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16871

Flood Risk Assessment Compliance

For
Camp Road, Upper Heyford
Parcel B1 & B2a

January 2014

Contents

Appendices

1.0 Introduction

1.1 This Flood Risk Assessment Compliance report has been prepared on behalf of Bovis Homes in support of their Reserved Matters application for Parcel B1 and B2a of the redevelopment off Camp Road, Upper Heyford.

1.2 The purpose of this report is to demonstrate that the proposed drainage design for Parcel B2a complies with the approved Flood Risk Assessment (FRA) carried out by Waterman dated October 2010 (Ref C11234 ES 001).

1.3 Parcel B1 is the Bovis Homes show houses located to the far west of the development, immediately south of Camp Road (refer to the Site Residential Parcel Plan given in **Appendix A**).

1.4 Parcel B2a is an extension to parcel B1 and is located to the west of the development and sout hand east of parcel B1.

1.5 This report is intended to assist in the discharge of Planning Condition 23 of the Outline Planning Consent (ref 10/01642/OUT) that requires the developer to demonstrate compliance with the approved FRA.

2.0 Overview of Approved FRA

2.1 The entire site is located within Flood Zone 1.

2.2 The FRA sets out a detailed approach to attenuation across the Upper Heyford site which comprises of areas identified for retention, areas for refurbishment and areas for redevelopment to provide new residential dwellings.

2.3 The Environment Agency (EA) has confirmed that areas identified solely for retention and refurbishment do not require attenuation of existing surface water discharge.

2.4 The fundamental principle of the FRA is that runoff from proposed areas of redevelopment should be attenuated to existing 1 in 100 year flows with a 30% allowance for climate change.

2.5 Attenuation is to be provided through the use of balancing ponds, permeable paving and attenuation tanks where necessary. Swales will be incorporated through the site where appropriate.

2.6 The FRA splits the development into four main catchment areas and provides a series of calculations for each.

2.7 The FRA also requires a 10% betterment of existing flows entering the eastern tributary of the Gallos Brook.

3.0 Proposed Development

3.1 Parcels B1 and B2a of the proposed development are located to the west of the Upper Heyford Site taking their main access off Camp Road.

3.2 Parcel B1 is the Bovis Homes show house complex and comprise of 9 dwellings and 0.521 hectares (refer to **Appendix C** for proposed layouts).

3.3 Parcel B2a comprises of 69 dwellings and 2.056 hectares (refer to **Appendix C** for proposed layouts).

3.4 The FRA denotes both parcels as being located within Catchment Area 1 as identified in the approved FRA. Catchment 1 comprises a total area of 9.03 hectares.

3.5 Parcel B1 and B2a form only a small part of Catchment Area 1, with the remaining area made up of future development parcels and public open space.

3.6 Following a detailed review of the topography and existing drainage it is noted that Parcel B1 is not located within Catchment 1 and drains to an outfall to the west of the development which is not identified in the FRA. This is acknowledged by the EA in their letter of 13 June 2013, which can be found in **Appendix B**.

3.7 Parcel B1 drains to one of the tributaries of Gallos Brook, which converges with the other outfalls from the development south of the A4095.

3.8 The Indicative Surface Water Drainage Layout within the approved FRA suggests attenuation of surface water for the entirety of Catchment 1 is located within a series of linked ponds immediately east of Parcel B2a.

3.9 Area B1 is assumed to be part of Catchment 1 within the FRA and therefore it is suggested the attenuation should be provided within the linked ponds.

Discharge Strategy

3.10 Paragraph 3.20 of the FRA states: “In accordance with PPS25, local policy and EA guidance the rate of surface water runoff from new development would be controlled so that it does not increase over the existing situation for the 1 in 100 year even, while taking climate change into account”.

3.11 It is proposed to discharge Parcel B1 to existing sewers (to be adopted by Albion Water) at a rate not exceeding 15 l/s in the 1 in 100year event including a 30% allowance for climate change. This discharge rate is derived by the capacity of downstream sewers and is approximately 50% less than the calculated 1 in 100 year existing rate. The existing sewers discharge to Gallos Brook via an existing interceptor.

3.12 Parcel B2a forms part of a wider catchment. The entire catchment will be restricted by a strategic flow control to a rate no greater than the existing 1 in 100 year rate prior to discharge to the existing watercourse. Sub parcels, such as parcel B2a, will not be restricted until it reaches the strategic control.

3.13 The FRA prescribes the following existing 1 in 100 year runoff rates for use in calculations:

Existing 1 in 100yr Greenfield runoff 10.7 l/s/ha
Existing 1 in 100yr Brownfield runoff 112.8 l/s/ha

3.14 The purpose of this report is not to revisit the calculation of these rates. Further information on how these rates were derived can be found in the approved FRA.

3.15 Following detailed assessment of the topographical survey and site visits the following calculations can be derived:

Parcel B1		
	Area (m^2)	**Existing 1 in 100yr Discharge (l/s)**
Permeable surfacing	2,735.09	2.93
Impermeable surfacing	2,441.96	27.55
Total	**5,177.05 m^2**	**30.48 l/s**
Allowable		**15.0 l/s**

FRA Catchment Area 1		
	Area (m^2)	**Existing 1 in 100yr Discharge (l/s)**
Permeable surfacing	31,414.52	26.79
Impermeable surfacing	58,838.83	663.70
Total	**90.253.35 m^2**	**690.49 l/s**
Allowable		**690 l/s**

Parcel B2a		
	Area (m^2)	**Existing 1 in 100yr Discharge (l/s)**
Permeable surfacing	14,785.18	15.82
Impermeable surfacing	5,509.19	62.14
Total	**20,294.37 m^2**	**77.99 l/s**
Allowable		**Free Discharge to strategic ponds**

Parcel B1 Attenuation Strategy

3.16 The FRA does not include any assessment of Parcel B1 as it incorrectly identified it as part of Catchment 1. The FRA does provide suggestions of the use of various SUDs features.

3.17 In keeping with the principles of the FRA it is proposed to use swales and permeable paving to provide attenuation at source. The permeable paving will be lined and also be enhanced by a crated tank beneath. Rainwater can only gain access to the tank once it has filtered through the permeable paving.

3.18 The use of both swales and permeable paving should see considerable improvement in water quality.

3.19 Flows will be restricted using a hydrobrake flow control.

3.20 All surface water sewers connecting Parcel B1 to the outfall at Gallos Brook are being adopted by Albion Water. Albion Water will also maintain the attenuation crates and swale.

Parcel B2a Attenuation Strategy

3.21 In accordance with FRA it is proposed to provide a series of cascading ponds immediately east of Parcel B2a. The cascading ponds will provide the majority of the attenuation required and provide enhancements in water quality.

3.22 Additional SUDs features have been incorporated within the development to provide at source attenuation where appropriate.

3.23 Permeable paving has been incorporated in parking courts throughout the development. Due to underlying rock ground water has been noted at circa 1,.2m below ground level. Permeable paving is therefore lined and used to both attenuate surface water and provide water quality improvements.

3.24 Living roofs have been discounted as they are not in keeping with the strict urban planning requirements within a conservation area. Rain water harvesting has also been discounted due to ongoing maintenance issues and integration into domestic plumbing. Water butts will be provided on social units.

4.0 **Hydraulic Performance**

Parcel B1

4.1 A detailed WinDes model has been constructed to simulate the 1 in 100 year (+ climate change).

4.2 The WinDes model (refer to **Appendix D**) demonstrates that the 1 in 100 year (+ climate change) discharge rate does not exceed 14.6 l/s.

4.3 The achieved discharge rate is 50% of the calculated existing runoff rate demonstrating a reduction in flood risk downstream of the catchment.

Parcel B2a

4.4 A detailed WinDes model has been constructed to simulate the full Catchment 1 area, including all sub parcels (refer to **Appendix E**).

4.5 The model comprises of all sub parcels that will drain into the cascading ponds and the strategic flying field diversion.

4.6 It should be noted that this report pertains only to Parcel B1 and B2a and further reports will be submitted as further sub parcels within Catchment 1 are development and submitted for approval.

4.7 The WinDes demonstrates that the achieved discharge rate, when all future parcels are considered, of just 197.5 l/s. This is a considerable reduction from the allowable 690 l/s.

4.8 The significant reduction in discharge rate can be attributed to the size of the ponds. The invert levels of the ponds are driven by the invert levels of the connections from the contributing sub parcels. This has meant the ponds provide an over provision of attenuation but due to the depth of the incoming connections cannot be made shallower and smaller. This over provision of attenuation has led to a reduction in the achieved discharge.

4.8 The proposals include 4 number ponds, whose performance can be summarized as follows:

	Min CL	IL	Pipe Ref	Max WL	Depth
Pond 1	124.835	122.890	1.009	124.745	1.855
Pond 2	124.340	122.635	1.013	123.172	0.537
Pond 3	123.860	121.700	1.015	122.466	0.766
Pond 4	123.235	121.224	1.019	122.352	1.128

Exceedance

4.9 During storms in excess of the designated storm, there is the potential for the storage structures and drainage system to be overwhelmed, leading to flooding. Indicative finished floor levels and external levels have been designed so that during these periods, flood water will be directed away from the proposed building entrances and into the roads and soft landscaping areas. The natural topography of the parcel falls from North to South with no low spots within the parcel.

Pollution prevention

4.10 As the parking areas are smaller than 800m sq, PPG3 states that trapped gullies will provide suitable protection against contamination. Permeable areas will filter through granular material.

4.11 It is noted that the offsite sewer passes through a petrol interceptor before discharge into the existing watercourse which meets the requirements of PPG3.

5.0 Summary and Conclusions

5.1 This report has been prepared to allow discharge of planning condition 23 which requires evidence of compliance with the approved Waterman Flood Risk Assessment.

5.2 The FRA confirms no attenuation is required for areas being refurbished or retained.

5.3 The FRA requires surface water runoff from new development to be restricted to existing 1 in 100 year runoff rates, and flows attenuated including a 30% allowance for climate change.

