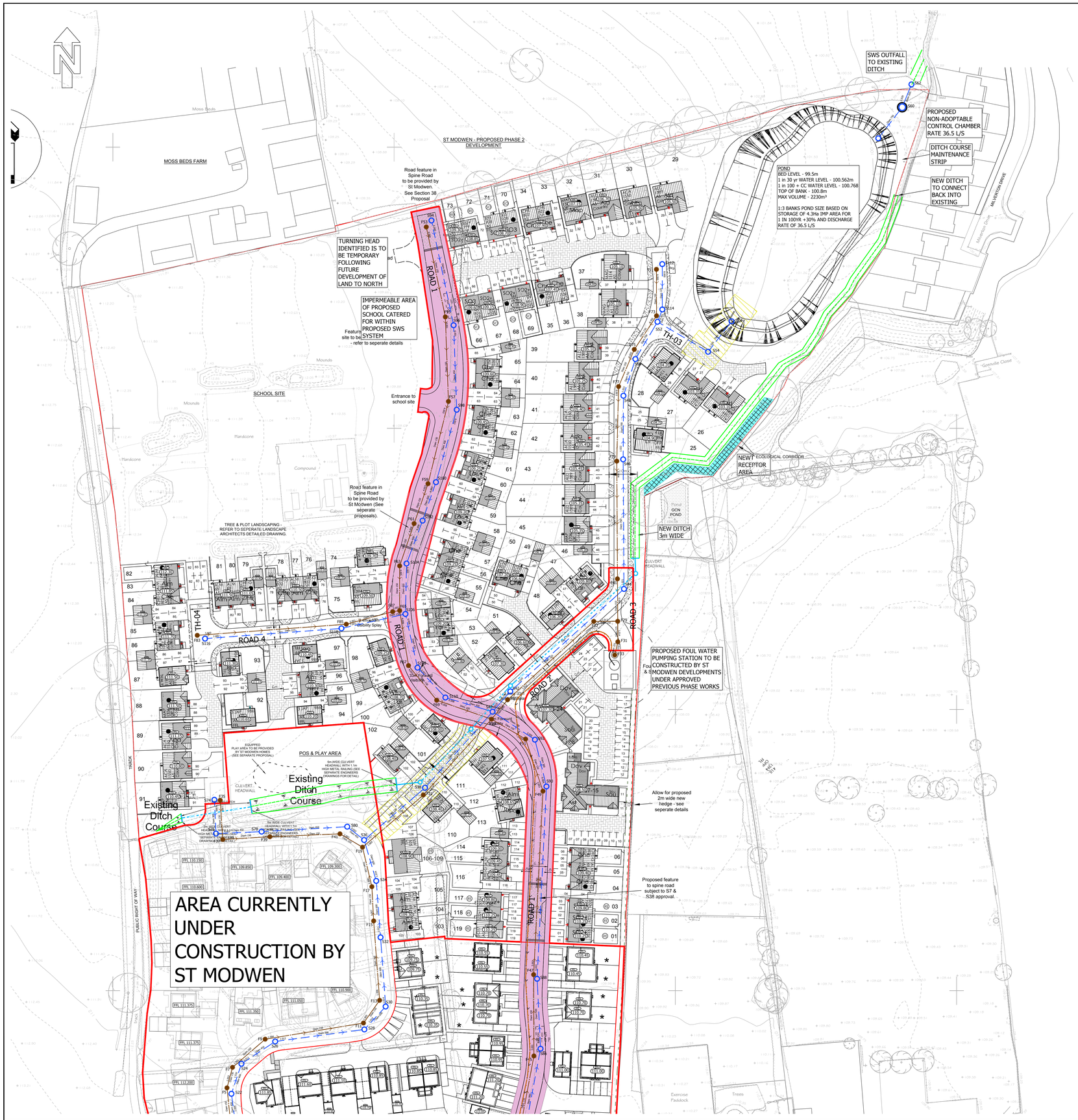
Scale	Drawn	Checked	Date
A1@ 1:250	RM	CJ	29.08.14

Project No.	Drawing No.	Rev.
P13-390	402	N

Scale Bar:
1:250 2 4 6 8 10 12 14 16 18

Severn House - 18 High Street - Longbridge - Birmingham - B31 2QQ - Tel: 0121 475 8405 - www.rodgersleask.co.uk

[iv] Travis Baker Drawing SK101 Drainage Strategy



1. DO NOT SCALE FROM THIS DRAWING. IF IN DOUBT CONTACT TRAVIS BAKER LIMITED.
2. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS RELATING TO THIS PROJECT.
4. ALL DIMENSIONS SHOULD BE CHECKED ON SITE PRIOR TO CONSTRUCTION. ANY DISCREPANCIES SHOULD BE IMMEDIATELY NOTIFIED IN WRITING TO TRAVIS BAKER LIMITED.
5. THE CONTRACTOR SHALL PRIOR TO CONSTRUCTION CHECK AND VERIFY THAT THE DETAILS SHOWN ON THIS DRAWING ARE FULLY COMPATIBLE WITH ANY AS CONSTRUCTED DIMENSIONS OR LEVELS. ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY IN WRITING TO TRAVIS BAKER LIMITED.
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PRELIMINARY

KEY

- Foul Water Sewer
- Foul Water Rising Main
- Surface Water Sewer
- Culverted Watercourse (CWC)
- Easement
- Newt Receptor Area
- Drainage, Highway and Ditch course works constructed by St Modwen Developments under approved previous phase works

