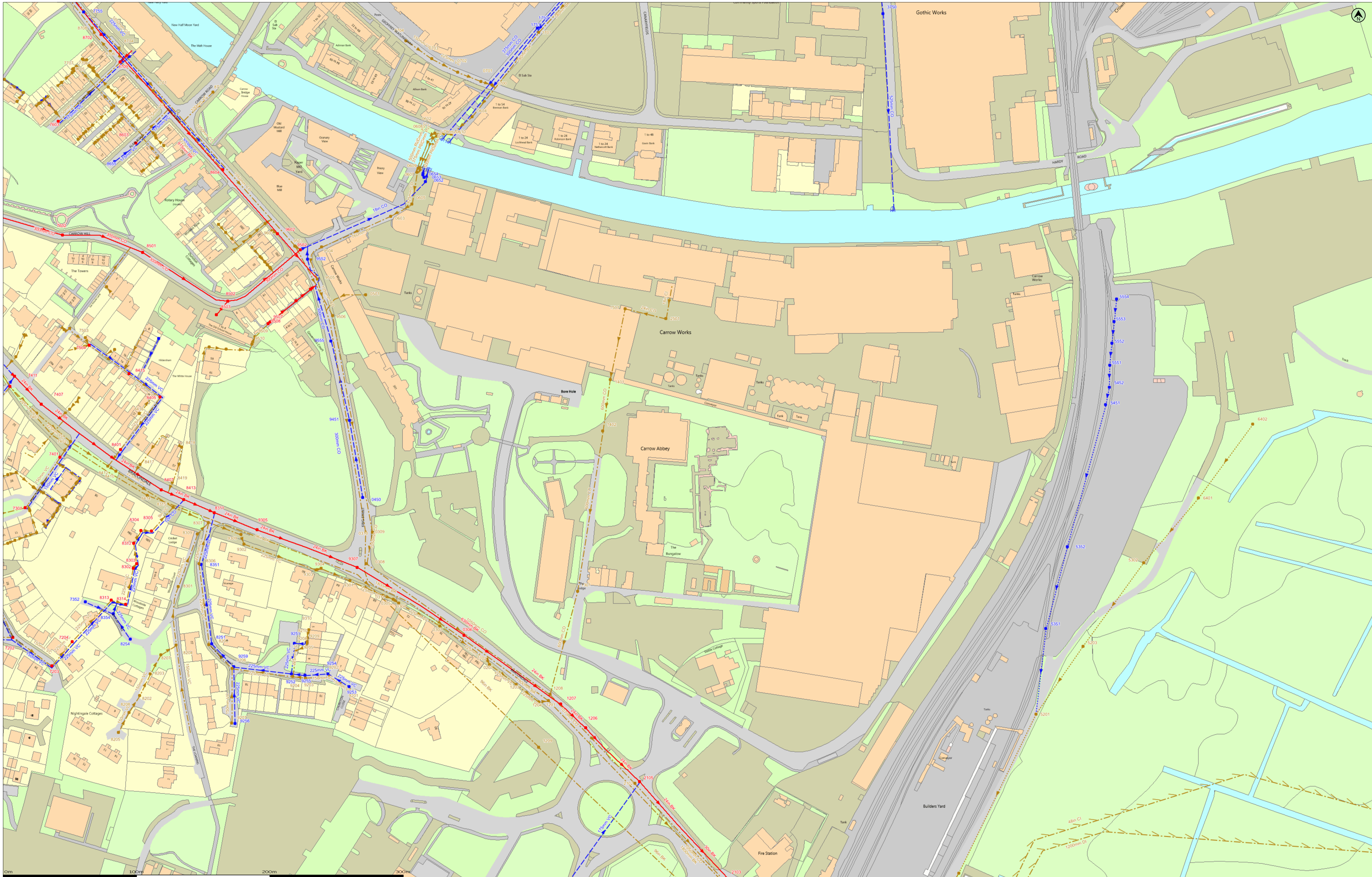


---

## Appendix B – Anglian Water Asset Map



(c) Crown copyright and database rights 2022 Ordnance Survey 100022432 Date: 09/05/22 Scale: 1:1250 Map Centre: 624247,307447 Data updated: 30/04/22 Our Ref: 850333 - 1 Wastewater Plan A1

This plan is provided by Anglian Water pursuant to its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. This information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2022 Ordnance Survey 100022432. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer	—	Outfall*	—
Surface Sewer	—	Sewage Treatment Works	⊕
Combined Sewer	—	Public Pumping Station	⊕
Final Effluent	—	Decommissioned Pumping Station	●
Rising Main*	—		
Private Sewer*	—		
Decommissioned Sewer*	—		
	—	Manhole*	●

\*Colour denotes effluent type

mike.smith9293@gmail.com	□
Carrow Works	●
	●



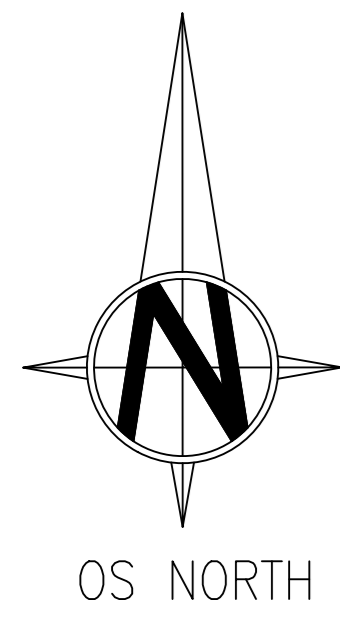


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## Appendix C – Utilities Survey







DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS

**NOTES**

- UNLESS NOTED OTHERWISE, ALL DIMENSIONS ON THIS DRAWING ARE IN METRES.
- TOPOGRAPHICAL SURVEY DATA IS BY CD SURVEYS LTD AND HAS BEEN USED FOR INFORMATION ONLY.
- REFER TO REPORT NO. A108750-1 UTILITIES SURVEY REPORT

**TOPO LEGEND**

AM	AERIAL MAST	C/WO	INSPECTION COVER WASH OUT
AC	AIR CONDITIONING UNIT	TJ	TRACK JOINT
AV	AIR VALVE	HO	HOIST
BB	BELGAN BEACON	LD	LADDER
BL	BED LEVEL	LB	LITTER BIN
BN	BENCHMARK	LA	LAF DOWN AREA
B	BOLLARD	LP	LAMP POST
BS	BUS STOP	ME	METRES EAST
CB	CABINET	MR	MANHOLE
CB/BT	CABINET BRITISH TELECOM	MW	MEAN HIGH WATER LEVEL
CB/EL	CABINET ELECTRIC	MW	MEAN LOW WATER LEVEL
CAW	CANAL	NR	NETRES NORTH
CAL	CANOPY LEVEL	MP	MARKER POST
CB	CORNER BARREN	MP/BA	MARKER POST BRITISH TELECOM
CSL	CABLE STRAN	MP/EL	MARKER POST ELECTRIC
CS	CANAL	MP/GA	MARKER POST GAS
CDC	CONC. DUCT COVER	MP/WA	MARKER POST WATER
CHS	CHEMICAL OIL STORE	NP	NOTICE BOARD
CLM	COLUMN	NP	NAME PLATE
CMB	CONCRETE BASE	OH	OVERHEAD BEAMS
CNP	CONCRETE PLINTH	OC	OVERHEAD CABLES
CONC	CONCRETE	OCBL	OVERHEAD CABLES
CP	CATCHPIT	OCPS	OVERHEAD PAPERDICE
CTL	CROWN PIPE LEVEL	OP	OVERHEAD PERISCOPE SUPPORT
CT	CONC. PILE SUPPORT	P	POLE
CS	CORNER BARREN	PB	POINTS BOX
DBB	DROP BARREN BOX	PC	PEDESTRIAN CROSSING
DBP	DROP BARREN POST	PCD	PEDESTRIAN CROSSING
DK	DROP KERB	PD	POINTS DETECTOR
DR	DRINKER	PE	PEDESTRIAN LIGHT
EER	EMERGENCY EQUIPMENT BOX	PL	POINTS LEVEL
EAS	EMERGENCY SHOWER	PLR	POINTS LEVEL
EL	ELEVA LEVEL	PLR	POINTS LEVEL
EP	ELECTRIC POLE	PK	POST MOTOR
ER	EARTH ROAD	PBX	POST BOX
FEDS	FLOWER BEDS	PR	POINT ROOFS
FE	FIRE EXTINGUISHER	PR	POINT ROOFS
FECL	CHAINLINK FENCE	RF	RIDGE LINE
FENE	FENCE	RE	RETAINING WALL
FENL	FENCE	RES	RETAINING WALL
FENP	FENCE	RS	ROAD SIGN
FENW	FENCE	RSL	ROLLER SHUTTER DOOR
FEPH	FENCE	RS	ROAD SIGN
FL	FLOOR LEVEL	RTW	RETAINING WALL
FL	FLOOR LEVEL	RW	RAIN WATER
FP	FOOTPATH	S	SCAR LINE
FS	FLAT STREET	SD	SCAR LINE
C/S/H	TREE GIRTH SPREAD HEIGHT	SN	SPREAD RESTRICTOR
GD	GATE DOUBLE	SN	SPREAD RESTRICTOR
GS	GATE SINGLE	SRK	SPILL RESPONSE KIT
GB	GATE BURSTLE	ST	STOP TAP
GBS	GAS BOTTLE STORE	STW	STOPS WITH HANDRAIL
GD	GRADED DUCT COVER	SV	STOP VALVE
GP	GRATED POST	SV	STOP VALVE
GRP	GRATED POINT	SW	SOIL WASH PIPE
GV	GAS VALVE	SM	SOIL WASH
CY	GULLY	TEL	TELEPHONE
HR	HANDRAIL	TL	TRAFFIC LIGHT
HR	HEIGHT RESTRICTOR	TL	TRAFFIC LIGHT
HL	HEIGHT	TS	THRESHOLD LEVEL
IB	INSPECTION BOX (NOT BARRIED)	TP	TELEPHONE POLE
IC	INSPECTION COVER UNKNOWN	TS	THRESHOLD LEVEL
IC/2H	INSPECTION COVER BORDOISE	UL	UNDERGROUPE LEVEL
IC/BT	INSPECTION COVER BRITISH TELECOM	UP	UP
IC/TH	INSPECTION COVER FIRE HYDRANT	UP	UP
IC/EL	INSPECTION COVER ELECTRIC	WJ	WELD JOINT
IC/GA	INSPECTION COVER GAS	WL	WATER LEVEL
IC/SL	INSPECTION COVER STREET LIGHT	WU	WASTE PIPE
IC/WA	INSPECTION COVER WATER	WYGOXX	SURVEY STATION

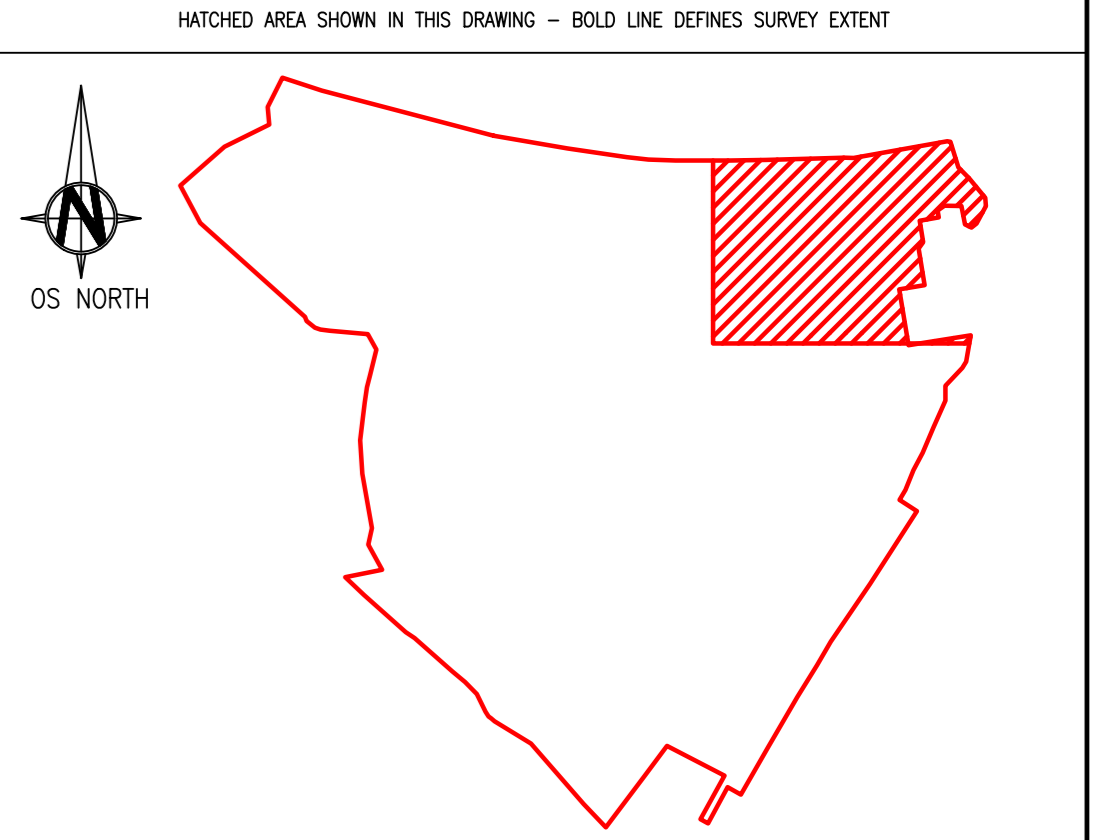
**GPR/UTILITIES LEGEND**

FOUL DRAINAGE	FOUL DRAINAGE	OC	ASSUMED CONNECTION
SURFACE WATER DRAINAGE	SURFACE WATER DRAINAGE	BA	ASSUMED
WATER	WATER	BS	BACK-SUPPLY LEVEL
GAS	GAS	CB	CABLE BOND
HV ELECTRICITY	HV ELECTRICITY	CD	DEPTH OF SURFACE (APPROX)
LV ELECTRICITY	LV ELECTRICITY	CF	DISCONTINUOUS TRAP
BT / OPENBRICK	BT / OPENBRICK	CG	ELECTRICITY TRAP
UNKNOWN SERVICE	UNKNOWN SERVICE	CH	END OF TRACE
UNDERGROUND CHAMBER	UNDERGROUND CHAMBER	CI	HOIST
		CL	LOW VOLTAGE
		CM	NO SURFACE REPRESENTATION
		CN	PIPE REPAIR
		CO	PIPE REPAIR
		CP	POSITIONING
		CQ	PRE REPAIR
		CR	SHARP TURN
		CS	UNABLE TO LEFT
		CT	UNABLE TO RIGHT
		CU	UNABLE TO TRACE
		CV	NO TRACE

**ASSOCIATED DRAWINGS**

- WY001 - CARROW WORKS, NORWICH, UTILITIES SURVEY, SHEET 1 OF 9
- WY002 - CARROW WORKS, NORWICH, UTILITIES SURVEY, SHEET 2 OF 9
- WY003 - CARROW WORKS, NORWICH, UTILITIES SURVEY, SHEET 3 OF 9 (THIS DRAWING)
- WY004 - CARROW WORKS, NORWICH, UTILITIES SURVEY, SHEET 4 OF 9
- WY005 - CARROW WORKS, NORWICH, UTILITIES SURVEY, SHEET 5 OF 9
- WY006 - CARROW WORKS, NORWICH, UTILITIES SURVEY, SHEET 6 OF 9
- WY007 - CARROW WORKS, NORWICH, UTILITIES SURVEY, SHEET 7 OF 9
- WY008 - CARROW WORKS, NORWICH, UTILITIES SURVEY, SHEET 8 OF 9
- WY009 - CARROW WORKS, NORWICH, UTILITIES SURVEY, SHEET 9 OF 9

**LOCATION PLAN**



REV	DESCRIPTION	BY	CHK	APP	DATE

SCALE 1:200

LAKELAND BUSINESS PARK  
LAMPLUGH ROAD  
COCKERMOUTH  
CA13 0QT

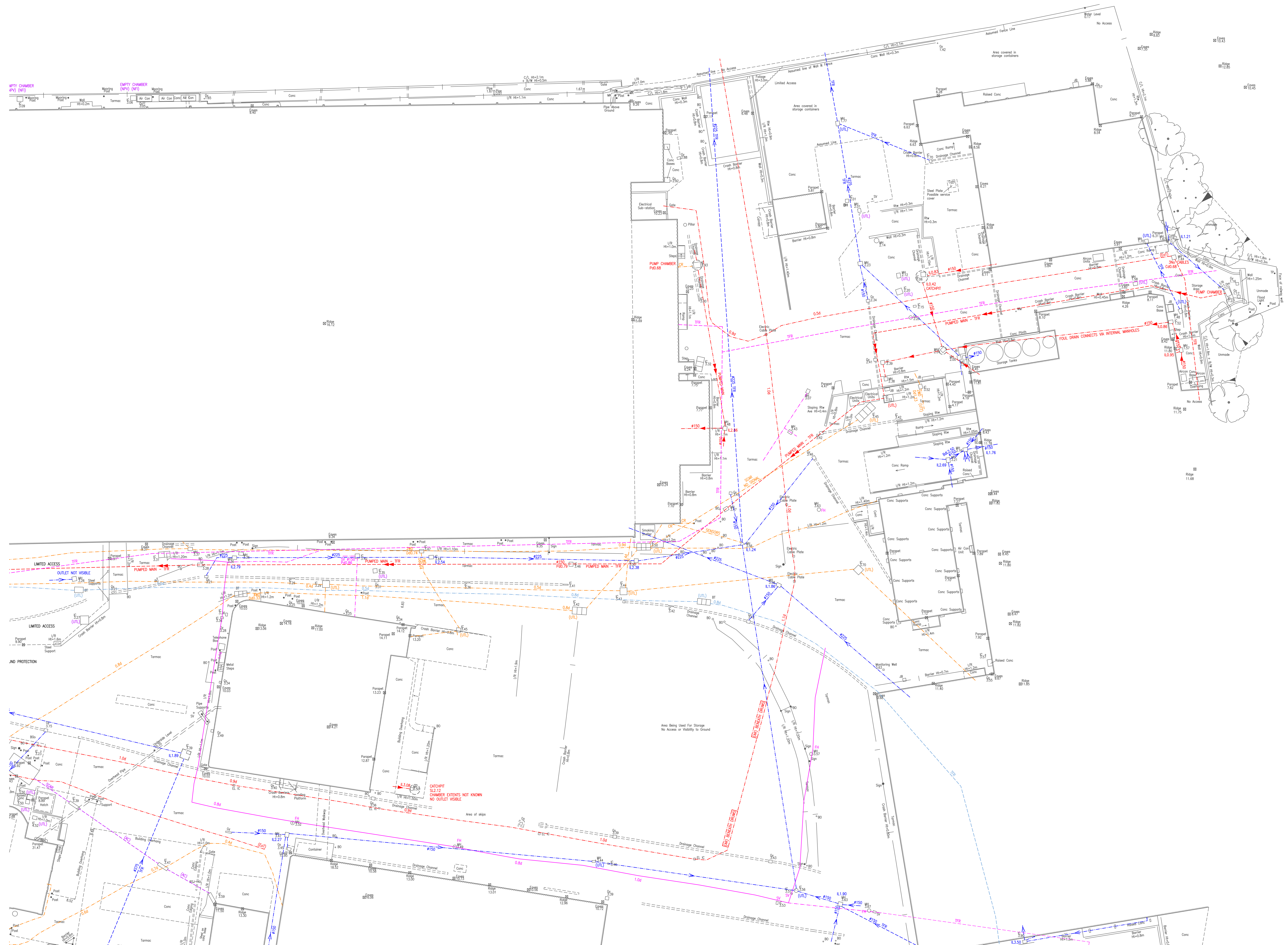
TEL: +44 (0)1900 898 600  
FAX: +44 (0)1900 826 324  
e-mail: cumbria@wyg.com

Project:  
Carrow Works  
Norwich  
NR1 2DD

Drawing Title:  
UTILITIES SURVEY  
SHEET 3 OF 9

Scale @	A0	Drawn	Date	Checked	Date	Approved	Date
1:200			22/11/18		22/11/18		22/11/18
Project No.	Office	Type	Drawing No.	Revision			
A108750-1	22	01	WY003	A			