5.4 WinDes models have been created and demonstrate a significant betterment in discharge rates on both Parcel B1 and B2a.

5.5 It is noted that the FRA incorrectly includes Parcel B1 within Catchment 1. This report demonstrates correspondence with the EA and maintains the philosophy of the FRA in restricting flows off site.

5.6 The significant reduction in discharge rates provides a betterment on the existing drainage situation and demonstrates a clear reduction in flood risk downstream.

APPENDIX A

Residential Parcel Plan

N

OUTFALL 4

OUTFALL 3

OUTFALL 1

OUTFALL 2

SCHOOL

VILLAGE GREEN

B1

B2a

B2b

B3

B4

B4a

B4b

B5a

B5b

D1c

D1b

D2a

D2b

D2c

D2d

D3a

D3b

D4a

D4b

D5a

D5b

D5d

N.T.S.

APPENDIX B

EA Correspondence

Mr John Freeman
Woods Hardwick Ltd
17 Goldington Road
BEDFORD
MK40 3NH

Our ref: WA/2013/114854/01-L01

Date: 13 June 2013

Dear Mr Freeman

QUERY REGARDING FLOOD RISK ASSESSMENT (FRA) FOR BOVIS SHOW HOME AREA
UPPER HEYFORD

Thank you for consulting us on this matter. We received your email on 21 May 2013 and we are now in a position to respond.

We are happy with the proposed amendment provided it is an isolated change. We would however want to see full details before being in a position to discharge the drainage condition.

It must be demonstrated that, in discharging to the west, there is no increase in flood risk. If the proposed amendment is a broader issue, we would suggest that you contacts us to discuss the wider scheme.

Yours sincerely,

Mr Jack Moeran
Planning Advisor

Direct dial 01491 828367
Direct e-mail planning-wallingford@environment-agency.gov.uk

Please note that the view expressed in this letter by the Environment Agency is a response to a pre application enquiry only and does not represent our final view in relation to any future planning application made in relation to this site. We reserve the right to change our position in relation to any such application.

You should seek your own expert advice in relation to technical matters relevant to any planning application before submission

APPENDIX C

Proposed levels and drainage layouts

CAMP ROAD

FOR CAMP ROAD DESIGN SEE DRAWINGS HEYF-5-556 TO HEYF-5-559 (NOT PART OF PARCEL B1 WORKS)

LIMIT OF PARCEL B1 HIGHWAY WORKS

RAMP

6.1m

500mm WIDE GABION BASKET WITH SOLID CORE & 50mm PIPE LAID AT BASE OF SWALE

STONE PITCHING HEADWALL

FFL 125.100

FFL 124.500

FFL 124.200

FFL 123.900

FFL 123.600

FFL 123.300

FFL 123.225

FFL 123.150

FFL 123.750

FFL 125.250

FGL 124.95

FGL 124.20

FGL 123.60

FGL 123.150

FGL 123.35

FFL 124.350

FGL 69.10

FFL 69.25

ROAD 2

STREET 01

TACTILE PAVING

BUNG REQUIRED TO F2 PIPE DURING USE OF TEMPORARY CONNECTION

LIMIT OF PARCEL B1 HIGHWAY WORKS

SEE INSET

REV T

REV S

3.7m Min with of fire tender route

5.5m

Flush square channel | Flush channel/ BN kerb | Flush 455mm quadrant kerb

Buildout detail (Pending approval by OCC)
Scale 1:100

Vehicular visibility splays

Pedestrian visibility splays (typically 2mx2m)

BUNG REQUIRED TO F2 PIPE DURING USE OF TEMPORARY CONNECTION

SEE LEFT

SEE LEFT

6.2m

LIMIT OF PARCEL B1 ADOPTABLE HIGHWAY WORKS

ROAD 2

RAMP

Adoptable Sewers

- SH F1 — Proposed Adoptable Foul Sewer
- SH S1 — Proposed Adoptable Storm Water Sewer
- PERFORATED PIPE — Permeable Paving Pipe
- Highway Gully (Existing)

Private Drains (Refer to Engineering Notes/Specification)

- Medium Foul I.C. (450mm dia. Depth to invert 600-1000mm) Non Entry I.C. (330mm dia. Depth to invert 1000-3000mm)
- Large Foul I.C. (1200x750mm or PC rings. Depth to invert 1000-1800mm)
- Medium Storm I.C. (450mm dia. Depth to invert 600-1000mm) Non Entry I.C. (330mm dia. Depth to invert 1000-3000mm)
- Large Storm I.C.(1200x750mm or PC rings. Depth to invert 1000-1800mm)
- Yard gully
- Drainage Channel
- Rodding Eye
- ACO Channel sump with silt trap and link pipe

Surface Finishes

- Adoptable Block Paving
- Adoptable Macadam Carriageway
- Adoptable Macadam Footpath
- Light Duty Vehicular Cross-over
- Private Block Paving
- PP — Private Lined Porous Paving
- Half Battered Kerb 125 X 255mm (HB2) laid with 125mm Upstand
- Bullnosed Kerb 125 x 150mm (BN) laid at 25mm kerbface at crossovers, laid flush or 0mm kerbface at tactile pram crossing points
- Edging 50 x 150mm (EF)
- Channel Block
- Storage Tank (Crated System)
- 124.00 — Proposed external levels
- F=124.00 — Proposed formation level of porous paving

Plot No. 6
Tanking (Max. height prefixed by TK)
Pedestrian Door to Garage
Unilog Retaining Wall. Max. retained height
sw - standing waste; aav - air admittance valve
Soil & vent pipe to tile or ridge vent
Exposed Brickwork. Max. height below dpc.
House Type
ss - stub stack; bf - balanced flue
Proposed Ground Level
Retaining Wall. Max retained height & type (refer to SRWT-4-01E for details)
Finished Floor Level
No of Steps. Ref going A-300, B-450, C-600, D-900
Shared drive construction
Gravel Board (RC - Reinforced Concrete Backing)

ADG1/1

A449

Notes

1. All levels relate to Ordnance Datum.

2. For adoptable roads and sewer details refer to drawings 601 and 602.

3. For road long sections refer to drawing 603.

Building Drainage

4. All connections to adoptable manholes from private building drainage to be 150mm diameter pipes unless otherwise specified.

5. All house drainage to be 100mm dia unless otherwise stated, and laid in accordance with current Building Regulations and BS8301 : 1985.

6. All private drainage products are to be Polypipe or similar approved.

7. Pipe bedding material is to be Class B with 150mm minimum thickness surround.

8. Backfill is to be be with selected fill free of stones larger than 40mm, lumps of clay over 100mm, timber, frozen material and vegetable matter.

9. Pipe protection of house drainage runs is required in accordance with the Typical House Drainage Details drawing. The contractor shall satisfy themselves and agree with the Site Management the actual extent of pipe protection required.

10. Pipes entering and leaving manholes/inspection chambers shall include a rocker pipe, 600mm in length.

11. Brickwork to chambers shall be Class B Engineering to BS3921.

12. Rainwater pipes are to be sited on side elevations whenever possible.

Regrade

13. All retaining walls with a height of 600mm or greater are to include 1.2m high post and rail fencing unless located in rear gardens. Similar retaining walls in rear gardens are to include 900mm height picket fence.

14. All flights of steps to primary level access, with more than 2 steps are to be provided with handrailing, except where the steps are 900mm ar more appart.

15. Brick retaining walls are to be used in preference to gravel boards for front garden areas.

General

16. Drainage and road design subject to Water and Highway Authority approval.

17. Edge restraint to private/blockwork - 2 stretcher course

18. Pedestrian visibility splays are not intended to be dedicated as adoptable highway

THIS LAYOUT SHOULD BE USED FOR

All adoptable sewer and highway works - postion and levels
All private building drainage - position and levels
All regrade and retaining works - position and levels
Road names and postal numbers
Street lighting and other furniture/signage

THIS LAYOUT SHOULD NOT BE USED FOR

Fencing and drive positions or materials
Private slabbing paths or areas
House types and positions

UNTIL TECHNICAL APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT AUTHORITIES, ALL DRAWINGS ARE ISSUED AS PRELIMINARY AND NOT FOR CONSTRUCTION. SHOULD THE CONTRACTOR COMMENCE SITE WORK PRIOR TO APPROVAL BEING GIVEN IT IS ENTIRELY AT HIS OWN RISK.

Revision	Description	Drawn	Checked	Date
T	Tactile paving and gulley positions amended	AT	JF	10.01.14
S	Limits of adoption amended to suit client comments, tactile paving added, buildout amended	AT	JF	10.01.14
R	Road dimension added at chainage 120	AT	JF	17.12.13
P	Indicative tie to gym layout added	AT	JF	03.12.13
N	Visibility splays added	AT	JF	02.12.13
M	Kerb radii to the south of plot 9 amended to suit latest site layout	AT	JF	31.10.13
L	Plot 2-5 parking court amended to suit latest layout	AT	JF	23.10.13
K	Plot 6 FFL raised, porous paving formation levels added, visitors parking shown as adoptable, chamber added downstream of tank and S7 removed	AT	JF	17.10.13
J	Scheme updated to suit latest layout, client comments and existing drainage information	AT	JF	16.10.13
H	Adoptable path added to West of swale and drive changed to porous paving	AT	JF	09.10.13
G	Foul within Highway upsized to 150Ø at Client request	SD	JF	04.10.13
F	Amendments to drainage design	SD	JF	02.10.13
E	Revised to suit latest site layout	SD	JF	27.09.13
D	Revised to suit latest site layout	AT	JF	10.09.13
C	Chamber references added	AT	JF	15.08.13
B	Road centreline levels added and extent of road amended	AT	JF	10.06.13
A	Latest layout and drainage design shown	AT	JF	04.06.13

Preliminary ■ Information ☐ Tender ☐ Construction ☐ As Built ☐

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Title UPPER HEYFORD

Details BOVIS SHOW HOMES ENGINEERING LAYOUT

Scale: 1:200 @ A1 Date: Dec 2012 Drawn: JGF Chk: IDB

HEYF-5-600 T

Please consider the environment before printing this drawing

Notes

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Notes

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2. For adoptable roads and sewer details refer to drawings 601 and 602.
3. For road long sections refer to drawing 603.

