

CRABTREE LANE, MANCHESTER

SURFACE WATER FLOOD RISK MODELLING REPORT

HYD1015

MAY 2025



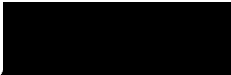
BETTS HYDRO
CONSULTING ENGINEERS

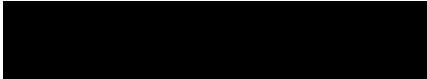


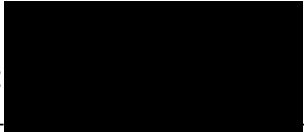
LAND AT CRABTREE LANE, MANCHESTER
SURFACE WATER FLOOD RISK MODELLING REPORT

Document Tracking Sheet

Document Reference: HYD1015_CRABTREE.LANE.MANCHESTER_SWFR
Revision: 4.0
Date of Issue: 14.05.25
Report Status: FINAL

Prepared by: 
Patrick Taylor BSc (Hons) FRGS
Flood Risk Modeller

Checked by: 
Dominic Kearney BEng (Hons), MSc, PhD GMICE
Principal Hydraulic Analyst

Authorised by: 
Richard Nicholas BEng (Hons) MSc MBA GMICE MCIWEM
Director

Revision History:

Rev.:	Date:	Status:	Prepared by:	Checked by:	Issued by:
4.0	14.05.2025	FINAL	PT	DK	PT
3.0	17.04.2025	DRAFT	PT	RN	PT
2.0	04.04.2025	DRAFT	PT	DK	PT
1.0	31.03.2025	DRAFT	PT	DK/RN	PT
0.0	23.03.2025	DRAFT	PT	RN	



Old Marsh Farm Barns
Welsh Road, Sealand
Flintshire, CH5 2LY
Telephone: 01244 8289 041

www.betts-associates.co.uk

This page has been intentionally left blank

CONTENTS

Document Tracking Sheet	ii
Figures & Tables.....	v
Specialist Software	v
Abbreviations & Acronyms	v
1.0 INTRODUCTION	1
1.1 Commission	1
1.2 Background	1
1.3 Approach	1
2.0 EXISTING SITE	2
2.1 Location	2
2.2 Long Term Surface Water Flood Mapping	2
3.0 DIRECT RAINFALL MODEL BUILD	4
3.1 Rainfall Data	4
3.2 Ground Model.....	5
4.0 RESULTS	7
4.1 Existing Scenario.....	7
<i>1 in 30 year event results.....</i>	<i>7</i>
<i>1 in 100 year event results.....</i>	<i>7</i>
<i>1 in 1000 year event results.....</i>	<i>7</i>
<i>1 in 30 year event results plus 40% climate change.....</i>	<i>7</i>
<i>1 in 100 year event results plus 45% climate change.....</i>	<i>8</i>
<i>Flood Hazard</i>	<i>8</i>
<i>Sensitivity testing</i>	<i>9</i>
<i>Results Discussion</i>	<i>10</i>
<i>Proposed Modelling.....</i>	<i>10</i>
5.0 CONCLUSIONS	12
BIBLIOGRAPHY & REFERENCES.....	13
Bibliography	13
Web-based References	13
 APPENDIX A: FEH RAINFALL DATA.....	
APPENDIX B: ReFH2 REPORT.....	
APPENDIX C: IRWELL MANAGEMENT CATCHMENT RAINFALL ALLOWANCES	
APPENDIX D: SURFACE WATER FLOOD PLANS.....	
APPENDIX E: PROPOSED SURFACE WATER PLANS.....	
APPENDIX E: NOTES OF LIMITATIONS	

Figures & Tables

Figure 1: Existing Features Plan (Google Maps, 2025)	2
Figure 2: Surface Water Flood Map Extract (Gov.UK, 2025)	3
Table 1: Key Catchment Descriptors (FEH 2025)	4
Table 2: Net Rainfall totals used in 2D Simulation (Betts Hydro, 2025)	4
Figure 3: Area of rainfall applied (Betts Hydro, 2025)	6
Figure 4: Existing Scenario 1% AEP plus 45%CC Water Flood Depth (Betts Hydro, 2025)	8
Figure 5: Existing Scenario 1% AEP plus 45%CC Water Flood Hazard (Betts Hydro, 2025)	9

Specialist Software

-  Flood Modeller 7.2
-  QGIS 3.34.15
-  ReFH2.3

Abbreviations & Acronyms

AEP	Annual Exceedance Probability	NPPF	National Planning Policy Framework
CC	Climate Change	OS	Ordnance Survey
EA	Environment Agency	TWL	Top Water Level
FEH	Flood Estimation Handbook	LLFA	Lead Local Flood Authority
FRA	Flood Risk Assessment	RP	Return Period
mAOD	Metres Above Ordnance Datum	ReFH2.3	Revitalised Flood Estimation Handbook
NaFRA2	National Flood Risk Assessment 2	RoFSW	Risk of Flooding From Surface Water
NGR	National Grid Reference		

1.0 INTRODUCTION

1.1 Commission

- 1.1.1 This report is a direct rainfall modelling exercise to ascertain flood risk and was commissioned by Keepmoat Homes for land at Crabtree Lane, Manchester.

1.2 Background

- 1.2.1 On the 28th January 2025 new National Flood Risk Assessment (NaFRA2) long term data was released which included revised surface water flood extents. This long term data also included a future scenario in which the uncertainty of climate change is considered. These future scenarios generally show increased extents of surface water flooding.
- 1.2.2 The National Planning Policy Framework (NPPF) requires that all sources of flood risk be considered including surface water. Where development is proposed within areas of medium and high risk the requirement to undertake the sequential test is potentially triggered. The Strategic Flood Risk Assessment (SFRA) mapping is the basis for applying the sequential test and the Risk of Flooding from Surface Water (RoFSW) mapping is used to establish areas that are potentially at greater risk.
- 1.2.3 Paragraph 175 of the NPPF establishes that site specific Flood Risk Assessment's (FRA's) can be used to supplement the RoFSW national data which has known limitations and defines the extents of 'chance' of flooding and not risk. The NPPF/Planning Policy Guidance (PPG) are clear that it is the 'risk' that should be assessed and that means that the consequence as well as likelihood should be considered.
- 1.2.4 To avoid the triggering of the sequential test the development proposals should avoid the areas identified as medium and high risk.

1.3 Approach

- 1.3.1 Betts Hydro have constructed a site specific direct rainfall model for land off Crabtree Lane, Manchester within Flood Modeller Pro using the Flood Estimation Handbook (FEH) Web Service to obtain the rainfall data and the revitalised flood handbook (ReFH2) to generate hyetographs.
- 1.3.2 The study focuses on surface water flood risk in the existing scenario for a range of return periods, including consideration for climate change.

2.0 EXISTING SITE

2.1 Location

2.1.1 The site is located off Crabtree Lane, Manchester. The nearest Ordnance Survey National Grid Reference is E: 388788, N: 398077 and the nearest postcode is M11 1GY. The whole site covers 3.053ha and is edged in red in Figure 1.

2.1.2 In terms of the surrounding land-use, the site is bound to the north by the Ashton Canal, with industrial and commercial development beyond. To the west sits Clayton Industrial Estate off Claytonbrook Road, and to the east are the school playing fields with the Edge Lane Allotments beyond. Further residential development can be found to the south of the site.



Figure 1: Existing Features Plan (Google Maps, 2025)

2.2 Long Term Surface Water Flood Mapping

2.2.1 The Environment Agency (EA) Long Term Flooding map shows that the site features areas of 'low', 'medium' and 'high' chance of surface water flood risk. For all events surface water flood chance extent is shown to be concentrated in the centre and the eastern corner of the site associated with existing depressions as seen in Figure 2.



Figure 2: Surface Water Flood Map Extract (Gov.UK, 2025)

2.2.2 The EA define the chance of flooding extents from surface water based on the following probability of occurrence;

- **High Chance** more than 3.3% chance each year
- **Medium Chance** between 1% and 3.33% chance each year
- **Low Chance** between 0.1% and 1% chance each year

2.2.3 The EA also provides surface water extents including for the impacts of climate change in the 2040 and 2060 (2050s epoch). This risk is referred to as 'future' risk and is generally more extensive than the non-climate change extents.

2.2.4 A site specific assessment has been undertaken to better define the flood depths, velocities and hazard for a range of chance events. This assessment also applies a greater climate change rainfall allowances for the 2070s epoch (appropriate for residential development).

3.0 DIRECT RAINFALL MODEL BUILD

3.1 Rainfall Data

3.1.1 Hyetographs for a range of rainfall events have been generated within ReFH2.3 software using FEH catchment descriptors and FEH 22 data from the FEH Web Service.

3.1.2 The key descriptors for the catchment are shown in Table 1:

Table 1: Key Catchment Descriptors (FEH 2025)

Description	
Catchment Area	1.4
BFIHOST	0.333
DPLBAR	2
DPSBAR	13
SAAR	923
SPRHOST	39.7
URBEXT2000	0.62

3.1.3 Hyetographs have been generated using ReFH2.3 for the following return periods:

-  1 in 30 year (3.3% AEP)
-  1 in 30 year (3.3% AEP) plus 40% climate change
-  1 in 100 year (1% AEP)
-  1 in 100 year (1% AEP) plus 45% climate change
-  1 in 1000 year (0.1% AEP)

3.1.4 The rainfall hyetograph storm duration is 5hours (the recommended storm duration for the catchment) with a timestep of 30 mins (see ReFH2.3 report in Appendix B). Net rainfall is applied in the model, this takes into account losses via infiltration, interception and evapotranspiration. As Urbext for the catchment is over 0.3, the summer urban hyetograph is used. Net rainfall used within the model are shown within Table 2 below.

Table 2: Net Rainfall totals used in 2D Simulation (Betts Hydro, 2025)

Time (hr)	Rainfall (mm)				
	1 in 30 year	1 in 30 year plus 40% CC	1 in 100 year	1 in 100 year +45% CC	1 in 1000 year
0	0.570	0.809	0.726	1.065	1.121
0.5	0.889	1.250	1.124	1.639	1.725
1	1.376	1.942	1.744	2.558	2.695
1.5	2.248	3.193	2.861	4.233	4.465
2	4.129	5.924	5.290	7.936	8.391
2.5	8.906	13.012	11.548	17.751	18.841
3	4.565	6.778	5.983	9.392	10.001
3.5	2.617	3.915	3.447	5.465	5.827
4	1.651	2.480	2.181	3.475	3.709
4.5	1.087	1.638	1.439	2.300	2.456
5	0.735	1.109	0.974	1.561	1.667

- 3.1.5 A rainfall climate change allowance of 40% is applied to the 30yr event and 45% applied for the 100yr event. This represents the upper allowance for the 3.3% AEP and 1% AEP event, in the Irwell Management catchment area respectively (2070s epoch).