STORM Network 1

Pipe Code	Diameter (mm)	Gradient (1:)	Pipe Type	Pipe Length	Upstream Manhole Number	Upstream Manhole Invert	Upstream Manhole Cover	Downstream Manhole Number	Downstream Manhole Invert	Downstream Manhole Cover
1.000	225	98	CLAY	11.730	S2	108.534	110.750	S4	108.414	110.481
1.001	225	103	CLAY	15.800	S4	108.414	110.481	S6	108.261	110.071
1.002	225	33	CLAY	19.343	S6	108.261	110.071	S8	107.666	109.406
1.003	225	24	CLAY	9.269	S8	107.666	109.406	S10	107.280	109.512
1.004	225	167	CLAY	23.346	S10	107.280	109.512	S12	107.140	110.988
1.005	225	166	CLAY	27.457	S12	107.140	110.988	S14	106.975	111.980
1.006	225	238	CLAY	24.943	S14	106.975	111.980	S16	106.870	112.541
1.007	300	229	CLAY	22.859	S16	106.870	112.541	S18	106.770	112.852
1.008	450	345	CONC	20.672	S18	106.620	112.852	S20	106.560	112.492
1.009	450	334	CONC	13.361	S20	106.560	112.492	S22	106.520	112.069
1.010	450	375	CONC	11.248	S22	106.520	112.069	S24	106.490	111.732
1.011	450	360	CONC	14.383	S24	106.490	111.732	S26	106.450	111.273
1.012	600	533	CONC	32.002	S26	106.300	111.273	S28	106.240	110.321
1.013	600	556	CONC	11.115	S28	106.240	110.321	S30	106.220	109.998
1.014	600	493	CONC	24.671	S30	106.220	109.998	S32	106.170	109.275
1.015	600	315	CONC	20.134	S32	106.170	109.275	S34	106.106	108.724
1.016	600	542	CONC	15.171	S34	106.106	108.724	S36	106.078	108.560
1.017	750	56	CONC	28.530	S36	105.928	108.560	S38	105.415	107.365
1.018	750	37	CONC	36.174	S38	105.415	107.365	S40	104.450	107.045
1.019	750	34	CONC	9.579	S40	104.450	107.045	S42	104.168	106.763
1.020	750	37	CONC	54.418	S42	104.168	106.763	S44	102.703	105.299
1.021	750	82	CONC	46.085	S44	102.703	105.299	S46	102.144	104.664
1.022	750	503	CONC	22.633	S46	102.144	104.664	S48	102.099	104.582
1.023	750	508	CONC	13.729	S48	102.099	104.582	S50	102.072	104.224
1.024	750	48	CONC	15.398	S50	102.072	104.224	S52	101.754	103.847
1.025	750	21	CONC	20.910	S52	101.753	103.847	S54	100.780	102.890
1.026	750	40	CONC	13.677	S54	100.780	102.890	S56	100.438	102.388
1.027	750	89	CONC	83.410	S56	100.438	102.388	S58	99.500	100.800
1.028	750	279	CONC	13.945	S58	99.500	100.800	S60	99.450	100.800
1.029	300	5	CLAY	8.760	S60	99.450	100.800	S62	97.520	98.574
2.000	225	21	CLAY	18.325	S64	109.520	110.711	S66	108.633	110.602
2.001	225	25	CLAY	8.178	S66	108.633	110.602	S68	108.300	109.710
2.002	225	11	CLAY	11.523	S68	108.300	109.710	S10	107.280	109.512
3.000	225	13	CLAY	25.280	S70	110.927	113.220	S72	109.000	112.802
3.001	225	6	CLAY	12.210	S72	109.000	112.802	S16	107.020	112.541
4.000	300	240	CLAY	12.018	S74	107.400	109.638	S76	107.350	109.637
4.001	450	232	CONC	16.245	S76	107.200	109.637	S78	107.130	109.146
4.002	450	45	CONC	30.485	S78	107.130	109.146	S80	106.460	108.538
4.003	450	33	CONC	7.662	S80	106.460	108.538	S36	106.228	108.560
5.000	300	239	CLAY	17.190	S82	109.749	111.249	S84	109.677	111.215
5.001	300	64	CLAY	30.562	S84	109.677	111.215	S86	109.200	110.700
5.002	300	55	CLAY	24.905	S86	109.200	110.700	S88	108.747	110.247
5.003	300	30	CLAY	68.490	S88	108.747	110.247	S90	106.494	107.994
5.004	300	26	CLAY	17.130	S90	106.494	107.994	S92	105.823	107.323
5.005	300	20	CLAY	18.045	S92	105.823	107.323	S40	104.900	107.045
6.000	450	250	CONC	38.074	S94	107.279	108.929	S96	107.127	109.400
6.001	450	251	CONC	30.092	S96	107.127	109.400	S98	107.007	109.383
6.002	450	250	CONC	26.786	S98	107.007	109.383	S100	106.900	109.209
6.003	450	250	CONC	14.477	S100	106.900	109.209	S102	106.842	109.259
6.004	450	251	CONC	16.311	S102	106.842	109.259	S104	106.777	109.333
6.005	450	249	CONC	17.950	S104	106.777	109.333	S106	106.705	109.117
6.006	450	251	CONC	19.574	S106	106.705	109.117	S108	106.627	108.449
6.007	450	26	CONC	14.530	S108	106.627	108.449	S110	106.070	107.720
6.008	450	13	CONC	17.505	S110	106.070	107.720	S40	104.750	107.045
8.000	225	39	CLAY	16.145	S112	102.724	104.149	S114	102.306	103.731
8.001	225	168	CLAY	4.704	S114	102.306	103.731	S52	102.278	103.847
7.000	225	31	CLAY	48.637	S116	109.976	111.401	S118	108.427	109.852
7.001	225	16	CLAY	23.311	S118	108.427	109.852	S106	106.930	109.117

FOUL Network 1

Pipe Code	Diameter (mm)	Gradient (1:)	Pipe Type	Pipe Length	Upstream Manhole Number	Upstream Manhole Invert	Upstream Manhole Cover	Downstream Manhole Number	Downstream Manhole Invert	Downstream Manhole Cover
1.000	150	33	CLAY	13.193	F1	111.391	112.714	F3	110.987	112.408
1.001	150	34	CLAY	12.915	F3	110.987	112.408	F5	110.602	112.028
1.002	150	35	CLAY	7.543	F5	110.602	112.028	F7	110.386	111.794
1.003	150	33	CLAY	15.334	F7	110.386	111.794	F9	109.917	111.357
1.004	150	32	CLAY	35.429	F9	109.917	111.357	F11	108.820	110.290
1.005	150	24	CLAY	9.905	F11	108.820	110.290	F13	108.414	109.935
1.006	150	37	CLAY	28.309	F13	108.414	109.935	F15	107.640	109.093
1.007	150	34	CLAY	12.185	F15	107.640	109.093	F17	107.281	108.760
1.008	150	143	CLAY	14.445	F17	107.281	108.760	F19	107.180	108.521
1.009	150	13	CLAY	28.530	F19	107.180	108.521	F21	105.065	107.462
1.010	150	38	CLAY	36.252	F21	105.065	107.462	F23	104.100	107.049
1.011	150	78	CLAY	8.956	F23	104.100	107.049	F25	103.985	106.838
1.012	150	28	CLAY	41.426	F25	103.985	106.838	F27	102.503	105.733
1.013	150	8	CLAY	8.502	F27	102.503	105.733	F29	101.372	105.691
1.014	225	166	CLAY	7.302	F29	101.297	105.691	F31	101.253	105.943
1.015	225	146	CLAY	4.832	F31	101.253	105.943	F33	101.220	105.858
2.000	150	150	CLAY	13.973	F35	107.805	109.645	F37	107.712	109.562
2.001	150	150	CLAY	16.772	F37	107.712	109.562	F39	107.600	109.059
2.002	150	97	CLAY	24.941	F39	107.600	109.059	F41	107.343	108.539
2.003	150	57	CLAY	9.322	F41	107.343	108.539	F19	107.180	108.521
3.000	150	59	CLAY	28.269	F43	109.327	111.266	F45	108.850	110.764
3.001	150	64	CLAY	28.931	F45	108.850	110.764	F47	108.397	110.254
3.002	150	29	CLAY	65.347	F47	108.397	110.254	F49	106.144	108.093
3.003	150	29	CLAY	19.517	F49	106.144	108.093	F51	105.473	107.270
3.004	150	10	CLAY	14.018	F51	105.473	107.270	F23	104.100	107.049
4.000	150	78	CLAY	32.680	F53	107.000	108.966	F55	106.579	109.376
4.001	150	135	CLAY	30.092	F55	106.579	109.376	F57	106.356	109.422
4.002	150	135	CLAY	30.150	F57	106.356	109.422	F59	106.133	109.215
4.003	150	135	CLAY	15.030	F59	106.133	109.215	F61	106.022	109.274
4.004	150	135	CLAY	15.899	F61	106.022	109.274	F63	105.904	109.298
4.005	150	135	CLAY	15.889	F63	105.904	109.298	F65	105.786	109.156
4.006	150	135	CLAY	19.802	F65	105.786	109.156	F67	105.639	108.519
4.007	150	135	CLAY	15.888	F67	105.639	108.519	F69	105.521	107.826
4.008	150	15	CLAY	20.646	F69	105.521	107.826	F23	104.100	107.049
6.000	150	135	CLAY	16.545	F71	102.325	104.106	F73	102.202	103.828
6.001	150	135	CLAY	14.338	F73	102.202	103.828	F75	102.096	104.207
6.002	150	135	CLAY	14.322	F75	102.096	104.207	F77	101.990	104.563
6.003	150	135	CLAY	26.549	F77	101.990	104.563	F79	101.794	104.712
6.004	150	135	CLAY	41.876	F79	101.794	104.712	F81	101.484	105.170
6.005	150	135	CLAY	15.075	F81	101.484	105.170	F29	101.372	105.691
5.000	150	31	CLAY	53.137	F83	109.625	111.496	F85	107.911	109.813
5.001	150	9	CLAY	17.094	F85	107.911	109.813	F87	106.053	109.090
5.002	150	9	CLAY	2.500	F87	106.053	109.090	F65	105.786	109.156