Building Drainage

4. All connections to adoptable manholes from private building drainage to be 150mm diameter pipes unless otherwise specified.
5. All house drainage to be 100mm dia unless otherwise stated, and laid in accordance with current Building Regulations and BS8301 : 1985.
6. All private drainage products are to be Polypipe or similar approved.
7. Pipe bedding material is to be Class B with 150mm minimum thickness surround.
8. Backfill is to be be with selected fill free of stones larger than 40mm, lumps of clay over 100mm, timber, frozen material and vegetable matter.
9. Pipe protection of house drainage runs is required in accordance with the Typical House Drainage Details drawing. The contractor shall satisfy themselves and agree with the Site Management the actual extent of pipe protection required.
10. Pipes entering and leaving manholes/inspection chambers shall include a rocker pipe, 600mm in length.
11. Brickwork to chambers shall be Class B Engineering to BS3921.
12. Rainwater pipes are to be sited on side elevations whenever possible.

Regrade

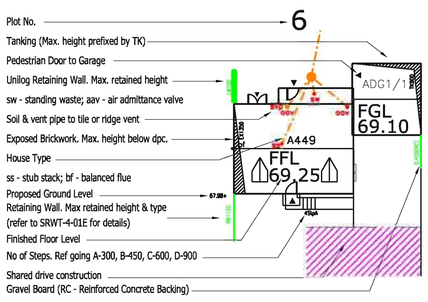
13. All retaining walls with a height of 600mm or greater are to include 1.2m high post and rail fencing unless located in rear gardens. Similar retaining walls in rear gardens are to include 900mm height picket fence.
14. All flights of steps to primary level access, with more than 2 steps are to be provided with handrailing, except where the steps are 900mm ar more appart.
15. Brick retaining walls are to be used in preference to gravel boards for front garden areas.

General

16. Drainage and road design subject to Water and Highway Authority approval.
17. Edge restraint to private/blockwork - 2 stretcher course

Adoptable Sewers
- Proposed Adoptable Foul Sewer
- Proposed Adoptable Surface Water Sewer
- Permeable Paving Pipe
- Highway Gully (Existing)

Private Drains (Refer to Engineering Notes/Specification)
- Medium Foul I.C. (450mm dia. Depth to invert 600-1000mm) Non Entry I.C. (330mm dia. Depth to invert 1000-3000mm)
- Large Foul I.C. (1200x750mm or PC rings. Depth to invert 1000-1800mm)
- Medium Surface Water I.C. (450mm dia. Depth to invert 600-1000mm) Non Entry I.C. (330mm dia. Depth to invert 1000-3000mm)
- Large Surface Water I.C.(1200x750mm or PC rings. Depth to invert 1000-1800mm)
- Yard gully
- Drainage Channel
- Rodding Eye



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Revision	Description	Drawn	Checked	Date
G	Connection from swales added	AT	JF	24.02.14
F	S29, S30 and S8 repositioned, S30a added	AT	JF	21.02.14
E	Revised to suit new plot 23-24 garage positions. Drives connecting to Camp Road amended. Plots 16-19 FFL amended. Private drainage between plots 25 and 26 amended	AT	JF	06.02.14
D	Pipe out of S17 amended	AT	JF	18.11.13
C	FW manhole in front of plot 10 renamed	AT	JF	04.11.13
B	Hydrobrake sizes added to flow control chambers	AT	JF	31.10.13
A	Latest layout, RWPs and SVPs shown. Drainage updated to reduce number of headwalls	AT	JF	30.10.13

Preliminary ☐ Information ☐ Tender ☐ Construction ☐ As Built ☐

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Title UPPER HEYFORD

Details BOVIS PARCEL B2A
PROPOSED ENGINEERING LAYOUT SHEET 1

Scale: A0- 1:200 Date: OCTOBER 2013 Drawn: AT Chk: JF

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HEYF-5-611 G

Notes

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FFL 124.200

F9 CL 124.050 IL 120.460

REV D

Pond 3 Vol 2484m cu

S49a (HW) CL 123.900 IL 122.030

S49 CL 123.900 IL 122.300

S17 (HW) CL 123.860 IL 121.700 (600Ø)

F10 CL 123.900 IL 120.190

S18 (FLOW CONTROL) CL 123.550 IL 121.650 (600Ø) Utilising a 279mm type MD6 hydrobrake or similar approved

SEE 611

LAP

LEAP

F11 CL 123.350 IL 119.780

S19 (HW) CL 123.264 IL 121.591 (600Ø)

Pond 4 Vol 1586m cu

S21 (FLOW CONTROL) CL 123.246 IL 121.246 (900Ø) Utilising a 461mm type MD6 hydrobrake or similar approved

F12 CL 123.30 IL 119.300 (150Ø)

S20 (HW) CL 123.235 IL 121.224 (900Ø)

Surface water gravity connection to western diversion manhole SD9 (IL 121.21). See drawings 400 and 401 for Western Diversion Layout

FD23 CL 123.200 IL 118.590

FD24 CL 123.220 IL 118.510

FD25 CL 123.220 IL 118.160

FD26 CL 123.100 IL 118.330

FD27 PUMPSTATION CL 122.800 IL 118.200

Foul Pump Station Compound

300m of foul rising main connecting to central diversion manhole FC8

PEDEST

Plot No.
Tanking (Max. height prefixed by TK)
Pedestrian Door to Garage
Unilog Retaining Wall. Max. retained height
sw - standing waste; aav - air admittance valve
Soil & vent pipe to tile or ridge vent
Exposed Brickwork. Max. height below dpc.
House Type
ss - stub stack; bf - balanced flue
Proposed Ground Level
Retaining Wall. Max retained height & type (refer to SRWT-4-018 for details)
Finished Floor Level
No of Steps. Ref going A-300, B-450, C-600, D-900
Stored drive construction
Gravel Board (RC - Reinforced Concrete Backing)

Adoptable Sewers
Proposed Adoptable Foul Sewer
Proposed Adoptable Surface Water Sewer
Permeable Paving Pipe
Highway Gully (Existing)

Private Drains (Refer to Engineering Notes/Specification)
Medium Foul I.C. (450mm dia. Depth to invert 600-1000mm) Non Entry I.C. (330mm dia. Depth to invert 1000-3000mm)
Large Foul I.C. (1200x750mm or PC rings. Depth to invert 1000-1800mm)
Medium Surface Water I.C. (450mm dia. Depth to invert 600-1000mm) Non Entry I.C. (330mm dia. Depth to invert 1000-3000mm)
Large Surface Water I.C.(1200x750mm or PC rings. Depth to invert 1000-1800mm)
Yard gully
Drainage Channel
Rodding Eye

Notes

1. All levels relate to Ordnance Datum.
2. For adoptable roads and sewer details refer to drawings 601 and 602.
3. For road long sections refer to drawing 603.

Building Drainage
4. All connections to adoptable manholes from private building drainage to be 150mm diameter pipes unless otherwise specified.
5. All house drainage to be 100mm dia unless otherwise stated, and laid in accordance with current Building Regulations and BS8301 : 1985.
6. All private drainage products are to be Polypipe or similar approved.
7. Pipe bedding material is to be Class B with 150mm minimum thickness surround.
8. Backfill is to be be with selected fill free of stones larger than 40mm, lumps of clay over 100mm, timber, frozen material and vegetable matter.
9. Pipe protection of house drainage runs is required in accordance with the Typical House Drainage Details drawing. The contractor shall satisfy themselves and agree with the Site Management the actual extent of pipe protection required.
10. Pipes entering and leaving manholes/inspection chambers shall include a rocker pipe, 600mm in length.
11. Brickwork to chambers shall be Class B Engineering to BS3921.

UNTIL TECHNICAL APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT AUTHORITIES, ALL DRAWINGS ARE ISSUED AS PRELIMINARY AND NOT FOR CONSTRUCTION. SHOULD THE CONTRACTOR COMMENCE SITE WORK PRIOR TO APPROVAL BEING GIVEN IT IS ENTIRELY AT HIS OWN RISK.

Revision	Description	Drawn	Checked	Date
D	Private drainage relocated	AT	JF	06.02.14
C	S18 and F11 repositioned	AT	JF	08.11.13
B	Hydrobrake spec added to flow control chambers	AT	JF	31.10.13
A	Route of off parcel foul sewer amended to suit client comments	AT	JF	30.10.13

Preliminary | Information | Tender | Construction | As Built

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Title: UPPER HEYFORD

Details: BOVIS PARCEL B2A
PROPOSED ENGINEERING LAYOUT SHEET 2

Scale: A0- 1:200 Date: OCTOBER 2013 Drawn: AT Chk: JF

Please consider the environment before printing this drawing

HEYF-5-612 D

NOTES

1. CONTRACTORS MUST CHECK ALL DIMENSIONS ON SITE. ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. DISCREPANCIES MUST BE REPORTED TO THE ARCHITECT OR ENGINEER BEFORE PROCEEDING. © THIS DRAWING IS COPYRIGHT
2. REPRODUCED FROM OS SITEMAP ® BY PERMISSION OF ORDNANCE SURVEY® ON BEHALF OF THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE. © CROWN COPYRIGHT 2008. ALL RIGHTS RESERVED. LICENCE NUMBER 100007126.
3. FOR WESTERN DIVERSION S104 LAYOUT SEE DRAWING HEYF-5-406
4. FOR CENTRAL DIVERSION S104 LAYOUT SEE DRAWING HEYF-5-425
5. FOR EASTERN DIVERSION S104 LAYOUT SEE DRAWING HEYF-5-446
6. FOR PARCEL B1 S104 LAYOUT SEE DRAWING HEYF-5-606
7. FOR PARCEL D1b S104 LAYOUT SEE DRAWING HEYF-5-833