3.2 Ground Model

- 3.2.1 The net rainfall was applied to a 2D ground model in order to predict surface water flow routes and areas where surface water accumulates.
- 3.2.2 One metre resolution LiDAR Digital Terrain Model (DTM) flown in 2022 has been obtained from the Defra Survey Data website for the Manchester area for model topography. The site specific topographic survey, undertaken in June 2021 is not incorporated into the model covering the site as there is limited level information due to dense vegetation at the time of the survey. A shapefile covering roads has been generated with road levels lowered by 0.1m to more accurately define kerb heights and roads as conveyance routes. Existing building footprints have been raised by 0.2m (including on site buildings) as recommended by Flood Modeller Pro guidance. The road and building mapping files were obtained from Ordnance Survey and Open Source Mapping respectively. These changes have been made to more accurately model surface water flow routes and are recommended for modelling direct rainfall.
- 3.2.3 A 2D rainfall area has been created to cover the site and surrounding area to accurately model catchment flow routes which may affect the site. The area in which the net rainfall has been applied to is shown in Figure 3 and has been defined through review of the contributing catchments using LiDAR elevation data. The model rainfall and model area has been sensitivity tested to ensure all contributing flow routes are considered (sensitivity testing is discussed further in Section 4).
- 3.2.4 Due to the presence of the Ashton Canal, which would intercept flows, incoming flows to the site are most likely to flow from higher elevations to the east of the site. The 2D simulations have been run over a 6 hour period with a 2m grid size and 1 second timestep.

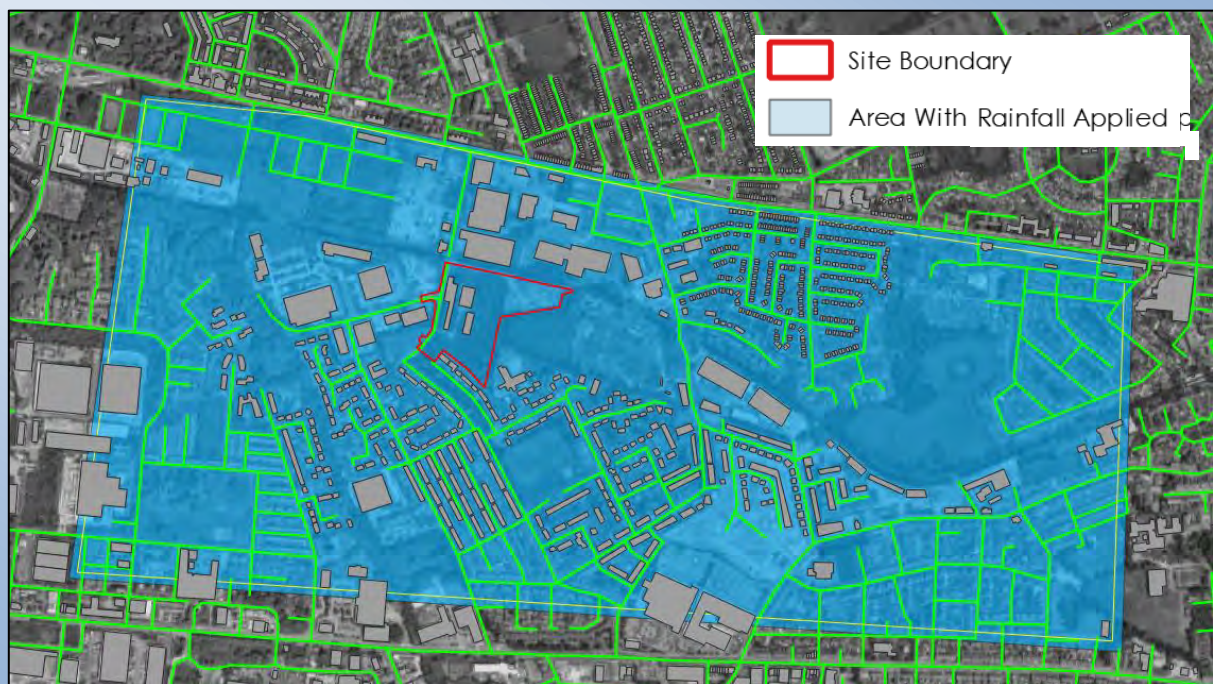


Figure 3: Area of rainfall applied (Betts Hydro, 2025)

4.0 RESULTS

4.1 Existing Scenario

4.1.1 Existing Scenario depth results are shown within Appendix D for the 1 in 30 year, 1 in 30 year plus climate change, 1 in 100 and 1 in 100 year plus climate change and the 1 in 1000 year event. The rainfall modelling results are considered conservative as losses to the sewer system in urban areas are not considered.

4.1.2 As rainfall is applied to every cell within the model domain (see Figure 4), in order to clearly define flow routes surface water flood depths below 0.02m are not shown in the flood depth results. The velocity results, however, do show areas of extent where depths are below 0.02m.

1 in 30 year event results

4.1.3 In the 30 year event (3.3% Annual Exceedance Probability), surface water flooding covers large areas within the site as shown in Drawing No. HYD1015/601/A within Appendix B. The peak surface water flood depth onsite is 0.52m in an area of proposed built form. The majority of flood depths onsite are below 0.20m. The maximum velocity onsite is 0.31m/s as shown in Drawing No. HYD1015/602/A, the majority of the site is below a velocity of 0.05m/s. This event typically defines the 'high chance' extent

1 in 100 year event results

4.1.4 In the 100 year event (1% AEP), surface water flooding covers large areas within the site as shown in Drawing No. HYD1015/603/A within Appendix B. The peak surface water flood depth onsite is 0.82m in an area of proposed built form. The majority of flood depths onsite are below 0.20m. The maximum velocity onsite is 0.90m/s as shown in Drawing No. HYD1015/604/A, the majority of the site is below a velocity of 0.05m/s. This event typically defines the 'medium chance' extent.

1 in 1000 year event results

4.1.5 In the 1000 year event (0.1% AEP), similar to the others events surface water flooding covers large areas within the site as shown in Drawing No. HYD1015/605/A within Appendix B. The peak surface water flood depth onsite is 0.85m in an area of proposed built form. The majority of flood depths onsite are below 0.20m. The maximum velocity onsite is 0.97m/s as shown in Drawing No. HYD1015/606/A, the majority of the site is below a velocity of 0.05m/s. This event typically defines the 'low chance' extent.

4.1.6 *1 in 30 year event results plus 40% climate change*

In the 30 year event (3.33% AEP) plus 40% climate change event, surface water flooding is shown to be more extensive than the non-climate change scenario as shown in Drawing No. HYD1015/610/A within Appendix B. The peak surface water flood depth in this area is 0.65m in an area proposed to have built form. The maximum velocity predicted is 0.55m/s as shown in Drawing No. HYD1015/611/A. This event typically defines the 'future high chance' extent. A hazard plan has been produced for this event in accordance with DEFRA guidance FD2320. The majority of predicted surface

water flooding is classified as 'very low hazard'. There are some areas of 'danger to some' and 'danger to most' concentrated in the eastern boundary in proposed areas of built form.

1 in 100 year event results plus 45% climate change

- 4.1.7 In the 100 year event (1% AEP) plus 45% climate change, surface water flooding is shown to have a similar extent to the 1 in 1000 year event as shown in Drawing No. HYD1015/613/A within Appendix B and Figure 4. The peak surface water flood depth is 0.82m. The majority of flood depths onsite are below 0.20m. The maximum velocity onsite is 0.90m/s as shown in Drawing No. HYD1015/614/A, the majority of the site is below a velocity of 0.05m/s. This event typically defines the 'future medium chance' event.

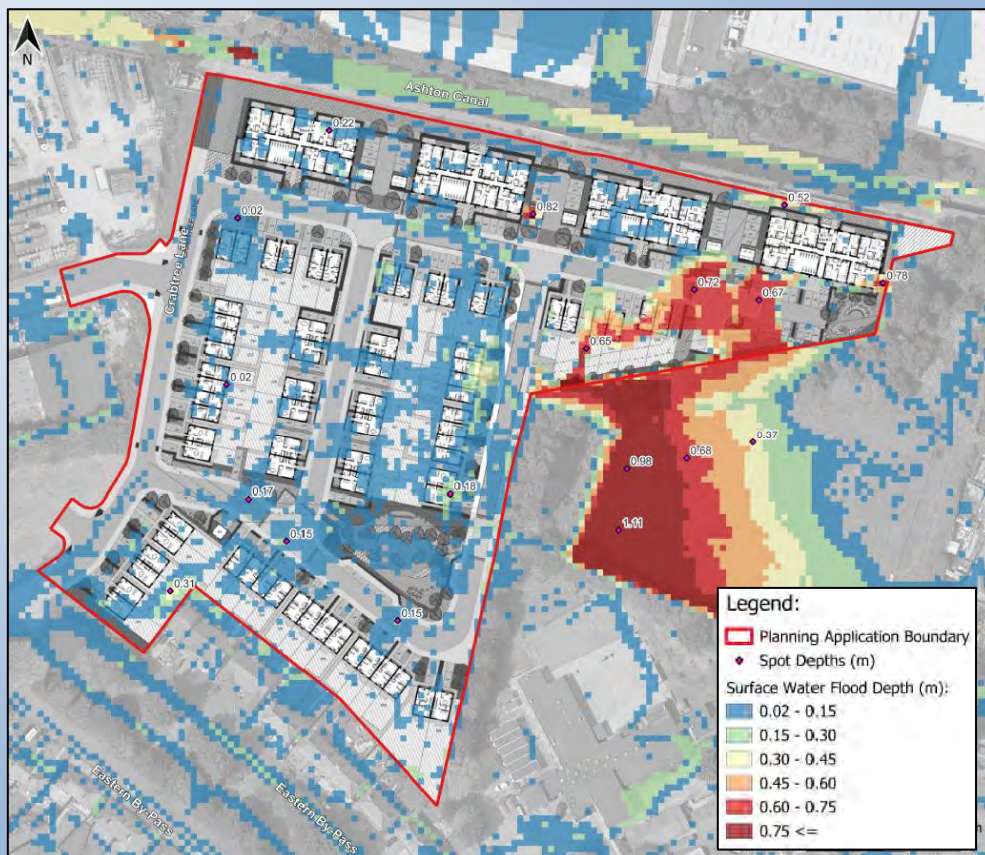
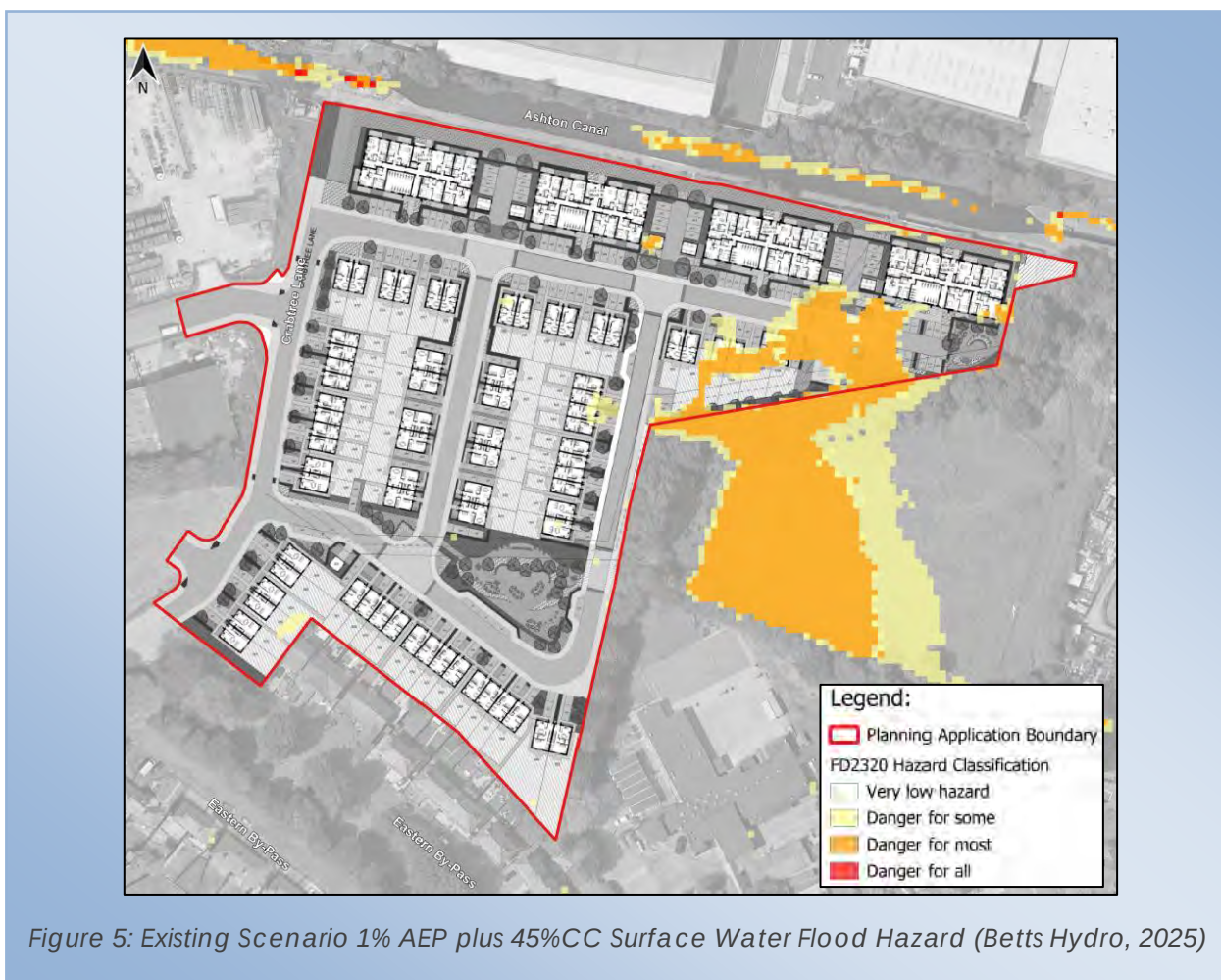