REV	DESCRIPTION	DATE	BY	AUTH

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CLIENT
BELLWAY HOMES WEST MIDLANDS
Bellway

PROJECT
PHASE 1 C, BRAMSHALL ROAD, UTTOXETER

TITLE
DRAINAGE STRATEGY

DRAWN	AUTHORISED	SCALE	DATE
NGW	DGB	1:500@A0	28/03/17

PROJECT NO.	DRAWING NO.	REV
16104	SK101	-

STATUS.
PRELIMINARY

[v] Hydraulic Modelling Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for PHASE 1 C SWS - 2017-03-27.SWS

Pipe Sizes UTTOXETER SWS - 2017-01-17 Manhole Sizes UTTOXETER SWS - 2017-01-17

FSR Rainfall Model - England and Wales

Return Period (years)	2	Add Flow / Climate Change (%)	0
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.050
Ratio R	0.368	Maximum Backdrop Height (m)	1.500
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)	600
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Network Design Table for PHASE 1 C SWS - 2017-03-27.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
1.000	11.730	0.120	97.8	0.070	4.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	15.800	0.153	103.3	0.023	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	19.343	0.595	32.5	0.018	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	9.269	0.386	24.0	0.013	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	18.325	0.887	20.7	0.022	4.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	8.178	0.333	24.6	0.030	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	11.523	1.020	11.3	0.039	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	23.346	0.140	166.8	0.009	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	27.457	0.165	166.4	0.033	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	24.943	0.105	237.6	0.064	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.000	25.280	1.927	13.1	0.035	4.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	12.210	1.980	6.2	0.041	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.007	22.859	0.100	228.6	0.040	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	4.15	108.534	0.070	0.0	0.0	0.0	1.32	52.6	0.0
1.001	0.00	4.35	108.414	0.093	0.0	0.0	0.0	1.29	51.1	0.0
1.002	0.00	4.49	108.261	0.111	0.0	0.0	0.0	2.30	91.6	0.0
1.003	0.00	4.55	107.666	0.124	0.0	0.0	0.0	2.68	106.6	0.0
2.000	0.00	4.11	109.520	0.022	0.0	0.0	0.0	2.89	115.0	0.0
2.001	0.00	4.16	108.633	0.052	0.0	0.0	0.0	2.65	105.4	0.0
2.002	0.00	4.21	108.300	0.091	0.0	0.0	0.0	3.92	155.7	0.0
1.004	0.00	4.94	107.280	0.224	0.0	0.0	0.0	1.01	40.1	0.0
1.005	0.00	5.39	107.140	0.257	0.0	0.0	0.0	1.01	40.2	0.0
1.006	0.00	5.88	106.975	0.321	0.0	0.0	0.0	0.84	33.6	0.0
3.000	0.00	4.12	110.927	0.035	0.0	0.0	0.0	3.63	144.4	0.0
3.001	0.00	4.15	109.000	0.076	0.0	0.0	0.0	5.30	210.9	0.0
1.007	0.00	6.25	106.870	0.437	0.0	0.0	0.0	1.04	73.2	0.0