B1

B2a

S29 3.000 S30 3.001 S30a 3.002 S8 3.008 S9 (HW)

Pond to be maintained by Albion

S10 (HW)

S11 (FLOW CONTROL)

S31 4.000 S32 4.001 S33 4.002 1.011

S12 (HW)

Pond to be maintained by Albion

S13 (HW)

S14 (FLOW CONTROL)

S15 (HW)

F1 F2 F3 F4 F5 F6 F7 F8 F9 F10 F11 F12 F14 F15 F18

S36 6.000 S37 6.001 S38 S39 6.003 S40 6.004 S41 6.005

S42 7.000

S44 8.001 S43 8.000

Drainage within parcel B2a to be adopted under seperate S104 application

SH F1c

SH F1a (used to relay flow to temporary outfall

SWS to be adopted as part of the parcel B1 S104 application

S49a (HW)

S49

S17 (HW)

S18 (FLOW CONTROL)

S19 (HW)

Pond to be maintained by Albion

S21 (FLOW CONTROL)

S20 (HW)

Connection to Western Diversion. (Western diversion to be adopted under a seperate Section 104 application)

Connection to Western Diversion. (Western diversion to be adopted under a seperate Section 104 application)

LAP

LEAP

SEATED AREA

BCP

SS

DV

Key

- Proposed surface water drainage to be adopted under a section 104 agreement
- Proposed foul water drainage to be adopted under a 104 agreement
- Proposed foul water drainage to be adopted under a separate 104 agreement
- Proposed surface water drainage to be adopted under a separate section 104 agreement
- Existing private foul water drainage to be retained
- Existing surface water drainage to be retained
- Parcel Boundary

REVISION	DESCRIPTION	DRAWN	CHECKED	DATE

PRELIMINARY ☐ INFORMATION ☐ TENDER ☐ CONSTRUCTION ☐ AS BUILT ☐

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TITLE UPPER HEYFORD
PARCEL B2a

DETAILS SECTION 104 LAYOUT

SCALE: 1:500 @ A1 DATE: JANUARY 2014 DRAWN: AT CHK:

Please consider the environment before printing this drawing

HEYF/5/622

APPENDIX D

Parcel B1 WinDes Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
Site Location	GB 450500 225250 SP 50500 25250
C (1km)	-0.023
D1 (1km)	0.328
D2 (1km)	0.309
D3 (1km)	0.264
E (1km)	0.292
F (1km)	2.461
Maximum Rainfall (mm/hr)	0
Foul Sewage (l/s/ha)	0.00
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

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)
1.000	9.050	0.650	13.9	0.026	5.00	0.0	0.600	\/	-1
1.001	9.000	0.500	18.0	0.016	0.00	0.0	0.600	\/	-1
1.002	6.600	0.250	26.4	0.024	0.00	0.0	0.600	\/	-1
1.003	13.650	0.287	47.6	0.000	0.00	0.0	0.600	o	150
1.004	45.020	0.115	391.5	0.053	0.00	0.0	0.600	o	450
2.000	24.080	0.130	185.2	0.076	5.00	0.0	0.600	o	375

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	5.01	123.850	0.026	0.0	0.0	0.0	14.05	50669.7	0.0
1.001	0.00	5.02	123.200	0.042	0.0	0.0	0.0	12.36	44557.7	0.0
1.002	0.00	5.03	122.700	0.066	0.0	0.0	0.0	10.20	36784.0	0.0
1.003	0.00	5.19	122.450	0.066	0.0	0.0	0.0	1.46	25.8	0.0
1.004	0.00	5.92	121.863	0.119	0.0	0.0	0.0	1.02	162.4	0.0
2.000	0.00	5.30	121.980	0.076	0.0	0.0	0.0	1.33	146.7	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
2.001	7.700	0.027	285.2	0.000	0.00	0.0	0.600	o	375
1.005	28.960	0.050	579.2	0.008	0.00	0.0	0.600	o	600
3.000	25.800	0.112	230.4	0.028	5.00	0.0	0.600	oo	41
1.006	10.020	0.017	589.4	0.049	0.00	0.0	0.600	o	600
1.007	20.670	0.156	132.5	0.000	0.00	0.0	0.600	o	150
1.008	16.030	0.300	53.4	0.000	0.00	0.0	0.600	o	150
1.009	71.700	0.910	78.8	0.000	0.00	0.0	0.600	o	225
1.010	50.410	0.120	420.1	0.000	0.00	0.0	0.600	o	525
1.011	10.500	0.030	350.0	0.000	0.00	0.0	0.600	o	525
1.012	37.570	0.090	417.4	0.000	0.00	0.0	0.600	o	525
1.013	43.870	0.110	398.8	0.000	0.00	0.0	0.600	o	525
1.014	9.140	0.030	304.7	0.000	0.00	0.0	0.600	o	525
1.015	3.100	0.010	310.0	0.000	0.00	0.0	0.600	o	525

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.001	0.00	5.42	121.850	0.076	0.0	0.0	0.0	1.07	117.9	0.0
1.005	0.00	6.40	121.598	0.203	0.0	0.0	0.0	1.00	284.1	0.0
3.000	0.00	5.42	121.660	0.028	0.0	0.0	0.0	1.03	145.2	0.0
1.006	0.00	6.57	121.548	0.280	0.0	0.0	0.0	1.00	281.6	0.0
1.007	0.00	6.97	121.531	0.280	0.0	0.0	0.0	0.87	15.4	0.0
1.008	0.00	7.16	121.375	0.280	0.0	0.0	0.0	1.38	24.4	0.0
1.009	0.00	7.97	121.000	0.280	0.0	0.0	0.0	1.47	58.6	0.0
1.010	0.00	8.74	119.790	0.280	0.0	0.0	0.0	1.09	235.2	0.0
1.011	0.00	8.89	119.670	0.280	0.0	0.0	0.0	1.19	257.9	0.0
1.012	0.00	9.47	119.640	0.280	0.0	0.0	0.0	1.09	236.0	0.0
1.013	0.00	10.12	119.550	0.280	0.0	0.0	0.0	1.12	241.5	0.0
1.014	0.00	10.24	119.440	0.280	0.0	0.0	0.0	1.28	276.6	0.0
1.015	0.00	10.28	119.410	0.280	0.0	0.0	0.0	1.27	274.2	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.015		123.500	119.400	0.000	0	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	1.200
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	3	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location GB 450500 225250 SP 50500 25250	
C (1km)	-0.023
D1 (1km)	0.328
D2 (1km)	0.309
D3 (1km)	0.264
E (1km)	0.292
F (1km)	2.461
Summer Storms	No
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	15

Online Controls for Storm

Orifice Manhole: Swale, DS/PN: 1.001, Volume (m³): 32.6

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 123.200

Orifice Manhole: Swale, DS/PN: 1.002, Volume (m³): 32.5

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 122.700

Hydro-Brake® Manhole: 9, DS/PN: 1.007, Volume (m³): 5.6

Design Head (m) 1.200 Hydro-Brake® Type Md5 SW Only Invert Level (m) 121.531
Design Flow (l/s) 15.0 Diameter (mm) 150

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.0	1.200	14.8	3.000	23.5	7.000	35.8
0.200	9.8	1.400	16.0	3.500	25.3	7.500	37.1
0.300	10.9	1.600	17.1	4.000	27.1	8.000	38.3
0.400	10.8	1.800	18.2	4.500	28.7	8.500	39.5
0.500	10.8	2.000	19.2	5.000	30.3	9.000	40.6
0.600	11.1	2.200	20.1	5.500	31.8	9.500	41.7
0.800	12.3	2.400	21.0	6.000	33.2		
1.000	13.6	2.600	21.8	6.500	34.5		

Storage Structures for Storm

Complex Manhole: SW MH, DS/PN: 2.001

Tank or Pond

Invert Level (m) 121.840

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	69.0	0.401	0.0	0.403	7.0	0.704	0.0
0.400	69.0	0.402	0.0	0.703	7.0		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	8.7
Membrane Percolation (mm/hr)	1000	Length (m)	60.0
Max Percolation (l/s)	145.0	Slope (1:X)	80.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	5
Invert Level (m)	122.630	Cap Volume Depth (m)	0.000

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

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia 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	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	100	+30%					
1.001	15 Winter	100	+30%					
1.002	60 Winter	100	+30%					
1.003	60 Winter	100	+30%	100/15 Winter				
1.004	60 Winter	100	+30%	100/15 Summer				
2.000	60 Winter	100	+30%	100/15 Winter				
2.001	60 Winter	100	+30%	100/15 Summer				
1.005	60 Winter	100	+30%	100/15 Summer				
3.000	60 Winter	100	+30%	100/15 Summer				
1.006	60 Winter	100	+30%	100/15 Summer				
1.007	60 Winter	100	+30%	100/15 Summer				
1.008	60 Winter	100	+30%					
1.009	60 Winter	100	+30%					
1.010	60 Winter	100	+30%					
1.011	60 Winter	100	+30%					
1.012	60 Winter	100	+30%					
1.013	60 Winter	100	+30%					
1.014	60 Winter	100	+30%					
1.015	60 Winter	100	+30%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m^3)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	Swale	124.051	-0.799	0.000	0.00	0.0	19.8	OK
1.001	Swale	124.051	-0.149	0.000	0.00	0.0	4.2	FLOOD RISK
1.002	Swale	123.465	-0.235	0.000	0.00	0.0	4.4	FLOOD RISK
1.003	Swale	122.805	0.205	0.000	0.32	0.0	7.6	SURCHARGED
1.004	5	122.807	0.494	0.000	0.14	0.0	20.0	SURCHARGED
2.000	SW MH	122.788	0.433	0.000	0.20	0.0	24.7	SURCHARGED
2.001	SW MH	122.785	0.560	0.000	0.23	0.0	18.9	FLOOD RISK
1.005	6	122.804	0.606	0.000	0.08	0.0	17.9	FLOOD RISK
3.000	13	122.812	0.852	0.000	0.07	0.0	8.6	SURCHARGED
1.006	8	122.811	0.663	0.000	0.12	0.0	18.2	FLOOD RISK
1.007	9	122.810	1.129	0.000	1.01	0.0	14.7	FLOOD RISK
1.008	Ex MH	121.463	-0.062	0.000	0.65	0.0	14.7	OK
1.009	Ex MH	121.077	-0.148	0.000	0.26	0.0	14.7	OK
1.010	Ex MH	119.883	-0.432	0.000	0.07	0.0	14.6	OK