Figure 4: Existing Scenario 1% AEP plus 45%CC Surface Water Flood Depth (Betts Hydro, 2025)

Flood Hazard

- 4.1.8 A hazard plan has been produced for the 1% AEP plus 45% allowance for climate change event in accordance with FD2320. The majority of predicted surface water flooding is classified as 'very low hazard'. There are some areas of 'danger to some' and 'danger to most' concentrated in the east in areas of proposed built form as shown in Figure 5.
- 4.1.9 To accurately define the hazard rating two separate simulations have been run with a debris factor of 0.5 and a debris factor 1. In accordance with EA guidance FD2320 depths below 0.25m apply a debris factor of 0.5 and for depths above 0.25m a debris

factor of 1 is applied. These outputs have been processed to provide a composite output.



- 4.1.10 It should be noted that direct rainfall does not take into account below ground systems. It is understood that a culverted watercourse bisects the site and would possibly receive, or direct surface water flows safely through the site.

Sensitivity testing

- 4.1.11 Sensitivity testing of the results in the 1 in 100 year event plus 45% climate change has been undertaken. Grid size, rainfall area and mannings values were tested to review model sensitivity to these parameters.
- 4.1.12 The model outputs are from a 2m grid cell size, however a 4m grid and 1m grid have also been simulated. Both these different grid sizes have negligible increases and decreases in extent relative to the 2m grid size.
- 4.1.13 The area in which outputs are generated and rainfall applied has been simulated with larger and smaller areas. The surface water extents are shown to remain the same onsite when the area boundaries are extended, this validates that the study area selected is large enough to capture all potential surface water flows to the

development site. A reduced area leads to a negligible reduction in surface water extent for the site.

- 4.1.14 The default manning value of 0.03 was adjusted +/- 20%. When mannings values are reduced and increased by 20% the change in extent is shown to be negligible in all areas of the model. A mannings value of 0.03 is considered an appropriate average the given the urban land uses (in accordance with Chow, 1959).
- 4.1.15 Based on sensitivity testing the model shows low sensitivity to changes in key model variables.

Results Discussion

- 4.1.16 The purpose of this direct rainfall modelling is to more accurately define predicted flood depth, velocity and hazard for a range of return periods (including more appropriate climate change allowances compared to the published EA data). The results are used to inform the planning layout and review detailed surface water flood depths and velocities.
- 4.1.17 Flood Risk is defined as the combination of likelihood or chance of an event happening and the consequences or impact if that event occurred. For the purposes of steering development to 'low' risk areas, these low risk areas are defined as either:
- 1 in 100 year event or lesser chance of flooding (<1% AEP)
 - 'Very low hazard' classification in events up to and including the 1 in 100 year event
- 4.1.18 Future scenarios that include climate change should be considered when assessing the potential flood risk in accordance with the NPPF.
- 4.1.19 The different 'chance events' have been simulated to understand the 'risk' on site. The depth and velocity are calculated to ascertain the hazard rating. Where built development is proposed within the extent described as at medium and high risk, then the requirement for the sequential test is potentially triggered.

Proposed Modelling

- 4.1.20 The proposed levels for the site have been incorporated into the 2D domain and run in the 1 in 100 year plus climate change event to review proposed future flood risk for the site (future medium chance).
- 4.1.21 As shown in Drawing No. HYD1015/713/B within Appendix E and Figure 6 shows the flood depths in the 1 in 100 year plus climate change event. All proposed buildings are predicted to be flood free in this event and have been raised to ensure this. There are some isolated areas of ponding in the eastern corner of the site. The maximum depth in this area is 0.38m. Velocities on the site are predicted to be low (generally below 0.10m/s).

- 4.2.22 Drawing No. HYD1015/715/B within Appendix E shows the predicted flood hazard for this event in which only areas of 'little danger' and isolated areas of 'danger to some' are located (lower hazard than in the existing scenario).
- 4.2.23 There is shown to be minimal increases to flood depths in the undeveloped area to the south-east of the site, however this area is predicted to flood by over 0.9m at present. There is no increase in surface water flood extent to dwellings in the wider area.

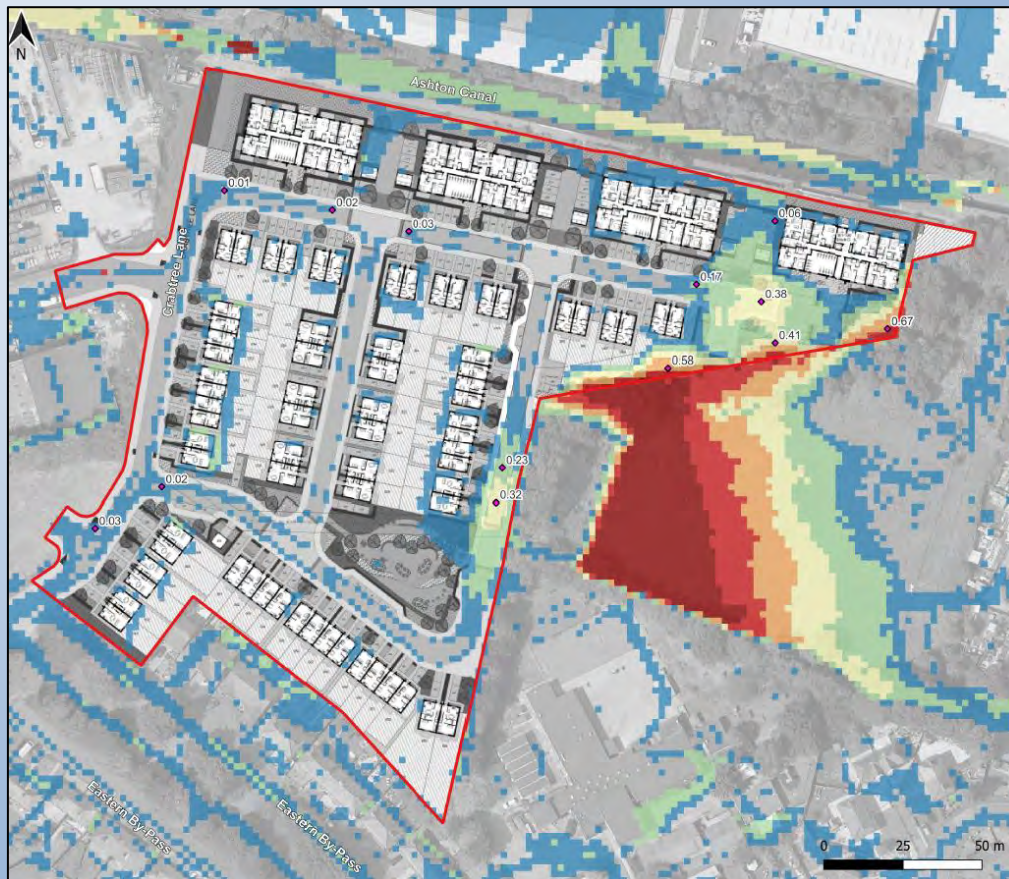


Figure 6: Proposed Scenario 1% AEP plus 45%CC Surface Water Flood Depth (Betts Hydro, 2025)

5.0 CONCLUSIONS

- 5.1 A site specific direct rainfall model has been constructed for Crabtree Lane within Flood Modeller Pro to provide site specific information. The site is shown to be at risk of surface water flooding for a range of return periods up to the 1 in 1000 year event (including the impacts of climate change).
- 5.2 Surface water flooding is predicted to affect areas of the site, towards the centre of the site, and near the eastern boundary. The extents of the direct rainfall modelling generally align with the EA surface water flood risk maps.
- 5.3 The site specific results define medium and high flood risk areas.
- 5.4 This site specific assessment identifies that the built form is within areas of medium and high surface water flood risk and potentially triggers the requirement for the sequential test. This should be discussed further with the LPA.
- 5.5 Proposed levels modelling predicts onsite buildings will be flood free from surface water flooding in the 1 in 100 year plus climate change event (future medium chance).
- 5.6 There are noted limitations to direct rainfall models. The results shown within this report are considered conservative as they do not account for below ground drainage systems.

BIBLIOGRAPHY & REFERENCES

Bibliography

Open Channel Hydraulics, Chow Mannings (1959)
National Planning Policy Framework, CLG (2024)
Planning Practice Guidance, CLG (2024)
Flood Risks to People Phase 2 FD2321, DEFRA (2006)
Flood Risk Guidance for New Development FD2320 (2005)
Explanatory Note for FD2320 and FD2321 (2008)

Web-based References

Centre for Ecology and Hydrology FEH Web - <https://fehweb.ceh.ac.uk/Map>
DEFRA LiDAR <https://environment.data.gov.uk/survey>
Google Maps – <http://maps.google.com/>
Ordnance Survey <https://osdatahub.os.uk/downloads/open/OpenRoads>
Open Source Mapping <https://osmbuildings.org/data/>

This page has been left intentionally blank

APPENDIX A: FEH RAINFALL DATA

Rainfall modelling FEH22

FEH22

FEH13

☒ Design Rainfall (Duration:*) 2.45 Hours Sliding

☐ Event Rarity Return period (†) 30 Years

☒ Annual Max. ☐ Peaks over threshold

Calculate



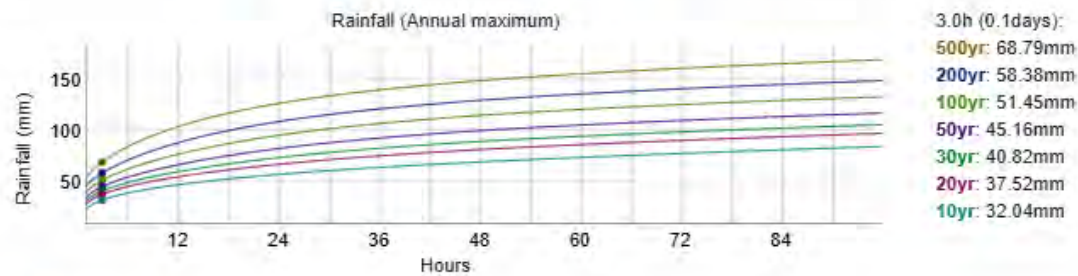
Export

Depth

38.75 mm

A design rainfall of 38.75 mm was calculated.

