







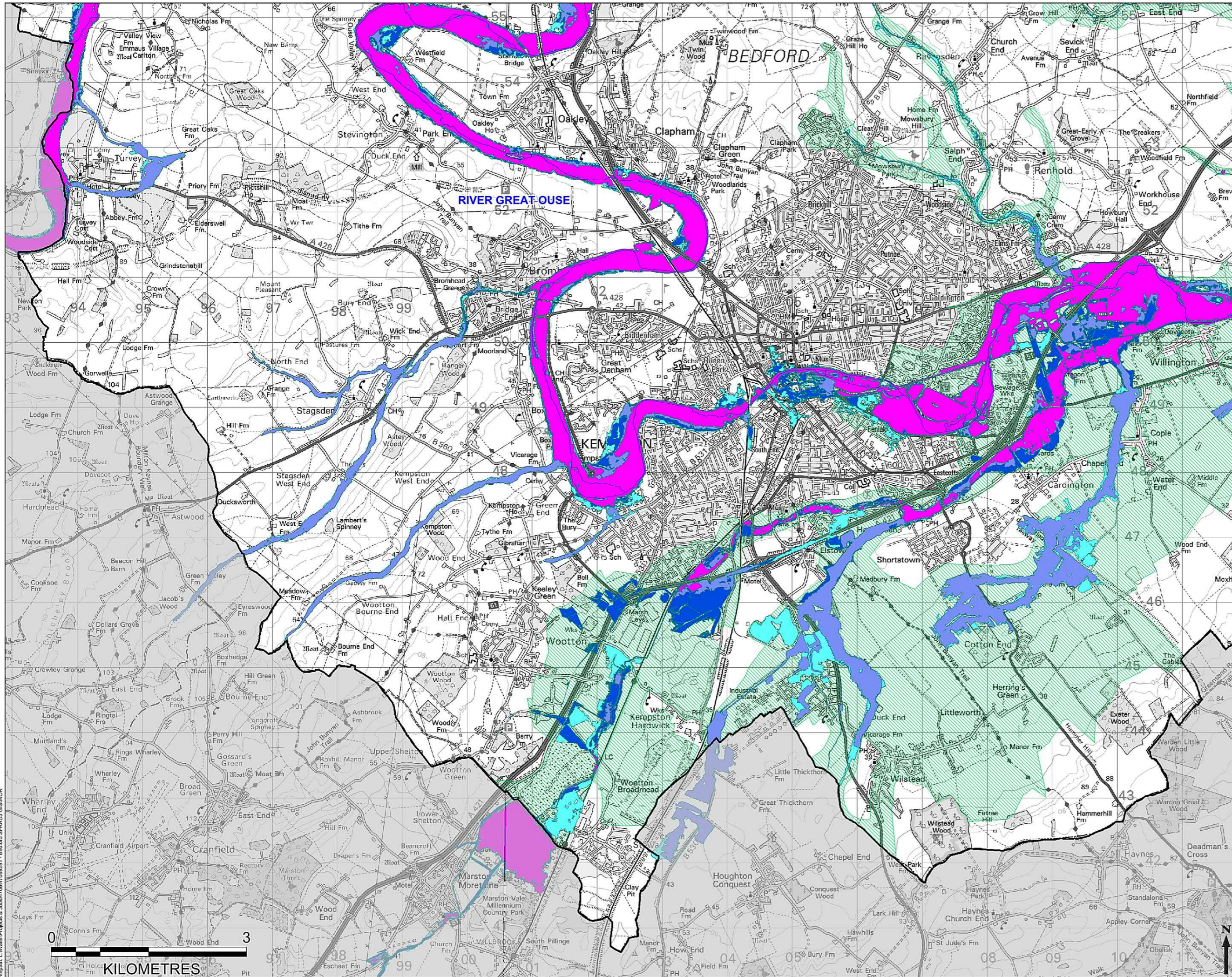


-  Selected location
-  Flood zone 3
-  Areas benefiting from flood defences
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Flood storage area



Legend

- Bedford Borough Council Administrative Boundary
- Main Rivers
- Internal Drainage Board District
- Flood Zone 2
- Flood Zone 3a
- Flood Zone 3a + Climate Change
- Flood Zone 3b

Overview

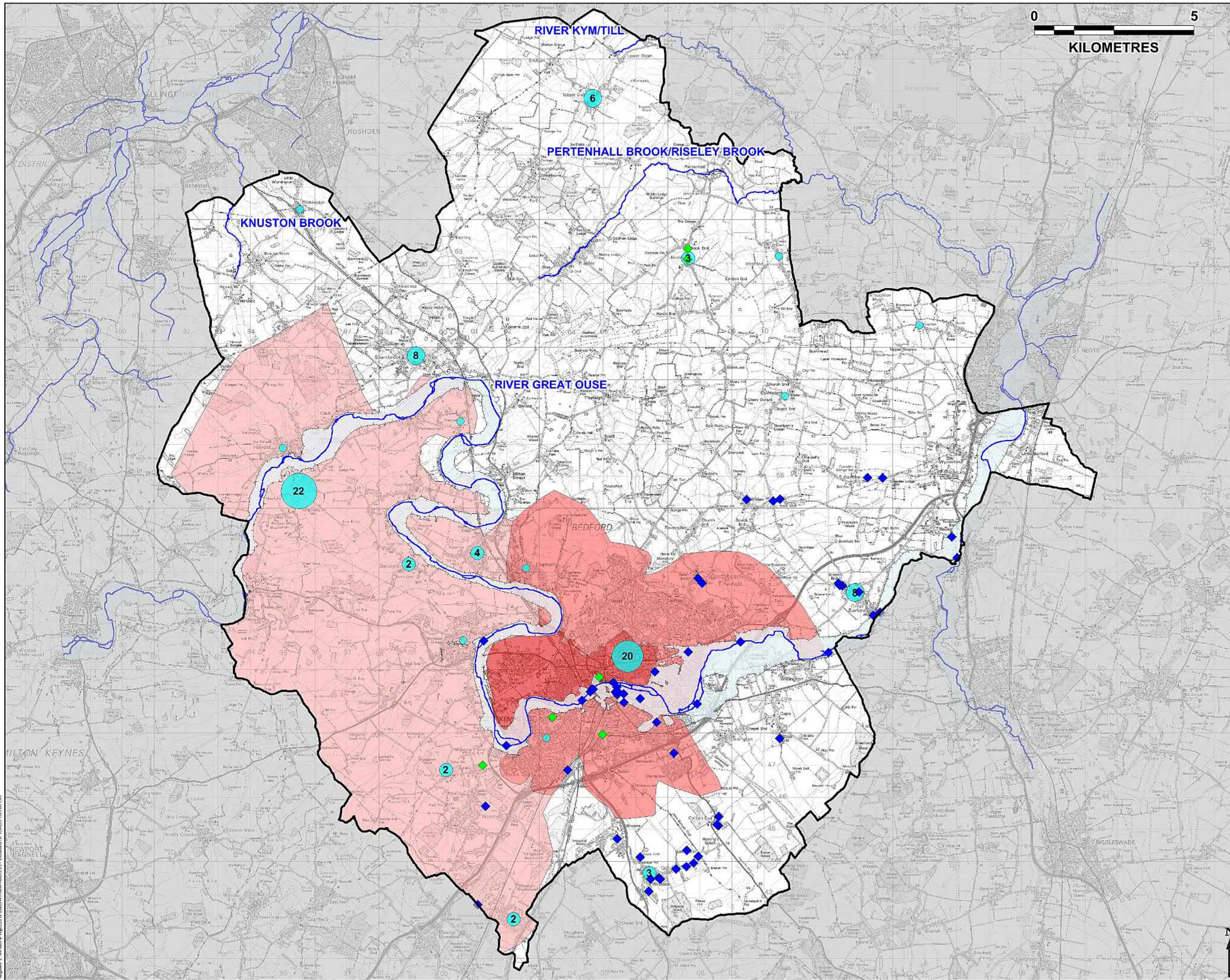
Copyright
 Some features of this map are based on information provided by the Environment Agency.
 © Environment Agency and database right 2014.