Network Design Table for PHASE 1 C SWS - 2017-03-27.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
1.008	20.673	0.060	344.6	0.026	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.009	13.361	0.040	334.0	0.075	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.010	11.248	0.030	374.9	0.012	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.011	14.383	0.040	359.6	0.084	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.012	32.002	0.060	533.4	0.038	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.013	11.115	0.020	555.8	0.120	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.014	24.671	0.050	493.4	0.049	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.015	20.134	0.064	314.6	0.063	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.016	15.171	0.028	541.8	0.043	0.00	0.0	0.600	o	600	Pipe/Conduit	
4.000	12.018	0.050	240.4	0.120	4.00	0.0	0.600	o	300	Pipe/Conduit	
4.001	16.245	0.070	232.1	0.100	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.002	30.485	0.670	45.5	0.100	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.003	7.662	0.232	33.0	0.050	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.017	28.530	0.513	55.6	0.031	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.018	36.174	0.965	37.5	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
5.000	17.190	0.072	238.8	0.277	4.00	0.0	0.600	o	300	Pipe/Conduit	
5.001	30.562	0.477	64.1	0.026	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.002	24.905	0.453	55.0	0.118	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.003	68.490	2.253	30.4	0.148	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.004	17.130	0.671	25.5	0.217	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.005	18.045	0.923	19.6	0.082	0.00	0.0	0.600	o	300	Pipe/Conduit	
6.000	38.074	0.152	250.5	0.658	4.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.008	0.00	6.56	106.620	0.463	0.0	0.0	0.0	1.09	173.3	0.0
1.009	0.00	6.77	106.560	0.538	0.0	0.0	0.0	1.11	176.0	0.0
1.010	0.00	6.95	106.520	0.550	0.0	0.0	0.0	1.04	166.0	0.0
1.011	0.00	7.17	106.490	0.634	0.0	0.0	0.0	1.07	169.6	0.0
1.012	0.00	7.68	106.300	0.672	0.0	0.0	0.0	1.05	296.2	0.0
1.013	0.00	7.86	106.240	0.792	0.0	0.0	0.0	1.03	290.1	0.0
1.014	0.00	8.24	106.220	0.841	0.0	0.0	0.0	1.09	308.0	0.0
1.015	0.00	8.48	106.170	0.904	0.0	0.0	0.0	1.37	386.7	0.0
1.016	0.00	8.73	106.106	0.947	0.0	0.0	0.0	1.04	293.8	0.0
4.000	0.00	4.20	107.400	0.120	0.0	0.0	0.0	1.01	71.4	0.0
4.001	0.00	4.40	107.200	0.220	0.0	0.0	0.0	1.33	211.6	0.0
4.002	0.00	4.57	107.130	0.320	0.0	0.0	0.0	3.02	480.4	0.0
4.003	0.00	4.61	106.460	0.370	0.0	0.0	0.0	3.55	564.2	0.0
1.017	0.00	8.85	105.928	1.348	0.0	0.0	0.0	3.76	1659.9	0.0
1.018	0.00	8.98	105.415	1.348	0.0	0.0	0.0	4.58	2023.1	0.0
5.000	0.00	4.28	109.749	0.277	0.0	0.0	0.0	1.01	71.6	0.0
5.001	0.00	4.54	109.677	0.303	0.0	0.0	0.0	1.97	139.1	0.0
5.002	0.00	4.74	109.200	0.421	0.0	0.0	0.0	2.12	150.2	0.0
5.003	0.00	5.14	108.747	0.569	0.0	0.0	0.0	2.86	202.3	0.0
5.004	0.00	5.23	106.494	0.786	0.0	0.0	0.0	3.12	220.8	0.0
5.005	0.00	5.31	105.823	0.868	0.0	0.0	0.0	3.57	252.5	0.0
6.000	0.00	4.50	107.279	0.658	0.0	0.0	0.0	1.28	203.6	0.0

Network Design Table for PHASE 1 C SWS - 2017-03-27.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
6.001	30.092	0.120	250.8	0.011	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.002	26.786	0.107	250.3	0.050	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.003	14.477	0.058	249.6	0.104	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.004	16.311	0.065	250.9	0.041	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.005	17.950	0.072	249.3	0.039	0.00	0.0	0.600	o	450	Pipe/Conduit	
7.000	48.637	1.549	31.4	0.154	4.00	0.0	0.600	o	225	Pipe/Conduit	
7.001	23.311	1.497	15.6	0.170	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.006	19.574	0.078	250.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.007	14.530	0.557	26.1	0.082	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.008	17.505	1.320	13.3	0.040	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.019	9.579	0.282	34.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.020	54.418	1.465	37.1	0.042	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.021	46.086	0.559	82.4	0.220	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.022	22.633	0.045	503.0	0.085	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.023	13.729	0.027	508.5	0.062	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.024	15.399	0.318	48.4	0.030	0.00	0.0	0.600	o	750	Pipe/Conduit	
8.000	16.145	0.418	38.6	0.200	4.00	0.0	0.600	o	225	Pipe/Conduit	
8.001	4.704	0.028	168.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.025	20.910	0.973	21.5	0.079	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.026	13.677	0.342	40.0	0.076	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.027	83.410	0.938	88.9	0.000	0.00	0.0	0.600	o	750	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)
6.001	0.00	4.89	107.127	0.669	0.0	0.0	0.0	1.28	203.5	0.0
6.002	0.00	5.24	107.007	0.719	0.0	0.0	0.0	1.28	203.6	0.0
6.003	0.00	5.42	106.900	0.823	0.0	0.0	0.0	1.28	203.9	0.0
6.004	0.00	5.64	106.842	0.864	0.0	0.0	0.0	1.28	203.4	0.0
6.005	0.00	5.87	106.777	0.903	0.0	0.0	0.0	1.28	204.1	0.0
7.000	0.00	4.35	109.976	0.154	0.0	0.0	0.0	2.34	93.2	0.0
7.001	0.00	4.46	108.427	0.324	0.0	0.0	0.0	3.33	132.5	0.0
6.006	0.00	6.13	106.705	1.227	0.0	0.0	0.0	1.28	203.4	0.0
6.007	0.00	6.19	106.627	1.309	0.0	0.0	0.0	3.99	635.1	0.0
6.008	0.00	6.24	106.070	1.349	0.0	0.0	0.0	5.61	891.6	0.0
1.019	0.00	9.02	104.450	3.565	0.0	0.0	0.0	4.81	2125.6	0.0
1.020	0.00	9.21	104.168	3.607	0.0	0.0	0.0	4.60	2032.4	0.0
1.021	0.00	9.46	102.703	3.827	0.0	0.0	0.0	3.08	1362.3	0.0
1.022	0.00	9.77	102.144	3.912	0.0	0.0	0.0	1.24	548.2	0.0
1.023	0.00	9.95	102.099	3.974	0.0	0.0	0.0	1.23	545.2	0.0
1.024	0.00	10.02	102.072	4.004	0.0	0.0	0.0	4.03	1779.3	0.0
8.000	0.00	4.13	102.724	0.200	0.0	0.0	0.0	2.11	84.0	0.0
8.001	0.00	4.21	102.306	0.200	0.0	0.0	0.0	1.01	40.0	0.0
1.025	0.00	10.07	101.753	4.283	0.0	0.0	0.0	6.05	2673.8	0.0
1.026	0.00	10.13	100.780	4.359	0.0	0.0	0.0	4.43	1958.5	0.0
1.027	0.00	10.59	100.438	4.359	0.0	0.0	0.0	2.97	1311.5	0.0

Network Design Table for PHASE 1 C SWS - 2017-03-27.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
1.028	13.946	0.050	278.9	0.291	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.029	8.760	1.930	4.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.028	0.00	10.73	99.500	4.650	0.0	0.0	0.0	1.67	738.1	0.0
1.029	0.00	10.75	99.450	4.650	0.0	0.0	0.0	7.43	525.0	0.0

Free Flowing Outfall Details for PHASE 1 C SWS - 2017-03-27.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.029	62	98.574	97.520	97.520	1200	0

Simulation Criteria for PHASE 1 C SWS - 2017-03-27.SWS

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
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	Summer
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	0.368		