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

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m^3)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.011	Ex MH	119.776	-0.419	0.000	0.09	0.0	14.6	OK
1.012	Ex MH	119.737	-0.428	0.000	0.07	0.0	14.6	OK
1.013	Ex MH	119.643	-0.432	0.000	0.07	0.0	14.6	OK
1.014	Ex MH	119.542	-0.423	0.000	0.08	0.0	14.6	OK
1.015	PI	119.513	-0.422	0.000	0.09	0.0	14.6	OK

APPENDIX E

Parcel B2a WinDes Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes MANHOLESFA5

FEH Rainfall Model

Return Period (years)	2
Site Location	GB 450500 225250 SP 50500 25250
C (1km)	-0.023
D1 (1km)	0.328
D2 (1km)	0.309
D3 (1km)	0.264
E (1km)	0.292
F (1km)	2.461
Maximum Rainfall (mm/hr)	0
Foul Sewage (l/s/ha)	0.00
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

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)
1.000	21.387	0.130	164.5	0.122	6.00	0.0	0.600	o	225
1.001	26.979	0.161	167.6	0.154	0.00	0.0	0.600	o	375
1.002	49.272	0.204	241.5	0.226	0.00	0.0	0.600	o	450
1.003	66.143	0.248	266.7	0.155	0.00	0.0	0.600	o	525
1.004	16.889	0.053	318.7	0.000	0.00	0.0	0.600	o	525
2.000	74.784	0.379	197.3	0.173	6.00	0.0	0.600	o	300

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	6.35	124.423	0.122	0.0	0.0	0.0	1.02	40.4	0.0
1.001	0.00	6.67	124.293	0.276	0.0	0.0	0.0	1.40	154.3	0.0
1.002	0.00	7.30	124.057	0.502	0.0	0.0	0.0	1.30	207.3	0.0
1.003	0.00	8.11	123.778	0.657	0.0	0.0	0.0	1.37	295.9	0.0
1.004	0.00	8.33	123.530	0.657	0.0	0.0	0.0	1.25	270.4	0.0
2.000	0.00	7.12	124.040	0.173	0.0	0.0	0.0	1.12	78.9	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.005	21.721	0.217	100.1	0.000	0.00	0.0	0.600	o	525
1.006	65.735	0.176	373.5	0.071	0.00	0.0	0.600	o	525
1.007	8.406	0.020	420.3	0.000	0.00	0.0	0.600	o	525
3.000	43.030	0.230	187.1	0.090	6.00	0.0	0.600	o	300
3.001	4.430	0.030	147.7	0.000	0.00	0.0	0.600	o	300
3.002	42.281	0.175	241.6	0.067	0.00	0.0	0.600	o	300
1.008	16.811	0.038	442.4	0.000	0.00	0.0	0.600	o	525
1.009	24.443	0.062	394.2	0.000	0.00	0.0	0.600	3 \=/	525
1.010	7.357	0.020	367.9	0.000	0.00	0.0	0.600	o	525
1.011	3.660	0.009	406.7	0.000	0.00	0.0	0.600	o	525
4.000	49.658	0.170	292.1	0.096	6.00	0.0	0.600	o	375
4.001	29.802	0.100	298.0	0.060	0.00	0.0	0.600	o	375
4.002	9.875	0.054	182.9	0.022	0.00	0.0	0.600	o	375
5.000	36.869	0.219	168.4	0.174	6.00	0.0	0.600	o	300
5.001	22.235	0.132	168.4	0.000	0.00	0.0	0.600	o	300
1.012	44.270	0.090	491.9	0.000	0.00	0.0	0.600	3 \=/	525

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)
1.005	0.00	8.50	123.478	0.830	0.0	0.0	0.0	2.24	484.7	0.0
1.006	0.00	9.45	123.186	0.901	0.0	0.0	0.0	1.15	249.6	0.0
1.007	0.00	9.58	123.010	0.901	0.0	0.0	0.0	1.09	235.1	0.0
3.000	0.00	6.63	123.650	0.090	0.0	0.0	0.0	1.15	81.0	0.0
3.001	0.00	6.68	123.420	0.090	0.0	0.0	0.0	1.29	91.3	0.0
3.002	0.00	7.38	123.390	0.157	0.0	0.0	0.0	1.01	71.2	0.0
1.008	0.00	9.84	122.990	1.058	0.0	0.0	0.0	1.06	229.1	0.0
1.009	0.00	10.27	122.952	1.058	0.0	0.0	0.0	0.94	137.5	0.0
1.010	0.00	10.38	122.890	1.058	0.0	0.0	0.0	1.16	251.5	0.0
1.011	0.00	10.43	122.870	1.058	0.0	0.0	0.0	1.10	239.1	0.0
4.000	0.00	6.78	123.100	0.096	0.0	0.0	0.0	1.05	116.5	0.0
4.001	0.00	7.26	122.930	0.156	0.0	0.0	0.0	1.04	115.3	0.0
4.002	0.00	7.38	122.830	0.178	0.0	0.0	0.0	1.34	147.6	0.0
5.000	0.00	6.51	123.077	0.174	0.0	0.0	0.0	1.21	85.5	0.0
5.001	0.00	6.81	122.858	0.174	0.0	0.0	0.0	1.21	85.4	0.0
1.012	0.00	11.31	122.726	1.410	0.0	0.0	0.0	0.84	122.9	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.013	6.454	0.015	430.3	0.000	0.00	0.0	0.600	o	525
1.014	4.436	0.009	492.9	0.000	0.00	0.0	0.600	o	525
6.000	25.590	0.455	56.2	0.108	6.00	0.0	0.600	o	225
7.000	18.881	0.080	236.0	0.065	6.00	0.0	0.600	o	300
6.001	15.459	0.070	220.8	0.040	0.00	0.0	0.600	o	300
6.002	10.259	0.050	205.2	0.000	0.00	0.0	0.600	o	300
6.003	18.087	0.095	190.4	0.065	0.00	0.0	0.600	o	300
8.000	36.049	0.215	167.7	0.093	6.00	0.0	0.600	o	225
8.001	26.594	0.115	231.3	0.107	0.00	0.0	0.600	o	300
6.004	59.029	0.150	393.5	0.067	0.00	0.0	0.600	o	525
6.005	15.889	0.040	397.2	0.190	0.00	0.0	0.600	o	525
9.000	45.463	0.202	225.1	0.228	6.00	0.0	0.600	o	300
9.001	24.747	0.110	225.0	0.000	0.00	0.0	0.600	o	300
1.015	60.578	0.121	500.6	0.000	0.00	0.0	0.600	3 \=/	900

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)
1.013	0.00	11.41	122.635	1.410	0.0	0.0	0.0	1.07	232.4	0.0
1.014	0.00	11.49	122.620	1.410	0.0	0.0	0.0	1.00	216.9	0.0
6.000	0.00	6.24	123.100	0.108	0.0	0.0	0.0	1.75	69.5	0.0
7.000	0.00	6.31	122.650	0.065	0.0	0.0	0.0	1.02	72.0	0.0
6.001	0.00	6.55	122.570	0.213	0.0	0.0	0.0	1.05	74.5	0.0
6.002	0.00	6.71	122.500	0.213	0.0	0.0	0.0	1.09	77.3	0.0
6.003	0.00	6.97	122.450	0.278	0.0	0.0	0.0	1.14	80.3	0.0
8.000	0.00	6.60	122.760	0.093	0.0	0.0	0.0	1.01	40.0	0.0
8.001	0.00	7.03	122.470	0.200	0.0	0.0	0.0	1.03	72.8	0.0
6.004	0.00	7.90	122.130	0.545	0.0	0.0	0.0	1.12	243.1	0.0
6.005	0.00	8.14	121.980	0.735	0.0	0.0	0.0	1.12	241.9	0.0
9.000	0.00	6.73	123.037	0.228	0.0	0.0	0.0	1.04	73.8	0.0
9.001	0.00	7.12	122.835	0.228	0.0	0.0	0.0	1.04	73.8	0.0
1.015	0.00	12.62	121.940	2.373	0.0	0.0	0.0	0.89	179.5	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
10.000	34.571	0.205	168.6	0.154	6.00	0.0	0.600	o	300
10.001	30.044	0.178	168.8	0.000	0.00	0.0	0.600	o	300
11.000	21.313	0.206	103.5	0.094	6.00	0.0	0.600	o	225
1.016	10.565	0.020	528.3	0.000	0.00	0.0	0.600	o	900
1.017	15.518	0.048	323.3	0.000	0.00	0.0	0.600	o	750
1.018	33.421	0.058	576.2	0.000	0.00	0.0	0.600	o	600
12.000	7.203	0.300	24.0	0.241	6.00	0.0	0.600	o	300
12.001	25.491	0.250	102.0	0.058	0.00	0.0	0.600	o	375
12.002	24.848	0.200	124.2	0.000	0.00	0.0	0.600	o	450
12.003	62.469	0.580	107.7	0.262	0.00	0.0	0.600	o	525
13.000	66.236	0.720	92.0	0.192	6.00	0.0	0.600	o	300
13.001	108.271	0.450	240.6	0.192	0.00	0.0	0.600	o	450
12.004	39.723	0.200	198.6	0.000	0.00	0.0	0.600	o	525
12.005	45.028	0.090	500.3	0.078	0.00	0.0	0.600	o	600
12.006	26.657	0.050	533.1	0.130	0.00	0.0	0.600	o	600
12.007	39.783	0.080	497.3	0.154	0.00	0.0	0.600	o	600
12.008	37.071	0.080	463.4	0.130	0.00	0.0	0.600	o	600