This map is based upon Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office. You are not permitted to copy, sub-license, distribute or sell any of this data to third parties in any form. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.
 © Crown Copyright and database rights 2014. Ordnance Survey 2014. Licence No. 100049028

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Drawing Status	FINAL	
Drawing Title	Modelled Flood Zones	
Bedford Borough Council Strategic Flood Risk Assessment Update 2014 		
Scale at A3	Date	Drawn: CB
1:70,000	March 2014	Approved: GH
<small>THIS DOCUMENT HAS BEEN PREPARED IN ACCORDANCE WITH THE SCOPE OF URS'S APPOINTMENT WITH ITS CLIENT AND IS SUBJECT TO THE TERMS OF THAT APPOINTMENT. URS ACCEPTS NO LIABILITY FOR ANY USE OF THIS DOCUMENT OTHER THAN BY ITS CLIENT AND ONLY FOR THE PURPOSES FOR WHICH IT WAS PREPARED AND PROVIDED. © URS INFRASTRUCTURE & ENVIRONMENT UK LTD 2014</small>		
<small>URS Infrastructure & Environment UK Ltd Scott House Alencon Link, Basingstoke Hampshire, RG21 7TP Telephone +44 (0)1256 310 200 Fax +44 (0)1256 310 201 www.ursglobal.com Drawing Number</small>		
FIGURE A1 iii		

Date: March 2014
 Filepath: \\water\projects & jobs\47064706201 - Bedford SFR\A1\GIS\WOR



Legend

- Bedford Borough Council Administrative Boundary
- Main Rivers
- EA Historic Flood Map
- EA Groundwater Flooding Incidents
- IDB Recorded Flooding Incident

Number of Sewer Flooding Incidents by Postcode

- 2
- 14
- 18

BBC Historic Flooding Number of properties

- 22
- 20
- 5 to 9
- 2 to 5
- 1

Copyright
 Some features of this map are based on information provided by the Environment Agency
 © Environment Agency and database right 2014.

This map is based upon Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office. You are not permitted to copy, sub-license, distribute or sell any of this data to third parties in any form. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.
 © Crown Copyright and database rights 2014.
 Ordnance Survey 2014. Licence No: 100049028

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Drawing Status: FINAL

Drawing Title:

Recorded Historic Flooding and Sewer Flooding Incidents

Bedford Borough Council
 Strategic Flood Risk Assessment Update 2014

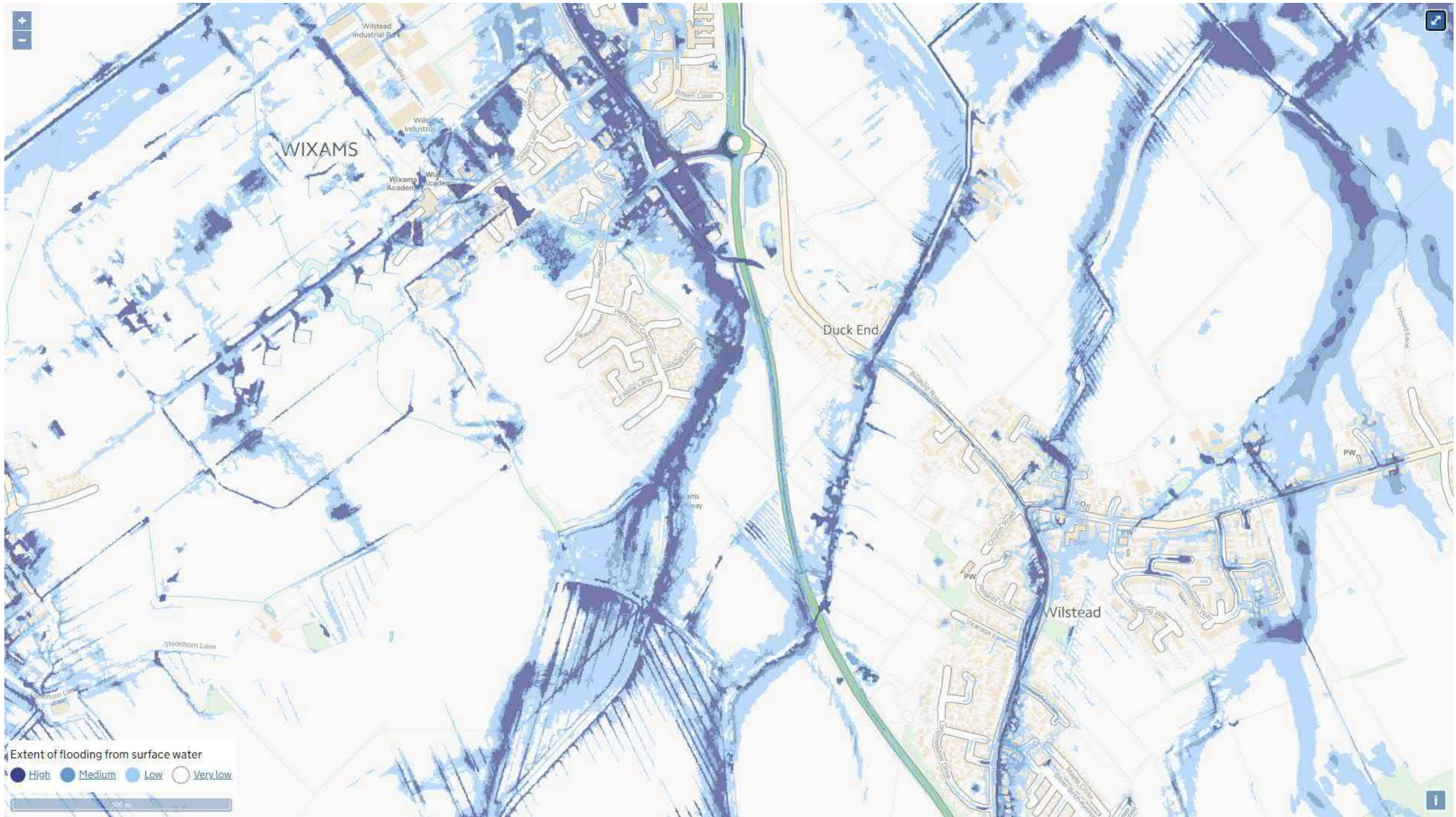
Scale at A3 1:110,000	Date March 2014	Drawn: CB Approved: GH
--------------------------	--------------------	---------------------------