Online Controls for PHASE 1 C SWS - 2017-03-27.SWS

Hydro-Brake Optimum® Manhole: 60, DS/PN: 1.029, Volume (m³): 10.0

Unit Reference	MD-SHE-0257-3650-1050-3650
Design Head (m)	1.050
Design Flow (l/s)	36.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	257
Invert Level (m)	99.450
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.050	36.5	Kick-Flo®	0.789	31.8
Flush-Flo™	0.409	36.5	Mean Flow over Head Range	-	30.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.3	0.800	32.0	2.000	49.8	4.000	69.6	7.000	91.4
0.200	26.4	1.000	35.7	2.200	52.1	4.500	73.7	7.500	94.5
0.300	35.8	1.200	38.9	2.400	54.4	5.000	77.6	8.000	97.6
0.400	36.5	1.400	41.9	2.600	56.5	5.500	81.3	8.500	100.5
0.500	36.2	1.600	44.7	3.000	60.6	6.000	84.8	9.000	103.3
0.600	35.5	1.800	47.3	3.500	65.3	6.500	88.2	9.500	106.1

Storage Structures for PHASE 1 C SWS - 2017-03-27.SWS

Tank or Pond Manhole: 60, DS/PN: 1.029

Invert Level (m) 99.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2126.4	0.600	2478.4	1.200	2850.2	1.800	2914.2	2.400	2914.2
0.100	2183.6	0.700	2539.1	1.300	2914.2	1.900	2914.2	2.500	2914.2
0.200	2241.4	0.800	2600.3	1.400	2914.2	2.000	2914.2		
0.300	2299.8	0.900	2662.1	1.500	2914.2	2.100	2914.2		
0.400	2358.8	1.000	2723.9	1.600	2914.2	2.200	2914.2		
0.500	2418.3	1.100	2786.8	1.700	2914.2	2.300	2914.2		

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for PHASE 1 C SWS - 2017-03-27.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
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	M5-60 (mm) 19.000	Cv (Summer) 0.750
Region England and Wales		Ratio R 0.368	Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30
Climate Change (%)	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)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	2	15 Winter	2	+0%	30/15 Winter				108.614	-0.145	0.000
1.001	4	15 Winter	2	+0%	30/15 Summer				108.505	-0.134	0.000
1.002	6	15 Winter	2	+0%	30/15 Summer				108.332	-0.154	0.000
1.003	8	15 Winter	2	+0%	30/15 Summer				107.739	-0.152	0.000
2.000	64	15 Winter	2	+0%					109.548	-0.197	0.000
2.001	66	15 Winter	2	+0%					108.681	-0.177	0.000
2.002	68	15 Winter	2	+0%	30/15 Summer				108.348	-0.177	0.000
1.004	10	15 Winter	2	+0%	2/15 Winter				107.527	0.022	0.000
1.005	12	15 Winter	2	+0%	2/15 Summer				107.433	0.068	0.000
1.006	14	15 Winter	2	+0%	2/15 Summer				107.290	0.090	0.000
3.000	70	15 Winter	2	+0%					110.958	-0.194	0.000
3.001	72	15 Winter	2	+0%					109.038	-0.187	0.000
1.007	16	15 Winter	2	+0%	30/15 Summer				107.084	-0.086	0.000
1.008	18	15 Winter	2	+0%	30/15 Summer				106.857	-0.213	0.000
1.009	20	15 Winter	2	+0%	30/15 Summer				106.818	-0.192	0.000
1.010	22	15 Winter	2	+0%	30/15 Summer				106.787	-0.183	0.000
1.011	24	15 Winter	2	+0%					106.753	-0.187	0.000
1.012	26	15 Winter	2	+0%					106.622	-0.278	0.000
1.013	28	15 Winter	2	+0%					106.588	-0.252	0.000
1.014	30	15 Winter	2	+0%					106.520	-0.300	0.000
1.015	32	15 Winter	2	+0%					106.474	-0.296	0.000
1.016	34	15 Winter	2	+0%					106.447	-0.259	0.000
4.000	74	15 Winter	2	+0%					107.526	-0.174	0.000
4.001	76	15 Winter	2	+0%					107.341	-0.309	0.000
4.002	78	15 Winter	2	+0%					107.233	-0.347	0.000
4.003	80	15 Winter	2	+0%					106.599	-0.311	0.000
1.017	36	30 Winter	2	+0%					106.096	-0.582	0.000
1.018	38	30 Winter	2	+0%					105.559	-0.606	0.000
5.000	82	15 Winter	2	+0%	30/15 Summer				109.954	-0.095	0.000
5.001	84	15 Winter	2	+0%					109.812	-0.165	0.000
5.002	86	15 Winter	2	+0%	30/15 Summer				109.354	-0.146	0.000

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for PHASE 1 C SWS - 2017-03-27.SWS

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	2	0.28		12.5	OK	
1.001	4	0.35		15.7	OK	
1.002	6	0.22		18.2	OK	
1.003	8	0.23		20.0	OK	
2.000	64	0.04		3.9	OK	
2.001	66	0.10		8.2	OK	
2.002	68	0.10		13.6	OK	
1.004	10	0.89		32.9	SURCHARGED	
1.005	12	0.93		34.8	SURCHARGED	
1.006	14	1.36		42.2	SURCHARGED	
3.000	70	0.05		6.2	OK	
3.001	72	0.07		12.0	OK	
1.007	16	0.85		55.1	OK	
1.008	18	0.41		57.8	OK	
1.009	20	0.52		65.3	OK	
1.010	22	0.63		66.7	OK	
1.011	24	0.64		75.1	OK	
1.012	26	0.32		77.4	OK	
1.013	28	0.63		87.6	OK	
1.014	30	0.37		90.4	OK	
1.015	32	0.32		93.6	OK	
1.016	34	0.62		95.8	OK	
4.000	74	0.37		21.3	OK	
4.001	76	0.22		35.5	OK	
4.002	78	0.12		49.4	OK	
4.003	80	0.21		56.1	OK	
1.017	36	0.11		127.4	OK	
1.018	38	0.08		127.5	OK	
5.000	82	0.80		49.2	OK	
5.001	84	0.41		52.3	OK	
5.002	86	0.51		68.5	OK	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for PHASE 1 C SWS - 2017-03-27.SWS