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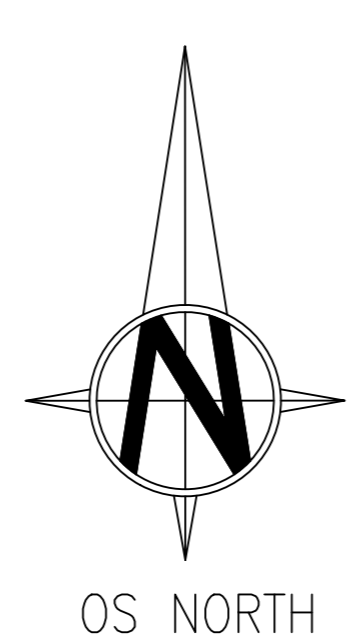
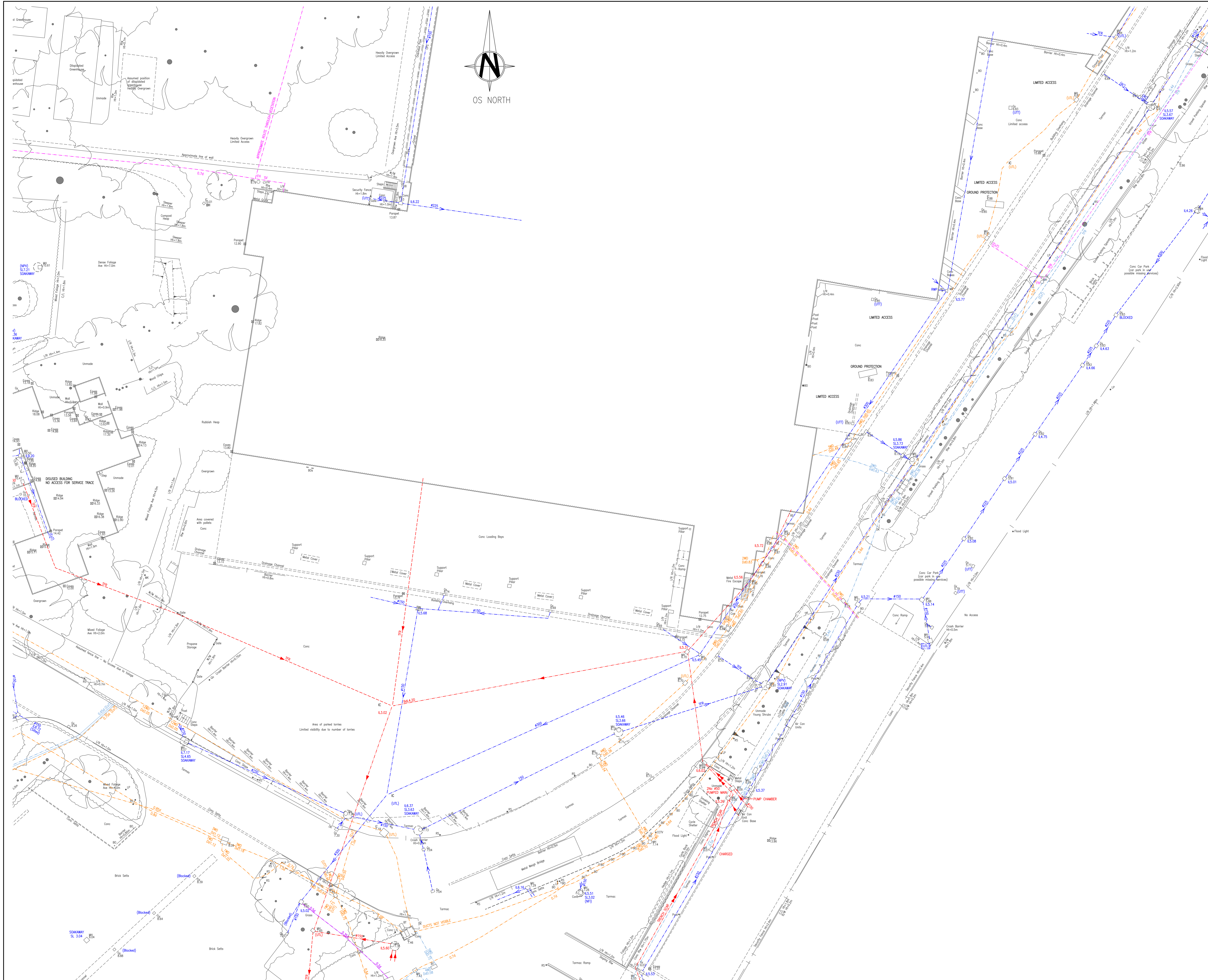












DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS

**NOTES**

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- TOPOGRAPHICAL SURVEY DATA IS BY CD SURVEYS LTD AND HAS BEEN USED FOR INFORMATION ONLY.
- REFER TO REPORT NO. A108750-1 UTILITIES SURVEY REPORT

**TOPO LEGEND**

AM	AIR MAST	C/WO	INSPECTION COVER WASH OUT
AV	AIR VALVE	LI	LOCK JOINT
BL	BELLEVILLE BRANCH	LJ	LEAD JOINT
BO	BED LEVEL	LAD	LADDER
B	BENCHMARK	LB	LIFT DOWN AREA
BOL	BOLLARD	LP	LAMP POST
BS	BORISOLE	ME	METRES EAST
BS	BURDULE	MB	MANHOLE
CAB/ET	CABINET	M/W	MEAN LOW WATER LEVEL
CAB/EL	CABINET BRITISH TELECOM	M/N	METRES NORTH
CAM	CANOPY	MP	MARKER POST
CB	CORNER BARRER	MB/IT	MARKER POST BRITISH TELECOM
CB/L	CABLE	M/EL	MARKER POST ELECTRIC
CC	CONCRETE	M/GAS	MARKER POST GAS
CDC	CONC. DUCT COVER	M/WA	MARKER POST WATER
CHS	CHEMICAL OIL STORE	NP	NOTICE BOARD
CLM	COLUMN	NPL	NAME PLATE
CMB	CONCRETE BASE	OH	OVERHEAD BEMS
CNP	CONCRETE PLINCH	OTL	OVERHEAD BRUSH TELECOM
CONC.	CONCRETE	CHKL	OVERHEAD CABLES
CP	CATCHPIT	OP	OVERHEAD PIPE SUPPORT
CPL	CROWN PIPE LEVEL	OP/L	OVERHEAD POWER LINES
CPS	CONC. PIPE SUPPORT	OP/S	OVERHEAD PIPE SUPPORT
CB	CABLE TRAY	OP/S	OVERHEAD PAPERBROCK
DB	DROP BARRER	OP/S	OVERHEAD PAPERBROCK SUPPORT
DBB	DROP BARRER BOX	P	POLE
DBP	DROP BARRER POST	PB	POINTS BOX
DK	DROP KERB	PC	PEDESTRIAN CROSSING
DR	DRAIN	PON	POINT CROSSING WIDE
EER	EMERGENCY EQUIPMENT BOX	PD	POINTS DETECTOR
EMS	EMERGENCY SHOWER	PL	PEDESTRIAN LIGHTING BOLLARD
EL	ELEMS LEVEL	PLR	POINTS LEVEL
EP	ELECTRIC POLE	PM	POINT MOTOR
ER	EARTH ROD	PKB	POST BOX
FREDS	FLOWER BEDS	PR	POINT ROSS
FE	FIRE EXTINGUISHER	PR	PEDESTRIAN CROSSING
FEL	CHAINLINK FENCE	PS	PEDESTRIAN CROSSING
FEN	FENCE	RE	ROAD
FEN	FENCE	RES	RESIDENTIAL
FENP	FENCE PALISADE FENCE	RS	ROAD SIGN
FENW	FENCE POST & RAIL FENCE	RS	ROAD SIGN
FENW	FENCE WILLOW FENCE	RSS	ROLLER SHUTTER DOOR
FL	FLOOR LIGHT	RTW	RETAINING WALL
FL	FLOOR LEVEL	RW	RAIN WATER PIPE
FP	FOOTPATH	S	SCAR LINE
FS	FLAT STREET	SD	SUDDING DOOR
G/S/H	GRASS SPREAD HEIGHT	SD	RAIL SIGNAL
GD	GATE DOUBLE	SL	SPREAD LEVEL
GAS	GATE SINGLE	SN	GENERAL SIGN
GAS	GATE TURNSTILE	SN	GENERAL SIGN
GB	GAS BIN	SRK	SPALL RESPONSE KIT
GBS	GAS BOTTLE STORE	ST	STOP SIGN
GDC	GRADED DUCT COVER	STW	STOP WITH HANDRAIL
GP	GRADIENT POST	SV	STOP VALVE
GRP	GRADE POINT	SVP	SOIL VENT PIPE
CV	CIVIL	SW	SOIL WARE
CY	CYLLING	SY	STOP SIGN
HER	HEIGHT RESTRICTOR	T	TRAFFIC LIGHT
HR	HEIGHT RESTRICTOR	TEL	TELEPHONE
HL	HEIGHT	TL	THRESHOLD LEVEL
IB	INSPECTION BOX (NOT BARRED)	TP	TELEPHONE POLE
I	INSPECTION COVER	TS	TRAFFIC SIGN
I/UB	INSPECTION COVER UNKNOWN	UL	UNDERGROUND LEVEL
I/WT	INSPECTION COVER BRITISH TELECOM	US	UNDERGROUND LEVEL
I/WH	INSPECTION COVER FIRE HYDRANT	UP	UPPER PIPE
I/EL	INSPECTION COVER ELECTRIC	UJ	UNDERGROUND JOINT
I/GA	INSPECTION COVER GAS	WJ	WATER JOINT
I/S	INSPECTION COVER STREET LIGHT	WU	WATER LEVEL
I/WA	INSPECTION COVER WATER	WP	WASTE PIPE
I/WA	INSPECTION COVER WATER	WYGOX	SURVEY STATION

**GPR/UTILITIES LEGEND**

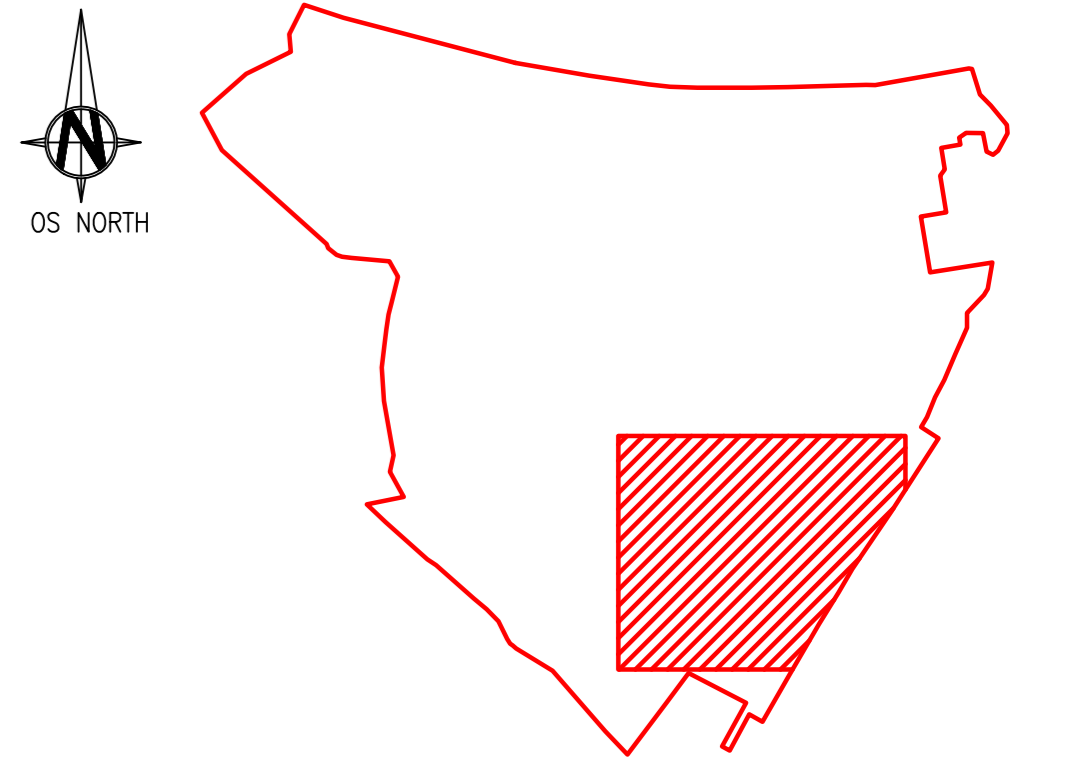
FOIA DRAINAGE	— (Red dashed line)	ACD	ASSUMED CONNECTION
SURFACE WATER DRAINAGE	— (Blue dashed line)	BA	BACK-SHOP LEVEL
WATER	— (Blue solid line)	CB	CABLE BOX
GAS	— (Orange solid line)	CD	DEPTH OF SERVICE (APPROX)
HV ELECTRICITY	— (Green solid line)	CF	DISCONNECTING SW
LV ELECTRICITY	— (Yellow solid line)	CT	ELECTRICITY TRACE
BT / OPENRIBBON	— (Purple solid line)	D/S	END OF TRACE
UNKNOWN SERVICE	— (Light blue solid line)	EW	WATER SERVICE
UNDERGROUND CHAMBER	— (Grey dashed line)	EV	HIGH VOLTAGE
		EV	LOW VOLTAGE
		EV	NO SERVICE INFORMATION
		EV	PIPE SEPARATION
		EV	POSTING
		EV	PRE REEF
		EV	SUMP PUMP
		EV	UNABLE TO LEFT
		EV	UNABLE TO RIGHT
		EV	UNABLE TO TRACE
		EV	W/ DEFECT

**ASSOCIATED DRAWINGS**

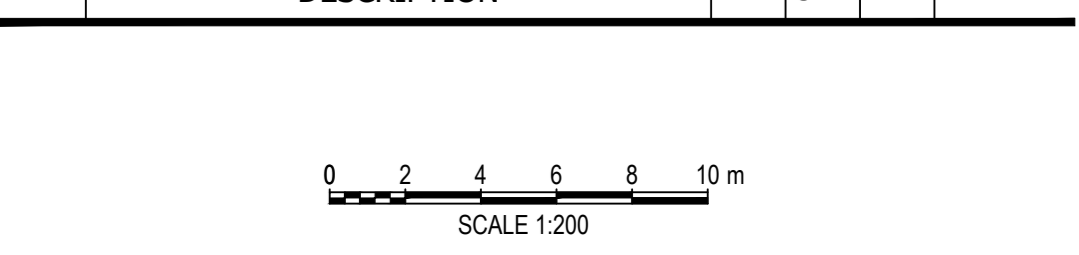
- WY001 - CARROW WORKS, NORWICH, UTILITIES SURVEY, SHEET 1 OF 9
- WY002 - CARROW WORKS, NORWICH, UTILITIES SURVEY, SHEET 2 OF 9
- WY003 - CARROW WORKS, NORWICH, UTILITIES SURVEY, SHEET 3 OF 9
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- WY008 - CARROW WORKS, NORWICH, UTILITIES SURVEY, SHEET 8 OF 9 (THIS DRAWING)
- WY009 - CARROW WORKS, NORWICH, UTILITIES SURVEY, SHEET 9 OF 9

**LOCATION PLAN**

HATCHED AREA SHOWN IN THIS DRAWING - BOLD LINE DEFINES SURVEY EXTENT



REV	DESCRIPTION	BY	CHK	APP	DATE
-----	-------------	----	-----	-----	------



LAKELAND BUSINESS PARK  
LAMPLUGH ROAD  
COCKERMOUTH  
CA13 0QT

WVG

TEL: +44 (0)1900 898 600  
FAX: +44 (0)1900 826 324  
e-mail: cumbria@wvg.com

Project:  
Carrow Works  
Norwich  
NR1 2DD

Drawing Title:  
**UTILITIES SURVEY**  
SHEET 8 OF 9

Scale @	AO	Drawn	Date	Checked	Date	Approved	Date
1:200		MD	22/11/18	DR	22/11/18	DR	22/11/18
Project No.	Office	Type	Drawing No.	Revision			
A108750-1	22	01	WYG008	A			

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## Appendix D – EA Product 4 Data

# Flood risk assessment data

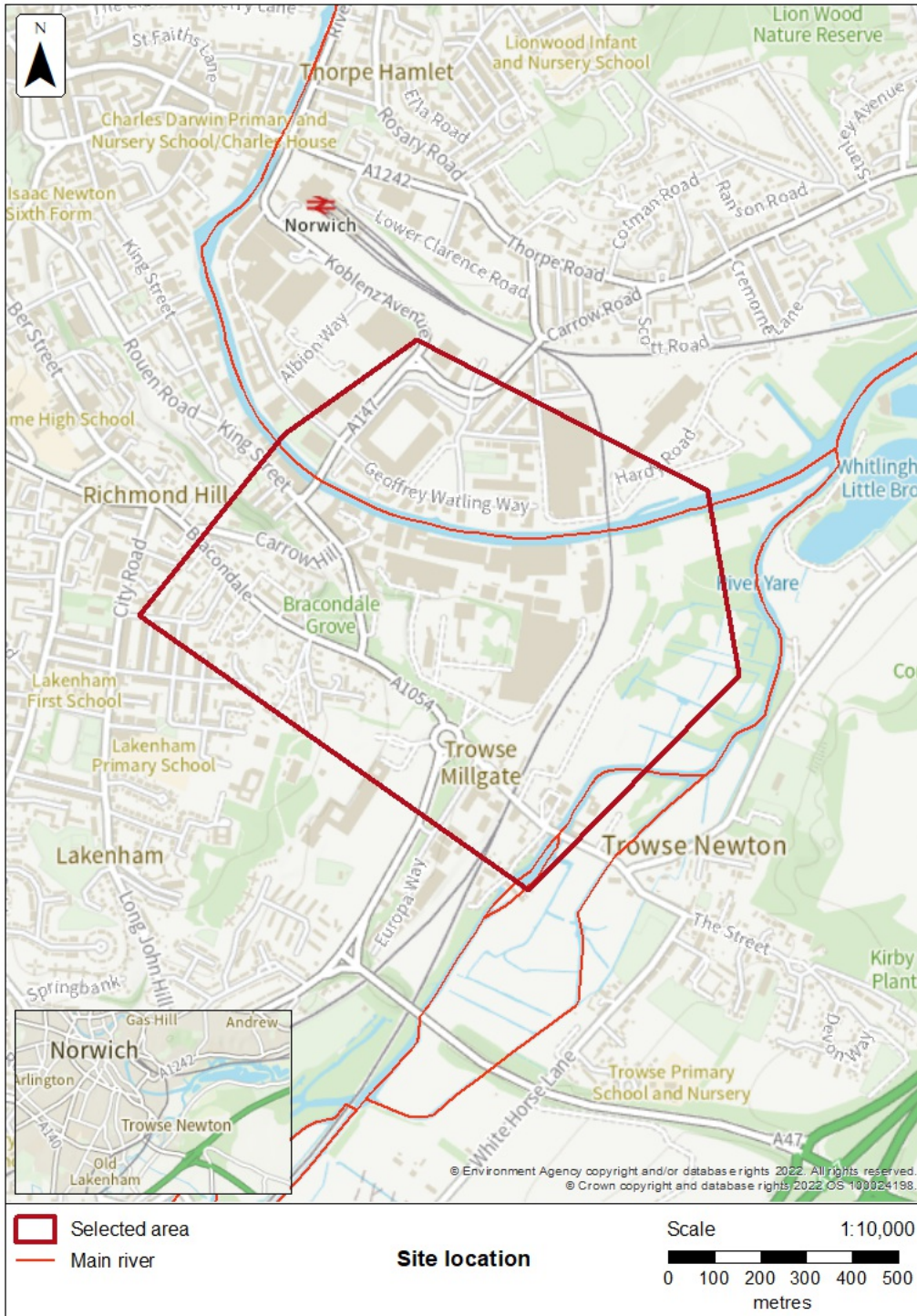
Location of site: 624223 / 307465 (shown as easting and northing coordinates)

Document created on: 29 March 2022

This information was previously known as a product 4.

Customer reference number: Y8P2767EXHXY

Map showing the location that flood risk assessment data has been requested for.



## How to use this information

You can use this information as part of a flood risk assessment for a planning application. To do this, you should include it in the appendix of your flood risk assessment.

**We recommend that you work with a flood risk consultant to get your flood risk assessment.**

## Included in this document

In this document you'll find:

- how to find information about surface water and other sources of flooding
- information on the models used
- definitions for the terminology used throughout
- flood map for planning (rivers and the sea)
- historic flooding
- modelled data
- climate change modelled data
- information about strategic flood risk assessments
- information about this data
- information about flood risk activity permits
- help and advice

## Information that's unavailable

This document **does not** contain:

- flood defences and attributes

We aren't able to display flood defence locations and attributes as there are no formal flood defences in the area of interest.



## Surface water and other sources of flooding

Use the [long term flood risk service](#) to find out about the risk of flooding from:

- surface water
- ordinary watercourses
- reservoirs

For information about sewer flooding, contact the relevant water company for the area.

## About the models used

Model name: River Wensum, Norwich, Norfolk, 2017

Scenario(s): Defended fluvial, defences removed fluvial, defended climate change fluvial, defences removed climate change fluvial

Date: 1 August 2017

These models contain the most relevant data for your area of interest.