This design rainfall has been calculated for a return period on the annual maximum scale.



Save graph as image

Close

Rainfall modelling FEH22

FEH22

FEH13

☒ Design Rainfall (Duration:*) 2.45 Hours Sliding

☐ Event Rarity Return period (†) 100 Years

☒ Annual Max. ☐ Peaks over threshold

Calculate



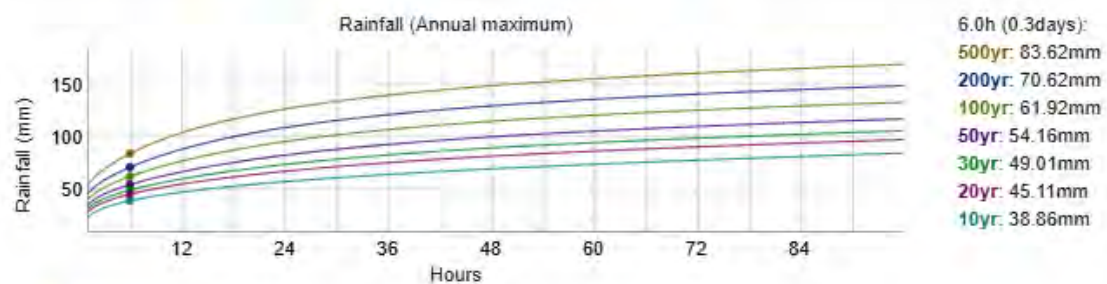
Export

Depth

48.92 mm

A design rainfall of 48.92 mm was calculated.

This design rainfall has been calculated for a return period on the annual maximum scale.



Save graph as image

Close

APPENDIX B: ReFH2 REPORT

UK Design Flood Estimation

Generated on Friday, March 14, 2025 3:12:03 PM by patricktaylor
Printed from the ReFH2 Flood Modelling software package, version 4.1.8879.22310

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

Site detailsChecksum: CC17-5A7B

Site name: FEH_Catchment_Descriptors_382950_379600_v5_0_1

Easting: 382950

Northing: 379600

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.63

Using plot scale calculations: No

Model: 2.3

Site description:None

Model run: 1 year

Summary of results

Rainfall - FEH22 (mm):	15.57	Total runoff (ML):	2.81
Total Rainfall (mm):	14.83	Total flow (ML):	5.80
Peak Rainfall (mm):	4.59	Peak flow (m ³ /s):	0.32

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.
* Indicates that the user locked the duration/timestep

Rainfall parameters (Rainfall - FEH22)

Name	Value	User-defined?
Duration (hh:mm:ss)	02:45:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.97	No
ARF (Areal reduction factor)	0.98	No
Seasonality	Summer	No

Loss model parameters

Name	Value	User-defined?
Cini (mm)	50.79	No
Cmax (mm)	451.45	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.59	No
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m ³ /s)	0.01	No
BL (hr)	27.55	No
BR	3.14	No

Urbanisation parameters

Name	Value	User-defined?
Sewer capacity (m ³ /s)	0	No
Exporting drained area (km ²)	0	No
Urban area (km ²)	0.45	No
Effective URBEXT2000	0.46	n/a
Impervious runoff factor	0.7	No
Imperviousness factor	0.4	No
Tp scaling factor	0.75	No
Depression storage depth (mm)	0.5	No

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	0.342	0.000	0.096	0.000	0.006	0.006
00:15:00	0.509	0.000	0.147	0.001	0.006	0.007
00:30:00	0.779	0.000	0.228	0.004	0.006	0.010
00:45:00	1.253	0.000	0.369	0.011	0.006	0.017
01:00:00	2.238	0.000	0.667	0.023	0.006	0.029
01:15:00	4.586	0.000	1.394	0.045	0.006	0.051
01:30:00	2.238	0.000	0.694	0.084	0.007	0.091
01:45:00	1.253	0.000	0.392	0.140	0.007	0.147
02:00:00	0.779	0.000	0.245	0.199	0.008	0.207
02:15:00	0.509	0.000	0.161	0.255	0.009	0.264
02:30:00	0.342	0.000	0.108	0.297	0.011	0.308
02:45:00	0.000	0.000	0.000	0.310	0.013	0.323
03:00:00	0.000	0.000	0.000	0.299	0.015	0.314
03:15:00	0.000	0.000	0.000	0.273	0.018	0.290
03:30:00	0.000	0.000	0.000	0.239	0.020	0.259
03:45:00	0.000	0.000	0.000	0.204	0.022	0.226
04:00:00	0.000	0.000	0.000	0.172	0.024	0.196
04:15:00	0.000	0.000	0.000	0.143	0.025	0.169
04:30:00	0.000	0.000	0.000	0.117	0.027	0.144
04:45:00	0.000	0.000	0.000	0.094	0.028	0.121
05:00:00	0.000	0.000	0.000	0.072	0.029	0.101
05:15:00	0.000	0.000	0.000	0.052	0.030	0.082
05:30:00	0.000	0.000	0.000	0.035	0.030	0.065
05:45:00	0.000	0.000	0.000	0.022	0.031	0.053
06:00:00	0.000	0.000	0.000	0.014	0.031	0.045
06:15:00	0.000	0.000	0.000	0.009	0.031	0.040
06:30:00	0.000	0.000	0.000	0.006	0.031	0.037
06:45:00	0.000	0.000	0.000	0.003	0.031	0.035
07:00:00	0.000	0.000	0.000	0.002	0.031	0.033
07:15:00	0.000	0.000	0.000	0.001	0.031	0.032
07:30:00	0.000	0.000	0.000	0.000	0.031	0.031
07:45:00	0.000	0.000	0.000	0.000	0.031	0.031
08:00:00	0.000	0.000	0.000	0.000	0.030	0.031
08:15:00	0.000	0.000	0.000	0.000	0.030	0.030

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
08:30:00	0.000	0.000	0.000	0.000	0.030	0.030
08:45:00	0.000	0.000	0.000	0.000	0.030	0.030
09:00:00	0.000	0.000	0.000	0.000	0.029	0.029
09:15:00	0.000	0.000	0.000	0.000	0.029	0.029
09:30:00	0.000	0.000	0.000	0.000	0.029	0.029
09:45:00	0.000	0.000	0.000	0.000	0.029	0.029
10:00:00	0.000	0.000	0.000	0.000	0.028	0.028
10:15:00	0.000	0.000	0.000	0.000	0.028	0.028
10:30:00	0.000	0.000	0.000	0.000	0.028	0.028
10:45:00	0.000	0.000	0.000	0.000	0.028	0.028
11:00:00	0.000	0.000	0.000	0.000	0.027	0.027
11:15:00	0.000	0.000	0.000	0.000	0.027	0.027
11:30:00	0.000	0.000	0.000	0.000	0.027	0.027
11:45:00	0.000	0.000	0.000	0.000	0.027	0.027
12:00:00	0.000	0.000	0.000	0.000	0.026	0.026
12:15:00	0.000	0.000	0.000	0.000	0.026	0.026
12:30:00	0.000	0.000	0.000	0.000	0.026	0.026
12:45:00	0.000	0.000	0.000	0.000	0.026	0.026
13:00:00	0.000	0.000	0.000	0.000	0.025	0.025
13:15:00	0.000	0.000	0.000	0.000	0.025	0.025
13:30:00	0.000	0.000	0.000	0.000	0.025	0.025
13:45:00	0.000	0.000	0.000	0.000	0.025	0.025
14:00:00	0.000	0.000	0.000	0.000	0.024	0.024
14:15:00	0.000	0.000	0.000	0.000	0.024	0.024
14:30:00	0.000	0.000	0.000	0.000	0.024	0.024
14:45:00	0.000	0.000	0.000	0.000	0.024	0.024
15:00:00	0.000	0.000	0.000	0.000	0.024	0.024
15:15:00	0.000	0.000	0.000	0.000	0.023	0.023
15:30:00	0.000	0.000	0.000	0.000	0.023	0.023
15:45:00	0.000	0.000	0.000	0.000	0.023	0.023
16:00:00	0.000	0.000	0.000	0.000	0.023	0.023
16:15:00	0.000	0.000	0.000	0.000	0.023	0.023
16:30:00	0.000	0.000	0.000	0.000	0.022	0.022
16:45:00	0.000	0.000	0.000	0.000	0.022	0.022
17:00:00	0.000	0.000	0.000	0.000	0.022	0.022

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
17:15:00	0.000	0.000	0.000	0.000	0.022	0.022
17:30:00	0.000	0.000	0.000	0.000	0.022	0.022
17:45:00	0.000	0.000	0.000	0.000	0.021	0.021
18:00:00	0.000	0.000	0.000	0.000	0.021	0.021
18:15:00	0.000	0.000	0.000	0.000	0.021	0.021
18:30:00	0.000	0.000	0.000	0.000	0.021	0.021
18:45:00	0.000	0.000	0.000	0.000	0.021	0.021
19:00:00	0.000	0.000	0.000	0.000	0.020	0.020
19:15:00	0.000	0.000	0.000	0.000	0.020	0.020
19:30:00	0.000	0.000	0.000	0.000	0.020	0.020
19:45:00	0.000	0.000	0.000	0.000	0.020	0.020
20:00:00	0.000	0.000	0.000	0.000	0.020	0.020
20:15:00	0.000	0.000	0.000	0.000	0.020	0.020
20:30:00	0.000	0.000	0.000	0.000	0.019	0.019
20:45:00	0.000	0.000	0.000	0.000	0.019	0.019
21:00:00	0.000	0.000	0.000	0.000	0.019	0.019
21:15:00	0.000	0.000	0.000	0.000	0.019	0.019
21:30:00	0.000	0.000	0.000	0.000	0.019	0.019
21:45:00	0.000	0.000	0.000	0.000	0.018	0.018
22:00:00	0.000	0.000	0.000	0.000	0.018	0.018
22:15:00	0.000	0.000	0.000	0.000	0.018	0.018
22:30:00	0.000	0.000	0.000	0.000	0.018	0.018
22:45:00	0.000	0.000	0.000	0.000	0.018	0.018
23:00:00	0.000	0.000	0.000	0.000	0.018	0.018
23:15:00	0.000	0.000	0.000	0.000	0.017	0.017
23:30:00	0.000	0.000	0.000	0.000	0.017	0.017
23:45:00	0.000	0.000	0.000	0.000	0.017	0.017
24:00:00	0.000	0.000	0.000	0.000	0.017	0.017
24:15:00	0.000	0.000	0.000	0.000	0.017	0.017
24:30:00	0.000	0.000	0.000	0.000	0.017	0.017
24:45:00	0.000	0.000	0.000	0.000	0.017	0.017
25:00:00	0.000	0.000	0.000	0.000	0.016	0.016
25:15:00	0.000	0.000	0.000	0.000	0.016	0.016
25:30:00	0.000	0.000	0.000	0.000	0.016	0.016
25:45:00	0.000	0.000	0.000	0.000	0.016	0.016