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)
5.003	88	15 Winter	2	+0%	30/15 Summer				108.891	-0.156	0.000
5.004	90	15 Winter	2	+0%	30/15 Summer				106.669	-0.125	0.000
5.005	92	15 Winter	2	+0%	30/15 Summer				105.992	-0.131	0.000
6.000	94	15 Winter	2	+0%	30/15 Summer				107.544	-0.185	0.000
6.001	96	15 Winter	2	+0%	30/15 Summer				107.396	-0.181	0.000
6.002	98	15 Winter	2	+0%	30/15 Summer				107.296	-0.161	0.000
6.003	100	15 Winter	2	+0%	30/15 Summer				107.237	-0.113	0.000
6.004	102	15 Winter	2	+0%	30/15 Summer				107.198	-0.094	0.000
6.005	104	15 Winter	2	+0%	30/15 Summer				107.154	-0.073	0.000
7.000	116	15 Winter	2	+0%					110.061	-0.140	0.000
7.001	118	15 Winter	2	+0%					108.529	-0.123	0.000
6.006	106	15 Winter	2	+0%	30/15 Summer				107.107	-0.048	0.000
6.007	108	15 Winter	2	+0%					106.828	-0.249	0.000
6.008	110	15 Winter	2	+0%					106.230	-0.290	0.000
1.019	40	15 Winter	2	+0%					104.827	-0.373	0.000
1.020	42	15 Winter	2	+0%					104.419	-0.499	0.000
1.021	44	15 Winter	2	+0%	30/15 Summer				103.044	-0.409	0.000
1.022	46	15 Winter	2	+0%	2/15 Summer				102.909	0.015	0.000
1.023	48	30 Winter	2	+0%	30/15 Summer				102.849	0.000	0.000
1.024	50	15 Winter	2	+0%					102.460	-0.362	0.000
8.000	112	15 Winter	2	+0%	30/15 Summer				102.833	-0.116	0.000
8.001	114	15 Summer	2	+0%	2/15 Summer				102.562	0.031	0.000
1.025	52	15 Winter	2	+0%					102.041	-0.462	0.000
1.026	54	15 Winter	2	+0%					101.172	-0.358	0.000
1.027	56	15 Winter	2	+0%					100.775	-0.413	0.000
1.028	58	15 Winter	2	+0%	30/15 Summer				100.205	-0.045	0.000
1.029	60	240 Winter	2	+0%	2/120 Winter				99.777	0.027	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.003	88	0.46		89.5	OK	
5.004	90	0.63		119.6	OK	
5.005	92	0.60		130.8	OK	
6.000	94	0.64		115.6	OK	
6.001	96	0.66		114.7	OK	
6.002	98	0.67		115.1	OK	
6.003	100	0.81		125.6	OK	
6.004	102	0.81		127.8	OK	
6.005	104	0.80		129.4	OK	
7.000	116	0.31		27.3	OK	
7.001	118	0.42		51.3	OK	
6.006	106	1.00		163.8	OK	
6.007	108	0.41		173.1	OK	
6.008	110	0.27		177.8	OK	
1.019	40	0.50		417.8	OK	
1.020	42	0.24		421.7	OK	
1.021	44	0.39		448.9	OK	
1.022	46	1.20		454.3	SURCHARGED	
1.023	48	1.60		426.3	OK	
1.024	50	0.53		464.4	OK	
8.000	112	0.48		35.6	OK	
8.001	114	1.25		35.9	SURCHARGED	
1.025	52	0.31		485.6	OK	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for PHASE 1 C SWS - 2017-03-27.SWS

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.026	54	0.54		492.6	OK	
1.027	56	0.41		486.3	OK	
1.028	58	1.00		472.2	OK	
1.029	60	0.10		36.1	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for PHASE 1 C SWS - 2017-03-27.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
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	M5-60 (mm) 19.000	Cv (Summer) 0.750
Region England and Wales		Ratio R 0.368	Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30
Climate Change (%)	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)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	2	15 Winter	30	+0%	30/15 Winter				108.772	0.013	0.000
1.001	4	15 Winter	30	+0%	30/15 Summer				108.743	0.104	0.000
1.002	6	15 Winter	30	+0%	30/15 Summer				108.685	0.199	0.000
1.003	8	15 Winter	30	+0%	30/15 Summer				108.635	0.744	0.000
2.000	64	15 Winter	30	+0%					109.559	-0.186	0.000
2.001	66	15 Winter	30	+0%					108.703	-0.155	0.000
2.002	68	15 Winter	30	+0%	30/15 Summer				108.637	0.112	0.000
1.004	10	15 Winter	30	+0%	2/15 Winter				108.603	1.098	0.000
1.005	12	15 Winter	30	+0%	2/15 Summer				108.356	0.991	0.000
1.006	14	15 Winter	30	+0%	2/15 Summer				107.966	0.766	0.000
3.000	70	15 Winter	30	+0%					110.972	-0.180	0.000
3.001	72	15 Winter	30	+0%					109.056	-0.169	0.000
1.007	16	15 Winter	30	+0%	30/15 Summer				107.365	0.195	0.000
1.008	18	15 Winter	30	+0%	30/15 Summer				107.098	0.028	0.000
1.009	20	15 Winter	30	+0%	30/15 Summer				107.024	0.014	0.000
1.010	22	15 Winter	30	+0%	30/15 Summer				106.982	0.012	0.000
1.011	24	30 Summer	30	+0%					106.940	0.000	0.000
1.012	26	15 Winter	30	+0%					106.900	0.000	0.000
1.013	28	15 Winter	30	+0%					106.816	-0.024	0.000
1.014	30	15 Winter	30	+0%					106.790	-0.030	0.000
1.015	32	15 Winter	30	+0%					106.721	-0.049	0.000
1.016	34	15 Winter	30	+0%					106.661	-0.045	0.000
4.000	74	15 Winter	30	+0%					107.585	-0.115	0.000
4.001	76	15 Summer	30	+0%					107.412	-0.238	0.000
4.002	78	15 Summer	30	+0%					107.287	-0.293	0.000
4.003	80	15 Summer	30	+0%					106.674	-0.236	0.000
1.017	36	15 Winter	30	+0%					106.173	-0.505	0.000
1.018	38	15 Winter	30	+0%					105.622	-0.543	0.000
5.000	82	15 Winter	30	+0%	30/15 Summer				110.129	0.080	0.000
5.001	84	15 Winter	30	+0%					109.882	-0.095	0.000
5.002	86	15 Winter	30	+0%	30/15 Summer				109.577	0.077	0.000

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for PHASE 1 C SWS - 2017-03-27.SWS

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	2	0.53		23.6	SURCHARGED	
1.001	4	0.65		29.2	SURCHARGED	
1.002	6	0.41		34.0	SURCHARGED	
1.003	8	0.37		32.3	SURCHARGED	
2.000	64	0.07		7.4	OK	
2.001	66	0.22		17.5	OK	
2.002	68	0.22		29.2	SURCHARGED	
1.004	10	1.42		52.4	SURCHARGED	
1.005	12	1.59		59.2	SURCHARGED	
1.006	14	2.35		72.8	SURCHARGED	
3.000	70	0.09		11.8	OK	
3.001	72	0.14		25.6	OK	
1.007	16	1.59		103.3	SURCHARGED	
1.008	18	0.79		111.6	SURCHARGED	
1.009	20	1.03		127.8	SURCHARGED	
1.010	22	1.22		129.8	SURCHARGED	
1.011	24	1.03		121.2	OK	
1.012	26	0.59		143.7	OK	
1.013	28	1.11		153.9	OK	
1.014	30	0.65		156.9	OK	
1.015	32	0.53		155.3	OK	
1.016	34	1.00		155.4	OK	
4.000	74	0.70		40.4	OK	
4.001	76	0.45		74.2	OK	
4.002	78	0.26		108.1	OK	
4.003	80	0.46		124.6	OK	
1.017	36	0.23		258.7	OK	
1.018	38	0.17		260.9	OK	
5.000	82	1.52		93.2	SURCHARGED	
5.001	84	0.80		100.9	OK	
5.002	86	0.99		132.2	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for PHASE 1 C SWS - 2017-03-27.SWS