## Terminology used

### Annual exceedance probability (AEP)

This refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood which is calculated to have a 1% chance of occurring in any one year, is described as 1% AEP.

### Metres above ordnance datum (mAOD)

All flood levels are given in metres above ordnance datum which is defined as the mean sea level at Newlyn, Cornwall.

## **Flood map for planning (rivers and the sea)**

Your development is in flood zone 3.

Flood zone 3 shows the area at risk of flooding for an undefended flood event with a:

- 0.5% or greater probability of occurring in any year for flooding from the sea
- 1% or greater probability of occurring in any year for fluvial (river) flooding

Flood zone 2 shows the area at risk of flooding for an undefended flood event with:

- between a 0.1% and 0.5% probability of occurring in any year for flooding from the sea
- between a 0.1% and 1% probability of occurring in any year for fluvial (river) flooding

It's important to remember that the flood zones on this map:

- refer to the land at risk of flooding and do not refer to individual properties
- refer to the probability of river and sea flooding, ignoring the presence of defences
- do not take into account potential impacts of climate change

This data is updated on a quarterly basis as better data becomes available.







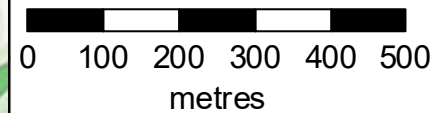
### Flood map for planning

Location (easting/northing)  
**624223/307465**

Scale  
**1:10,000**

Created  
**29 Mar 2022**

-  Selected area
-  Main river
-  Flood zone 3
-  Flood zone 2



## Historic flooding

This map is an indicative outline of areas that have previously flooded. Remember that:

- our records are incomplete, so the information here is based on the best available data
- it is possible not all properties within this area will have flooded
- other flooding may have occurred that we do not have records for
- flooding can come from a range of different sources - we can only supply flood risk data relating to flooding from rivers or the sea

You can also contact your Lead Local Flood Authority or Internal Drainage Board to see if they have other relevant local flood information. Please note that some areas do not have an Internal Drainage Board.

[Download recorded flood outlines in GIS format](#)



### Historic flood map

Location (easting/northing)  
**624223/307465**

Scale  
**1:10,000**

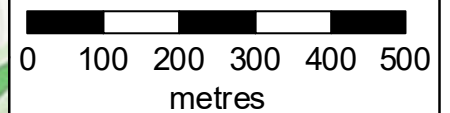
Created  
**29 Mar 2022**

 Selected area

 Main river

Date of flood event

 September, 1912



## Historic flood event data

Start date	End date	Source of flood	Cause of flood	Affects location
27 September 1912	28 September 1912	main river	unknown	Yes

## Modelled data

This section provides details of different scenarios we have modelled and includes the following (where available):

- outline maps showing the area at risk from flooding in different modelled scenarios
- modelled node point map(s) showing the points used to get the data to model the scenarios and table(s) providing details of the flood risk for different return periods
- map(s) showing the approximate water levels for the return period with the largest flood extent for a scenario and table(s) of sample points providing details of the flood risk for different return periods

## Climate change

The climate change data included in the models may not include the latest [flood risk assessment climate change allowances](#). Where the new allowances are not available you will need to consider this data and factor in the new allowances to demonstrate the development will be safe from flooding.

The Environment Agency will incorporate the new allowances into future modelling studies. For now, it's your responsibility to demonstrate that new developments will be safe in flood risk terms for their lifetime.

## Modelled scenarios

The following scenarios are included:

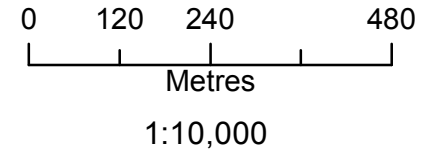
- Defended modelled fluvial: risk of flooding from rivers where there are flood defences
- Defences removed modelled fluvial: risk of flooding from rivers where flood defences have been removed
- No defences exist modelled fluvial: risk of flooding from rivers where there are no flood defences
- Defended climate change modelled fluvial: risk of flooding from rivers where there are flood defences, including estimated impact of climate change
- Defences removed climate change modelled fluvial: risk of flooding from rivers where flood defences have been removed, including estimated impact of climate change

# Wensum 2017 Tidal Modelled Defended Outlines

East Norwich Created: 08/04/2022 Ref: EAN/2022/256173



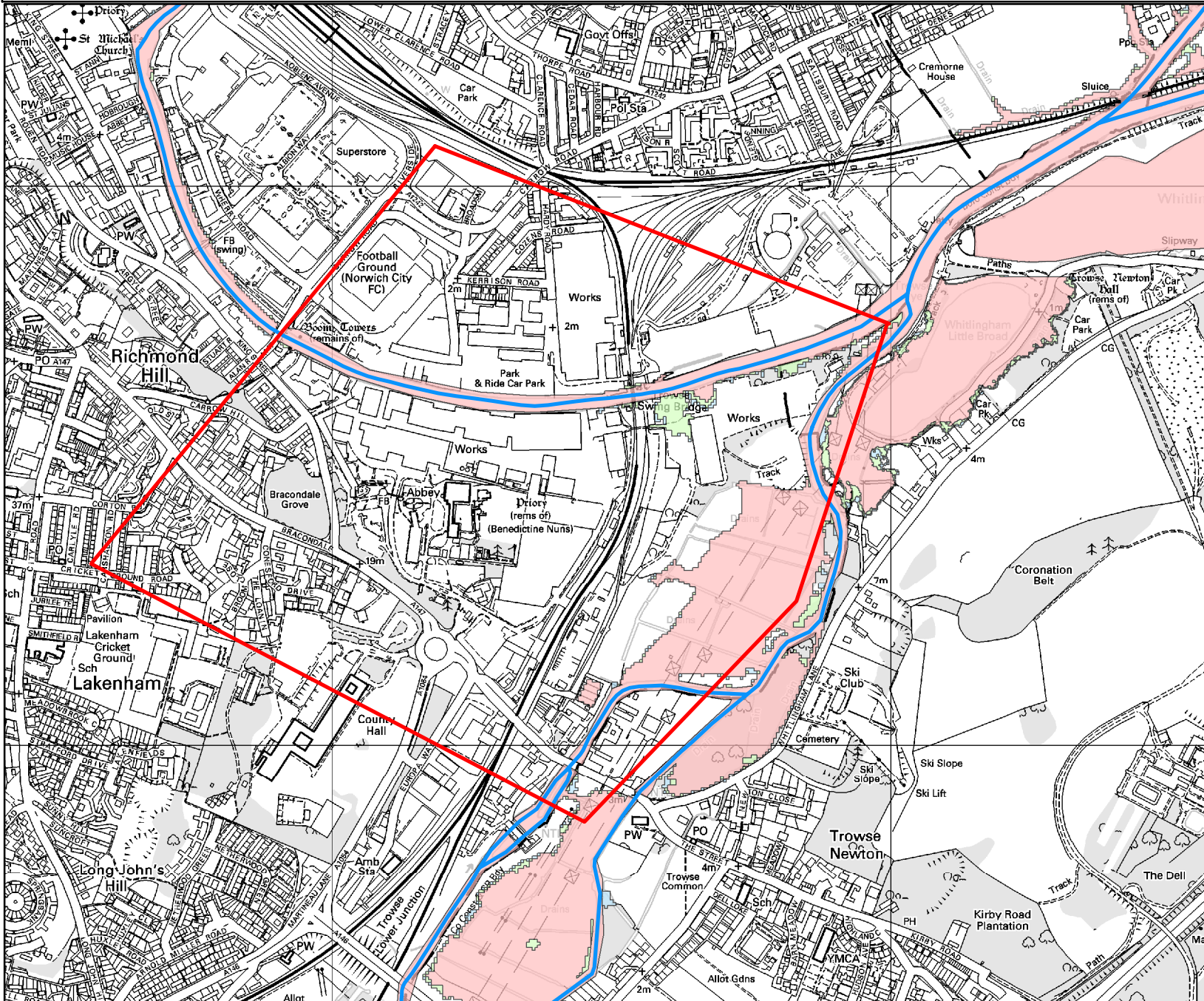
Environment Agency  
Iceni House  
Cobham Road  
Ipswich  
Suffolk  
IP3 9JD



## Legend

- Site Location
- Main Rivers
- 1 in 20 (5%)
- 1 in 200 (0.5%)
- 1 in 1000 (0.1%)

This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences if present.



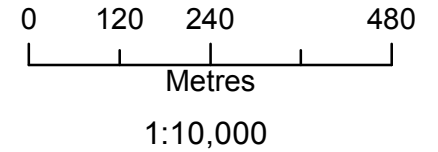


# Wensum 2017 Tidal Modelled Undefended Outlines

East Norwich Created: 08/04/2022 Ref: EAN/2022/256173



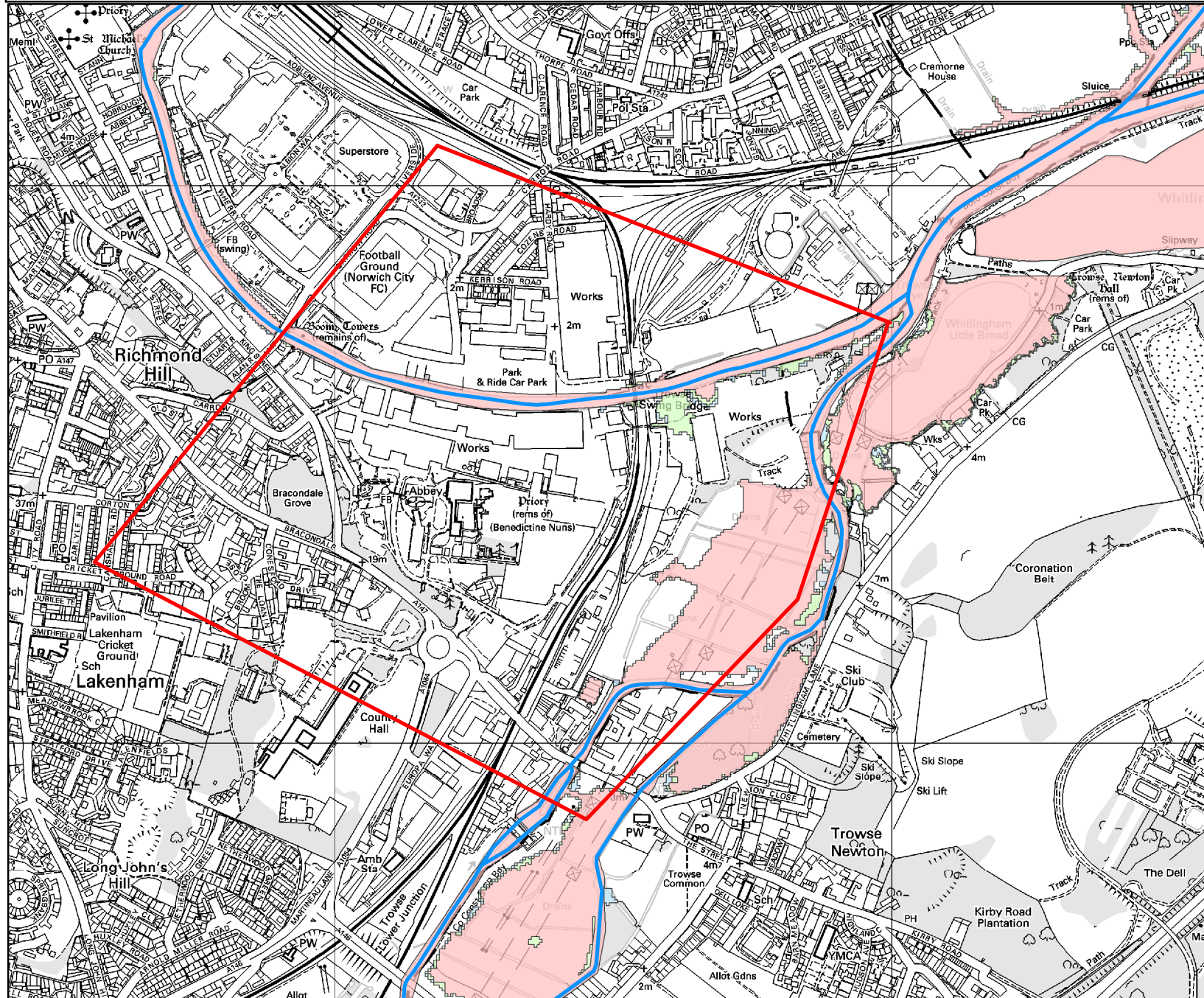
Environment Agency  
Iceni House  
Cobham Road  
Ipswich  
Suffolk  
IP3 9JD



## Legend

- Site Location
- Main Rivers
- 1 in 20 (5%)
- 1 in 200 (0.5%)
- 1 in 1000 (0.1%)

This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences if present.

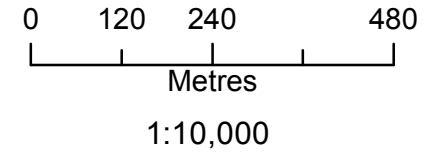


# Wensum 2017 Fluvial Modelled Defended Outlines

East Norwich Created: 08/04/2022 Ref: EAN/2022/256173



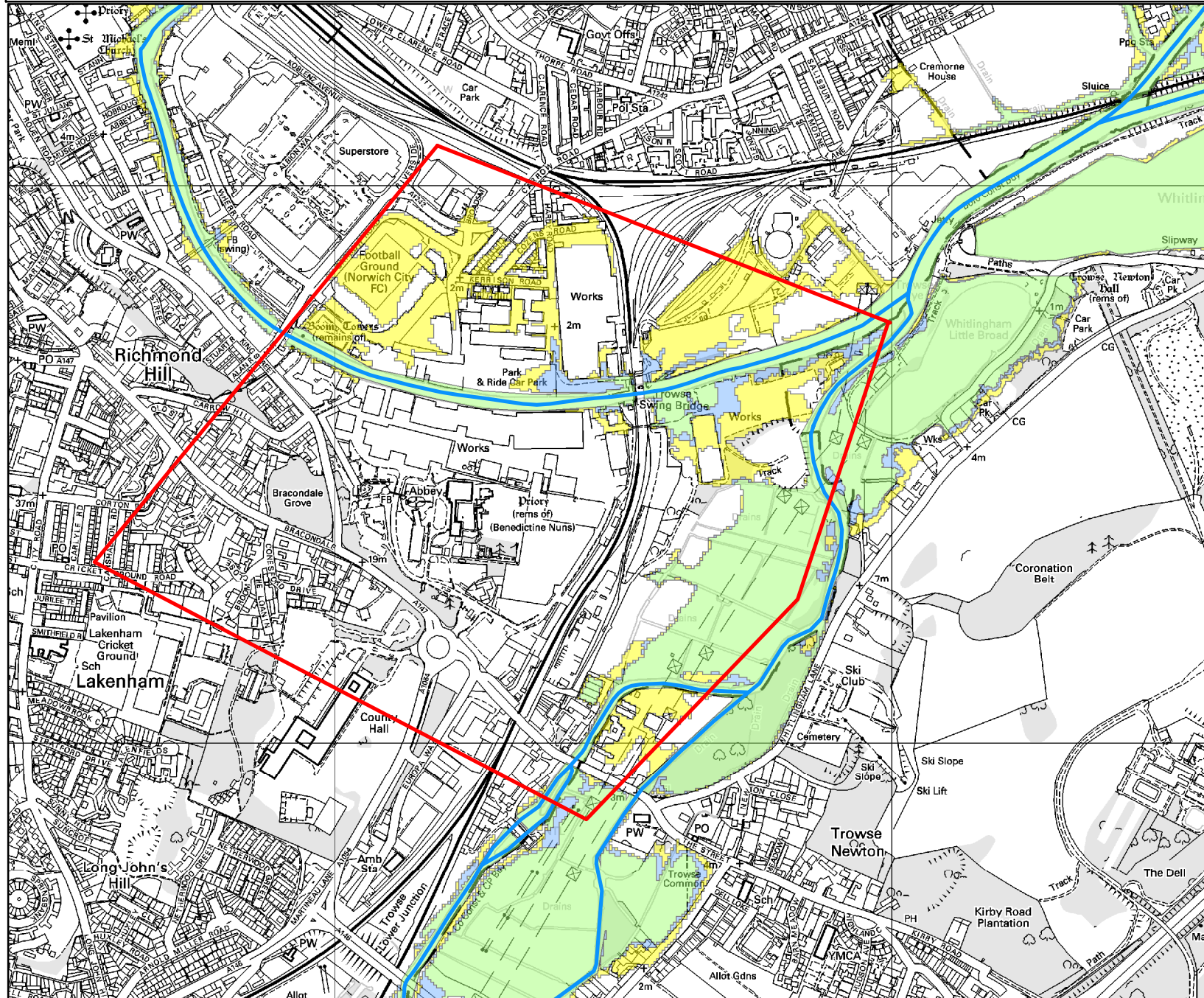
Environment Agency  
Iceni House  
Cobham Road  
Ipswich  
Suffolk  
IP3 9JD



## Legend

- Site Location
- Main Rivers
- 1 in 20 (5%)
- 1 in 100 (1%)
- 1 in 1000 (0.1%)

This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences if present.

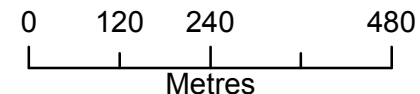


# Wensum 2017 Fluvial Modelled Undefended Outlines

East Norwich Created: 08/04/2022 Ref: EAN/2022/256173



Environment Agency  
Iceni House  
Cobham Road  
Ipswich  
Suffolk  
IP3 9JD

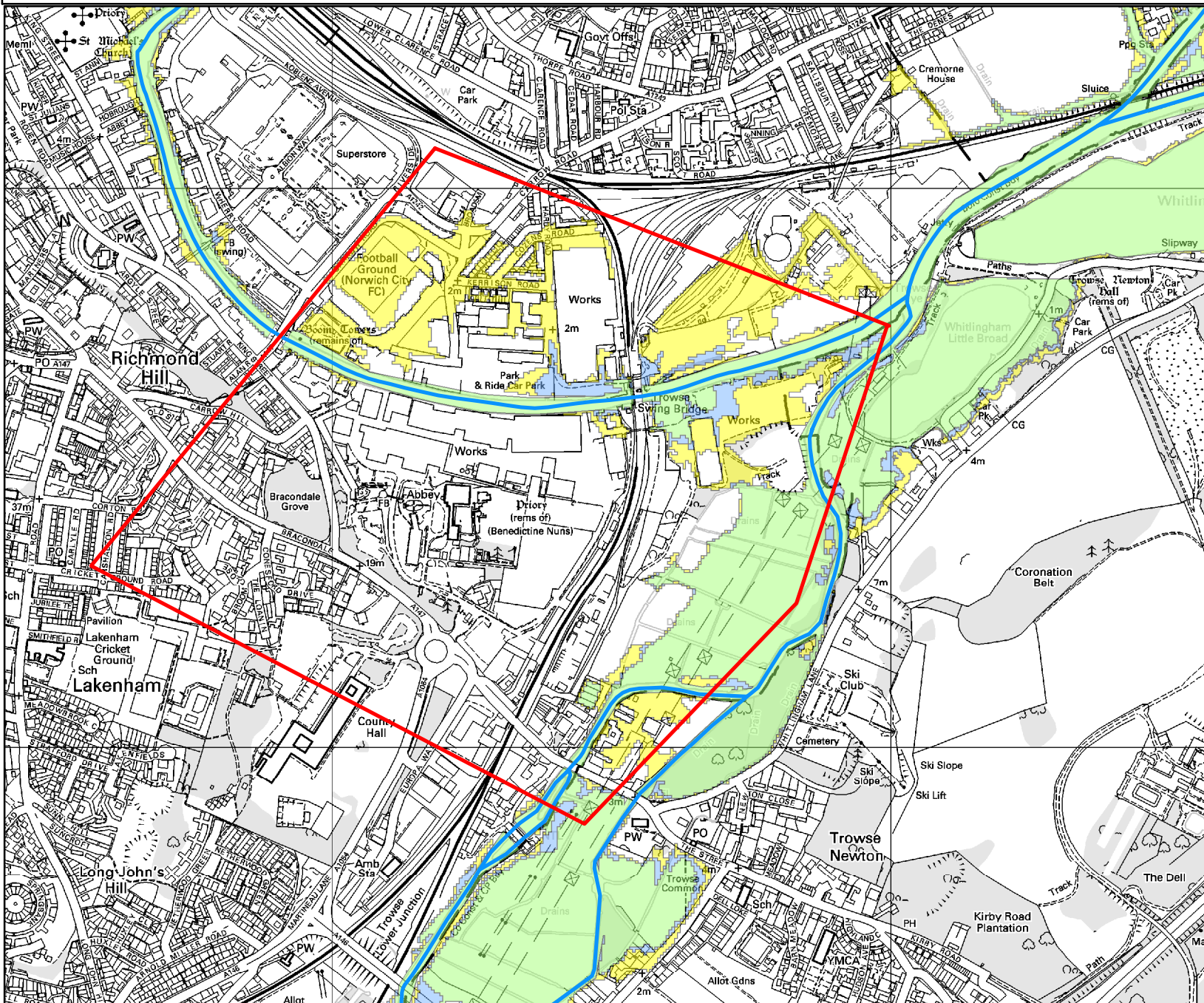


1:10,000

## Legend

- Site Location
- Main Rivers
- 1 in 20 (5%)
- 1 in 100 ( 1%)
- 1 in 1000 (0.1%)

This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences if present.