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
26:00:00	0.000	0.000	0.000	0.000	0.016	0.016
26:15:00	0.000	0.000	0.000	0.000	0.016	0.016
26:30:00	0.000	0.000	0.000	0.000	0.016	0.016
26:45:00	0.000	0.000	0.000	0.000	0.015	0.015
27:00:00	0.000	0.000	0.000	0.000	0.015	0.015
27:15:00	0.000	0.000	0.000	0.000	0.015	0.015
27:30:00	0.000	0.000	0.000	0.000	0.015	0.015
27:45:00	0.000	0.000	0.000	0.000	0.015	0.015
28:00:00	0.000	0.000	0.000	0.000	0.015	0.015
28:15:00	0.000	0.000	0.000	0.000	0.015	0.015
28:30:00	0.000	0.000	0.000	0.000	0.014	0.014
28:45:00	0.000	0.000	0.000	0.000	0.014	0.014
29:00:00	0.000	0.000	0.000	0.000	0.014	0.014
29:15:00	0.000	0.000	0.000	0.000	0.014	0.014
29:30:00	0.000	0.000	0.000	0.000	0.014	0.014
29:45:00	0.000	0.000	0.000	0.000	0.014	0.014
30:00:00	0.000	0.000	0.000	0.000	0.014	0.014
30:15:00	0.000	0.000	0.000	0.000	0.014	0.014
30:30:00	0.000	0.000	0.000	0.000	0.013	0.013
30:45:00	0.000	0.000	0.000	0.000	0.013	0.013
31:00:00	0.000	0.000	0.000	0.000	0.013	0.013
31:15:00	0.000	0.000	0.000	0.000	0.013	0.013
31:30:00	0.000	0.000	0.000	0.000	0.013	0.013
31:45:00	0.000	0.000	0.000	0.000	0.013	0.013
32:00:00	0.000	0.000	0.000	0.000	0.013	0.013
32:15:00	0.000	0.000	0.000	0.000	0.013	0.013
32:30:00	0.000	0.000	0.000	0.000	0.013	0.013
32:45:00	0.000	0.000	0.000	0.000	0.012	0.012
33:00:00	0.000	0.000	0.000	0.000	0.012	0.012
33:15:00	0.000	0.000	0.000	0.000	0.012	0.012
33:30:00	0.000	0.000	0.000	0.000	0.012	0.012
33:45:00	0.000	0.000	0.000	0.000	0.012	0.012
34:00:00	0.000	0.000	0.000	0.000	0.012	0.012
34:15:00	0.000	0.000	0.000	0.000	0.012	0.012
34:30:00	0.000	0.000	0.000	0.000	0.012	0.012

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
34:45:00	0.000	0.000	0.000	0.000	0.012	0.012
35:00:00	0.000	0.000	0.000	0.000	0.011	0.011
35:15:00	0.000	0.000	0.000	0.000	0.011	0.011
35:30:00	0.000	0.000	0.000	0.000	0.011	0.011
35:45:00	0.000	0.000	0.000	0.000	0.011	0.011
36:00:00	0.000	0.000	0.000	0.000	0.011	0.011
36:15:00	0.000	0.000	0.000	0.000	0.011	0.011
36:30:00	0.000	0.000	0.000	0.000	0.011	0.011
36:45:00	0.000	0.000	0.000	0.000	0.011	0.011
37:00:00	0.000	0.000	0.000	0.000	0.011	0.011
37:15:00	0.000	0.000	0.000	0.000	0.011	0.011
37:30:00	0.000	0.000	0.000	0.000	0.010	0.010
37:45:00	0.000	0.000	0.000	0.000	0.010	0.010
38:00:00	0.000	0.000	0.000	0.000	0.010	0.010
38:15:00	0.000	0.000	0.000	0.000	0.010	0.010
38:30:00	0.000	0.000	0.000	0.000	0.010	0.010
38:45:00	0.000	0.000	0.000	0.000	0.010	0.010
39:00:00	0.000	0.000	0.000	0.000	0.010	0.010
39:15:00	0.000	0.000	0.000	0.000	0.010	0.010
39:30:00	0.000	0.000	0.000	0.000	0.010	0.010
39:45:00	0.000	0.000	0.000	0.000	0.010	0.010
40:00:00	0.000	0.000	0.000	0.000	0.010	0.010
40:15:00	0.000	0.000	0.000	0.000	0.009	0.009
40:30:00	0.000	0.000	0.000	0.000	0.009	0.009
40:45:00	0.000	0.000	0.000	0.000	0.009	0.009
41:00:00	0.000	0.000	0.000	0.000	0.009	0.009
41:15:00	0.000	0.000	0.000	0.000	0.009	0.009
41:30:00	0.000	0.000	0.000	0.000	0.009	0.009
41:45:00	0.000	0.000	0.000	0.000	0.009	0.009
42:00:00	0.000	0.000	0.000	0.000	0.009	0.009
42:15:00	0.000	0.000	0.000	0.000	0.009	0.009
42:30:00	0.000	0.000	0.000	0.000	0.009	0.009
42:45:00	0.000	0.000	0.000	0.000	0.009	0.009
43:00:00	0.000	0.000	0.000	0.000	0.009	0.009
43:15:00	0.000	0.000	0.000	0.000	0.008	0.008

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
43:30:00	0.000	0.000	0.000	0.000	0.008	0.008
43:45:00	0.000	0.000	0.000	0.000	0.008	0.008
44:00:00	0.000	0.000	0.000	0.000	0.008	0.008
44:15:00	0.000	0.000	0.000	0.000	0.008	0.008
44:30:00	0.000	0.000	0.000	0.000	0.008	0.008
44:45:00	0.000	0.000	0.000	0.000	0.008	0.008
45:00:00	0.000	0.000	0.000	0.000	0.008	0.008
45:15:00	0.000	0.000	0.000	0.000	0.008	0.008
45:30:00	0.000	0.000	0.000	0.000	0.008	0.008
45:45:00	0.000	0.000	0.000	0.000	0.008	0.008
46:00:00	0.000	0.000	0.000	0.000	0.008	0.008
46:15:00	0.000	0.000	0.000	0.000	0.008	0.008
46:30:00	0.000	0.000	0.000	0.000	0.008	0.008
46:45:00	0.000	0.000	0.000	0.000	0.007	0.007
47:00:00	0.000	0.000	0.000	0.000	0.007	0.007
47:15:00	0.000	0.000	0.000	0.000	0.007	0.007
47:30:00	0.000	0.000	0.000	0.000	0.007	0.007
47:45:00	0.000	0.000	0.000	0.000	0.007	0.007
48:00:00	0.000	0.000	0.000	0.000	0.007	0.007
48:15:00	0.000	0.000	0.000	0.000	0.007	0.007
48:30:00	0.000	0.000	0.000	0.000	0.007	0.007
48:45:00	0.000	0.000	0.000	0.000	0.007	0.007
49:00:00	0.000	0.000	0.000	0.000	0.007	0.007
49:15:00	0.000	0.000	0.000	0.000	0.007	0.007
49:30:00	0.000	0.000	0.000	0.000	0.007	0.007
49:45:00	0.000	0.000	0.000	0.000	0.007	0.007
50:00:00	0.000	0.000	0.000	0.000	0.007	0.007
50:15:00	0.000	0.000	0.000	0.000	0.007	0.007
50:30:00	0.000	0.000	0.000	0.000	0.007	0.007
50:45:00	0.000	0.000	0.000	0.000	0.006	0.006
51:00:00	0.000	0.000	0.000	0.000	0.006	0.006
51:15:00	0.000	0.000	0.000	0.000	0.006	0.006

Appendix

Catchment descriptors

Name	Value	User-defined value used?
Area (km ²)	0.63	No
ALTBAR	73	No
ASPBAR	219	No
ASPVAR	0.53	No
BFIHOST	0.55	No
BFIHOST19	0.57	No
DPLBAR (km)	0.69	No
DPSBAR (mkm ⁻¹)	9.6	No
FARL	1	No
LDP	1.58	No
PROPWET	0.52	No
RMED1H	10.3	No
RMED1D	29.8	No
RMED2D	41.3	No
SAAR (mm)	822	No
SAAR4170 (mm)	807	No
SPRHOST	28.02	No
URBEXT2000	0.46	No
URBEXT1990	0.21	No
URBCONC	0.93	No
URBLOC	0.99	No
DDF parameter C	-0.03	No
DDF parameter D1	0.33	No
DDF parameter D2	0.38	No
DDF parameter D3	0.28	No
DDF parameter E	0.3	No
DDF parameter F	2.4	No
DDF parameter C (1km grid value)	-0.03	No
DDF parameter D1 (1km grid value)	0.33	No
DDF parameter D2 (1km grid value)	0.38	No
DDF parameter D3 (1km grid value)	0.28	No
DDF parameter E (1km grid value)	0.3	No
DDF parameter F (1km grid value)	2.4	No