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)
5.003	88	15 Winter	30	+0%	30/15 Summer				109.173	0.126	0.000
5.004	90	15 Winter	30	+0%	30/15 Summer				107.457	0.663	0.000
5.005	92	15 Winter	30	+0%	30/15 Summer				106.454	0.331	0.000
6.000	94	15 Winter	30	+0%	30/15 Summer				108.386	0.657	0.000
6.001	96	15 Winter	30	+0%	30/15 Summer				108.226	0.649	0.000
6.002	98	15 Winter	30	+0%	30/15 Summer				108.090	0.633	0.000
6.003	100	15 Winter	30	+0%	30/15 Summer				107.943	0.593	0.000
6.004	102	15 Winter	30	+0%	30/15 Summer				107.772	0.480	0.000
6.005	104	15 Winter	30	+0%	30/15 Summer				107.590	0.363	0.000
7.000	116	15 Winter	30	+0%					110.099	-0.102	0.000
7.001	118	15 Winter	30	+0%					108.593	-0.059	0.000
6.006	106	15 Winter	30	+0%	30/15 Summer				107.399	0.244	0.000
6.007	108	15 Winter	30	+0%					106.938	-0.139	0.000
6.008	110	15 Winter	30	+0%					106.306	-0.214	0.000
1.019	40	15 Winter	30	+0%					105.168	-0.032	0.000
1.020	42	15 Winter	30	+0%					104.536	-0.382	0.000
1.021	44	15 Winter	30	+0%	30/15 Summer				103.741	0.288	0.000
1.022	46	15 Winter	30	+0%	2/15 Summer				103.416	0.522	0.000
1.023	48	15 Winter	30	+0%	30/15 Summer				103.103	0.254	0.000
1.024	50	15 Winter	30	+0%					102.677	-0.145	0.000
8.000	112	15 Winter	30	+0%	30/15 Summer				103.063	0.114	0.000
8.001	114	15 Winter	30	+0%	2/15 Summer				102.720	0.189	0.000
1.025	52	15 Winter	30	+0%					102.170	-0.333	0.000
1.026	54	15 Winter	30	+0%					101.446	-0.084	0.000
1.027	56	15 Winter	30	+0%					101.084	-0.104	0.000
1.028	58	15 Winter	30	+0%	30/15 Summer				100.519	0.269	0.000
1.029	60	240 Winter	30	+0%	2/120 Winter				100.068	0.318	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.003	88	0.88		170.8	SURCHARGED	
5.004	90	1.22		230.2	SURCHARGED	
5.005	92	1.16		252.4	SURCHARGED	
6.000	94	1.13		204.3	SURCHARGED	
6.001	96	1.12		195.5	SURCHARGED	
6.002	98	1.17		201.1	SURCHARGED	
6.003	100	1.47		227.1	SURCHARGED	
6.004	102	1.50		237.7	SURCHARGED	
6.005	104	1.51		244.9	SURCHARGED	
7.000	116	0.58		51.8	OK	
7.001	118	0.90		108.9	OK	
6.006	106	1.98		324.7	SURCHARGED	
6.007	108	0.81		342.6	OK	
6.008	110	0.54		350.1	OK	
1.019	40	1.00		831.4	OK	
1.020	42	0.48		839.0	OK	
1.021	44	0.76		863.8	SURCHARGED	
1.022	46	2.31		873.5	SURCHARGED	
1.023	48	3.30		880.1	SURCHARGED	
1.024	50	1.00		882.0	OK	
8.000	112	0.90		66.7	SURCHARGED	
8.001	114	2.29		65.8	SURCHARGED	
1.025	52	0.59		916.1	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for PHASE 1 C SWS - 2017-03-27.SWS

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.026	54	1.00		915.3	OK	
1.027	56	0.77		912.2	OK	
1.028	58	1.97		931.6	FLOOD RISK	
1.029	60	0.10		36.5	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for PHASE 1 C SWS - 2017-03-27.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	5.000
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	M5-60 (mm)	19.000
Region	England and Wales	Ratio R	0.368
Cv (Summer)	0.750		
Cv (Winter)	0.840		

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 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)
1.000	2	15 Winter	100	+30%	100/15 Summer				109.721	0.962
1.001	4	15 Winter	100	+30%	100/15 Summer				109.648	1.009
1.002	6	15 Winter	100	+30%	100/15 Summer				109.532	1.046
1.003	8	15 Winter	100	+30%	100/15 Summer	100/15 Winter			109.408	1.517
2.000	64	15 Winter	100	+30%					109.572	-0.173
2.001	66	15 Winter	100	+30%	100/15 Summer				109.476	0.618
2.002	68	15 Winter	100	+30%	100/15 Summer				109.453	0.928
1.004	10	15 Winter	100	+30%	100/15 Summer				109.400	1.895
1.005	12	15 Winter	100	+30%	100/15 Summer				109.138	1.773
1.006	14	15 Winter	100	+30%	100/15 Summer				108.701	1.501
3.000	70	15 Winter	100	+30%					110.985	-0.167
3.001	72	15 Winter	100	+30%					109.074	-0.151
1.007	16	15 Winter	100	+30%	100/15 Summer				107.884	0.714
1.008	18	15 Winter	100	+30%	100/15 Summer				107.424	0.354
1.009	20	15 Winter	100	+30%	100/15 Summer				107.356	0.346
1.010	22	15 Winter	100	+30%	100/15 Summer				107.250	0.280
1.011	24	15 Winter	100	+30%	100/15 Summer				107.138	0.198
1.012	26	15 Winter	100	+30%	100/15 Summer				106.977	0.077
1.013	28	15 Winter	100	+30%	100/15 Summer				106.918	0.078
1.014	30	15 Winter	100	+30%	100/15 Summer				106.877	0.057
1.015	32	15 Winter	100	+30%	100/15 Summer				106.813	0.043
1.016	34	15 Winter	100	+30%	100/15 Summer				106.720	0.014
4.000	74	15 Summer	100	+30%	100/15 Summer				107.720	0.020
4.001	76	15 Winter	100	+30%					107.494	-0.156
4.002	78	15 Summer	100	+30%					107.339	-0.241
4.003	80	15 Winter	100	+30%					106.760	-0.150
1.017	36	15 Winter	100	+30%					106.282	-0.396
1.018	38	15 Winter	100	+30%					105.918	-0.247
5.000	82	15 Winter	100	+30%	100/15 Summer				111.006	0.957
5.001	84	15 Winter	100	+30%	100/15 Summer				110.847	0.870
5.002	86	15 Winter	100	+30%	100/15 Summer				110.558	1.058