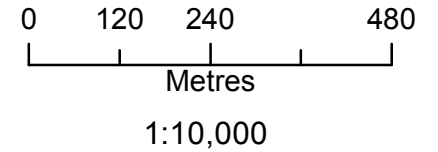


# Wensum 2017 Fluvial Modelled Defended Climate Change Outlines

## East Norwich Created: 08/04/2022 Ref: EAN/2022/256173



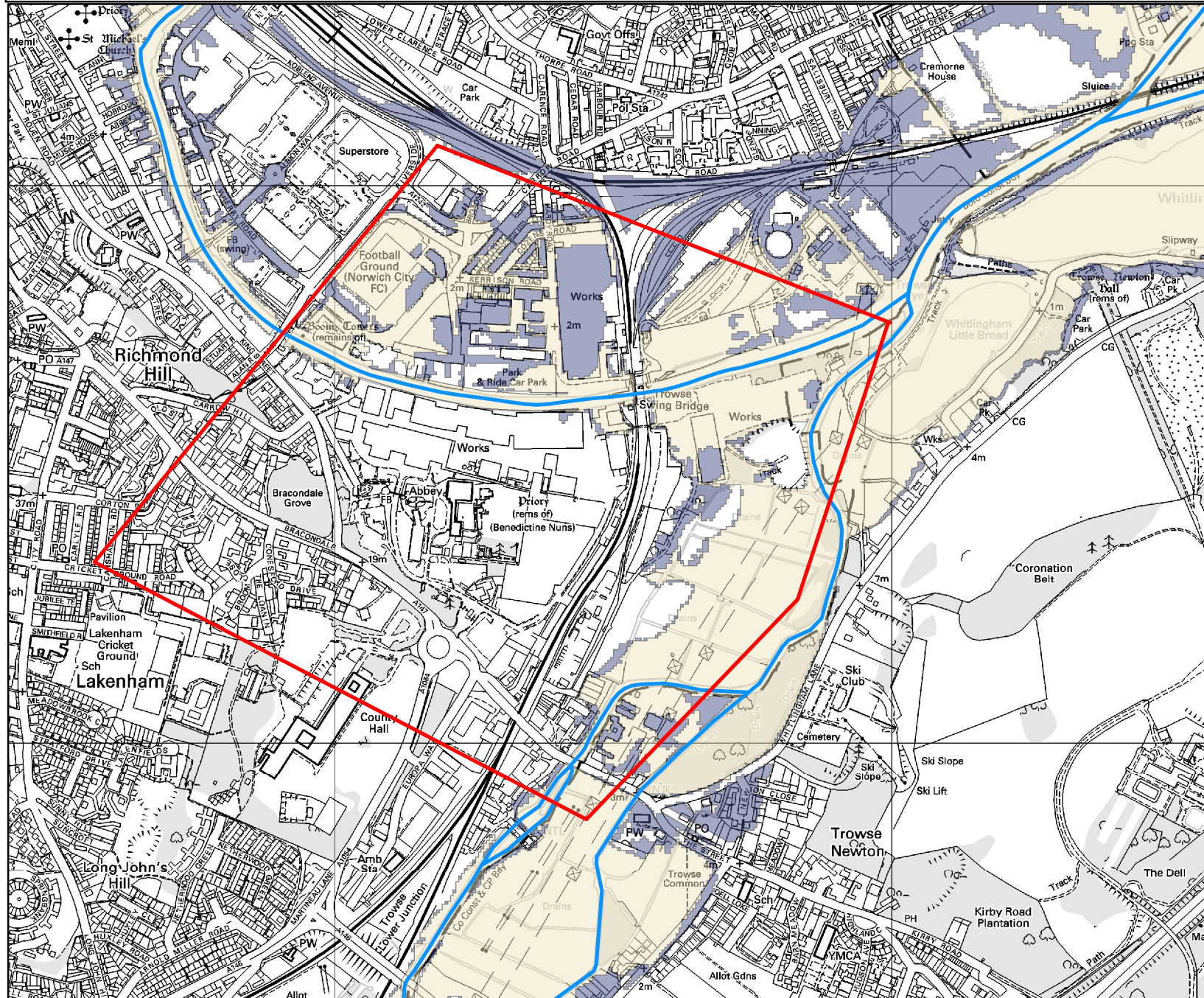
Environment Agency  
Iceni House  
Cobham Road  
Ipswich  
Suffolk  
IP3 9JD



### Legend

- Site Location
- Main Rivers
- 1 in 100 + 25% (\*CC)
- 1 in 1000 + 25% (\*CC)

This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences if present.

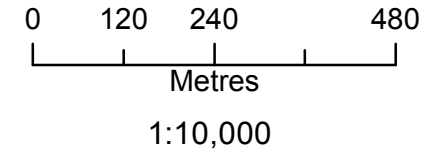


# Wensum 2017 Fluvial Modelled Undefined Climate Change Outlines

## East Norwich Created: 08/04/2022 Ref: EAN/2022/256173



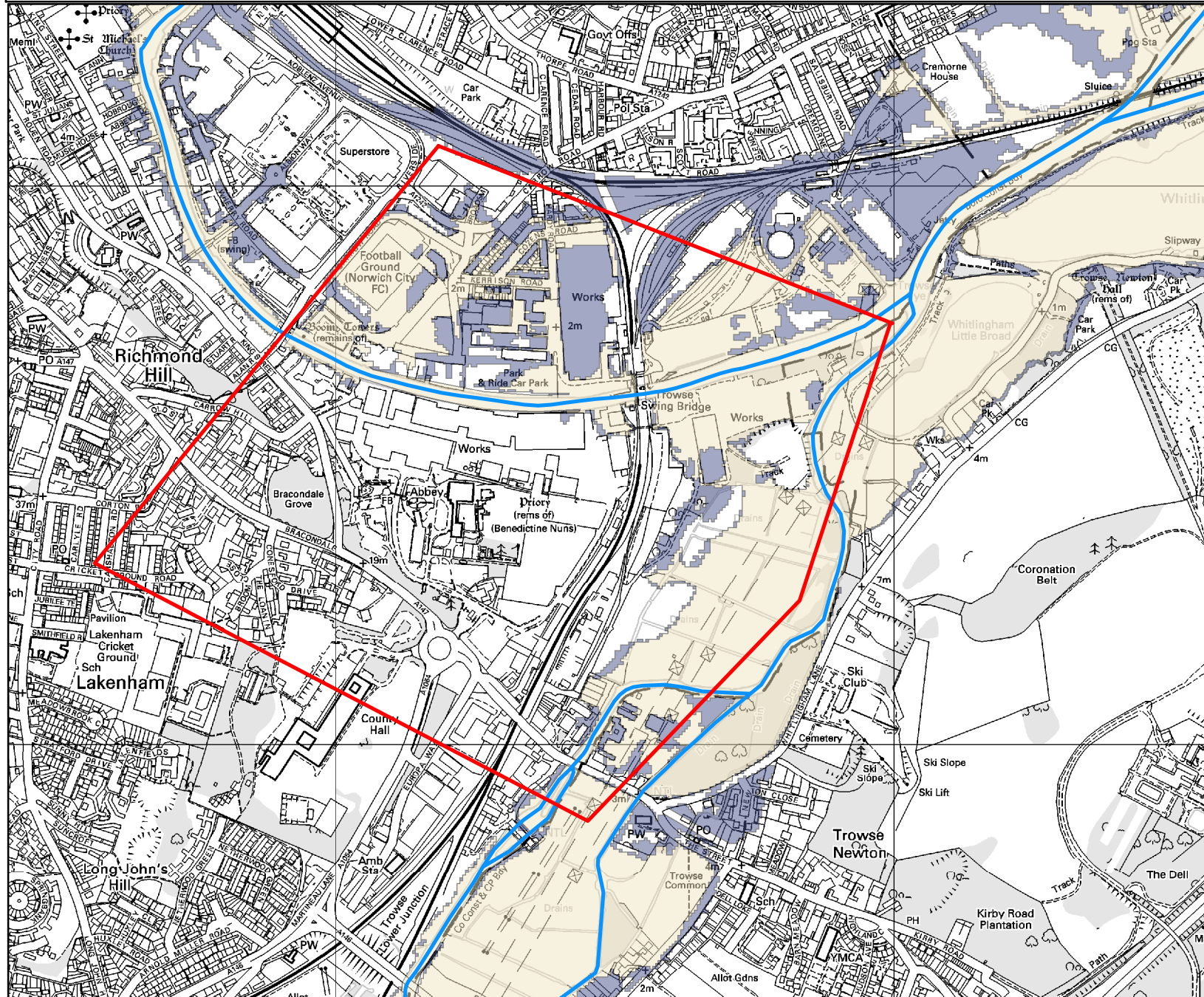
Environment Agency  
Iceni House  
Cobham Road  
Ipswich  
Suffolk  
IP3 9JD



### Legend

- Site Location
- Main Rivers
- 1 in 100 +25% (\*CC)
- 1 in 1000 + 25% (\*CC)

This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences if present.








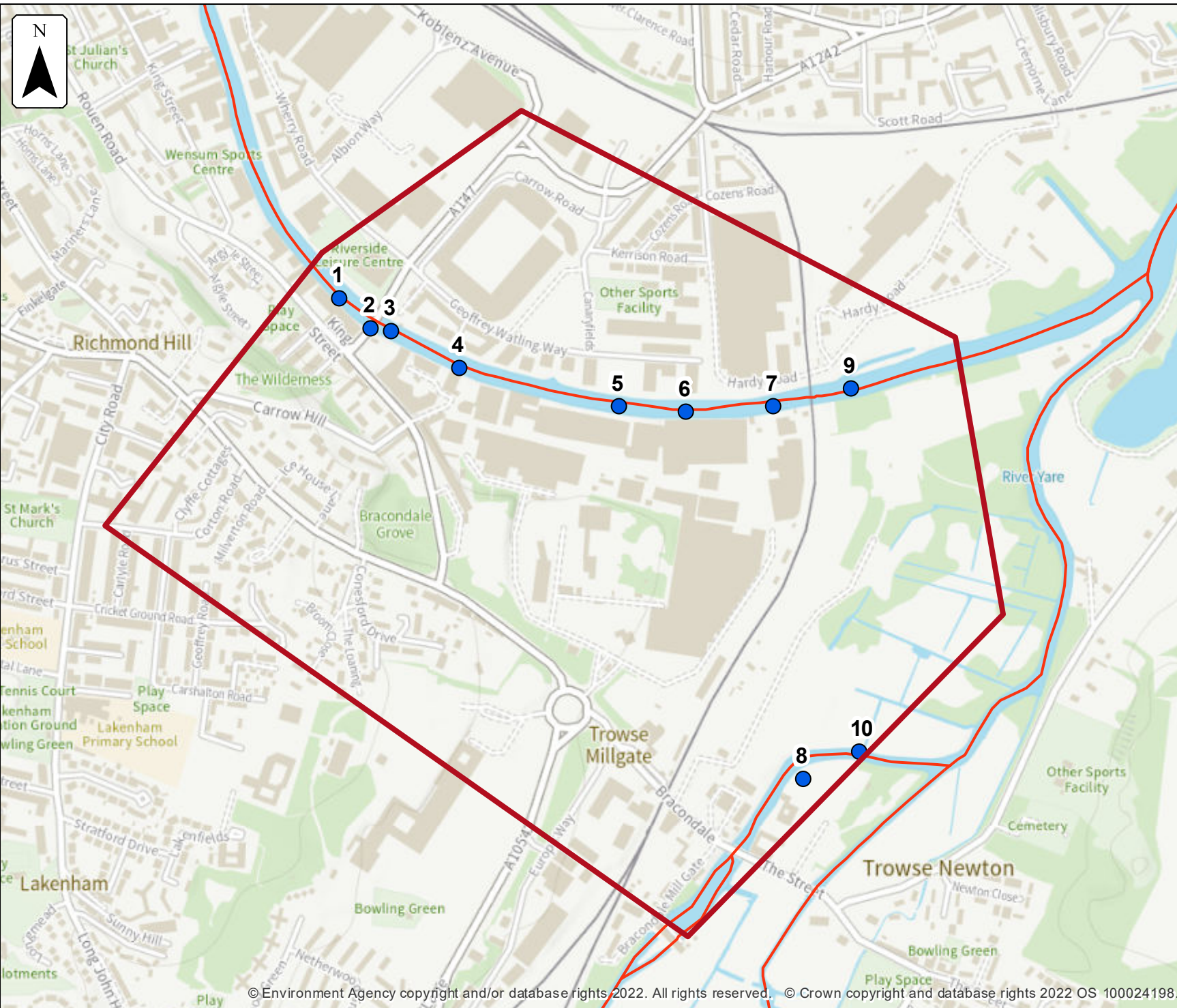
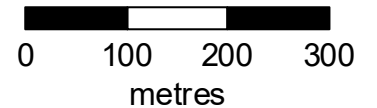
## Defended modelled fluvial node locations

Location (easting/northing)  
**624223/307465**

Scale            Created  
**1:7,500            29 Mar 2022**

Model name  
**River Wensum,  
Norwich, Norfolk,**

-  Selected area
-  Modelled location
-  Main river



## Modelled node locations data

### Defended

Label	Modelled location ID	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	919059	623854	307767	1.35	17.50	1.68	59.40	1.75	64.94	1.78	66.85	1.43	17.50	2.24	113.56
2	919115	623901	307723	1.56	51.42	1.68	59.42	1.75	64.96	1.77	66.86	1.43	17.54	1.48	16.57
3	919311	623929	307720	1.34	17.59	1.66	59.44	1.72	64.97	1.74	66.87	1.92	83.68	2.18	113.58
4	919145	624030	307665	1.34	17.80	1.65	59.48	1.71	65.01	1.73	66.91	1.42	17.80	1.47	16.72
5	919091	624262	307611	1.50	51.54	1.62	59.59	1.68	65.10	1.69	66.98	1.42	18.18	2.10	113.23
6	918999	624359	307602	1.49	51.58	1.61	59.64	1.67	65.14	1.67	67.02	1.42	18.25	2.08	113.42
7	919212	624486	307610	1.34	18.66	1.59	59.70	1.65	65.18	1.65	67.06	1.42	18.66	2.05	109.16
8	919078	624530	307068	1.57	26.98	1.68	31.14	1.72	33.46	1.71	34.84	1.42	5.90	2.07	49.40
9	919213	624598	307636	1.48	51.66	1.59	59.76	1.65	65.23	1.65	67.10	1.79	82.52	1.47	18.05
10	919002	624609	307109	1.58	26.66	1.69	28.37	1.74	28.31	1.73	27.90	1.42	5.84	1.47	5.84

Data in this table comes from the River Wensum, Norwich, Norfolk, 2017 model.  
 Level values are shown in mAOD, and flow values are shown in cubic metres per second.  
 Any blank cells show where a particular scenario has not been modelled for this location.






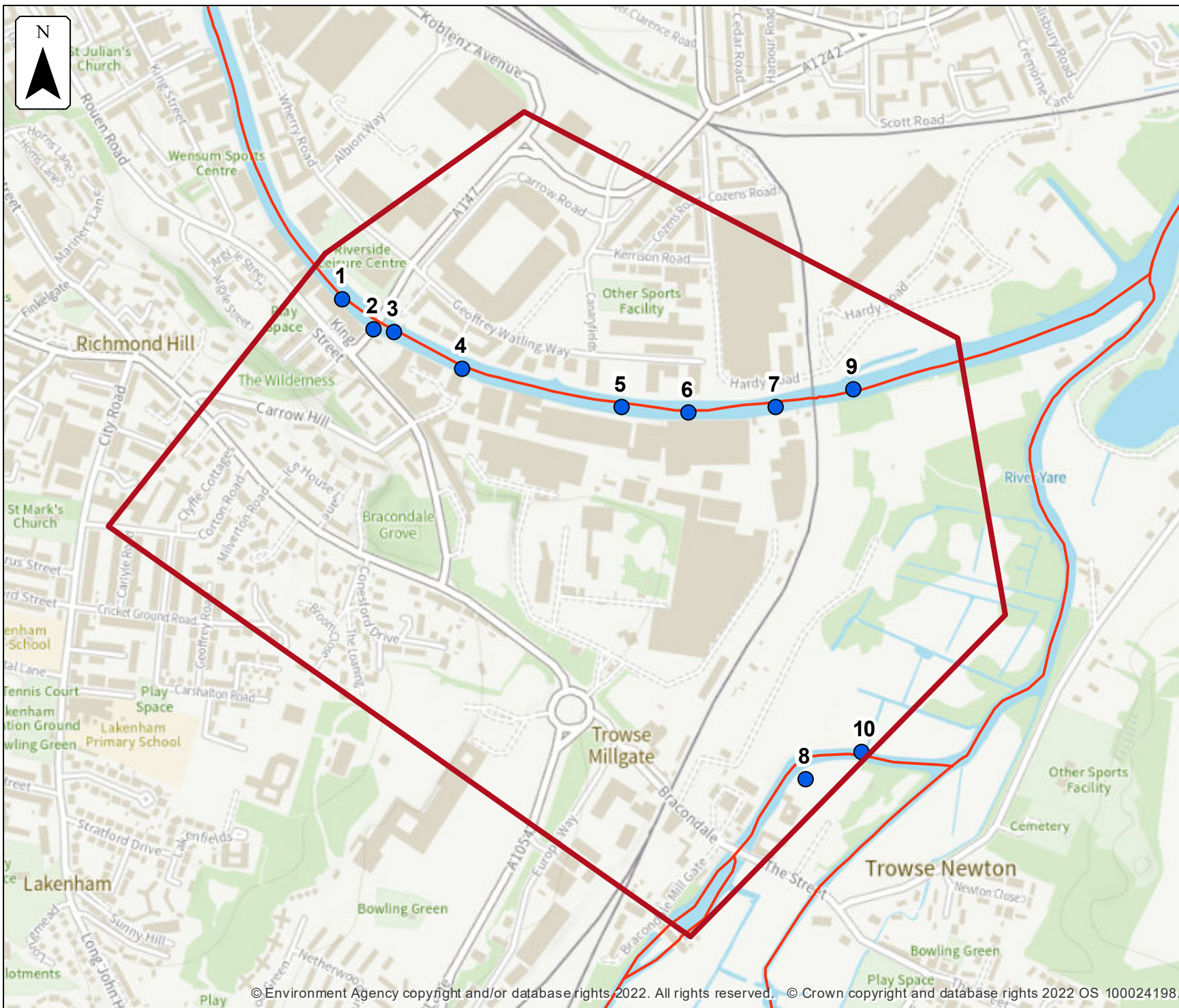
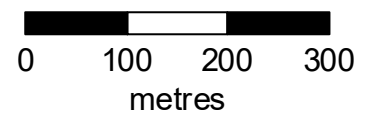
## Defences removed modelled fluvial node locations

Location (easting/northing)  
**624223/307465**

Scale            Created  
**1:7,500            29 Mar 2022**

Model name  
**River Wensum,  
Norwich, Norfolk,**

-  Selected area
-  Modelled location
-  Main river





## Modelled node locations data

### Defences removed

Label	Modelled location ID	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	919059	623854	307767	1.57	51.43	1.68	59.43	1.75	64.98	1.78	66.96	1.95	83.45	2.25	113.47
2	919115	623901	307723	1.56	51.45	1.68	59.45	1.75	65.0	1.77	66.97	1.94	83.37	1.48	16.57
3	919311	623929	307720	1.54	51.46	1.66	59.47	1.72	65.01	1.75	66.98	1.90	83.62	2.19	113.43
4	919145	624030	307665	1.53	51.49	1.65	59.52	1.71	65.05	1.73	67.02	1.42	17.80	2.17	113.26
5	919091	624262	307611	1.50	51.57	1.62	59.63	1.68	65.14	1.70	67.09	1.84	83.58	1.47	17.05
6	918999	624359	307602	1.49	51.60	1.60	59.68	1.67	65.18	1.69	67.13	1.81	83.58	2.08	113.35
7	919212	624486	307610	1.48	51.64	1.59	59.74	1.65	65.23	1.67	67.17	1.79	82.25	2.06	109.17
8	919078	624530	307068	1.57	26.98	1.68	31.14	1.72	33.46	1.74	34.83	1.84	39.67	2.07	49.40
9	919213	624598	307636	1.48	51.68	1.59	59.80	1.65	65.27	1.67	67.21	1.78	82.40	2.06	110.80
10	919002	624609	307109	1.58	26.66	1.69	28.37	1.74	28.31	1.75	27.90	1.85	28.90	2.08	39.51

Data in this table comes from the River Wensum, Norwich, Norfolk, 2017 model.  
 Level values are shown in mAOD, and flow values are shown in cubic metres per second.  
 Any blank cells show where a particular scenario has not been modelled for this location.