THIS DOCUMENT HAS BEEN PREPARED BY ACCORDANCE WITH THE SCOPE OF URS'S APPOINTMENT WITH ITS CLIENT AND IS SUBJECT TO THE TERMS OF THAT APPOINTMENT. URS ACCEPTS NO LIABILITY FOR ANY USE OF THIS DOCUMENT OTHER THAN BY ITS CLIENT AND ONLY FOR THE PURPOSES FOR WHICH IT WAS PREPARED AND PROVIDED.
 © URS INFRASTRUCTURE & ENVIRONMENT UK LTD 2014

URS Infrastructure & Environment UK Ltd
 Scott House
 Alconton Lane, Basingstoke
 Hampshire, RG21 7SP
 Telephone +44 (0)1256 310 200
 Fax +44 (0)1256 310 201
 www.ursglobes.com

Drawing Number
FIGURE A2

Data: March 2014
 Floods: URS Infrastructure & Environment UK Ltd
 Design: URS Infrastructure & Environment UK Ltd





A6

KEY

1D Domain

- Culvert

1D Boundary Conditions

- Downstream Boundary Condition

2D Domain

- ▭ Model Extent

2D Boundary Conditions

- Upstream ('QT')
- Downstream ('HQ')

Flood Zones

- Flood Zone 2
- Flood Zone 3a
- Flood Zone 3b

A6

A6

**PRELIMINARY FLOOD RISK MODELLING
FLOOD ZONES
(FEH + 50% FLOWS)**





A6

KEY

1D Domain

- Culvert

1D Boundary Conditions

- Downstream Boundary Condition

2D Domain

- ▭ Model Extent

2D Boundary Conditions

- Upstream ('QT')
- Downstream ('HQ')

Climate Change

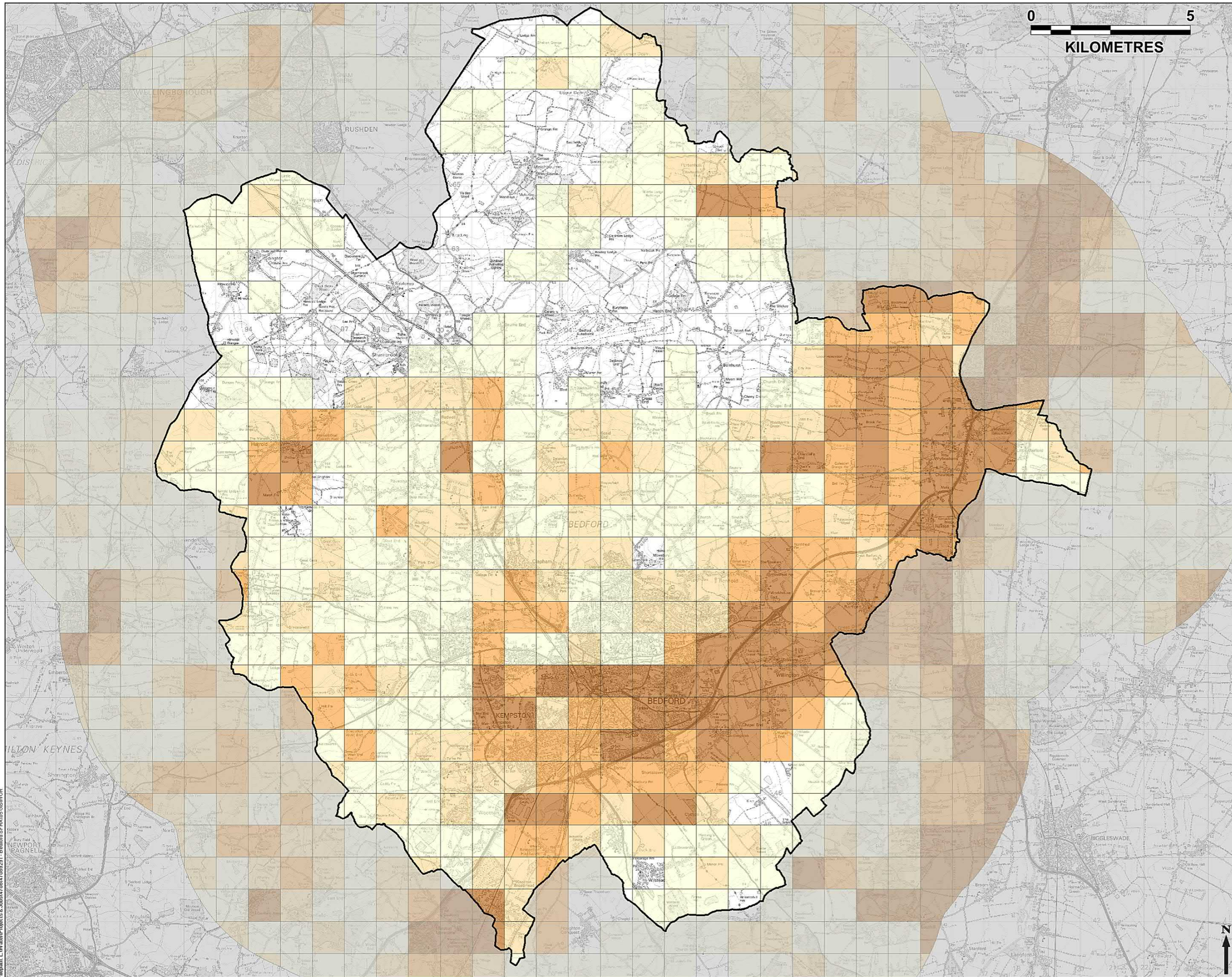
- 1.0% AEP
- 1.0% AEP + 35%
- 1.0% AEP + 65%

A6

A6

**PRELIMINARY FLOOD RISK MODELLING
CLIMATE CHANGE
(FEH + 50% FLOWS)**





Legend

Bedford Borough Council Administrative Boundary

Areas Susceptible to Groundwater Flooding

- < 25%
- >= 25% < 50%
- >= 50% < 75%
- >= 75%

Copyright
 Some features of this map are based on information provided by the Environment Agency.
 © Environment Agency and database right 2014.