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)
10.000	0.00	6.48	122.851	0.154	0.0	0.0	0.0	1.21	85.4	0.0
10.001	0.00	6.89	122.646	0.154	0.0	0.0	0.0	1.21	85.3	0.0
11.000	0.00	6.28	122.300	0.094	0.0	0.0	0.0	1.29	51.1	0.0
1.016	0.00	12.75	121.720	2.621	0.0	0.0	0.0	1.36	862.8	0.0
1.017	0.00	12.92	121.700	2.621	0.0	0.0	0.0	1.55	685.2	0.0
1.018	0.00	13.47	121.650	2.621	0.0	0.0	0.0	1.01	284.8	0.0
12.000	0.00	6.04	124.300	0.241	0.0	0.0	0.0	3.22	227.8	0.0
12.001	0.00	6.27	123.925	0.299	0.0	0.0	0.0	1.79	198.2	0.0
12.002	0.00	6.50	123.600	0.299	0.0	0.0	0.0	1.82	289.9	0.0
12.003	0.00	6.98	123.325	0.561	0.0	0.0	0.0	2.16	467.1	0.0
13.000	0.00	6.67	124.140	0.192	0.0	0.0	0.0	1.64	115.9	0.0
13.001	0.00	8.05	123.270	0.384	0.0	0.0	0.0	1.31	207.8	0.0
12.004	0.00	8.47	122.745	0.945	0.0	0.0	0.0	1.59	343.3	0.0
12.005	0.00	9.17	122.470	1.023	0.0	0.0	0.0	1.08	305.9	0.0
12.006	0.00	9.59	122.380	1.153	0.0	0.0	0.0	1.05	296.2	0.0
12.007	0.00	10.20	122.330	1.307	0.0	0.0	0.0	1.09	306.8	0.0
12.008	0.00	10.75	122.250	1.437	0.0	0.0	0.0	1.12	318.0	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
12.009	78.090	0.160	488.1	0.206	0.00	0.0	0.600	o	600
12.010	27.032	0.050	540.6	0.100	0.00	0.0	0.600	o	750
12.011	37.638	0.070	537.7	0.129	0.00	0.0	0.600	o	750
12.012	25.690	0.050	513.8	0.000	0.00	0.0	0.600	o	750
1.019	36.931	0.074	499.1	0.000	0.00	0.0	0.600	3 \=/	600
14.000	50.472	0.206	245.0	0.135	6.00	0.0	0.600	o	300
14.001	11.781	0.048	245.4	0.000	0.00	0.0	0.600	o	300
14.002	14.910	0.061	244.4	0.000	0.00	0.0	0.600	o	300
14.003	11.041	0.045	245.4	0.000	0.00	0.0	0.600	o	300
14.004	16.375	0.067	244.4	0.151	0.00	0.0	0.600	o	375
14.005	55.840	0.208	268.5	0.039	0.00	0.0	0.600	o	375
14.006	15.399	0.080	192.5	0.000	0.00	0.0	0.600	o	375
14.007	22.843	0.050	456.9	0.000	0.00	0.0	0.600	3 \=/	600
15.000	48.032	0.484	99.2	0.115	6.00	0.0	0.600	o	225
15.001	24.549	0.146	168.1	0.057	0.00	0.0	0.600	o	225
14.008	18.318	0.037	495.1	0.000	0.00	0.0	0.600	3 \=/	600
1.020	5.486	0.009	609.6	0.000	0.00	0.0	0.600	o	900

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)
12.009	0.00	11.94	122.170	1.643	0.0	0.0	0.0	1.10	309.7	0.0
12.010	0.00	12.31	121.860	1.743	0.0	0.0	0.0	1.20	528.6	0.0
12.011	0.00	12.84	121.810	1.872	0.0	0.0	0.0	1.20	530.1	0.0
12.012	0.00	13.19	121.740	1.872	0.0	0.0	0.0	1.23	542.4	0.0
1.019	0.00	14.20	121.591	4.493	0.0	0.0	0.0	0.85	133.4	0.0
14.000	0.00	6.84	122.125	0.135	0.0	0.0	0.0	1.00	70.7	0.0
14.001	0.00	7.04	121.919	0.135	0.0	0.0	0.0	1.00	70.6	0.0
14.002	0.00	7.29	121.871	0.135	0.0	0.0	0.0	1.00	70.8	0.0
14.003	0.00	7.47	121.810	0.135	0.0	0.0	0.0	1.00	70.6	0.0
14.004	0.00	7.71	121.765	0.286	0.0	0.0	0.0	1.15	127.5	0.0
14.005	0.00	8.55	121.698	0.325	0.0	0.0	0.0	1.10	121.6	0.0
14.006	0.00	8.75	121.470	0.325	0.0	0.0	0.0	1.30	143.9	0.0
14.007	0.00	9.18	121.390	0.325	0.0	0.0	0.0	0.89	139.5	0.0
15.000	0.00	6.61	122.216	0.115	0.0	0.0	0.0	1.31	52.2	0.0
15.001	0.00	7.02	121.657	0.172	0.0	0.0	0.0	1.01	40.0	0.0
14.008	0.00	9.54	121.340	0.497	0.0	0.0	0.0	0.85	134.0	0.0
1.020	0.00	14.27	121.224	4.990	0.0	0.0	0.0	1.26	802.7	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.021	3.088	0.005	617.6	0.000	0.00	0.0	0.600	o	900
16.000	141.271	0.323	437.4	1.950	6.00	0.0	0.600	o	750
16.001	16.712	0.038	439.8	0.000	0.00	0.0	0.600	o	750
16.002	83.792	0.195	429.7	0.050	0.00	0.0	0.600	o	750
16.003	4.000	0.012	333.3	0.000	0.00	0.0	0.600	o	750
16.004	30.650	0.125	245.2	0.000	0.00	0.0	0.600	o	750
17.000	6.517	0.560	11.6	0.255	6.00	0.0	0.600	o	150
16.005	46.640	0.440	106.0	0.000	0.00	0.0	0.600	o	750
16.006	10.069	0.025	402.8	0.000	0.00	0.0	0.600	o	750
16.007	94.926	0.237	400.5	0.000	0.00	0.0	0.600	o	750
16.008	51.382	0.128	401.4	0.000	0.00	0.0	0.600	o	750
16.009	36.859	0.092	400.6	0.000	0.00	0.0	0.600	o	750
16.010	75.440	0.188	401.3	0.000	0.00	0.0	0.600	o	750
1.022	75.093	0.300	250.3	0.000	0.00	0.0	0.600	o	900
1.023	13.927	0.056	248.7	0.000	0.00	0.0	0.600	o	900
1.024	12.562	0.050	251.2	0.000	0.00	0.0	0.600	o	900
1.025	43.989	0.176	249.9	0.000	0.00	0.0	0.600	o	900
1.026	11.362	0.045	252.5	0.000	0.00	0.0	0.600	o	900

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)
1.021	0.00	14.31	121.215	4.990	0.0	0.0	0.0	1.25	797.4	0.0
16.000	0.00	7.77	123.463	1.950	0.0	0.0	0.0	1.33	588.3	0.0
16.001	0.00	7.98	123.140	1.950	0.0	0.0	0.0	1.33	586.7	0.0
16.002	0.00	9.02	123.102	2.000	0.0	0.0	0.0	1.34	593.6	0.0
16.003	0.00	9.06	122.907	2.000	0.0	0.0	0.0	1.53	674.7	0.0
16.004	0.00	9.35	122.595	2.000	0.0	0.0	0.0	1.78	787.6	0.0
17.000	0.00	6.04	124.545	0.255	0.0	0.0	0.0	2.97	52.5	0.0
16.005	0.00	9.63	122.470	2.255	0.0	0.0	0.0	2.72	1200.8	0.0
16.006	0.00	9.75	122.030	2.255	0.0	0.0	0.0	1.39	613.3	0.0
16.007	0.00	10.89	122.005	2.255	0.0	0.0	0.0	1.39	615.0	0.0
16.008	0.00	11.51	121.768	2.255	0.0	0.0	0.0	1.39	614.3	0.0
16.009	0.00	11.95	121.640	2.255	0.0	0.0	0.0	1.39	614.9	0.0
16.010	0.00	12.85	121.548	2.255	0.0	0.0	0.0	1.39	614.4	0.0
1.022	0.00	14.95	121.210	7.245	0.0	0.0	0.0	1.98	1257.0	0.0
1.023	0.00	15.07	120.910	7.245	0.0	0.0	0.0	1.98	1261.1	0.0
1.024	0.00	15.17	120.854	7.245	0.0	0.0	0.0	1.97	1254.7	0.0
1.025	0.00	15.54	120.804	7.245	0.0	0.0	0.0	1.98	1258.0	0.0
1.026	0.00	15.64	120.628	7.245	0.0	0.0	0.0	1.97	1251.6	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.027	49.420	0.133	371.6	1.000	0.00	0.0	0.600	o	900
1.028	36.960	0.265	139.5	1.000	0.00	0.0	0.600	o	900
1.029	119.800	0.640	187.2	0.500	0.00	0.0	0.600	o	900
1.030	1.350	0.005	270.0	0.000	0.00	0.0	0.600	o	600