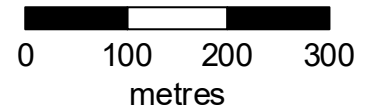
## Defended climate change modelled fluvial node locations

Location (easting/northing)  
**624223/307465**

Scale            Created  
**1:7,500            29 Mar 2022**

Model name  
**River Wensum,  
Norwich, Norfolk,**

-  Selected area
-  Modelled location
-  Main river



## Modelled node locations data

### Defended climate change

Label	Modelled location ID	Easting	Northing	1.0% AEP (+20%)		1.0% AEP (+25%)		1.0% AEP (+35%)		1.0% AEP (+65%)		0.5% AEP (+20%)		0.5% AEP (+25%)		0.5% AEP (+35%)		0.5% AEP (+65%)		0.1% AEP (+20%)		0.1% AEP (+25%)	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	919059	623854	307767	2.16	85.94	2.25	92.37	2.32	96.38	2.53	124.92	2.36	104.57	2.40	108.16	2.50	122.86	2.83	156.04	2.51	138.97	2.67	143.98
2	919115	623901	307723	2.15	85.14	2.24	91.17	2.31	94.96	2.52	119.42	2.34	103.03	2.38	106.36	2.49	118.21	2.82	151.12	2.50	134.38	2.66	136.60
3	919311	623929	307720	2.12	85.86	2.19	92.18	2.26	95.98	2.45	123.86	2.30	104.21	2.33	107.58	2.43	122.01	2.74	156.79	2.42	138.21	2.58	142.37
4	919145	624030	307665	2.11	85.79	2.17	91.82	2.24	95.70	2.43	120.58	2.28	103.70	2.32	107.05	2.40	119.26	2.71	148.73	2.39	136.29	2.56	136.75
5	919091	624262	307611	2.08	85.67	2.12	91.73	2.19	95.56	2.36	120.79	2.23	103.59	2.27	107.0	2.34	119.37	2.62	149.41	2.30	136.12	2.49	136.96
6	918999	624359	307602	2.06	85.82	2.11	92.03	2.17	95.71	2.33	120.88	2.21	103.69	2.25	106.93	2.31	119.11	2.58	149.20	2.26	135.63	2.46	136.70
7	919212	624486	307610	2.05	81.91	2.10	87.23	2.15	90.76	2.30	114.48	2.19	98.11	2.23	101.22	2.29	113.12	2.54	140.63	2.22	129.61	2.44	128.91
8	919078	624530	307068	2.07	41.27	2.11	42.85	2.16	46.03	2.30	55.16	2.18	46.56	2.22	48.33	2.29	51.67	2.52	60.26	2.20	58.06	2.46	58.32
9	919213	624598	307636	2.05	83.33	2.09	88.66	2.15	92.29	2.29	115.36	2.19	99.70	2.23	103.05	2.28	114.03	2.54	143.04	2.21	131.30	2.43	130.37
10	919002	624609	307109	2.07	32.90	2.11	34.62	2.16	37.89	2.30	47.0	2.18	38.0	2.23	39.62	2.29	43.13	2.52	53.13	2.21	47.88	2.46	50.88

Data in this table comes from the River Wensum, Norwich, Norfolk, 2017 model.  
 Level values are shown in mAOD, and flow values are shown in cubic metres per second.  
 Any blank cells show where a particular scenario has not been modelled for this location.






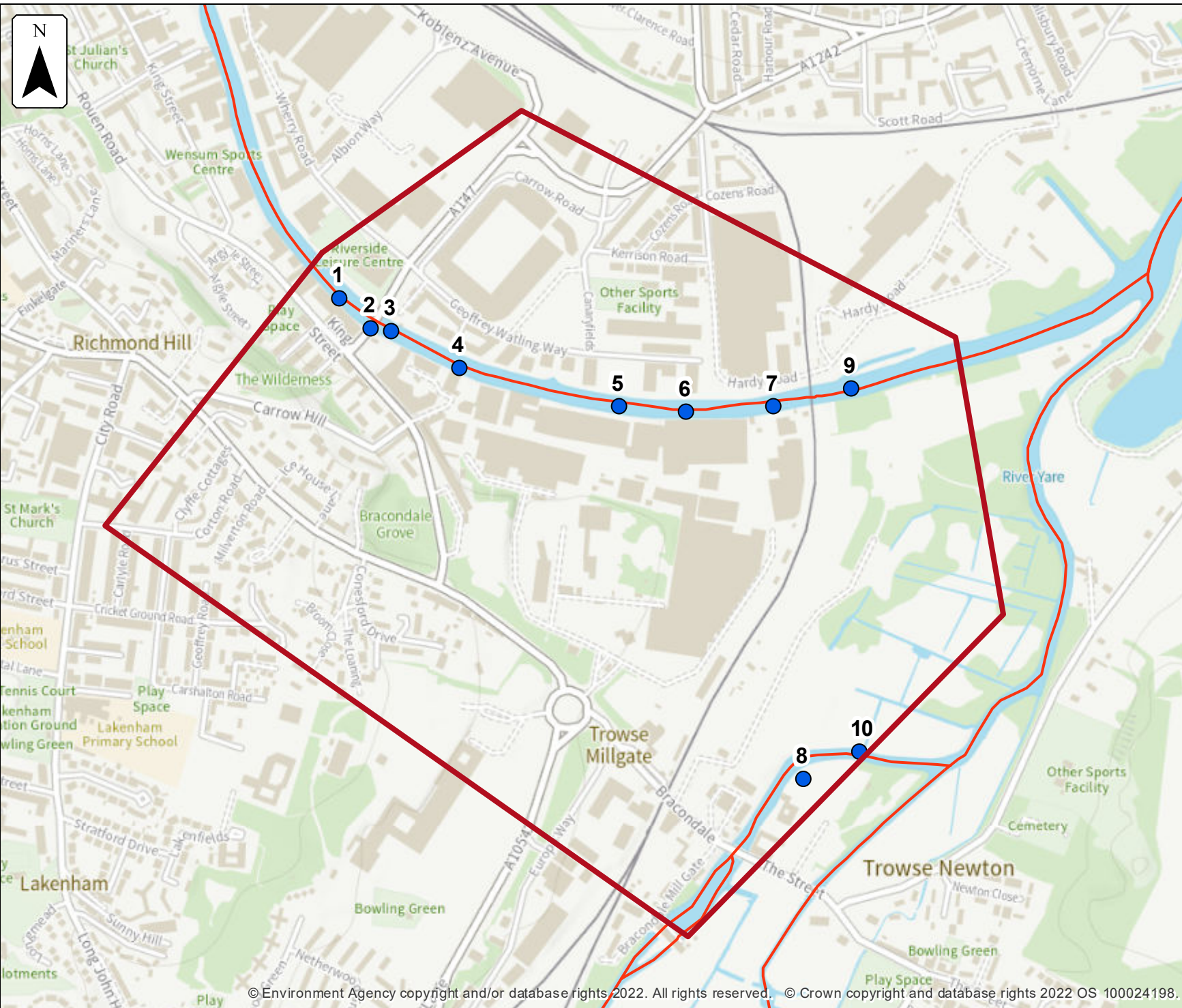
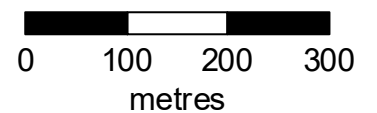
## Defences removed climate change modelled fluvial node locations

Location (easting/northing)  
**624223/307465**

Scale            Created  
**1:7,500            29 Mar 2022**

Model name  
**River Wensum,  
Norwich, Norfolk,**

-  Selected area
-  Modelled location
-  Main river



## Modelled node locations data

### Defences removed climate change

Label	Modelled location ID	Easting	Northing	1.0% AEP (+25%)		1.0% AEP (+35%)		1.0% AEP (+65%)		0.5% AEP (+25%)		0.5% AEP (+65%)		0.1% AEP (+20%)		0.1% AEP (+25%)	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	919059	623854	307767	2.26	92.58	2.32	96.29	2.53	124.95	2.40	107.90	2.83	156.61	2.96	171.17	2.67	144.06
2	919115	623901	307723	2.24	91.31	2.31	94.98	2.52	119.39	2.38	106.19	2.82	151.15	2.94	164.65	2.66	136.99
3	919311	623929	307720	2.20	92.32	2.26	95.98	2.45	123.97	2.34	107.48	2.74	156.78	2.85	170.01	2.59	143.42
4	919145	624030	307665	2.18	92.09	2.25	95.82	2.42	120.59	2.32	107.0	2.71	148.85	2.82	160.98	2.57	137.79
5	919091	624262	307611	2.13	91.98	2.20	95.56	2.36	120.89	2.28	106.88	2.62	149.51	2.73	161.10	2.50	138.07
6	918999	624359	307602	2.11	92.30	2.18	95.82	2.32	120.58	2.25	107.12	2.58	149.39	2.68	161.23	2.47	138.04
7	919212	624486	307610	2.10	87.38	2.16	90.84	2.30	114.28	2.24	101.39	2.54	140.76	2.64	152.59	2.45	130.56
8	919078	624530	307068	2.11	42.85	2.17	46.03	2.30	55.18	2.22	48.33	2.52	60.27	2.60	56.60	2.46	58.40
9	919213	624598	307636	2.09	88.80	2.16	92.29	2.29	115.49	2.23	102.98	2.54	143.22	2.63	155.36	2.44	132.01
10	919002	624609	307109	2.11	34.59	2.17	37.87	2.30	46.98	2.23	39.62	2.52	53.11	2.61	49.0	2.46	50.94

Data in this table comes from the River Wensum, Norwich, Norfolk, 2017 model.  
 Level values are shown in mAOD, and flow values are shown in cubic metres per second.  
 Any blank cells show where a particular scenario has not been modelled for this location.

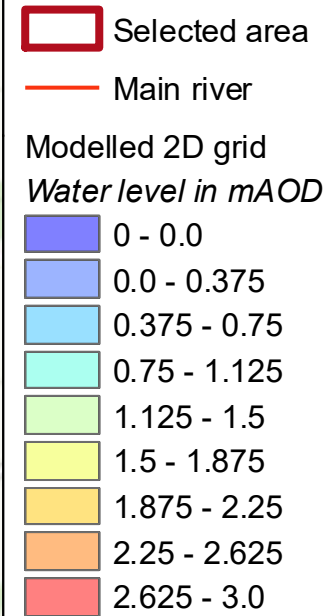


### Defended modelled fluvial extent and height

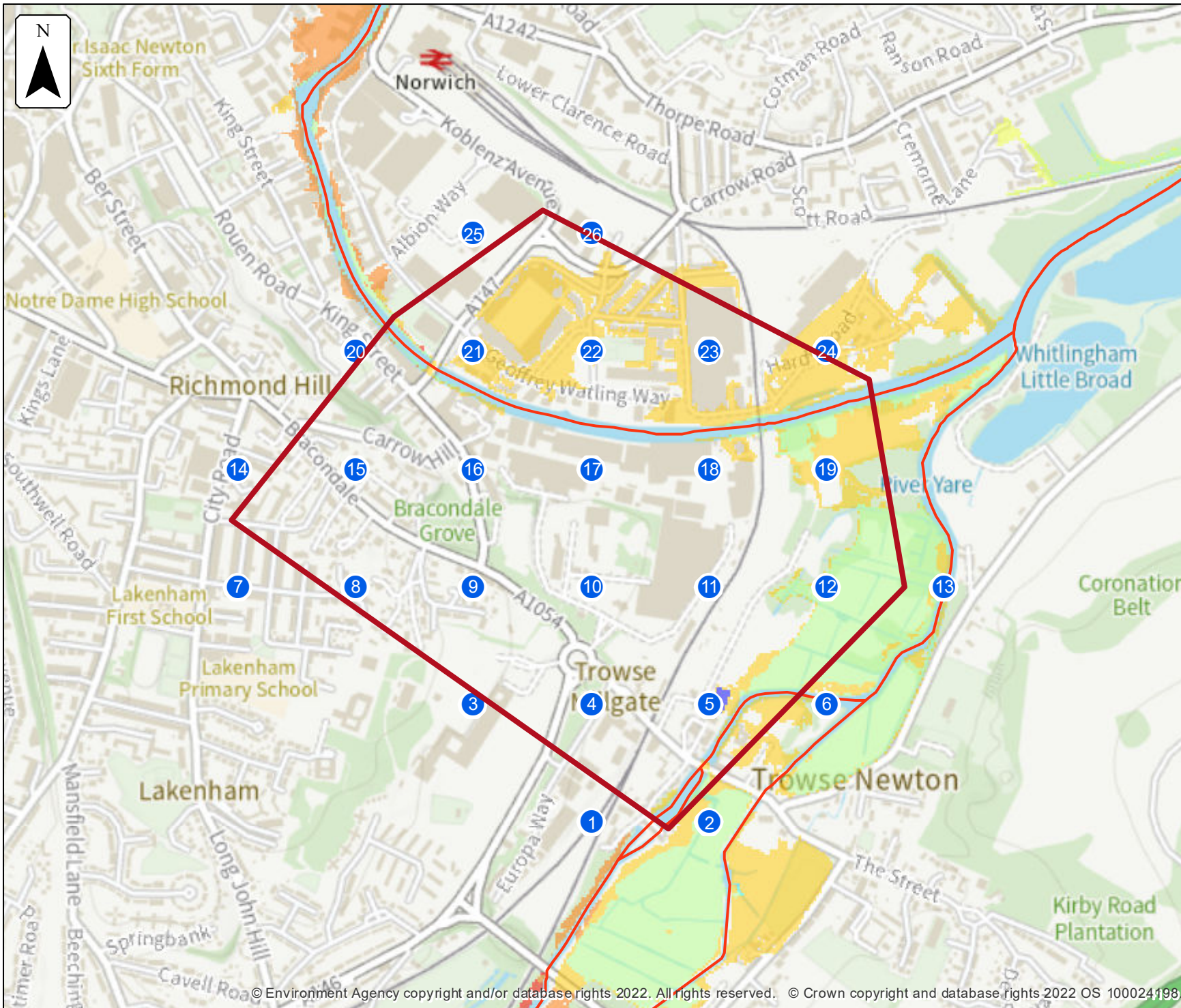
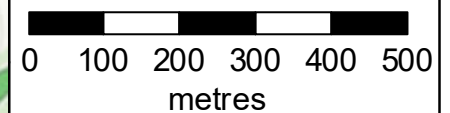
Location (easting/northing)  
**624223/307465**

Scale Created  
**1:10,000 29 Mar 2022**

Model name  
**River Wensum,  
Norwich, Norfolk,**



This map shows the 0.1% AEP height data



# Sample point data

## Defended

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP		
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	
1	624212	306855	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
2	624440	306855	0.73	1.64	0.86	1.77	0.91	1.82	0.94	1.85	0.52	1.43	0.56	1.47	
3	623984	307083	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
4	624212	307083	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
5	624440	307083	0.09	0	0.09	0	0.09	0	0.09	0	0.09	0	0.09	0	
6	624668	307083	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.40	2.08
7	623528	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
8	623756	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
9	623984	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
10	624212	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
11	624440	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
12	624668	307311	0.30	1.57	0.40	1.67	0.45	1.73	0.47	1.74	0.15	1.43	0.20	1.47	
13	624896	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
14	623528	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
15	623756	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
16	623984	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
17	624212	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
18	624440	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
19	624668	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.24	2.03
20	623756	307767	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
21	623984	307767	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.57	2.02
22	624212	307767	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.13	2.02
23	624440	307767	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
24	624668	307767	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.30	2.03
25	623984	307995	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
26	624212	307995	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Data in this table comes from the River Wensum, Norwich, Norfolk, 2017 model.

Height values are shown in mAOD, and depth values are shown in metres.

Any blank cells show where a particular scenario has not been modelled for this location.

Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.





### Defences removed modelled fluvial extent and height

Location (easting/northing)  
**624223/307465**

Scale Created  
**1:10,000 29 Mar 2022**

Model name  
**River Wensum,  
Norwich, Norfolk,**

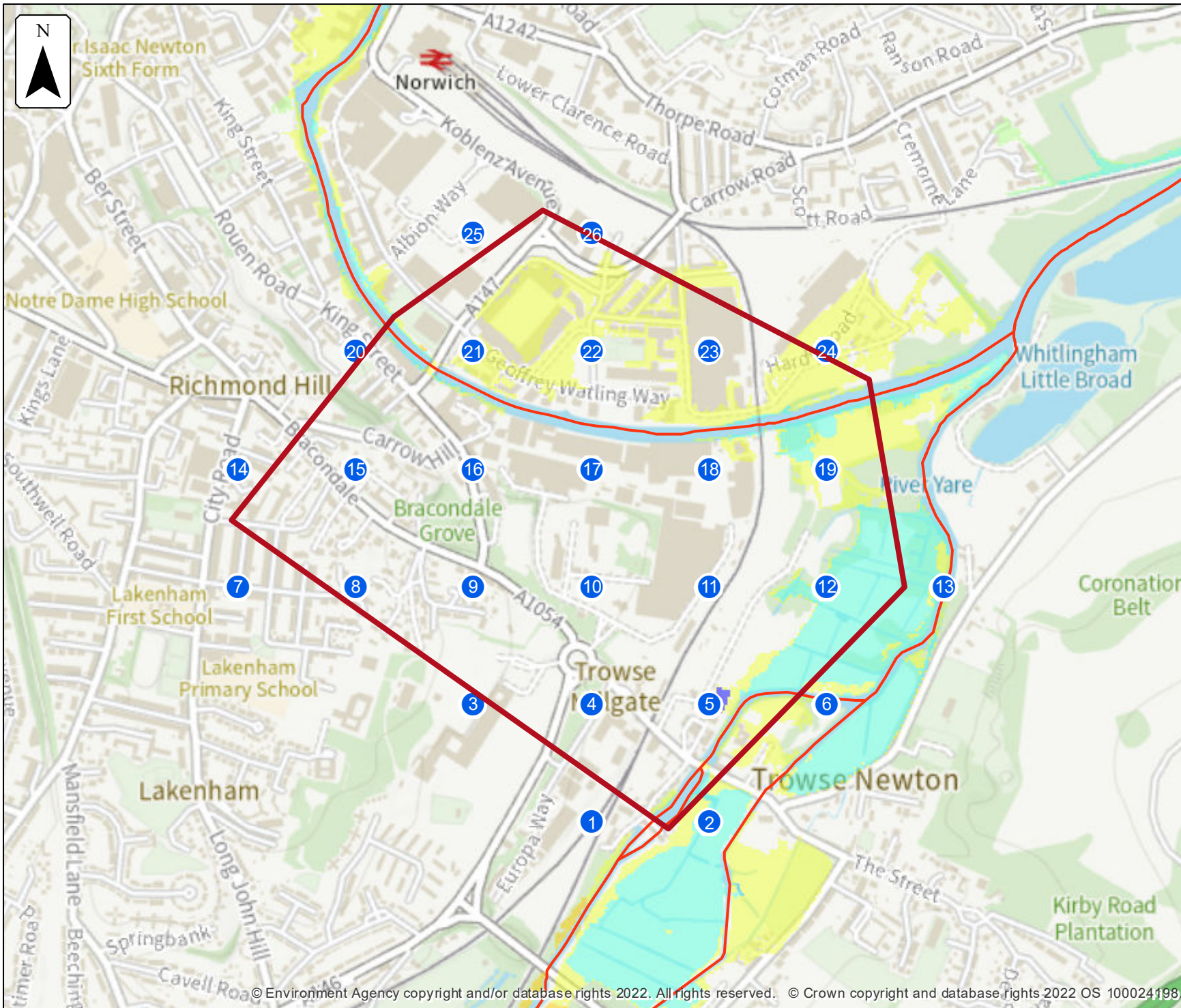
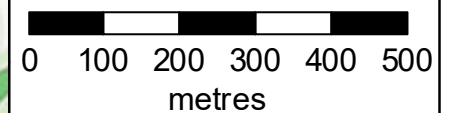
Selected area

Main river

Modelled 2D grid  
Water level in mAOD

- 0 - 0.0
- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0

This map shows the  
0.1% AEP height data



# Sample point data

## Defences removed

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP		
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	
1	624212	306855	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
2	624440	306855	0.43	1.34	0.86	1.77	0.91	1.82	0.94	1.85	1.04	1.95	0.56	1.47	
3	623984	307083	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
4	624212	307083	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
5	624440	307083	0.09	0	0.09	0	0.09	0	0.09	0	0.09	0	0.09	0	
6	624668	307083	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.40	2.08
7	623528	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
8	623756	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
9	623984	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
10	624212	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
11	624440	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
12	624668	307311	0.07	1.34	0.40	1.67	0.45	1.72	0.47	1.74	0.57	1.84	0.20	1.47	
13	624896	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
14	623528	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
15	623756	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	
16	623984	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
17	624212	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
18	624440	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
19	624668	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.25	2.04
20	623756	307767	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
21	623984	307767	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.58	2.03
22	624212	307767	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.13	2.03
23	624440	307767	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
24	624668	307767	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.31	2.04
25	623984	307995	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
26	624212	307995	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Data in this table comes from the River Wensum, Norwich, Norfolk, 2017 model.