This map is based upon Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office. You are not permitted to copy, sub-license, distribute or sell any of this data to third parties in any form. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.
 © Crown Copyright and database rights 2014.
 Ordnance Survey 2014. Licence No. 100049028

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Drawing Status: FINAL

Drawing Title

Areas Susceptible to Groundwater Flooding

Bedford Borough Council
 Strategic Flood Risk Assessment Update 2014

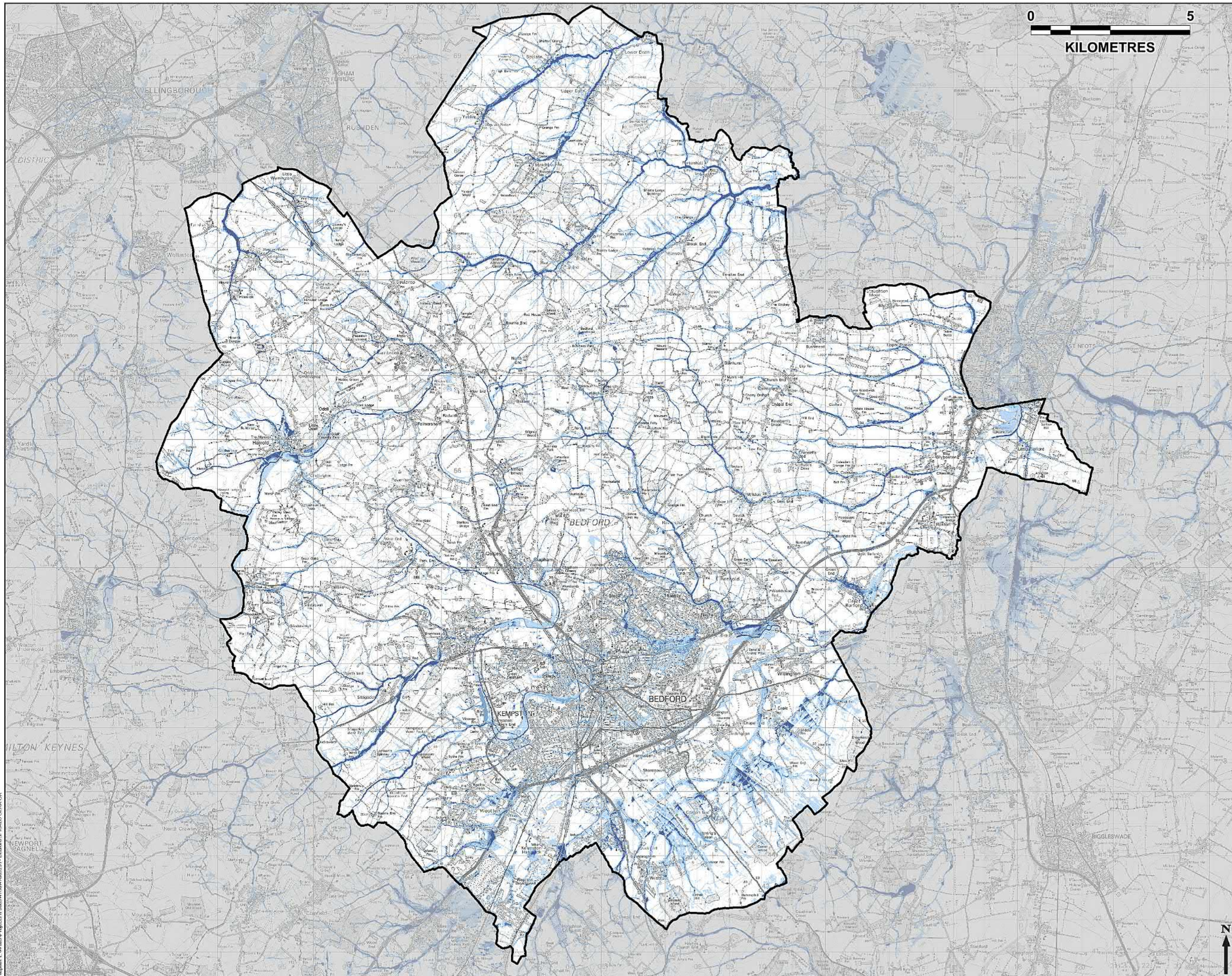
Scale at A3 1:110,000	Date February 2014	Drawn: CB Approved: GH
---------------------------------	------------------------------	---------------------------

THIS DOCUMENT HAS BEEN PREPARED IN ACCORDANCE WITH THE SCOPE OF URS'S APPOINTMENT WITH ITS CLIENT AND IS SUBJECT TO THE TERMS OF THAT APPOINTMENT. URS ACCEPTS NO LIABILITY FOR ANY USE OF THIS DOCUMENT OTHER THAN BY ITS CLIENT AND ONLY FOR THE PURPOSES FOR WHICH IT WAS PREPARED AND PROVIDED.
 © URS INFRASTRUCTURE & ENVIRONMENT UK LTD 2014


URS Infrastructure & Environment UK Ltd
 Scott House
 Alencon Link, Basingstoke
 Hampshire, RG21 7FP
 Telephone +44 (0)1256 310 200
 Fax +44 (0)1256 310 201
 www.ursglobal.com

Drawing Number
FIGURE A4


Date: February 2014
 Drawing Title: Strategic Flood Risk Assessment Update 2014 - Bedford Strategic Flood Risk Assessment Update 2014





Legend

 Bedford Borough Council Administrative Boundary

Risk of Surface Water Flooding (AEP)

 High (1 in 30 year)

 Medium (1 in 100 year)

 Low (1 in 1000 year)

Copyright
 Some features of this map are based on information provided by the Environment Agency
 © Environment Agency and database right 2014.