APPENDIX C: Irwell Management Catchment rainfall allowances



Irwell Management Catchment peak rainfall allowances

✕

3.3% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	25%	35%
2070s	30%	40%

1% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	25%	40%
2070s	30%	45%

*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125

APPENDIX D: SURFACE WATER FLOOD PLANS

HYD1015_601_A_DIRECT.RAINFALL.30.YEAR.DEPTH_A3L

HYD1015_602_A_DIRECT.RAINFALL.30.YEAR.VELOCITY_A3L

HYD1015_603_A_DIRECT.RAINFALL.100.YEAR.DEPTH_A3L

HYD1015_604_A_DIRECT.RAINFALL.100.YEAR.VELOCITY_A3L

HYD1015_607_A_DIRECT.RAINFALL.1000.YEAR.DEPTH_A3L

HYD1015_608_A_DIRECT.RAINFALL.1000.YEAR.VELOCITY_A3L

HYD1015_610_A_DIRECT.RAINFALL.30.YEAR.CC.DEPTH_A3L

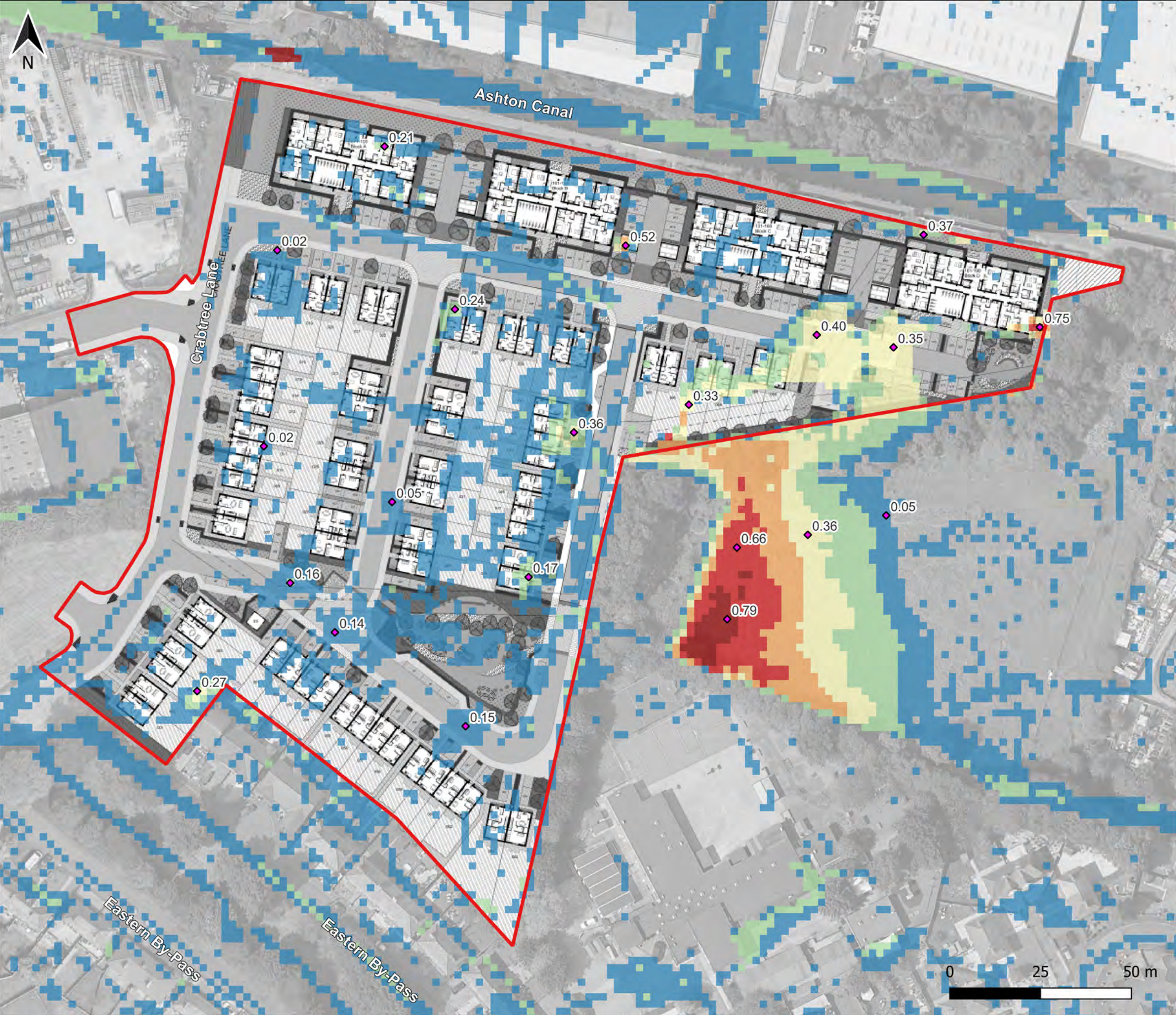
HYD1015_611_A_DIRECT.RAINFALL.30.YEAR.CC.VELOCITY_A3L

HYD1015_612_A_DIRECT.RAINFALL.30.YEAR.CC.HAZARD_A3L

HYD1015_613_A_DIRECT.RAINFALL.100.YEAR.CC.DEPTH_A3L

HYD1015_614_A_DIRECT.RAINFALL.100.YEAR.CC.VELOCITY_A3L

HYD1015_615_A_DIRECT.RAINFALL.100.YEAR.CC.HAZARD_A3L



DO NOT SCALE

- Legend:**
- Planning Application Boundary
 - ◆ Spot Depths (m)
- Surface Water Flood Depth (m):
- 0.02 - 0.15
 - 0.15 - 0.30
 - 0.30 - 0.45
 - 0.45 - 0.60
 - 0.60 - 0.75
 - 0.75 <=

* Excludes flood depths below 0.02m

A	21/03/25	PT	PRELIMINARY FOR ISSUE	DK
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

PROJECT:
**CRABTREE LANE
MANCHESTER**

TITLE:
**DIRECT RAINFALL MODELLING
1 IN 30 (3.3% AEP)
DEPTH PLAN**

DATE: MAR '25	SCALE @ SIZE: 1:1000@A3	DRAWN: PT	CHECKED: DK
PROJECT No: HYD1015	DRAWING No: 601	REV: A	



DO NOT SCALE

Legend:

 Planning Application Boundary

◆ Spot Velocity (m/s)

Surface Water Velocity (m/s):

≤ 0.10

0.10 - 0.25

0.25 - 0.40

0.40 - 0.55

0.55 - 0.70

> 0.70

* Includes flood extent where depths are below 0.02m

A	21/03/25	PT	PRELIMINARY FOR ISSUE	DK
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

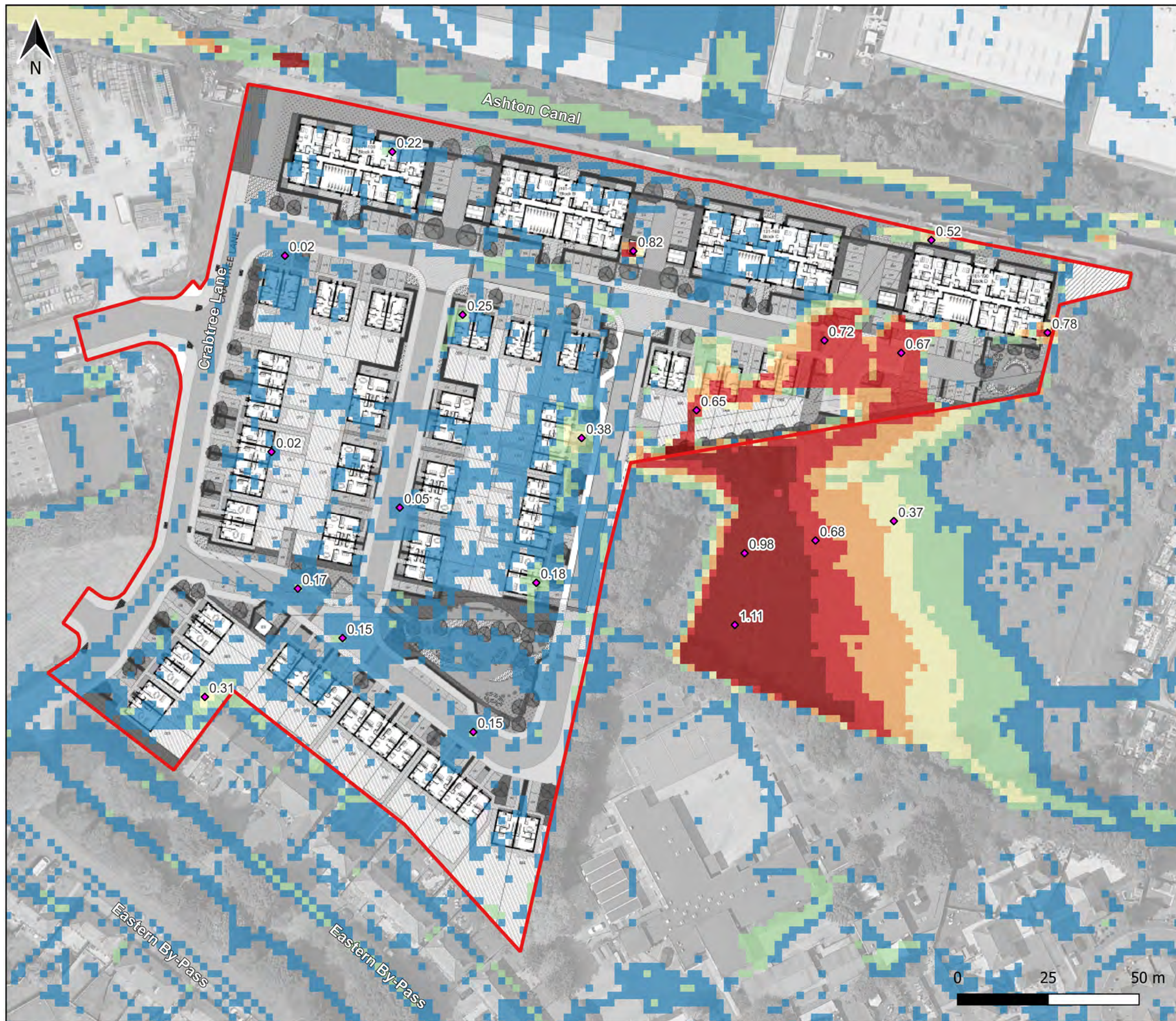
PROJECT:

CRABTREE LANE
MANCHESTER

TITLE:

DIRECT RAINFALL MODELLING
1 IN 30 (3.3% AEP)
VELOCITY PLAN

DATE: MAR '25	SCALE @ SIZE: 1:1000@A3	DRAWN: PT	CHECKED: DK
PROJECT No: HYD1015	DRAWING No: 602	REV: A	



DO NOT SCALE

Legend:

- Planning Application Boundary
- Spot Depths (m)

Surface Water Flood Depth (m):

- 0.02 - 0.15
- 0.15 - 0.30
- 0.30 - 0.45
- 0.45 - 0.60
- 0.60 - 0.75
- 0.75 <=

* Excludes flood depths below 0.02m

A	21/03/25	PT	PRELIMINARY FOR ISSUE	DK
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

PROJECT:

CRABTREE LANE
MANCHESTER

TITLE:

DIRECT RAINFALL MODELLING
1 IN 100 (1% AEP)
DEPTH PLAN

DATE: MAR '25	SCALE @ SIZE: 1:1000@A3	DRAWN: PT	CHECKED: DK
PROJECT No: HYD1015	DRAWING No: 603	REV: A	



DO NOT SCALE

Legend:

- Planning Application Boundary
- Spot Velocity (m/s)

Surface Water Velocity (m/s):

- ≤ 0.10
- 0.10 - 0.25
- 0.25 - 0.40
- 0.40 - 0.55
- 0.55 - 0.70
- > 0.70

* Includes flood extent where depths are below 0.02m

A	21/03/25	PT	PRELIMINARY FOR ISSUE	DK
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

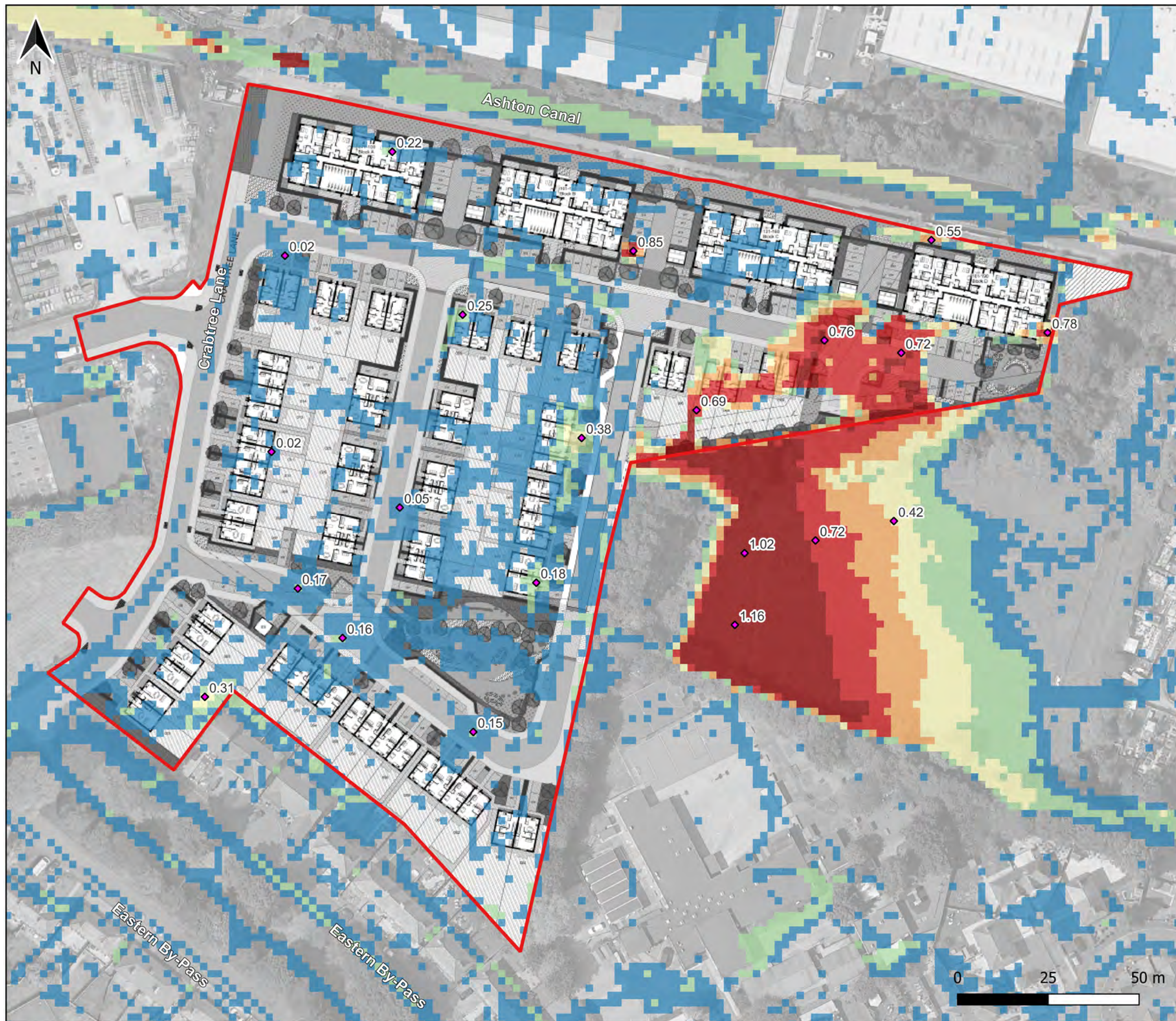
PROJECT:

CRABTREE LANE
MANCHESTER

TITLE:

DIRECT RAINFALL MODELLING
1 IN 100 (1% AEP)
VELOCITY PLAN

DATE: MAR '25	SCALE @ SIZE: 1:1000@A3	DRAWN: PT	CHECKED: DK
PROJECT No: HYD1015	DRAWING No: 604	REV: A	



DO NOT SCALE

Legend:

- Planning Application Boundary
- Spot Depths (m)

Surface Water Flood Depth (m):

- 0.02 - 0.15
- 0.15 - 0.30
- 0.30 - 0.45
- 0.45 - 0.60
- 0.60 - 0.75
- 0.75 <=

* Excludes flood depths below 0.02m

A	21/03/25	PT	PRELIMINARY FOR ISSUE	DK
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

PROJECT:
**CRABTREE LANE
MANCHESTER**

TITLE:
**DIRECT RAINFALL MODELLING
1 IN 1000 (0.1% AEP)
DEPTH PLAN**

DATE: MAR '25	SCALE @ SIZE: 1:1000@A3	DRAWN: PT	CHECKED: DK
PROJECT No: HYD1015	DRAWING No: 605	REV: A	



DO NOT SCALE

Legend:

- Planning Application Boundary
- Spot Velocity (m/s)

Surface Water Velocity (m/s):

- <= 0.10
- 0.10 - 0.25
- 0.25 - 0.40
- 0.40 - 0.55
- 0.55 - 0.70
- > 0.70

* Includes flood extent where depths are below 0.02m

A	21/03/25	PT	PRELIMINARY FOR ISSUE	DK
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



BETTS HYDRO
CONSULTING ENGINEERS

Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

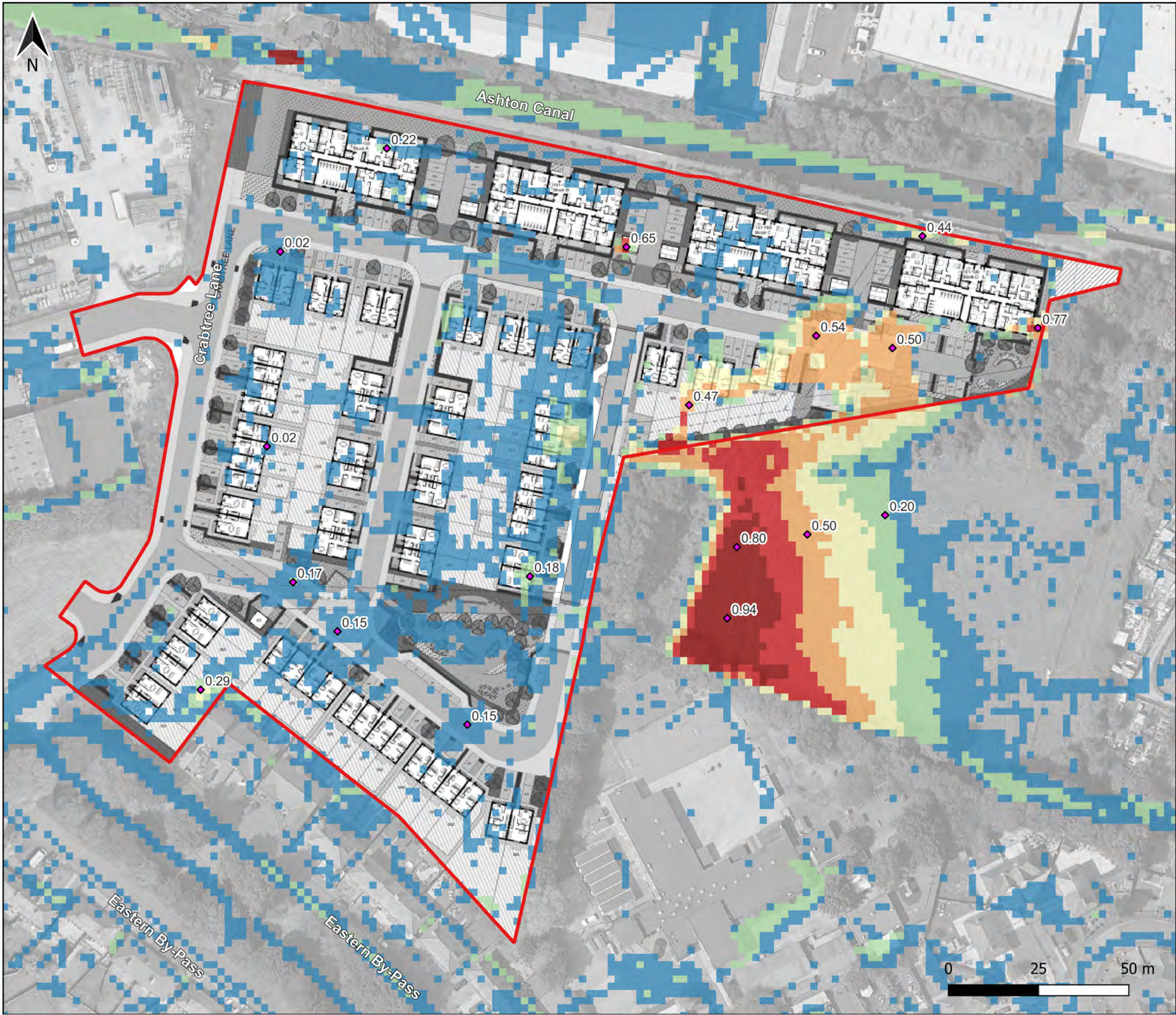
PROJECT:

CRABTREE LANE
MANCHESTER

TITLE:

DIRECT RAINFALL MODELLING
1 IN 1000 (0.1% AEP)
VELOCITY PLAN

DATE: MAR '25	SCALE @ SIZE: 1:1000@A3	DRAWN: PT	CHECKED: DK
PROJECT No: HYD1015	DRAWING No: 606	REV: A	



DO NOT SCALE

Legend:

- Planning Application Boundary
- Spot Depths (m)

Surface Water Flood Depth (m):

- 0.02 - 0.15
- 0.15 - 0.30
- 0.30 - 0.45
- 0.45 - 0.60
- 0.60 - 0.75
- 0.75 <=

* Excludes flood depths below 0.02m

A	21/03/25	JT	PRELIMINARY FOR ISSUE	PT
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



BETTS HYDRO
CONSULTING ENGINEERS

Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

PROJECT:
**CRABTREE LANE
MANCHESTER**

TITLE:
DIRECT RAINFALL MODELLING
1 IN 30 (3.3% AEP)
PLUS 40% CLIMATE CHANGE ALLOWANCE
DEPTH PLAN

DATE: MAR '25	SCALE @ SIZE: 1:1000@A3	DRAWN: JT	CHECKED: PT
PROJECT No: HYD1015	DRAWING No: 610	REV: A	



DO NOT SCALE

Legend:

- Planning Application Boundary
- Spot Velocity (m/s)

Surface Water Velocity (m/s):

- <= 0.10
- 0.10 - 0.25
- 0.25 - 0.40
- 0.40 - 0.55
- 0.55 - 0.70
- > 0.70

* Includes flood extent where depths are below 0.02m

A	21/03/25	JT	PRELIMINARY FOR ISSUE	PT
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



BETTS HYDRO
CONSULTING ENGINEERS

Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

PROJECT:
**CRABTREE LANE
MANCHESTER**

TITLE:
**DIRECT RAINFALL MODELLING
1 IN 30 (3.3% AEP)
PLUS 40% CLIMATE CHANGE ALLOWANCE
VELOCITY PLAN**

DATE: MAR '25	SCALE @ SIZE: 1:1000@A3	DRAWN: JT	CHECKED: PT
PROJECT No: HYD1015	DRAWING No: 611	REV: A	



DO NOT SCALE

Legend:

 Planning Application Boundary

FD2320 Hazard Classification

Very low hazard

Danger for some

Danger for most

Danger for all

Showing composite output in which for depths above 0.25m a debris factor of 1 is applied. For depths below 0.25m a debris factor of 0.5m is applied.

A	21/03/25	JT	PRELIMINARY FOR ISSUE	PT
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