Height values are shown in mAOD, and depth values are shown in metres.

Any blank cells show where a particular scenario has not been modelled for this location.

Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.



# Defended climate change modelled fluvial extent and height

Location (easting/northing)  
**624223/307465**










Scale Created  
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Model name  
**River Wensum, Norwich, Norfolk,**

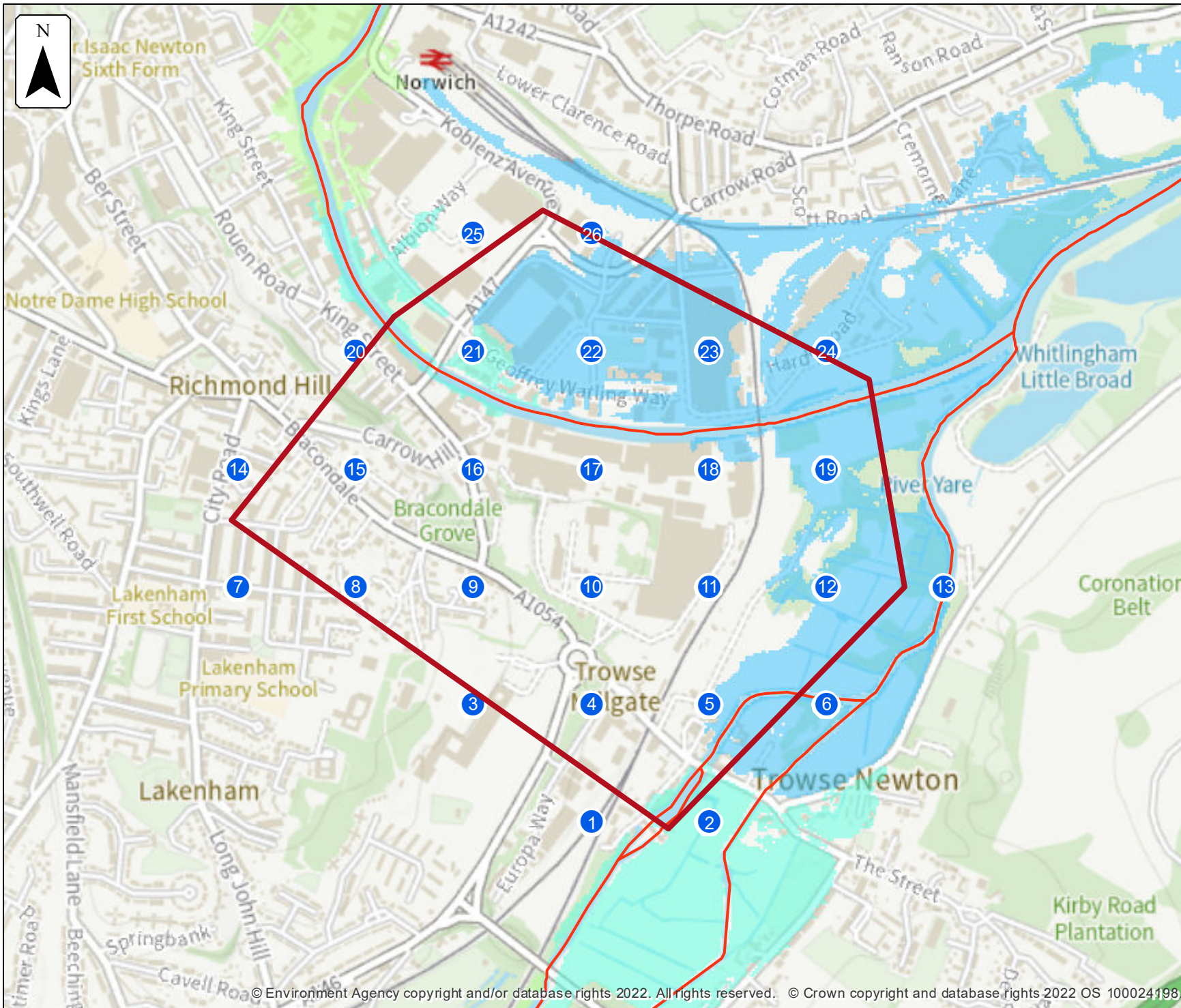
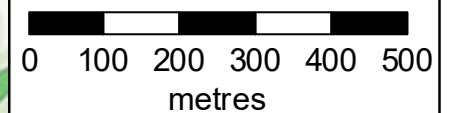
 Selected area

 Main river

Modelled 2D grid  
Water level in mAOD

-  0 - 2.0
-  2.0 - 2.25
-  2.25 - 2.5
-  2.5 - 2.75
-  2.75 - 3.0
-  3.0 - 3.25
-  3.25 - 3.5
-  3.5 - 3.75
-  3.75 - 4.0

This map shows the 0.1% AEP +25% height data



# Sample point data

## Defended climate change

Label	Easting	Northing	1% AEP (+20%)		1% AEP (+25%)		1% AEP (+35%)		1% AEP (+65%)		0.5% AEP (+20%)		0.5% AEP (+25%)		0.5% AEP (+35%)		0.5% AEP (+65%)		0.1% AEP (+20%)		0.1% AEP (+25%)		
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth
1	624212	306855	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
2	624440	306855	1.26	2.17	1.30	2.21	1.36	2.27	1.53	2.44	1.38	2.29	1.42	2.33	1.50	2.41	1.74	2.65	1.64	2.55	1.70	2.61	
3	623984	307083	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
4	624212	307083	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
5	624440	307083	2.02	2.07	2.06	2.11	2.11	2.16	2.25	2.30	2.13	2.18	2.17	2.22	2.23	2.29	2.47	2.52	2.35	2.41	2.41	2.46	
6	624668	307083	0.39	2.07	0.43	2.11	0.48	2.16	0.62	2.29	0.50	2.18	0.54	2.22	0.61	2.28	0.84	2.52	0.72	2.40	0.78	2.46	
7	623528	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
8	623756	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
9	623984	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
10	624212	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
11	624440	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
12	624668	307311	0.80	2.07	0.83	2.10	0.89	2.16	1.02	2.29	0.91	2.18	0.95	2.22	1.01	2.28	1.25	2.52	1.13	2.40	1.18	2.45	
13	624896	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
14	623528	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
15	623756	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
16	623984	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
17	624212	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
18	624440	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
19	624668	307539	0.25	2.04	0.29	2.08	0.35	2.13	0.49	2.27	0.38	2.16	0.41	2.20	0.47	2.26	0.73	2.51	0.59	2.37	0.64	2.42	
20	623756	307767	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
21	623984	307767	0.56	2.01	0.62	2.07	0.71	2.16	0.94	2.40	0.76	2.20	0.80	2.26	0.92	2.37	1.24	2.68	1.02	2.47	1.09	2.54	
22	624212	307767	0.11	2.01	0.17	2.07	0.25	2.15	0.45	2.35	0.29	2.19	0.34	2.23	0.43	2.33	0.71	2.61	0.52	2.42	0.59	2.49	
23	624440	307767	NoData	NoData	NoData	NoData	NoData	NoData	0.01	2.31	NoData	NoData	NoData	NoData	NoData	NoData	0.27	2.56	0.09	2.38	0.16	2.45	
24	624668	307767	0.31	2.04	0.35	2.08	0.40	2.13	0.54	2.27	0.43	2.16	0.47	2.20	0.53	2.26	0.78	2.51	0.64	2.37	0.69	2.42	
25	623984	307995	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.11	2.74	NoData	NoData	NoData	NoData	
26	624212	307995	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Data in this table comes from the River Wensum, Norwich, Norfolk, 2017 model.  
Height values are shown in mAOD, and depth values are shown in metres.  
Any blank cells show where a particular scenario has not been modelled for this location.  
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.

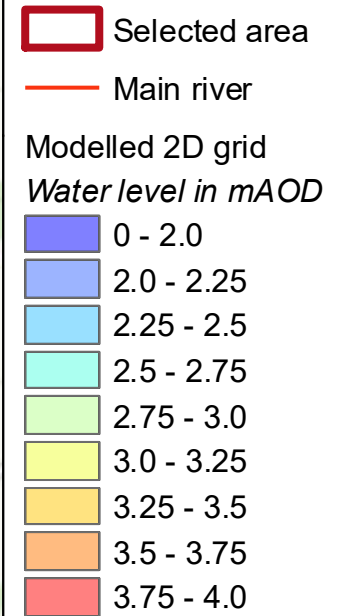


# Defences removed climate change modelled fluvial extent and height

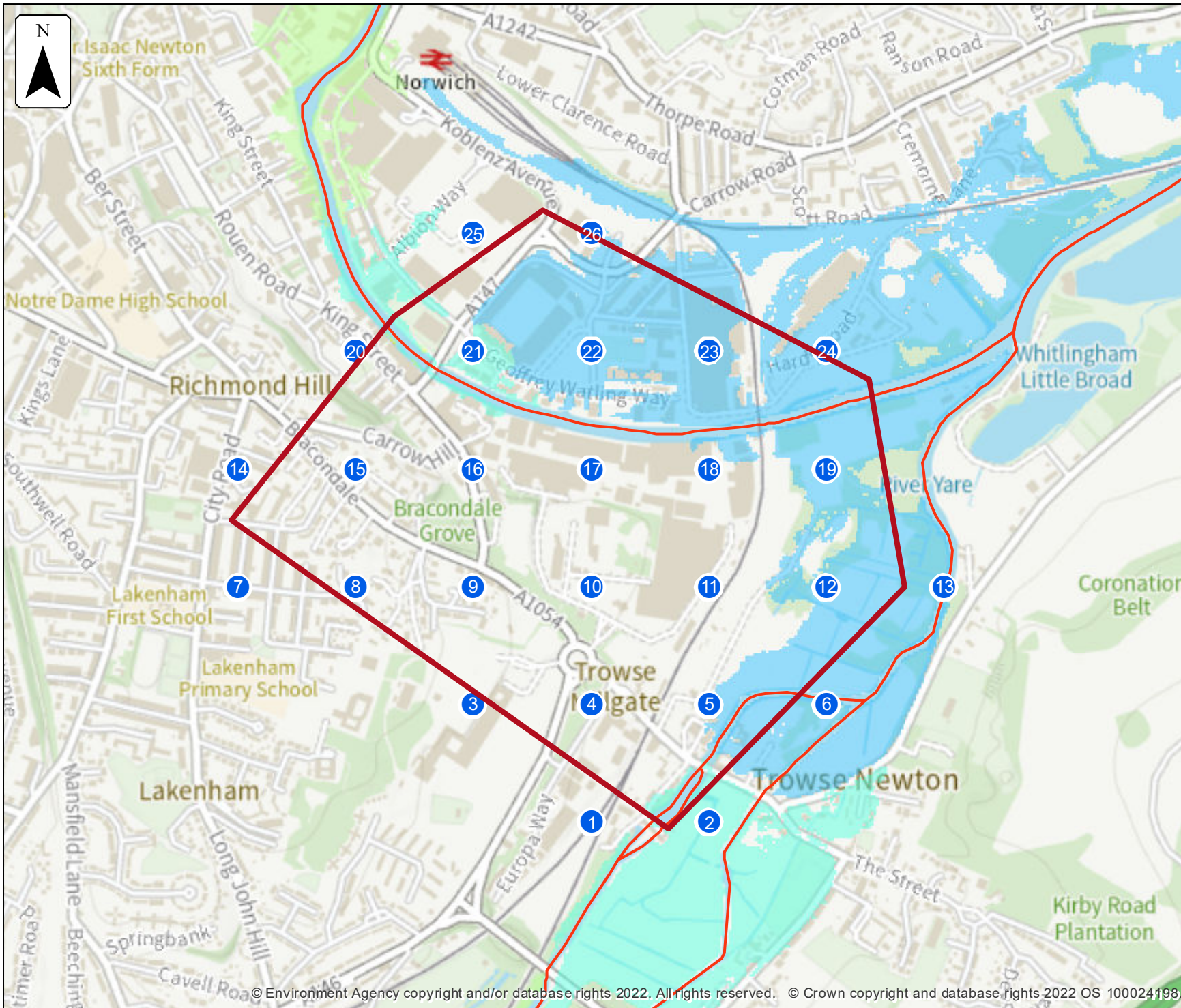
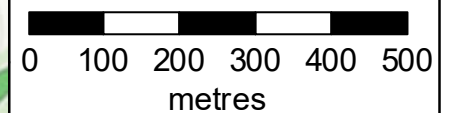
Location (easting/northing)  
**624223/307465**

Scale Created  
**1:10,000 29 Mar 2022**

Model name  
**River Wensum,  
Norwich, Norfolk,**



This map shows the  
0.1% AEP +25% height data



# Sample point data

## Defences removed climate change

Label	Easting	Northing	1% AEP (+25%)		1% AEP (+35%)		1% AEP (+65%)		0.5% AEP (+25%)		0.5% AEP (+65%)		0.1% AEP (+20%)		0.1% AEP (+25%)	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
1	624212	306855	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
2	624440	306855	1.30	2.21	1.37	2.28	1.54	2.45	1.43	2.34	1.74	2.65	1.64	2.55	1.70	2.61
3	623984	307083	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
4	624212	307083	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
5	624440	307083	2.06	2.11	2.12	2.17	2.25	2.30	2.17	2.22	2.47	2.52	2.35	2.41	2.41	2.46
6	624668	307083	0.43	2.11	0.49	2.17	0.62	2.29	0.54	2.22	0.84	2.52	0.72	2.40	0.78	2.46
7	623528	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
8	623756	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
9	623984	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
10	624212	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
11	624440	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
12	624668	307311	0.83	2.11	0.89	2.16	1.02	2.29	0.95	2.22	1.25	2.52	1.13	2.40	1.19	2.46
13	624896	307311	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
14	623528	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
15	623756	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
16	623984	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
17	624212	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
18	624440	307539	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData



Label	Easting	Northing	1% AEP (+25%)		1% AEP (+35%)		1% AEP (+65%)		0.5% AEP (+25%)		0.5% AEP (+65%)		0.1% AEP (+20%)		0.1% AEP (+25%)	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
19	624668	307539	0.29	2.08	0.36	2.14	0.49	2.27	0.42	2.20	0.73	2.51	0.59	2.37	0.64	2.43
20	623756	307767	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
21	623984	307767	0.63	2.08	0.72	2.17	0.94	2.39	0.81	2.26	1.23	2.68	1.02	2.47	1.09	2.55
22	624212	307767	0.18	2.08	0.26	2.16	0.45	2.35	0.34	2.24	0.71	2.61	0.52	2.42	0.59	2.49
23	624440	307767	NoData	NoData	NoData	NoData	0.01	2.30	NoData	NoData	0.27	2.56	0.09	2.38	0.16	2.45
24	624668	307767	0.35	2.08	0.41	2.14	0.54	2.27	0.47	2.20	0.78	2.51	0.64	2.37	0.69	2.42
25	623984	307995	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.11	2.74	NoData	NoData	NoData	NoData
26	624212	307995	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Data in this table comes from the River Wensum, Norwich, Norfolk, 2017 model.

Height values are shown in mAOD, and depth values are shown in metres.

Any blank cells show where a particular scenario has not been modelled for this location.

Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.

## Strategic flood risk assessments

We recommend that you check the relevant local authority's strategic flood risk assessment (SFRA) as part of your work to prepare a site specific flood risk assessment.

This should give you information about:

- the potential impacts of climate change in this catchment
- areas defined as functional floodplain
- flooding from other sources, such as surface water, ground water and reservoirs

## About this data

This data has been generated by strategic scale flood models and is not intended for use at the individual property scale. If you're intending to use this data as part of a flood risk assessment, please include an appropriate modelling tolerance as part of your assessment. The Environment Agency regularly updates its modelling. We recommend that you check the data provided is the most recent, before submitting your flood risk assessment.

## Flood risk activity permits

Under the Environmental Permitting (England and Wales) Regulations 2016 some developments may require an environmental permit for flood risk activities from the Environment Agency. This includes any permanent or temporary works that are in, over, under, or nearby a designated main river or flood defence structure.

[Find out more about flood risk activity permits](#)

## Help and advice

Contact the East Anglia Environment Agency team at [enquiries\\_eastanglia@environment-agency.gov.uk](mailto:enquiries_eastanglia@environment-agency.gov.uk) for:

- [more information about getting a product 5, 6, 7 or 8](#)
- general help and advice about the site you're requesting data for

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## Appendix E – Flood Risk Mitigation Technical Design Note

Project name	East Norwich		
Design note title	Flood Risk - Mitigation Options		
Document reference	16650-HYD-XX-XX-TN-FR-0000 P02		
Author	Simon Mirams		
Revision	P02		
Date	15 March 2022	Approved	✓

## 1. INTRODUCTION

The East Norwich Masterplan is being developed to support the Site Allocation for up to 4,000 homes and 6,000 jobs within the Greater Norwich Local Plan. The Masterplan area is comprised of four parcels of land, they are as below and as shown on Figure 1.

- The Carrow Works site;
- The Deal Ground;
- May Gurney, and
- The Utilities Site.

This technical note details works undertaken by Hydrock to both quantify the existing level of risk to the site from fluvial and tidal sources but also to determine what level of mitigation is required to ensure the development can meet the requirements of National Planning Policy Framework (NPPF) and the Environment Agency (EA) whilst still providing the required housing numbers. In order to meet these requirements this note explains mitigation measures that have been modelled to ensure that the development proposals are 'safe' whilst resulting in no increase in flood risk to third party land.

The post development scenarios investigated has used the emerging masterplan drawing (Ref 20118\_AAM\_SK\_027) that has been prepared and issued by Allies and Morrison. This document has been prepared through detailed discussions and has incorporated all of the recommendations as detailed within previous Hydrock reports (ref - 16650-HYD-XX-XX-RP-FR-0001-P01 and 16650-HYD-XX-XX-RP-FR-0003-P01). In addition, the principles discussed in the Hydrock report have been discussed with the EA and Norwich City Council to determine acceptability. Following the meeting the scope of post development scenario modelling was verbally agreed along with some additional EA/NCC requirements and these, where possible, have been addressed/included within this note.

All measures being proposed are for measures to be provided within the site boundary to suitably manage/redistribute flows such that all development is safe and in line with National Guidance but also ensure no detrimental impact on flood risk elsewhere and, where possible, provide a betterment.

## 2. BASELINE MODEL AND UPDATES

### 2.1 Introduction

A request for product 6 and 7 data was made to the EA in December 2021 for the River Wensum Catchment Model Review and Update study which was published in May 2017. Through discussions the EA have confirmed that the modelling study is fit for purpose with the only updates/alterations needed being to reflect the latest climate change allowances. The latest updates were made in August 2021 and as such the model does not include for these. These values were discussed and agreed with the EA at a meeting in December 2021 and it is these that have been used within the modelling.

A review of the existing model has confirmed that the River Wensum is tidally influenced up to New Mills in Norwich (622616, 309026) and Trowse Mill on the River Yare which is upstream of the site. As such the model includes both fluvial and tidal inflows to ensure the interaction is suitably represented. A schematic of the tidal limit of the Wensum and provided model is shown in figure 1 and 2 below.

Whilst the site is within an area that is tidally influenced it has been confirmed with the EA that any post development scenario focus on ensuring the fluvial events are suitably managed/compensated within the site boundary. This is not to say the risks from tidal sources are to be ignored but just that compensation storage etc is not required and the impact of fluvially dominant flood events is considered worse in this area. As such the design event for the purposes of this note is the 1 in 100 year plus climate change fluvial event. This was agreed with the EA at a December 2021 meeting and confirmed via email in February 2022.