This map is based upon Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationary Office. You are not permitted to copy, sub-license, distribute or sell any of this data to third parties in any form. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.
 © Crown Copyright and database rights 2014.
 Ordnance Survey 2014. Licence No: 100049028

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Drawing Status: FINAL

Drawing Title

Updated Flood Maps for Surface Water Flooding (uFMFSW)

Bedford Borough Council
 Strategic Flood Risk Assessment Update 2014



Scale at A3 1:110,000	Date February 2014	Drawn: CB Approved: GH
--------------------------	-----------------------	---------------------------

THIS DOCUMENT HAS BEEN PREPARED BY ACCORDANCE WITH THE SCOPE OF URS'S APPOINTMENT WITH ITS CLIENT AND IS SUBJECT TO THE TERMS OF THAT APPOINTMENT. URS ACCEPTS NO LIABILITY FOR ANY USE OF THIS DOCUMENT OTHER THAN BY ITS CLIENT AND ONLY FOR THE PURPOSES FOR WHICH IT WAS PREPARED AND PROVIDED.
 © URS INFRASTRUCTURE & ENVIRONMENT UK LTD 2014.

URS Infrastructure & Environment UK Ltd
 Scott House
 Alconton Lane, Basingstoke
 Hampshire, RG21 7SP
 Telephone +44 (0)1256 310 200
 Fax +44 (0)1256 310 201
 www.ursglobes.com



Drawing Number

FIGURE A3

Date: February 2014
 Project: URS Strategic Flood Risk Assessment Update 2014

APPENDIX D

SURFACE WATER DRAINAGE STRATEGY



- Where this drawing has been issued in electronic .dwg format it has been done so in good faith. JNPGROUP do not take any responsibility for any inaccuracies in the electronic data, which should be checked against the paper (or .pdf) drawing issue. Any apparent discrepancies should be immediately reported to JNPGROUP. The electronic .dwg file should not be assumed to be to scale and should not be used for 'overlaying', setting out or checking of any third party information. All dimensions should be taken from the paper (or .pdf) version of the drawing. Electronic drawings may contain third party information. JNPGROUP take no responsibility for this information, which should be checked against the originators paper drawing(s).
- All working dimensions to be checked on site.
- Do not scale.
- Any discrepancies between drawings of different scales, and between drawings and specification where appropriate to be notified to The Engineer for decision.
- Copyright reserved. This drawing may only be used for The Client and location specified in the title block. It may not be copied or disclosed to any third party without the prior written consent of JNPGROUP.
- This drawing should only be used for construction if the drawing status is "Construction". JNPGROUP take no responsibility for construction works undertaken to drawings which are not marked with this status.

Health & Safety Note

The details on this drawing have been prepared on the assumption that a competent contractor will be carrying out the works. If the contractor(s) considers that there is insufficient Health and Safety information on this drawing, this should immediately be brought to the attention of the designer.

Key

- Surface Water Sewer
- Foul Water Sewer
- New Public Foul Sewer
- Swale
- Detention Basin
- Foul Pump Station
- Catchment Area
- Existing Ground Contours

No.	Date	Revision	Drawn/Checked/Approved

S2 - Suitable for Information




Client: Wates Development Ltd.
Site: Wixam Woods, Bedford

Preliminary Drainage Strategy

Checked: FI 60_20
Drawn by: As Shown

Approved by: [Signatures]

C86343-JNP-XX-XX- X -S-1000

JNP Group		Page 1
Link House St Marys Way Chesham HP5 1HR		
Date 23/07/2020 16:34 File	Designed by JNP.User Checked by	
XP Solutions	Source Control 2018.1.1	

FEH Mean Annual Flood

Input

```

Site Location GB 505950 243500 TL 05950 43500 SPRHOST 55.280
Area (ha)                297.750 BFIHOST  0.308
SAAR (mm)                 574     FARL   1.000
URBEXT (USER)             0.0000

```

Results

QMED Rural (1/s) 595.3 QMED Urban (1/s) 595.3

Calculated by:

Site name:

Site location:

Site Details

Latitude:

Longitude:

Reference:

Date:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach

Notes

Site characteristics

Total site area (ha):

Methodology

Q_{MED} estimation method:

Q_{MED} (l/s):

Q_{BAR} / Q_{MED} factor:

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

Hydrological characteristics

	Default	Edited
SAAR (mm):	563	563
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.



Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	<input type="text"/>	2.25
1 in 1 year (l/s):	<input type="text"/>	1.95
1 in 30 years (l/s):	<input type="text"/>	5.5
1 in 100 year (l/s):	<input type="text"/>	8
1 in 200 years (l/s):	<input type="text"/>	9.46

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.



Catchment C2

⚡ Quick Storage Estimate ⏪ ⏩ ✖

 Variables Results Design Overview 2D Overview 3D Vt	Variables	
	FEH Rainfall ▼	Cv (Summer) <input style="width: 100%;" type="text" value="0.750"/>
	Return Period (years) <input style="width: 100%;" type="text" value="100"/>	Cv (Winter) <input style="width: 100%;" type="text" value="0.840"/>
	Version <input style="width: 50%;" type="text" value="2013"/> Catchment <input style="width: 50%;" type="text" value="..."/>	Impemeable Area (ha) <input style="width: 100%;" type="text" value="0.750"/>
	Site <input style="width: 100%;" type="text" value="GB 505950 243500 TL 05950 43500"/>	Maximum Allowable Discharge (l/s) <input style="width: 100%;" type="text" value="1.7"/>
		Infiltration Coefficient (m/hr) <input style="width: 100%;" type="text" value="0.00000"/> 
		Safety Factor <input style="width: 100%;" type="text" value="2.0"/>
	Climate Change (%) <input style="width: 100%;" type="text" value="40"/>	
<input type="button" value="Analyse"/> <input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Help"/>		

Enter Maximum Allowable Discharge between 0.0 and 999999.0


⚡ Quick Storage Estimate ⏪ ⏩ ✖

 Variables Results Design Overview 2D Overview 3D Vt	Variables	
	FEH Rainfall ▼	Cv (Summer) <input style="width: 100%;" type="text" value="0.750"/>
	Return Period (years) <input style="width: 100%;" type="text" value="100"/>	Cv (Winter) <input style="width: 100%;" type="text" value="0.840"/>
	Version <input style="width: 50%;" type="text" value="2013"/> Catchment <input style="width: 50%;" type="text" value="..."/>	Impemeable Area (ha) <input style="width: 100%;" type="text" value="0.750"/>
	Site <input style="width: 100%;" type="text" value="GB 505950 243500 TL 05950 43500"/>	Maximum Allowable Discharge (l/s) <input style="width: 100%;" type="text" value="1.7"/>
		Infiltration Coefficient (m/hr) <input style="width: 100%;" type="text" value="0.00000"/> 
		Safety Factor <input style="width: 100%;" type="text" value="2.0"/>
	Climate Change (%) <input style="width: 100%;" type="text" value="40"/>	
<input type="button" value="Analyse"/> <input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Help"/>		