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)
1.027	0.00	16.15	120.583	8.245	0.0	0.0	0.0	1.62	1030.3	0.0
1.028	0.00	16.38	120.450	9.245	0.0	0.0	0.0	2.65	1686.8	0.0
1.029	0.00	17.25	120.185	9.745	0.0	0.0	0.0	2.29	1454.9	0.0
1.030	0.00	17.27	119.545	9.745	0.0	0.0	0.0	1.48	417.7	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.030	Watercourse	121.200	119.540	121.405	0	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	1.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location GB 450500 225250 SP 50500 25250	
C (1km)	-0.023
D1 (1km)	0.328
D2 (1km)	0.309
D3 (1km)	0.264
E (1km)	0.292
F (1km)	2.461
Summer Storms	No
Winter Storms	Yes

Synthetic Rainfall Details

Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	15

Online Controls for Storm

Hydro-Brake® Manhole: 10, DS/PN: 1.010, Volume (m³): 439.1

Design Head (m) 2.000 Hydro-Brake® Type Md6 SW Only Invert Level (m) 122.890
Design Flow (l/s) 7.5 Diameter (mm) 96

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.9	1.200	5.8	3.000	9.1	7.000	13.9
0.200	4.3	1.400	6.2	3.500	9.8	7.500	14.4
0.300	4.1	1.600	6.7	4.000	10.5	8.000	14.9
0.400	4.0	1.800	7.1	4.500	11.2	8.500	15.3
0.500	4.0	2.000	7.4	5.000	11.8	9.000	15.8
0.600	4.2	2.200	7.8	5.500	12.3	9.500	16.2
0.800	4.7	2.400	8.1	6.000	12.9		
1.000	5.3	2.600	8.5	6.500	13.4		

Hydro-Brake® Manhole: 14, DS/PN: 1.014, Volume (m³): 5.4

Design Head (m) 2.000 Hydro-Brake® Type Md6 SW Only Invert Level (m) 122.620
Design Flow (l/s) 20.5 Diameter (mm) 159

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.3	1.200	16.0	3.000	25.0	7.000	38.2
0.200	12.3	1.400	17.1	3.500	27.0	7.500	39.5
0.300	15.0	1.600	18.3	4.000	28.8	8.000	40.8
0.400	15.1	1.800	19.4	4.500	30.6	8.500	42.1
0.500	14.6	2.000	20.4	5.000	32.3	9.000	43.3
0.600	14.1	2.200	21.4	5.500	33.8	9.500	44.5
0.800	14.1	2.400	22.3	6.000	35.3		
1.000	14.9	2.600	23.3	6.500	36.8		

Hydro-Brake® Manhole: 18, DS/PN: 1.018, Volume (m³): 11.0

Design Head (m) 2.000 Hydro-Brake® Type Md6 SW Only Invert Level (m) 121.650
Design Flow (l/s) 64.0 Diameter (mm) 279

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.1	1.200	57.0	3.000	77.0	7.000	117.5
0.200	25.9	1.400	57.5	3.500	83.1	7.500	121.6
0.300	42.9	1.600	59.1	4.000	88.8	8.000	125.6
0.400	55.5	1.800	61.2	4.500	94.2	8.500	129.5
0.500	60.8	2.000	63.8	5.000	99.3	9.000	133.2
0.600	62.0	2.200	66.4	5.500	104.2	9.500	136.9
0.800	60.6	2.400	69.1	6.000	108.8		
1.000	58.1	2.600	71.8	6.500	113.2		

Hydro-Brake® Manhole: 20, DS/PN: 1.020, Volume (m³): 408.0

Design Head (m) 2.000 Hydro-Brake® Type Md6 SW Only Invert Level (m) 121.224
Design Flow (l/s) 200.0 Diameter (mm) 461

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	14.1	1.200	215.7	3.000	215.6	7.000	320.8
0.200	43.3	1.400	210.4	3.500	229.3	7.500	332.1
0.300	79.3	1.600	204.9	4.000	243.5	8.000	343.0
0.400	116.9	1.800	201.3	4.500	257.7	8.500	353.5
0.500	152.0	2.000	199.9	5.000	271.3	9.000	363.8
0.600	181.1	2.200	200.6	5.500	284.4	9.500	373.7
0.800	211.8	2.400	202.9	6.000	297.0		
1.000	217.5	2.600	206.4	6.500	309.1		

Storage Structures for Storm

Tank or Pond Manhole: 9, DS/PN: 1.009

Invert Level (m) 122.952

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	65.0	2.400	430.0

Tank or Pond Manhole: 12, DS/PN: 1.012

Invert Level (m) 122.726

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	173.0	1.800	746.0

Porous Car Park Manhole: 36 (B2a), DS/PN: 6.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	14.1
Membrane Percolation (mm/hr)	1000	Length (m)	20.0
Max Percolation (l/s)	78.3	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	124.280	Cap Volume Depth (m)	0.000

Porous Car Park Manhole: 43 (B2a), DS/PN: 8.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.6
Membrane Percolation (mm/hr)	1000	Length (m)	25.0
Max Percolation (l/s)	45.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	123.840	Cap Volume Depth (m)	0.000

Tank or Pond Manhole: 16, DS/PN: 1.016

Invert Level (m) 121.720

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	640.0	2.150	1751.0

Tank or Pond Manhole: 20, DS/PN: 1.020

Invert Level (m) 121.224

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	297.0	2.000	1420.0

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

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

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

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	100	+30%	100/15 Summer	100/15 Summer			4
1.001	15 Winter	100	+30%	100/15 Summer	100/15 Summer			2
1.002	15 Winter	100	+30%	100/15 Summer	100/15 Summer			2
1.003	15 Winter	100	+30%	100/15 Summer	100/15 Summer			2
1.004	15 Winter	100	+30%	100/15 Summer	100/15 Summer			2
2.000	15 Winter	100	+30%	100/15 Summer	100/15 Winter			1
1.005	15 Winter	100	+30%	100/15 Summer				
1.006	15 Winter	100	+30%	100/15 Summer				
1.007	480 Winter	100	+30%	100/15 Summer				
3.000	480 Winter	100	+30%	100/15 Summer				
3.001	480 Winter	100	+30%	100/15 Summer				
3.002	480 Winter	100	+30%	100/15 Summer				
1.008	480 Winter	100	+30%	100/15 Summer				
1.009	480 Winter	100	+30%					
1.010	480 Winter	100	+30%	100/15 Summer				
1.011	120 Winter	100	+30%					
4.000	15 Winter	100	+30%					
4.001	15 Winter	100	+30%	100/15 Winter				
4.002	15 Winter	100	+30%	100/15 Winter				
5.000	15 Winter	100	+30%	100/15 Summer				
5.001	15 Winter	100	+30%	100/15 Summer				
1.012	120 Winter	100	+30%					
1.013	120 Winter	100	+30%	100/60 Winter				
1.014	120 Winter	100	+30%	100/60 Winter				
6.000	15 Winter	100	+30%	100/15 Summer				
7.000	15 Winter	100	+30%	100/15 Summer	100/15 Summer			2
6.001	15 Winter	100	+30%	100/15 Summer				
6.002	15 Winter	100	+30%	100/15 Summer				
6.003	15 Winter	100	+30%	100/15 Summer				
8.000	15 Winter	100	+30%	100/15 Summer				
8.001	15 Winter	100	+30%	100/15 Summer				
6.004	15 Winter	100	+30%	100/15 Summer				
6.005	15 Winter	100	+30%	100/15 Summer				
9.000	15 Winter	100	+30%	100/15 Summer	100/15 Summer			2
9.001	15 Summer	100	+30%	100/15 Summer				
1.015	240 Winter	100	+30%					
10.000	15 Winter	100	+30%	100/15 Summer				
10.001	15 Winter	100	+30%	100/15 Summer				

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

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
11.000	15 Winter	100	+30%	100/15 Summer				
1.016	240 Winter	100	+30%					
1.017	120 Winter	100	+30%					
1.018	120 Winter	100	+30%	100/30 Summer				
12.000	15 Winter	100	+30%	100/15 Summer	100/15 Summer			2
12.001	15 Winter	100	+30%	100/15 Summer	100/15 Winter			1
12.002	15 Winter	100	+30%	100/15 Summer				
12.003	15 Winter	100	+30%	100/15 Summer				
13.000	15 Winter	100	+30%	100/15 Summer	100/15 Summer			2
13.001	15 Winter	100	+30%	100/15 Summer	100/15 Summer			2
12.004	15 Winter	100	+30%	100/15 Summer	100/15 Winter			1
12.005	15 Winter	100	+30%	100/15 Summer				
12.006	15 Winter	100	+30%	100/15 Summer	100/15 Summer			4
12.007	15 Winter	100	+30%	100/15 Summer	100/15 Summer			4
12.008	15 Winter	100	+30%	100/15 Summer				
12.009	15 Winter	100	+30%	100/15 Summer				
12.010	15 Winter	100	+30%	100/15 Summer				
12.011	15 Winter	100	+30%	100/15 Summer				
12.012	15 Winter	100	+30%	100/15 Summer				
1.019	60 Winter	100	+30%					
14.000	15 Winter	100	+30%	100/15 Summer	100/15 Summer			2
14.001	15 Winter	100	+30%	100/15 Summer				
14.002	15 Winter	100	+30%	100/15 Summer				
14.003	15 Winter	100	+30%	100/15 Summer				
14.004	15 Winter	100	+30%	100/15 Summer				
14.005	15 Winter	100	+30%	100/15 Summer				
14.006	60 Winter	100	+30%	100/15 Summer				
14.007	60 Winter	100	+30%					
15.000	15 Winter	100	+30%	100/15 Summer	100/15 Summer			2
15.001	15 Winter	100	+30%	100/15 Summer				
14.008	60 Winter	100	+30%					
1.020	60 Winter	100	+30%	100/15 Summer				
1.021	30 Winter	100	+30%					
16.000	15 Winter	100	+30%	100/15 Summer	100/15 Summer			4
16.001	15 Summer	100	+30%	100/15 Summer				
16.002	30 Winter	100	+30%	100/15 Summer	100/15 Summer			4
16.003	30 Winter	100	+30%	100/15 Summer				
16.004	30 Winter	100	+30%	100/15 Summer				
17.000	15 Winter	100	+30%	100/15 Summer	100/15 Summer			6
16.005	15 Winter	100	+30%	100/15 Summer				
16.006	15 Winter	100	+30%	100/15 Summer				
16.007	15 Winter	100	+30%	100/15 Summer				
16.008	15 Winter	100	+30%	100/15 Summer				
16.009	15 Winter	100	+30%	100/15 Summer				
16.010	15 Winter	100	+30%	100/15 Summer				
1.022	30 Winter	100	+30%					
1.023	30 Winter	100	+30%	100/15 Winter				
1.024	30 Winter	100	+30%	100/15 Summer				
1.025	15 Winter	100	+30%	100/15 Summer				
1.026	15 Winter	100	+30%	100/15 Summer				
1.027	15 Winter	100	+30%	100/15 Summer				