Figure 1: Site location and extent of tidal influence

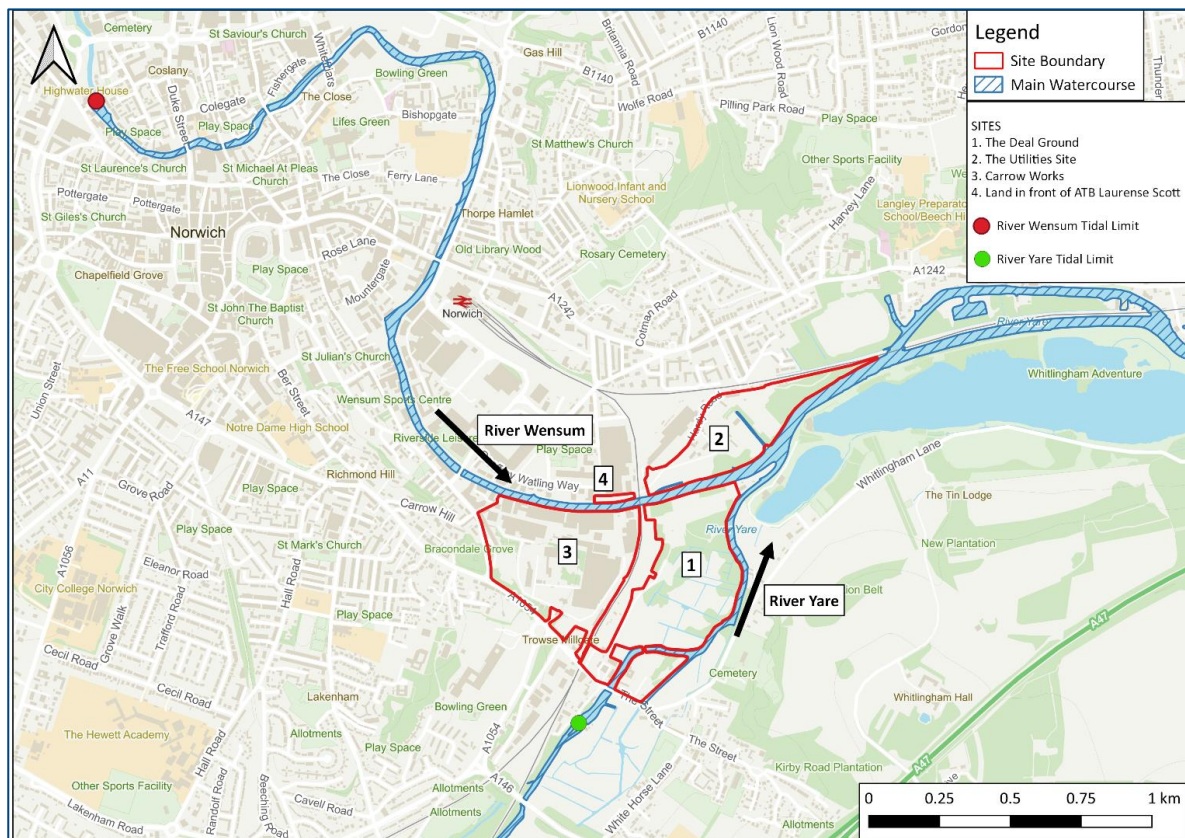
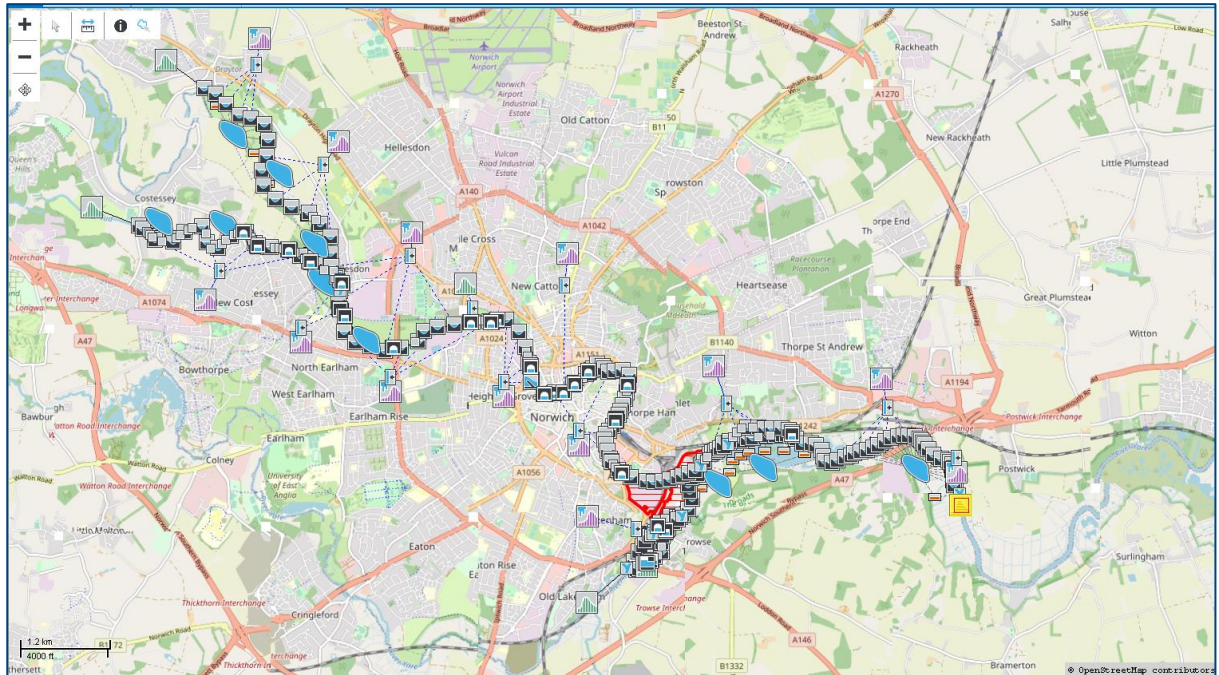


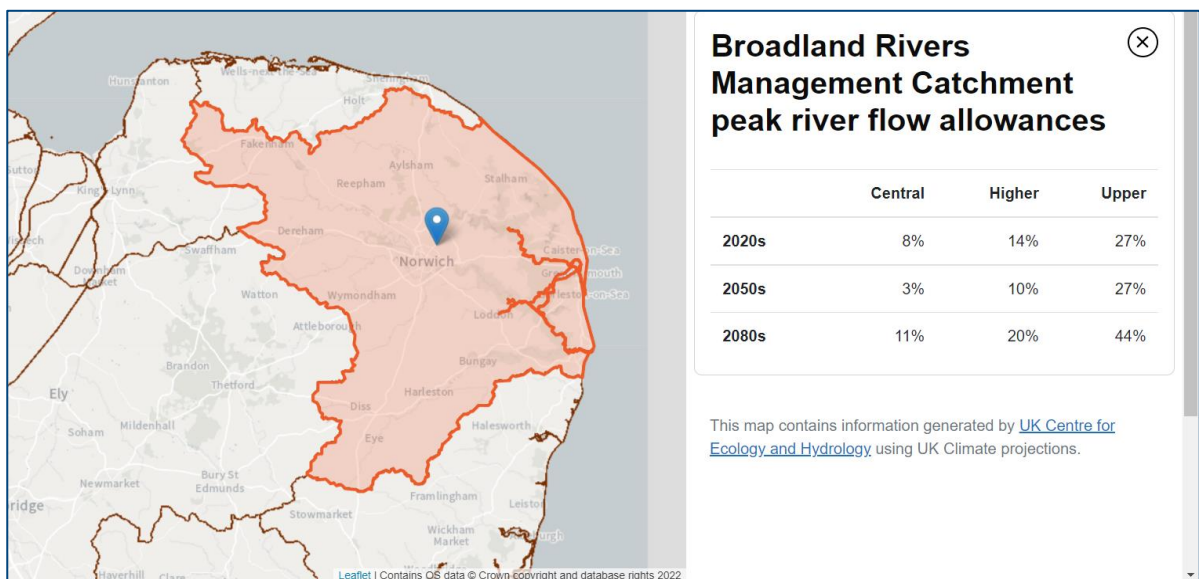
Figure 2: EA 2017 Wensum Model Schematic (Masterplan area shown in hashed red)



## 2.2 Climate Change Allowances - Fluvial

As discussed, the provided modelling was undertaken in 2017 and does not make reference to the latest climate change allowances and, as such, these require updating. Current DEFRA Climate change guidance provides uplifts to peak river flows based on the wider river management catchment that the watercourse is located within. Norwich and the surrounding area are located within the Broadland Rivers Management Catchment area. Figure 3 below is an extract from the DEFRA website and displays the peak river flow uplifts to be applied for this catchment.

Figure 3 Climate Change Uplifts for Broadlands Management Catchment



Current guidance indicates that the uplift allowance to be used, should be based on the flood risk vulnerability classification of the development as per Annex 3 of the National Planning Policy Framework (NPPF) and what flood zone the development is located within when referring to the

existing flood mapping. The proposed masterplan is comprised of mixed development uses, including residential and commercial which are classed as "More Vulnerable" and "Less Vulnerable" respectively within Annex 3. For both these classifications it is appropriate to use the central allowance.

It also states that for strategic flood risk assessments, both the central and higher central allowances should be assessed. Therefore, for assessing the baseline flood risk scenario, two climate change uplift simulations have been assessed with both 11% and 20% uplifts to the previously modelling 100yr fluvial flows having been applied. Given this, and in order to adopt a conservatory approach where possible the design event for assessing mitigation measures is the 1 in 100year plus 20% climate change event with existing tidal levels. This has been agreed with the EA and no further changes have been made to the hydrology within the provided modelling.

## 2.3 Climate Change Allowances - Tidal

As stated previously, the River Wensum and River Yare are tidally influenced. Therefore, any allowances for climate change should also take into account any changes to sea levels that are predicted to occur. Current guidance provides annual uplift rates to existing sea levels based on the river basin district that the proposed development is located within. Norwich is located within the Anglian district.

Figure 4: Extract of Guidance on Sea level uplift allowances

**Table 2: sea level allowances by river basin district for each epoch in mm for each year (based on a 1981 to 2000 baseline) – the total sea level rise for each epoch is in brackets**

Area of England	Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
Anglian	Higher central	5.8 (203)	8.7 (261)	11.6 (348)	13 (390)	1.20
Anglian	Upper end	7 (245)	11.3 (339)	15.8 (474)	18.1 (543)	1.60
South east	Higher central	5.7 (200)	8.7 (261)	11.6 (348)	13.1 (393)	1.20
South east	Upper end	6.9 (242)	11.3 (339)	15.8 (474)	18.2 (546)	1.60

This guidance states that for flood risk assessments and strategic flood risk assessments, both the higher central and upper end allowances should normally be assessed. Based on the assumption of a construction start date of 2025 and that the design life of the Masterplan area would be 100 years, this would equate to an uplift to the existing peak tide levels of 1.10m and 1.41m for the higher central and upper end allowances respectively. Whilst model runs for these events have been undertaken these are not being used as a design event, with this being the fluvial events as detailed in Section 2.3. Whilst this is the case, the modelled flood depths will be used in informing on site mitigation measures given the potential risks from this source.

## 2.4 Climate Change Uplifts Conclusion

It was agreed in February 2022 at a meeting with the EA (and confirmed by email), that flood depths predicted during a modelled scenario where both the river inflows and tide levels were updated for

climate change would not be required as this would, if anything, be an overestimation of flood levels at the site. Results generated from the 2017 study indicate that the modelled peak tidal flood levels are lower than the equivalent fluvial flood levels for all return periods. For this reason, the climate change scenario used for assessing the baseline predevelopment flood risk, is the 1% AEP + 20% climate change uplift fluvial event, combined with the present day tidal event.



## 3. CONFIRMATION OF THE EXISTING SITUATION

To assess the existing level of flood risk the following event simulations have been completed:

- 1 in 20yr, 5% AEP (Flood Zone 3b)
- 1 in 100yr, 1 % AEP (Flood Zone 3a)
- 1 in 100yr + 20% climate change uplift
- 1 in 1000yr, 0.1% AEP (Flood Zone 2)

The baseline model generated outlines that match those currently shown on the Flood Map for Planning for both the 1 in 100 year (Flood Zone 3) and 1 in 1,000 year (Flood Zone 2) events as shown in Figure 5 below. This confirms that the model is in working order and the existing flood zones are repeatable. Given the approved nature of the EA's model this gives confidence in the generated outputs for both the 1 in 20 year and 1 in 100 year plus 20% events. The 1 in 20 year and 1 in 100 year plus 20% outlines are shown in Figure 6 and 7 below and shows the predicted extents at the site for each event.

Figure 5: Flood Map for Planning

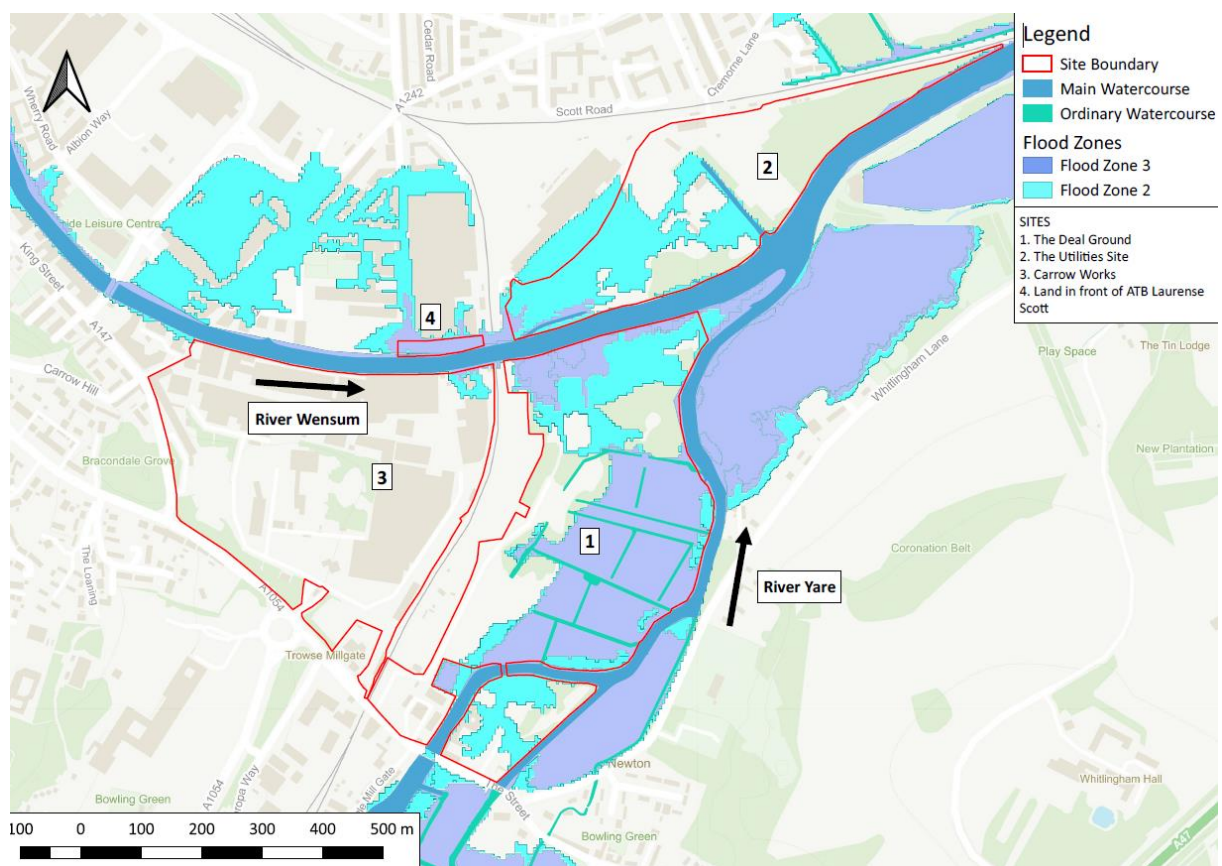


Figure 6: 1 in 100yr plus 20% fluvial flood extents.

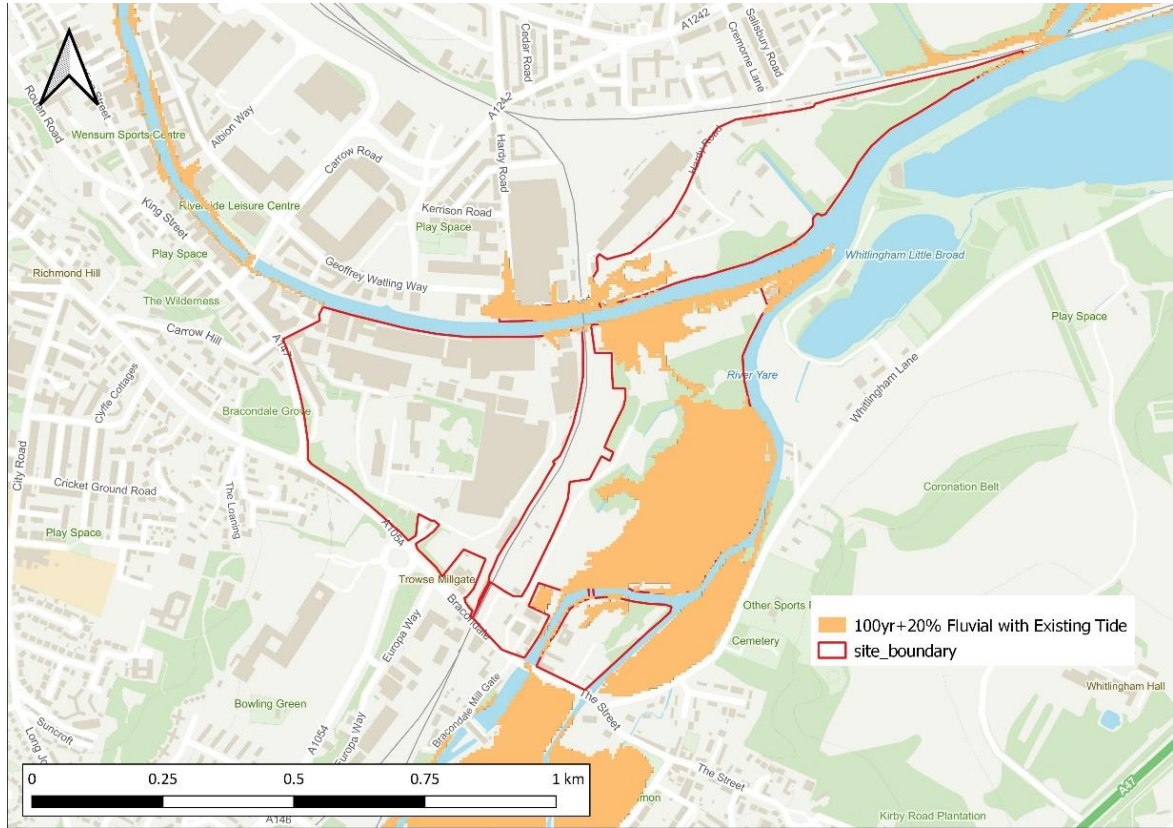
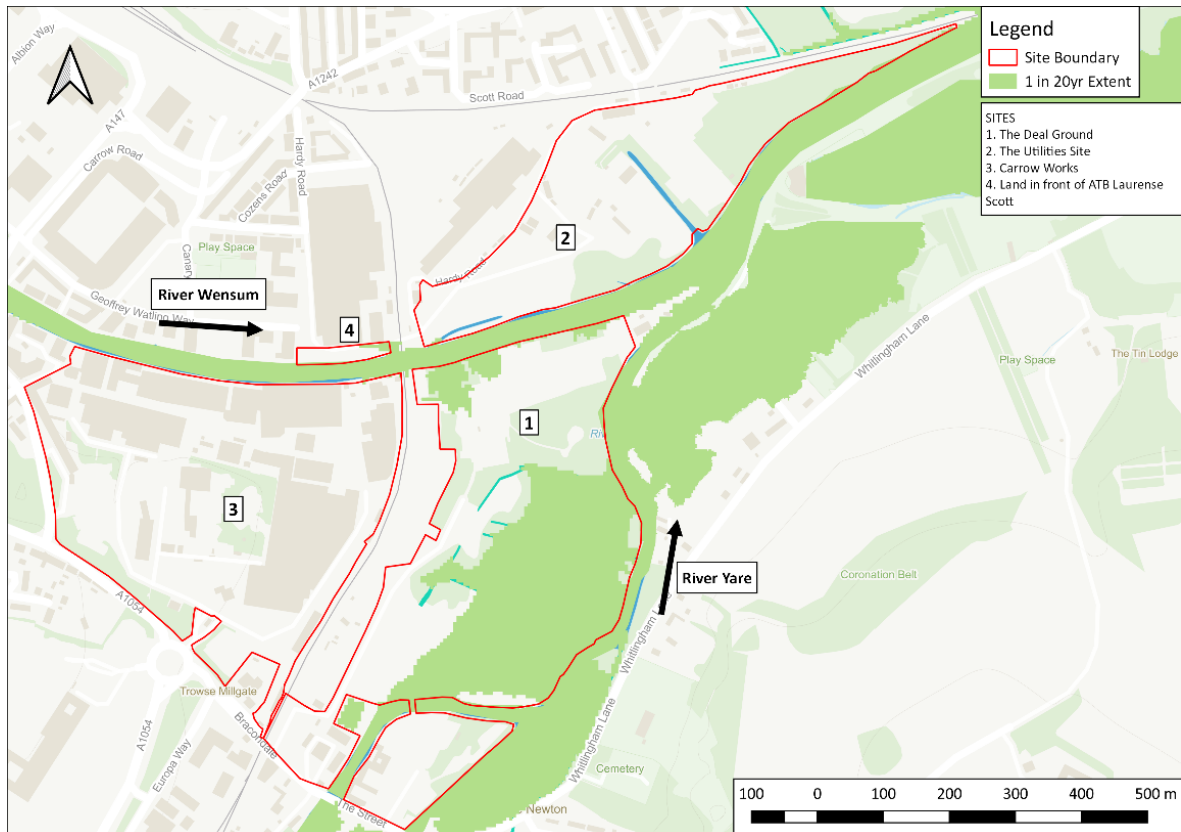


Figure 7: 1 in 20 year flood extent (approx. red line plan shown)



These outputs have shown the following:

- a. The Deal Ground - the northern and eastern sections of this parcel are shown as being at high and medium risk (Flood Zones 3 and 2 respectively). Much of the areas of Flood Zone 3 are shown to be around the (expected) lower lying areas to the east that are crossed by a series of land drainage ditches. Another smaller area of Flood Zone 2 is shown to affect a line along the northern boundary of this parcel. The area at medium risk is predominantly along the northern site boundary but this extends to provide connectivity into the lower lying eastern section of the site. As shown in Figure 7, the eastern and northern limit as shown as being inundated during the 1 in 20 year event and therefore within Flood Zone 3b: Functional Floodplain. The updated modelling shows that whilst climate change allowances have increased the extent of flooding these are not significant with the majority of flooding being limited to the existing pattern with floodplains for both watercourses being kept separate with flooding from the River Yare being contained within the lower lying areas to the south east and the flooding associated with the River Wensum being restricted to the northern boundaries of the site. That said the inclusion of climate change values has shown a small area of flooding that connects the two floodplains. This flows from the River Wensum in a southerly direction before draining into the lower lying area of land adjacent to the River Yare.
- b. Utilities Sites - The western sections of this site are shown as being almost entirely at medium risk and within Flood Zone 2. Small areas of Flood Zone 3 (High Risk) are identified at the south western boundary and immediately adjacent to the River Wensum. The impacts of climate change have resulted in an increase in flood extents within the site but these are contained within the south western limit of the site.
- c. Carrow Works & Carrow House - This parcel is shown as being entirely within Flood Zone 1 and at 'low' risk from fluvial and tidal flooding. In being classified as this Flood Zone it is considered that site levels are suitably raised above the extreme fluvial and tidal flood events.
- d. ATB Laurence Scott Land - This parcel is shown as being entirely within Flood Zone 3 and at high risk from fluvial/tidal flooding. This is the same when climate change allowances are included, this site is entirely within this flood extent.