Enter Maximum Allowable Discharge between 0.0 and 999999.0

Catchment C3

Quick Storage Estimate




- Variables
- Results
- Design
- Overview 2D
- Overview 3D
- Vt

Variables

FEH Rainfall	Cv (Summer)	0.750
Return Period (years) <input type="text" value="100"/>	Cv (Winter)	0.840
Version <input type="text" value="2013"/> Catchment <input type="button" value="..."/>	Impemeable Area (ha)	1.730
Site <input type="text" value="GB 505950 243500 TL 05950 43500"/>	Maximum Allowable Discharge (l/s)	3.9
	Infiltration Coefficient (m/hr)	0.00000 <input type="button" value="⌨"/>
	Safety Factor	2.0
	Climate Change (%)	40

Enter Maximum Allowable Discharge between 0.0 and 999999.0

Quick Storage Estimate



- Variables
- Results
- Design
- Overview 2D
- Overview 3D
- Vt

Results

Global Variables require approximate storage of between 1373 m³ and 1769 m³.

These values are estimates only and should not be used for design purposes.


Enter Maximum Allowable Discharge between 0.0 and 999999.0

VI

March 2020

Catchment C4


⚡ Quick Storage Estimate _ □ ×



Variables

FEH Rainfall	Cv (Summer)	0.750
Return Period (years) <input type="text" value="100"/>	Cv (Winter)	0.840
Version <input type="text" value="2013"/> Catchment <input type="text"/>	Impermeable Area (ha)	1.220
Site <input type="text" value="GB 505950 243500 TL 05950 43500"/>	Maximum Allowable Discharge (l/s)	2.8
	Infiltration Coefficient (m/hr)	0.00000 <input type="button" value="⊞"/>
	Safety Factor	2.0
	Climate Change (%)	40

Enter Maximum Allowable Discharge between 0.0 and 999999.0



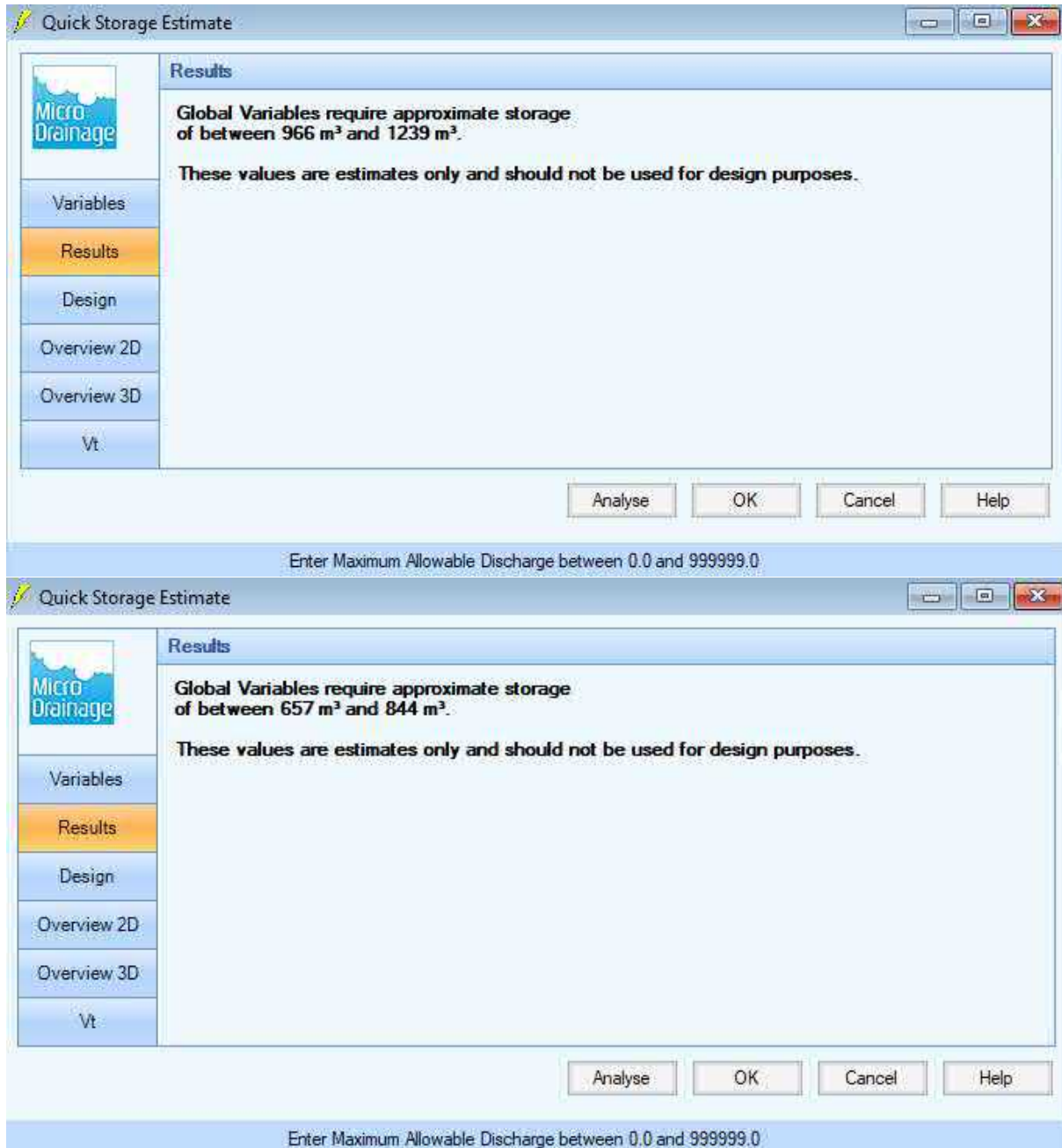
Results

Global Variables require approximate storage of between 966 m³ and 1239 m³.

These values are estimates only and should not be used for design purposes.