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for PHASE 1 C SWS - 2017-03-27.SWS

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	2	0.000	0.70		31.2	SURCHARGED	
1.001	4	0.000	0.83		37.5	SURCHARGED	
1.002	6	0.000	0.43		35.7	SURCHARGED	
1.003	8	2.379	0.56		49.0	FLOOD	1
2.000	64	0.000	0.12		12.5	OK	
2.001	66	0.000	0.28		23.0	SURCHARGED	
2.002	68	0.000	0.27		35.1	FLOOD RISK	
1.004	10	0.000	1.85		68.3	FLOOD RISK	
1.005	12	0.000	1.99		74.1	SURCHARGED	
1.006	14	0.000	2.81		87.0	SURCHARGED	
3.000	70	0.000	0.15		19.8	OK	
3.001	72	0.000	0.24		43.1	OK	
1.007	16	0.000	2.15		139.3	SURCHARGED	
1.008	18	0.000	1.06		149.5	SURCHARGED	
1.009	20	0.000	1.45		180.8	SURCHARGED	
1.010	22	0.000	1.76		187.4	SURCHARGED	
1.011	24	0.000	1.88		221.5	SURCHARGED	
1.012	26	0.000	0.96		234.4	SURCHARGED	
1.013	28	0.000	2.01		278.1	SURCHARGED	
1.014	30	0.000	1.22		294.7	SURCHARGED	
1.015	32	0.000	1.08		313.8	SURCHARGED	
1.016	34	0.000	2.10		325.8	SURCHARGED	
4.000	74	0.000	1.19		68.8	SURCHARGED	
4.001	76	0.000	0.76		125.0	OK	
4.002	78	0.000	0.43		178.9	OK	
4.003	80	0.000	0.76		205.1	OK	
1.017	36	0.000	0.45		502.0	OK	
1.018	38	0.000	0.32		498.0	OK	
5.000	82	0.000	1.92		117.4	FLOOD RISK	
5.001	84	0.000	0.90		114.0	SURCHARGED	
5.002	86	0.000	1.03		138.7	FLOOD RISK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for PHASE 1 C SWS - 2017-03-27.SWS

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)
5.003	88	15 Winter	100	+30%	100/15 Summer				110.079	1.032
5.004	90	15 Winter	100	+30%	100/15 Summer	100/15 Winter			107.996	1.202
5.005	92	15 Winter	100	+30%	100/15 Summer				106.986	0.863
6.000	94	15 Winter	100	+30%	100/15 Summer	100/15 Winter			108.935	1.206
6.001	96	15 Winter	100	+30%	100/15 Summer				108.769	1.192
6.002	98	15 Winter	100	+30%	100/15 Summer				108.601	1.144
6.003	100	15 Winter	100	+30%	100/15 Summer				108.423	1.073
6.004	102	15 Winter	100	+30%	100/15 Summer				108.206	0.914
6.005	104	15 Winter	100	+30%	100/15 Summer				107.962	0.735
7.000	116	15 Winter	100	+30%	100/15 Summer				110.325	0.124
7.001	118	15 Winter	100	+30%	100/15 Summer				109.445	0.793
6.006	106	15 Winter	100	+30%	100/15 Summer				107.694	0.539
6.007	108	15 Winter	100	+30%	100/15 Winter				107.135	0.058
6.008	110	15 Winter	100	+30%					106.394	-0.126
1.019	40	15 Winter	100	+30%	100/15 Summer				105.809	0.609
1.020	42	30 Winter	100	+30%	100/15 Summer				105.363	0.445
1.021	44	30 Winter	100	+30%	100/15 Summer				104.837	1.384
1.022	46	30 Winter	100	+30%	100/15 Summer				104.324	1.430
1.023	48	30 Winter	100	+30%	100/15 Summer				103.828	0.979
1.024	50	30 Winter	100	+30%	100/15 Summer				103.320	0.498
8.000	112	15 Winter	100	+30%	100/15 Summer				103.331	0.382
8.001	114	30 Winter	100	+30%	100/15 Summer				102.874	0.343
1.025	52	30 Winter	100	+30%	100/15 Summer				102.810	0.307
1.026	54	30 Winter	100	+30%	100/15 Summer				102.260	0.730
1.027	56	30 Winter	100	+30%	100/15 Summer				101.700	0.512
1.028	58	30 Winter	100	+30%	100/15 Summer				100.771	0.521
1.029	60	480 Winter	100	+30%	100/15 Summer				100.503	0.753

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.003	88	0.000	0.95		184.7	FLOOD RISK	
5.004	90	2.498	1.29		242.9	FLOOD	1
5.005	92	0.000	1.25		271.2	SURCHARGED	
6.000	94	5.819	1.24		223.3	FLOOD	1
6.001	96	0.000	1.25		218.0	SURCHARGED	
6.002	98	0.000	1.35		233.6	SURCHARGED	
6.003	100	0.000	1.73		268.5	SURCHARGED	
6.004	102	0.000	1.77		280.3	SURCHARGED	
6.005	104	0.000	1.79		290.0	SURCHARGED	
7.000	116	0.000	0.86		76.3	SURCHARGED	
7.001	118	0.000	1.10		133.3	SURCHARGED	
6.006	106	0.000	2.57		420.8	SURCHARGED	
6.007	108	0.000	1.06		444.7	SURCHARGED	
6.008	110	0.000	0.70		451.6	OK	
1.019	40	0.000	1.37		1137.0	SURCHARGED	
1.020	42	0.000	0.63		1095.9	SURCHARGED	
1.021	44	0.000	0.97		1102.6	SURCHARGED	
1.022	46	0.000	2.93		1110.2	SURCHARGED	
1.023	48	0.000	4.18		1114.8	SURCHARGED	
1.024	50	0.000	1.27		1118.0	SURCHARGED	
8.000	112	0.000	1.09		81.3	SURCHARGED	
8.001	114	0.000	2.35		67.4	SURCHARGED	
1.025	52	0.000	0.75		1161.7	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for PHASE 1 C SWS - 2017-03-27.SWS

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.026	54	0.000	1.28		1173.5	SURCHARGED	
1.027	56	0.000	0.99		1171.4	SURCHARGED	
1.028	58	0.000	2.58		1217.3	FLOOD RISK	
1.029	60	0.000	0.11		36.6	FLOOD RISK	