The provided mapping has included the 1 in 100 year plus climate change event as these are not shown on the EA's Flood Map for Planning but Figure 6 confirms that during such an event large portions of the site are shown to be affected. A summary of the flood levels is shown in Table 1 below.

*Table 1: Flood Levels - taken from onsite. NOTE - flood levels are consistent across the site due to flat topography.*

Event	River Wensum Flood Level (m AOD)	River Yare Flood Level (m AOD)
1 in 100 year	1.66	1.74
1 in 100year plus 20% CC	1.78	1.83
1 in 1000 year	2.02	2.07

The review of the baseline model, and inclusion of the latest climate change allowances has confirmed that the above summary of fluvial flood risk is an accurate representation of flood risk to the site. This also confirms that the existing flood extents shown on the Flood Map for Planning are correct and confirms where mitigation measures are required - i.e., mostly within the Deal Ground.

## 4. PROPOSED MITIGATION

Given the confirmation that section of the Deal Ground is at high risk of fluvial flooding (all modelled events) mitigation measures are required in order to ensure the proposed development could be achieved safely whilst resulting in no detrimental impact to third party land - i.e., be policy compliant.

Previous reports prepared by Hydrock (ref 16650-HYD-XX-XX-RP-FR-0001-P01) have outlined principles of mitigation. These include the lowering of river frontage areas and use of proposed marinas in order to provide 'blue corridors' through the proposed development and ensure any flooding maintains connectivity with the existing watercourses. In addition, some localised areas are likely to need to be lowered in order to provide required compensation storage.

The above approach was discussed with the EA and Norwich City Council and it was agreed that all measures outlined were sound and a reasonable approach. However, the main comment from the EA was in relation to development being proposed within the Functional Floodplain. The EA's position was that whilst ground raising in these areas of risk are not necessarily in line with NPPF the EA stated that if areas of Flood Zone 3b could be managed by ground lowering only, then they would be happy to consider the proposals.

As part of previous discussions reservations were made by Norwich City Council as to the efficiency of the marinas in providing compensation storage. Their concerns related to how the additional storage from the marinas would be quantified owing to other issues (ground water, existing river levels etc). As such, and for the purposes of this assessment the marinas have been included but with a 'water level'. In the absence of the provided modelling including a 1 in 2-year levels this was assumed as being 100mm below the modelled 1 in 20-year level in order to, where possible, adopt a conservative approach and ensure no overestimation of available storage is made.

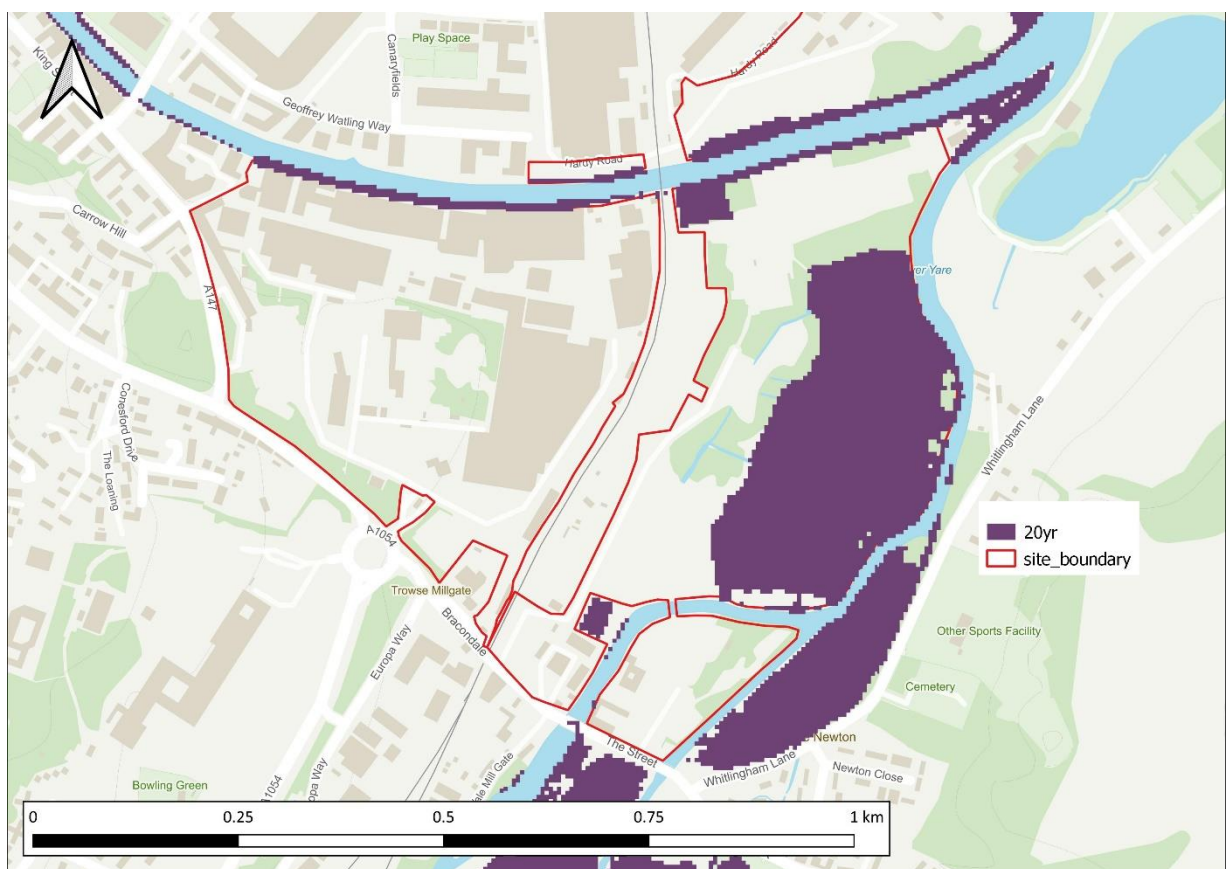
### 4.1 Ground lowering

In line with EA requirements ground lowering only was investigated to redistribute the 1 in 20-year flood extent away from areas earmarked for development. In order to achieve this the river frontage through all parcels was lowered. This was lowered to a level of 1.4m AOD through the wider site area and extended 10m through the development site on both sides of the River Wensum. The 10m wide corridor was considered consistent with the typical easement requirement and through the lowering of this it maintained an access route for management and maintenance whilst also provide a pedestrian link to the watercourse (i.e., provide a wider use for flood compensation areas). It should be noted that the model resolution is at 5m and as such, modelling at 8m width would have effectively resulted in a 10m wide corridor due to modelling constraints and this is why a 10m width was used.

The river corridor areas have been lowered to an elevation of 1.4m AOD with the marinas, as stated, being a maximum of 100mm below these levels and at a level of 1.3m AOD. In setting ground levels to this level, it ensured storage would be mobilised during the 1 in 20-year event but not at events smaller than this so as to ensure the amenity use of the area remains.

On review of the model outputs, it was evident that whilst lowering of the river frontages and inclusion of marinas provided a significant amount of flood storage and redistributed the majority of the Functional Floodplain, there were some localised areas within the Deal Ground parcel that are currently at a level lower than the modelled 1 in 20-year flood level (and lower than 1.3m AOD). These areas are adjacent to the proposed marina at the north western limit of the site and adjacent to the water meadows to the west. As such, and given further lowering of the river frontages was not possible (for operational reasons - i.e., it would be in flood too frequently) localised areas of raising were required to prevent 1 in 20-year flood outlines extending into the site. However, in order to meeting EA requirements these were kept to an absolute minimum. Figure 8 shows the 1 in 20-year output for both the lowering of the river frontages and localised raising.

Figure 8: 1 in 20-year flood extent with post development mitigation in place (approx. red line plan shown)



## 4.2 Ground raising

In line with general approach the EA have agreed that it would be acceptable to raise areas within the 1 in 100-year and 1 in 100-year plus climate change event provided suitable compensation storage was provided within the site boundary. As such, it was proposed for development parcels to be raised so as to ensure all development is set above and outside these events.

Through modelling of the proposed raising, an area of high ground to the northern area of the water meadow within the Deal Ground site has been identified as being outside any proposed development, proposed for public open space and outside the flood extents. As such, and in order to compensate for lost storage as a result of the proposed ground raising, this area was lowered to a level of 1.1m AOD to provide connectivity to the water meadow but also provide compensation floodplain storage. In setting the land lowering this has been aimed at limiting the ground raising required. However there has been a

need to raise proposed development parcels to a level of 2m AOD based on the current modelling (which equates to a maximum raise of circa 400mm - subject to confirmation of site levels). In setting development at this level it ensures all finished floor levels are raised a minimum of 300mm above the 100-year plus climate change flood level of 1.65m AOD and therefore in line with typical requirements with all development being considered to be 'safe'. This approach has also been applied to the areas of the Utilities Land that were shown as being within the 100-year plus climate change extents.

The proposed lowering of this area and raising of proposed development parcels has been modelled in detail. This modelling included the proposed lowering with sloping sides and a gradient falling towards the River Yare to ensure it is 'free draining'. The outputs for this scenario are shown in Figure 9 below but confirms suitable compensatory storage is available through the lowering of the area of public space and that the raising of ground results in no detrimental impact on flood risk elsewhere, as shown in Figure 10 below.

Figure 9: Ground raising compensatory storage areas.

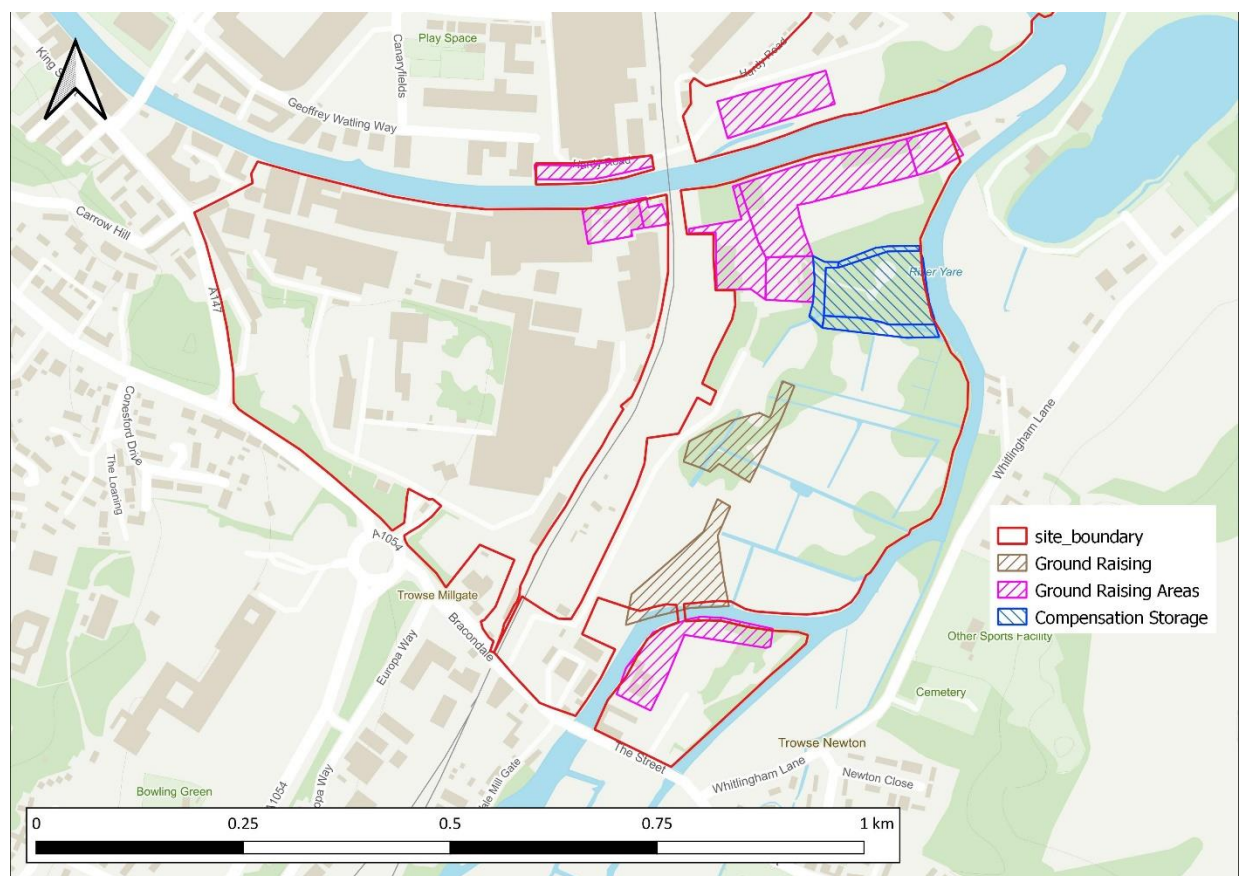
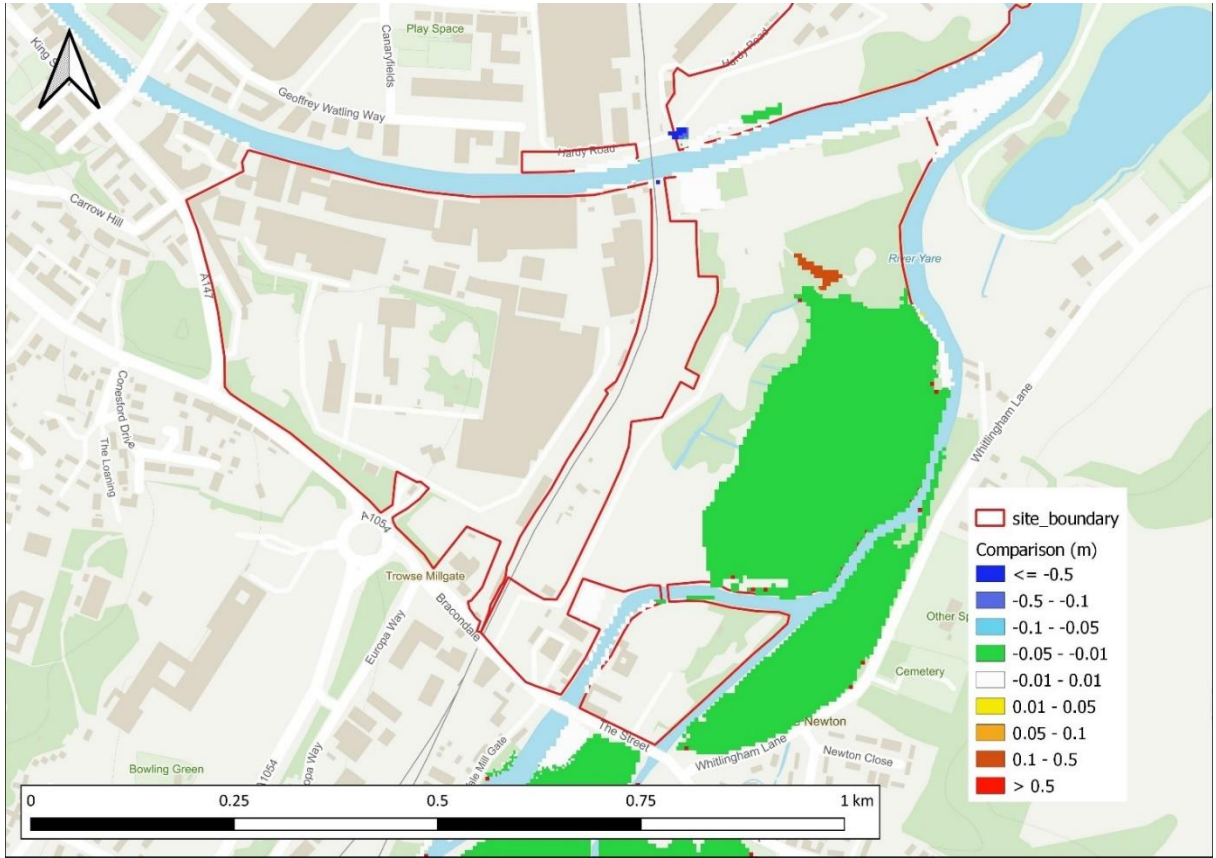


Figure 10: Comparison of Flood Depths.



## 5. CONCLUSION

As has been detailed within this note, the proposed development site is currently shown to be at an increased risk of fluvial and tidal flooding with the Deal Ground parcel being particularly susceptible. As such, and as discussed with the EA and NCC, mitigation measures are required in order to ensure the development is safe for its design life but also resulting in no increase in flood risk elsewhere.

As such a number of measures have been investigated across a number of events. These are summarised below:

- Lowering of River Frontage - 10m wide corridor to be lowered to provide a 'blue corridor' whilst also providing amenity space.
- Installation of Marinas - These are to be areas of new marinas achieved through ground lowering. These areas have been set to provide a conservatively low volume of storage to address concerns raised by NCC but also to make an allowance for existing constraints- groundwater levels etc.
- Raising of Development Parcels (for 100yr+CC events only) - It is proposed for development parcels to be raised to a level of 2m AOD. This sets the development at a level of 300mm above the predicted flood level and in line with typical EA guidance.
- Compensation Storage provided through lowering of areas to the north of Water Meadow area - This area has been modelled to be at a level of 1.1m AOD to ensure it freely drains back to the River Yare.

All of the above have been modelled in detail and the outputs have demonstrated that such measures have managed the flood risk through the site such that the proposals can come forward in line with policy with respect to fluvial flooding but, and critically, resulting in no increase in flood risk to third party land. As such, and whilst some very minor land raising is needed for localised low areas the proposals also address this in line with discussions/requirements made to date by the EA and NCC. It should be noted that this remains subject to confirmation through detailed review of the modelling but, on the assumption, this is given, the development is considered to suitably address fluvial flood risk.

Whilst fluvial risks are managed through the measures detailed above it should be noted that through inclusion of climate change allowances areas of the Deal Ground would remain as being at risk from tidal flooding. As such, additional measures would be needed. This is considered as being less onerous and achievable through design - such as duplex units on ground floor (i.e. no sleeping accommodation), a flood resilient/resistant construction for ground floors (i.e. water entry strategy), and preparation of a detail and robust Flood Evacuation Management Plan to deal with any potential issues related to access and egress.



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