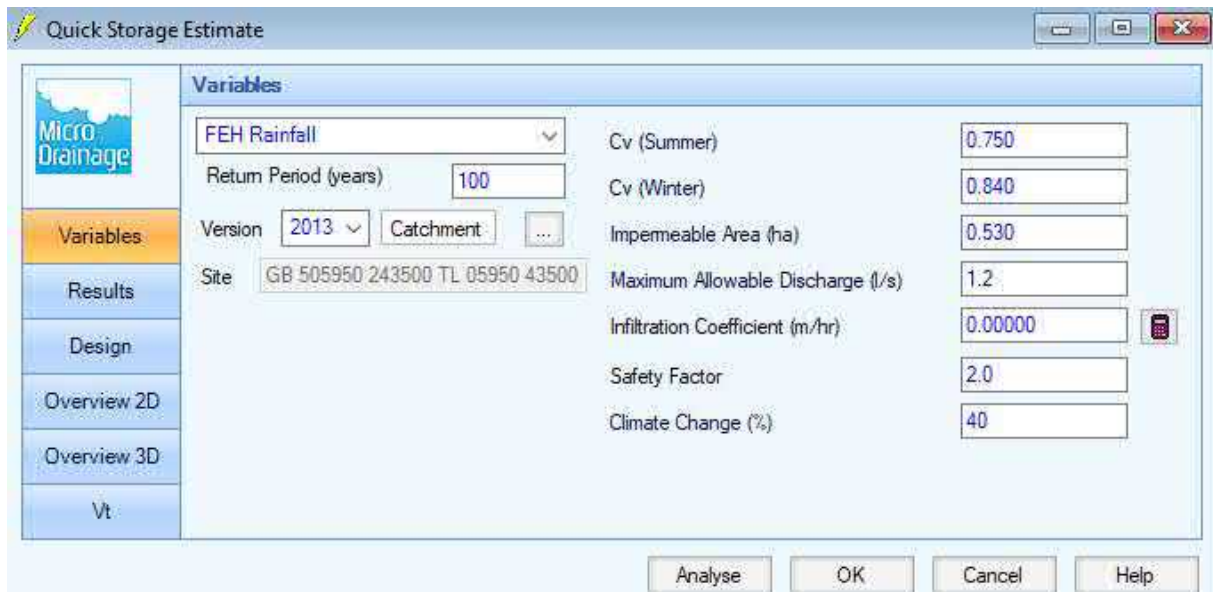
Enter Maximum Allowable Discharge between 0.0 and 999999.0

Catchment C5



The image shows two screenshots of the 'Quick Storage Estimate' window in the Micro Drainage software. Both windows display the same text in the 'Results' section: 'Global Variables require approximate storage of between 966 m³ and 1239 m³.' and 'These values are estimates only and should not be used for design purposes.' The top screenshot shows a storage range of 966 m³ to 1239 m³, while the bottom screenshot shows a storage range of 657 m³ to 844 m³. The interface includes a sidebar with navigation options (Variables, Results, Design, Overview 2D, Overview 3D, Vt), a status bar at the bottom of each window indicating 'Enter Maximum Allowable Discharge between 0.0 and 999999.0', and buttons for 'Analyse', 'OK', 'Cancel', and 'Help'.

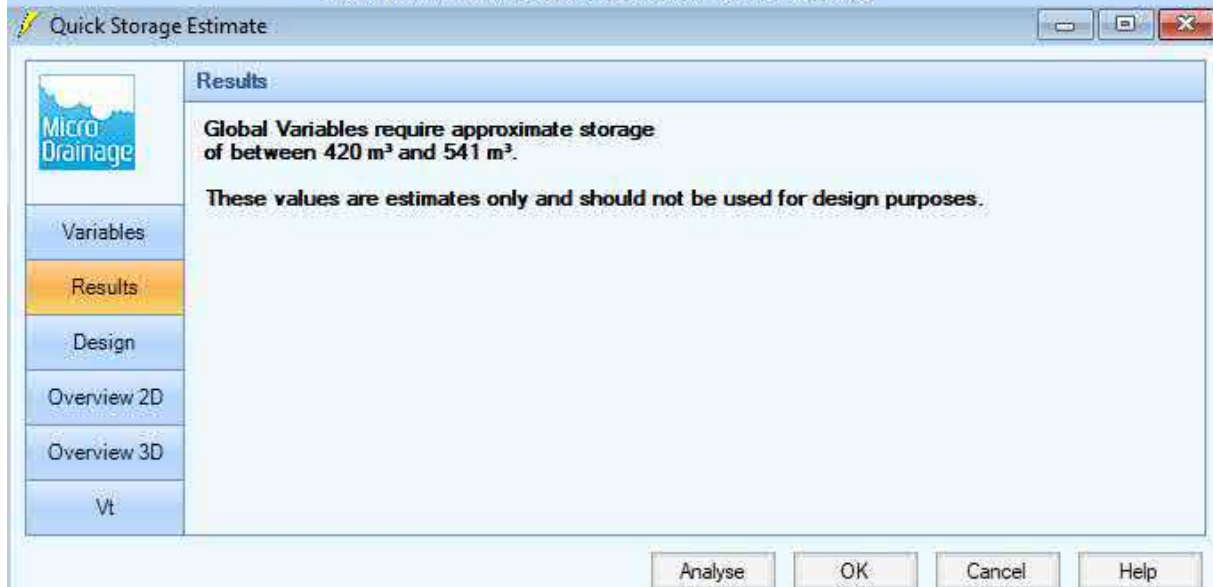
Catchment C6



Variable	Value
FEH Rainfall	FEH Rainfall
Return Period (years)	100
Version	2013
Catchment	...
Site	GB 505950 243500 TL 05950 43500
Cv (Summer)	0.750
Cv (Winter)	0.840
Impervious Area (ha)	0.530
Maximum Allowable Discharge (l/s)	1.2
Infiltration Coefficient (m/hr)	0.00000
Safety Factor	2.0
Climate Change (%)	40

Buttons: Analyse, OK, Cancel, Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0