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

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.028	15 Winter	100	+30%	100/15 Summer				
1.029	15 Winter	100	+30%	100/15 Summer	100/15 Winter			1
1.030	15 Winter	100	+30%	100/15 Summer	100/15 Summer			2

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	1	125.701	1.053	12.885	2.13	0.0	78.3	FLOOD
1.001	2	125.614	0.946	8.306	1.12	0.0	150.8	FLOOD
1.002	3	125.551	1.044	4.170	1.60	0.0	301.9	FLOOD
1.003	4	125.339	1.036	3.782	1.32	0.0	357.3	FLOOD
1.004	5	125.078	1.023	7.207	1.58	0.0	321.9	FLOOD
2.000	28	125.665	1.325	0.722	1.34	0.0	101.7	FLOOD
1.005	6	124.971	0.968	0.000	1.13	0.0	405.3	FLOOD RISK
1.006	7	124.765	1.054	0.000	1.74	0.0	397.8	FLOOD RISK
1.007	8	124.748	1.213	0.000	0.46	0.0	57.0	SURCHARGED
3.000	29 (B2a)	124.750	0.800	0.000	0.08	0.0	5.9	SURCHARGED
3.001	30 (B2a)	124.749	1.029	0.000	0.10	0.0	5.7	SURCHARGED
3.002	30a (B2a)	124.749	1.059	0.000	0.15	0.0	10.1	SURCHARGED
1.008	8a	124.747	1.232	0.000	0.44	0.0	66.5	SURCHARGED
1.009	9	124.745	-0.637	0.000	0.00	0.0	29.5	OK
1.010	10	124.745	1.330	0.000	0.05	0.0	7.0	FLOOD RISK
1.011	11	123.174	-0.221	0.000	0.04	0.0	6.4	OK
4.000	31 (B2a)	123.356	-0.119	0.000	0.61	0.0	65.8	OK
4.001	32 (B2a)	123.307	0.002	0.000	0.96	0.0	98.1	SURCHARGED
4.002	33 (B2a)	123.221	0.016	0.000	1.00	0.0	107.1	SURCHARGED
5.000	34	123.853	0.476	0.000	1.50	0.0	118.3	SURCHARGED
5.001	35	123.335	0.177	0.000	1.56	0.0	117.7	SURCHARGED
1.012	12	123.173	-1.346	0.000	0.00	0.0	28.2	OK
1.013	13	123.172	0.012	0.000	0.11	0.0	16.0	SURCHARGED
1.014	14	123.175	0.030	0.000	0.09	0.0	15.1	SURCHARGED
6.000	36 (B2a)	124.328	1.003	0.000	1.12	0.0	71.7	FLOOD RISK
7.000	42 (B2a)	123.796	0.846	5.954	0.88	0.0	54.9	FLOOD
6.001	37 (B2a)	123.825	0.955	0.000	1.82	0.0	114.1	SURCHARGED
6.002	38 (B2a)	123.675	0.875	0.000	1.92	0.0	116.7	SURCHARGED
6.003	39 (B2a)	123.520	0.770	0.000	2.10	0.0	145.4	SURCHARGED
8.000	43 (B2a)	123.929	0.944	0.000	1.72	0.0	64.9	FLOOD RISK
8.001	44 (B2a)	123.519	0.749	0.000	1.91	0.0	124.8	SURCHARGED
6.004	40 (B2a)	123.078	0.423	0.000	1.39	0.0	305.5	SURCHARGED
6.005	41 (B2a)	122.767	0.262	0.000	2.65	0.0	427.1	SURCHARGED
9.000	45	123.909	0.572	8.604	1.67	0.0	115.4	FLOOD
9.001	46	123.349	0.214	0.000	1.75	0.0	115.0	SURCHARGED
1.015	15	122.466	-1.834	0.000	0.00	0.0	126.1	OK
10.000	47	123.440	0.289	0.000	1.32	0.0	103.8	FLOOD RISK
10.001	48	123.067	0.121	0.000	1.32	0.0	102.7	SURCHARGED
11.000	49 (B2a)	122.734	0.209	0.000	1.43	0.0	66.6	SURCHARGED
1.016	16	122.456	-0.164	0.000	0.17	0.0	58.6	OK
1.017	17	122.450	0.000	0.000	0.13	0.0	58.0	OK
1.018	18	122.395	0.145	0.000	0.25	0.0	58.4	SURCHARGED
12.000	50	125.445	0.845	10.274	1.02	0.0	139.4	FLOOD

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

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
12.001	51	125.331	1.031	0.428	1.04	0.0	177.9	FLOOD
12.002	52	125.200	1.150	0.000	0.63	0.0	153.2	FLOOD RISK
12.003	53	125.051	1.201	0.000	0.74	0.0	313.8	FLOOD RISK
13.000	63	125.393	0.953	8.870	0.90	0.0	100.0	FLOOD
13.001	64	125.013	1.293	6.606	0.91	0.0	179.9	FLOOD
12.004	54	124.756	1.486	0.321	1.54	0.0	460.8	FLOOD
12.005	55	124.274	1.204	0.000	1.84	0.0	485.9	SURCHARGED
12.006	56	123.948	0.968	23.142	1.84	0.0	436.0	FLOOD
12.007	57	123.760	0.830	25.021	1.92	0.0	501.8	FLOOD
12.008	58	123.631	0.781	0.000	1.87	0.0	501.9	FLOOD RISK
12.009	59	123.413	0.643	0.000	1.94	0.0	549.6	FLOOD RISK
12.010	60	122.796	0.186	0.000	1.45	0.0	581.1	SURCHARGED
12.011	61	122.697	0.137	0.000	1.43	0.0	614.1	SURCHARGED
12.012	62	122.543	0.053	0.000	1.49	0.0	605.7	SURCHARGED
1.019	19	122.352	-0.912	0.000	0.03	0.0	488.8	OK
14.000	65	123.153	0.728	3.207	1.30	0.0	86.8	FLOOD
14.001	66	122.978	0.759	0.000	1.52	0.0	86.4	FLOOD RISK
14.002	67	122.906	0.735	0.000	1.52	0.0	89.9	SURCHARGED
14.003	68	122.828	0.718	0.000	1.62	0.0	91.4	FLOOD RISK
14.004	69	122.755	0.615	0.000	1.60	0.0	165.8	SURCHARGED
14.005	70	122.567	0.494	0.000	1.63	0.0	185.1	SURCHARGED
14.006	71	122.443	0.598	0.000	0.74	0.0	82.3	SURCHARGED
14.007	72	122.396	-0.072	0.000	0.02	0.0	81.3	FLOOD RISK
15.000	74	123.259	0.818	4.347	1.33	0.0	66.2	FLOOD
15.001	75	122.766	0.884	0.000	2.61	0.0	96.0	SURCHARGED
14.008	73	122.369	-0.041	0.000	0.03	0.0	97.6	FLOOD RISK
1.020	20	122.334	0.210	0.000	0.40	0.0	202.3	SURCHARGED
1.021	21	122.052	-0.063	0.000	0.38	0.0	197.5	OK
16.000	EX MH	125.457	1.244	103.918	1.66	0.0	914.3	FLOOD
16.001	EX MH	124.909	1.019	0.000	2.61	0.0	898.3	SURCHARGED
16.002	SD1	124.660	0.808	8.952	1.55	0.0	828.8	FLOOD
16.003	SD2	124.366	0.709	0.000	2.31	0.0	816.4	SURCHARGED
16.004	PI	124.166	0.821	0.000	1.34	0.0	812.5	SURCHARGED
17.000	0622	125.387	0.692	36.530	1.50	0.0	66.4	FLOOD
16.005	SD3	123.977	0.757	0.000	0.88	0.0	879.4	SURCHARGED
16.006	SD4	123.727	0.947	0.000	2.88	0.0	880.1	SURCHARGED
16.007	SD5	123.487	0.732	0.000	1.47	0.0	823.8	SURCHARGED
16.008	SD6	123.031	0.513	0.000	1.54	0.0	801.8	SURCHARGED
16.009	SD7	122.730	0.340	0.000	1.61	0.0	796.8	SURCHARGED
16.010	SD8	122.472	0.174	0.000	1.43	0.0	779.0	SURCHARGED
1.022	SD9	122.045	-0.065	0.000	0.71	0.0	768.8	OK
1.023	SD10	121.896	0.086	0.000	1.04	0.0	780.7	SURCHARGED
1.024	SD11	121.839	0.085	0.000	1.08	0.0	782.9	SURCHARGED
1.025	SD12	121.813	0.109	0.000	0.77	0.0	734.3	SURCHARGED
1.026	SD13	121.903	0.375	0.000	1.05	0.0	729.6	SURCHARGED
1.027	0307	121.955	0.472	0.000	0.87	0.0	726.4	SURCHARGED
1.028	0306	121.926	0.576	0.000	0.76	0.0	879.3	FLOOD RISK
1.029	0305	121.795	0.710	0.006	0.88	0.0	1160.9	FLOOD
1.030	0369	121.248	1.103	12.946	4.50	0.0	1068.5	FLOOD