Results

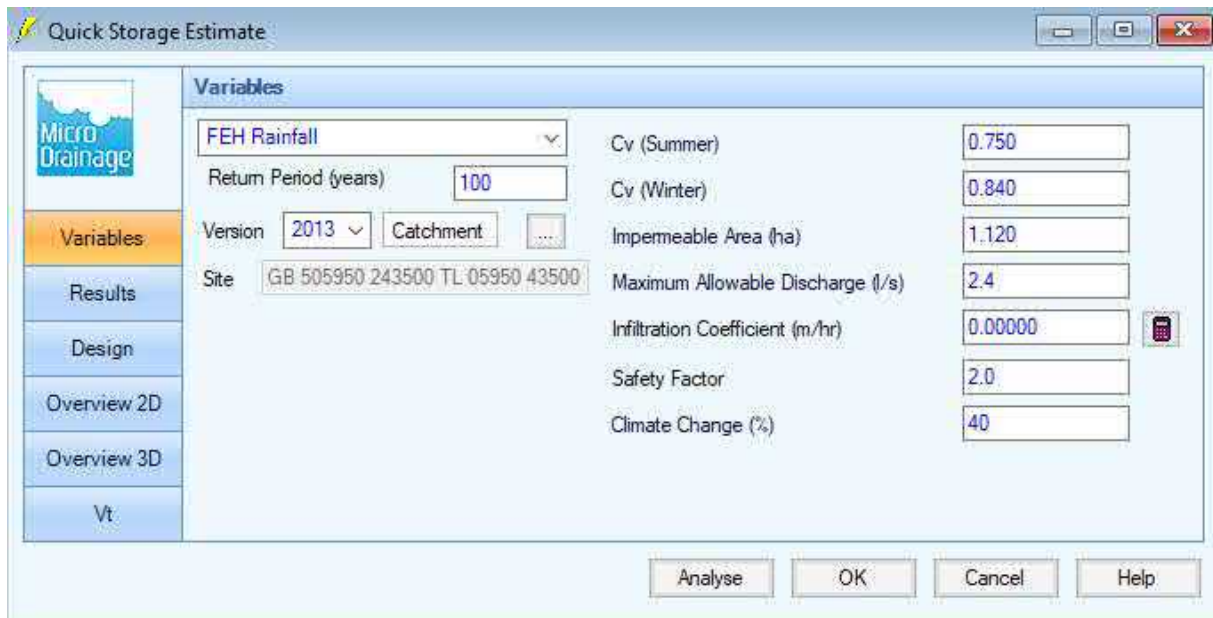
Global Variables require approximate storage of between 420 m³ and 541 m³.

These values are estimates only and should not be used for design purposes.

Buttons: Analyse, OK, Cancel, Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0

Catchment C7



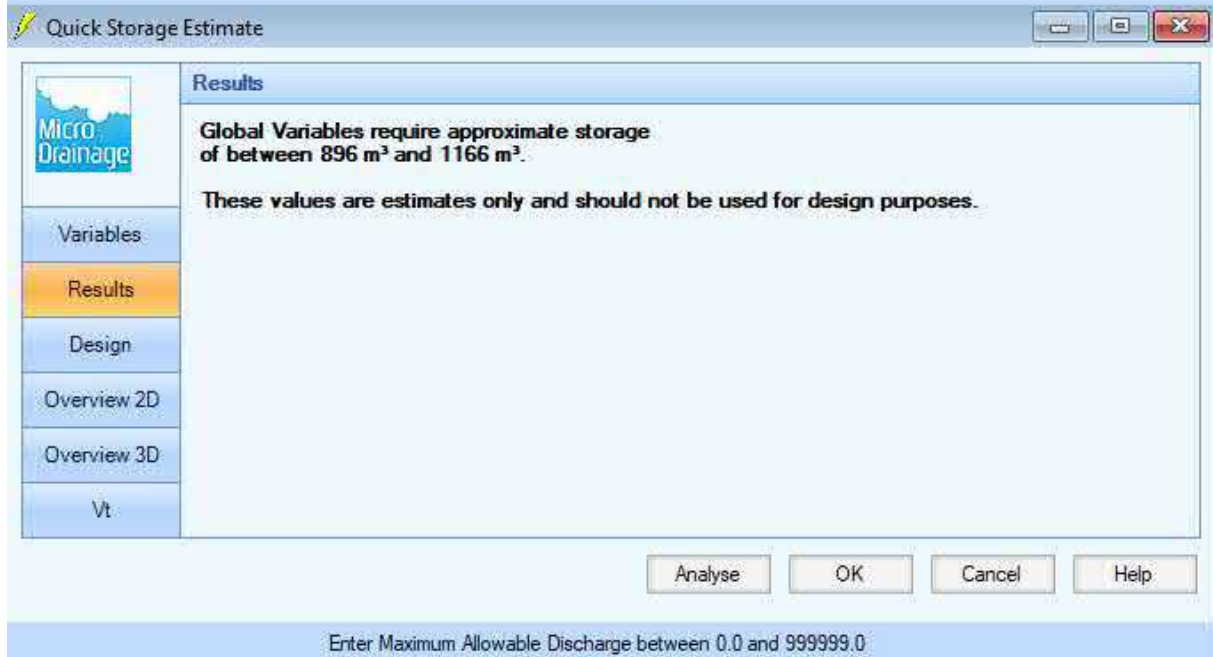
Quick Storage Estimate

Variables

FEH Rainfall	Cv (Summer)	0.750
Return Period (years): 100	Cv (Winter)	0.840
Version: 2013	Impemeable Area (ha)	1.120
Catchment: [...]	Maximum Allowable Discharge (l/s)	2.4
Site: GB 505950 243500 TL 05950 43500	Infiltration Coefficient (m/hr)	0.00000
	Safety Factor	2.0
	Climate Change (%)	40

Buttons: Analyse, OK, Cancel, Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0



Quick Storage Estimate

Results

Global Variables require approximate storage of between 896 m³ and 1166 m³.

These values are estimates only and should not be used for design purposes.

Buttons: Analyse, OK, Cancel, Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0



JNP GROUP

CONSULTING ENGINEERS

Brighouse

Woodvale House
Woodvale Road
Brighouse
West Yorkshire
HD6 4AB

telephone

01484 400691

email

brighouse@jnpgroup.co.uk

Chesham (HQ)

Link House
St Mary's Way
Chesham
Buckinghamshire
HP5 1HR

telephone

01494 771221

email

chesham@jnpgroup.co.uk

Glasgow

Oxford House
71 Oxford Street
Glasgow
G59 5EP

telephone

0141 378 0808

email

glasgow@jnpgroup.co.uk

Hartlepool

The Innovation Centre
Venture Court
Queens Meadow Business Park
Hartlepool
TS25 5TG

telephone

01429 239539

email

hartlepool@jnpgroup.co.uk

Leamington Spa

Marlborough House
48 Holly Walk
Leamington Spa
Warwickshire
CV32 4XP

telephone

01926 889955

email

leamingtonspa@jnpgroup.co.uk

Sheffield

MBP2 Meadowhall Business Park
Carbrook Hall Road
Sheffield
South Yorkshire
S9 2EQ

telephone

0114 244 3500

email

sheffield@jnpgroup.co.uk