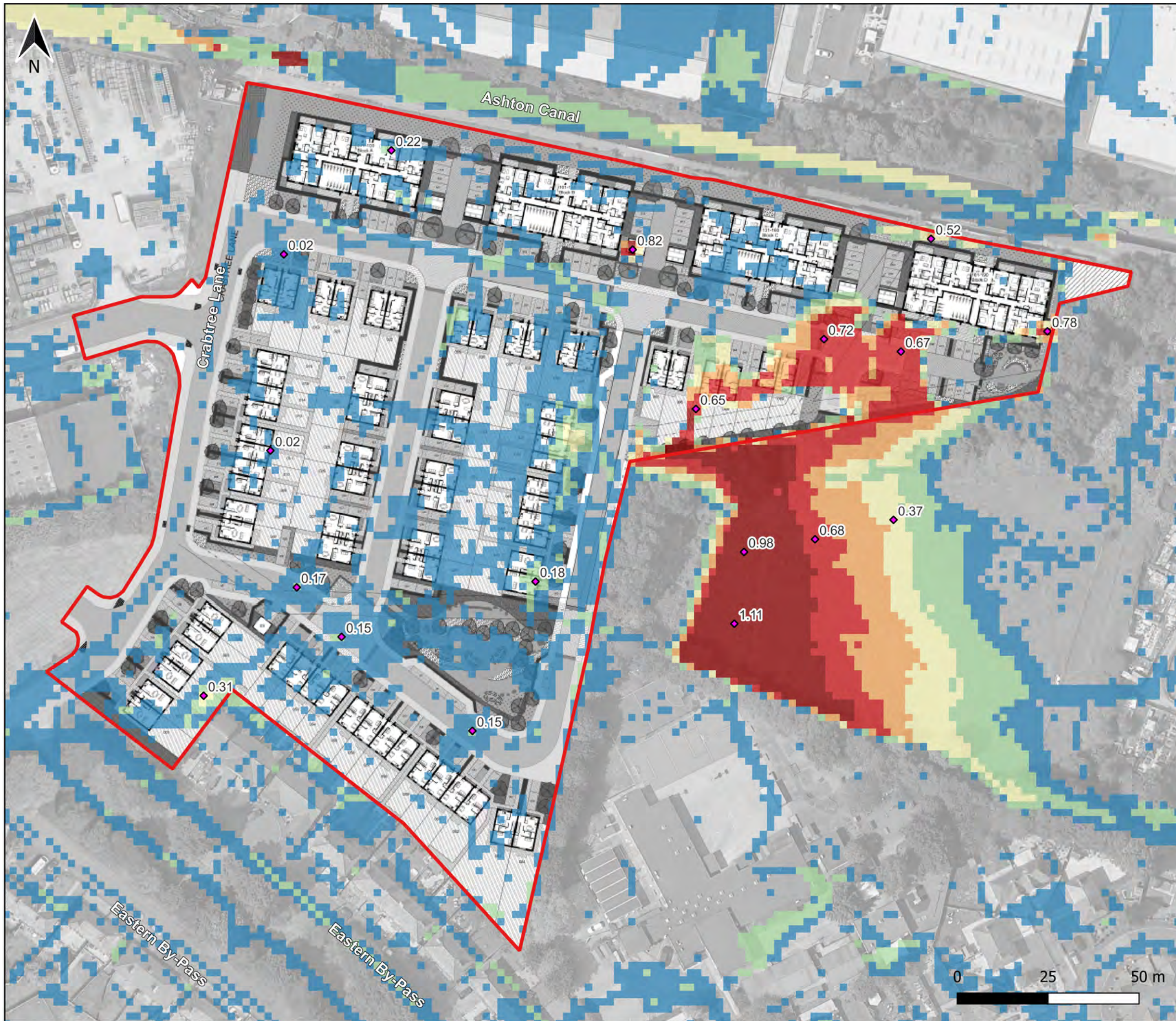
PROJECT:

CRABTREE LANE
MANCHESTER

TITLE:

DIRECT RAINFALL MODELLING
1 IN 30 (3.3% AEP)
PLUS 40% CLIMATE CHANGE ALLOWANCE
HAZARD PLAN

DATE: MAR '25	SCALE @ SIZE: 1:1000@A3	DRAWN: JT	CHECKED: PT
PROJECT No: HYD1015	DRAWING No: 612	REV: A	



DO NOT SCALE

Legend:

- Planning Application Boundary
- Spot Depths (m)

Surface Water Flood Depth (m):

- 0.02 - 0.15
- 0.15 - 0.30
- 0.30 - 0.45
- 0.45 - 0.60
- 0.60 - 0.75
- 0.75 <=

* Excludes flood depths below 0.02m

A	21/03/25	JT	PRELIMINARY FOR ISSUE	PT
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

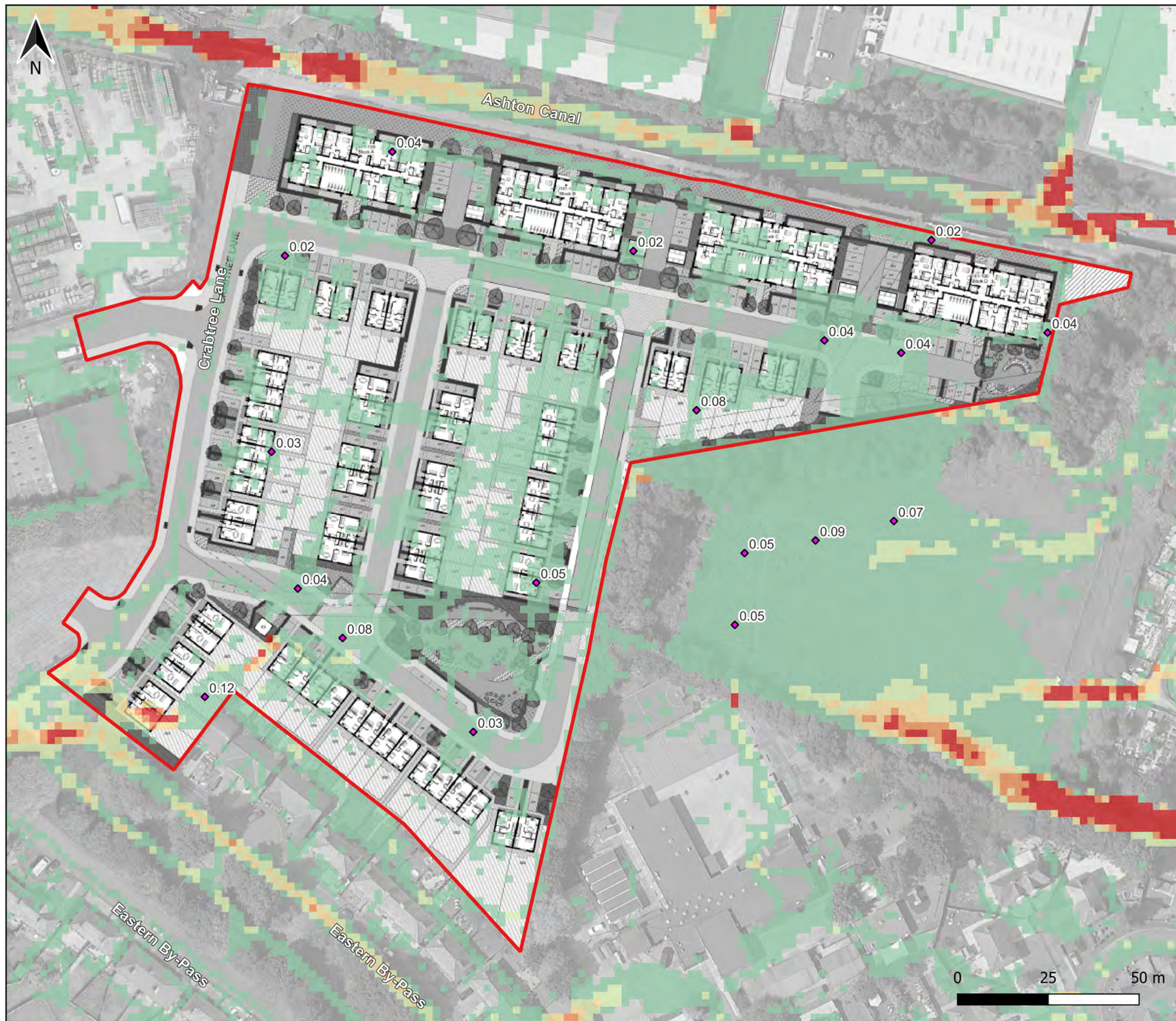
PROJECT:

CRABTREE LANE
MANCHESTER

TITLE:

DIRECT RAINFALL MODELLING
1 IN 100 (1% AEP)
PLUS 45% CLIMATE CHANGE ALLOWANCE
DEPTH PLAN

DATE: MAR '25	SCALE @ SIZE: 1:1000@A3	DRAWN: JT	CHECKED: PT
PROJECT No: HYD1015	DRAWING No: 613	REV: A	



DO NOT SCALE

Legend:

Planning Application Boundary

◆ Spot Velocity (m/s)

Surface Water Velocity (m/s):

<= 0.10

0.10 - 0.25

0.25 - 0.40

0.40 - 0.55

0.55 - 0.70

> 0.70

* Includes flood extent where depths are below 0.02m

A	21/03/25	JT	PRELIMINARY FOR ISSUE	PT
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

PROJECT:

CRABTREE LANE
MANCHESTER

TITLE:

DIRECT RAINFALL MODELLING
1 IN 100 (1% AEP)
PLUS 45% CLIMATE CHANGE ALLOWANCE
VELOCITY PLAN

DATE: MAR '25	SCALE @ SIZE: 1:1000@A3	DRAWN: JT	CHECKED: PT
PROJECT No: HYD1015	DRAWING No: 614	REV: A	



DO NOT SCALE

- Legend:
- Planning Application Boundary
 - FD2320 Hazard Classification
 - Very low hazard
 - Danger for some
 - Danger for most
 - Danger for all

Showing composite output in which for depths above 0.25m a debris factor of 1 is applied. For depths below 0.25m a debris factor of 0.5m is applied.

A	21/03/25	JT	PRELIMINARY FOR ISSUE	PT
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

PROJECT:	CRABTREE LANE MANCHESTER
TITLE:	DIRECT RAINFALL MODELLING 1 IN 100 (1% AEP) PLUS 45% CLIMATE CHANGE ALLOWANCE HAZARD PLAN

DATE: MAR '25	SCALE @ SIZE: 1:1000@A3	DRAWN: JT	CHECKED: PT
PROJECT No: HYD1015	DRAWING No: 615	REV: A	

APPENDIX E: PROPOSED SURFACE WATER FLOOD PLANS

HYD1015_713_A_PROPOSED-DIRECT.RAINFALL.100.YEAR.CC.DEPTH_A3L

HYD1015_714_A_PROPOSED-DIRECT.RAINFALL.100.YEAR.CC.VELOCITY_A3L

HYD1015_715_A_PROPOSED-DIRECT.RAINFALL.100.YEAR.CC.HAZARD_A3L



LEGEND

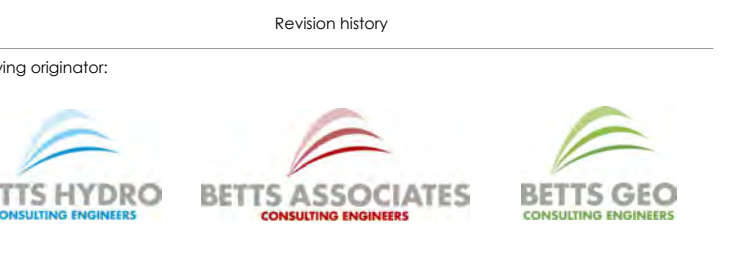
- Site Boundary
- Proposed Finished Floor Level
- Existing Boundary Ground Level
- Proposed Road / Driveway Contour - Major (0.50m interval)
- Proposed Road / Driveway Contour - Minor (0.05m interval)
- Proposed Spot Level
- Existing Surface Water Sewer
- Existing Foul Water Sewer
- Existing Combined Sewer
- Existing Surface Water Sewer to be Abandoned
- Existing Foul Water Sewer to be Abandoned
- Existing Combined Sewer to be Abandoned
- Proposed Surface Water Sewer
- Proposed Highway Drainage
- Proposed Foul Water Sewer
- Proposed Combined Sewer
- Proposed Sewer Easement (from centre line of pipe work)

IMPORTANT - Invert levels at proposed points of connection are to be confirmed prior to any works commencing on site as onsite drainage and slab levels may be affected

Notes

- Planning layout ref. 02292-S_03-Siteplan - Ground Floor-D11_250129.
- Topographical survey provided by 'Survey Eng Ltd', ref. MC13.115_E Crabtree Lane, Openshaw - Topo Survey', Dated June 2021.
- Road detail, levels and layout are subject to local authority section 38 Highways approval.

Mark	Date	Details	Revision history	By
P04	08.05.25	Whole Site levels reviewed and raised, no changes to proposed sewer invert levels.		CP
P03	14.04.25	FFL's raised @ Plots 34-36, 45-50 & apartment Bloc C & D		CP
P02	18.02.25	EA surface water extents (future) removed		NR
P01	31.01.25	EA surface water extents (future) added		CP
		Preliminary issue for review		

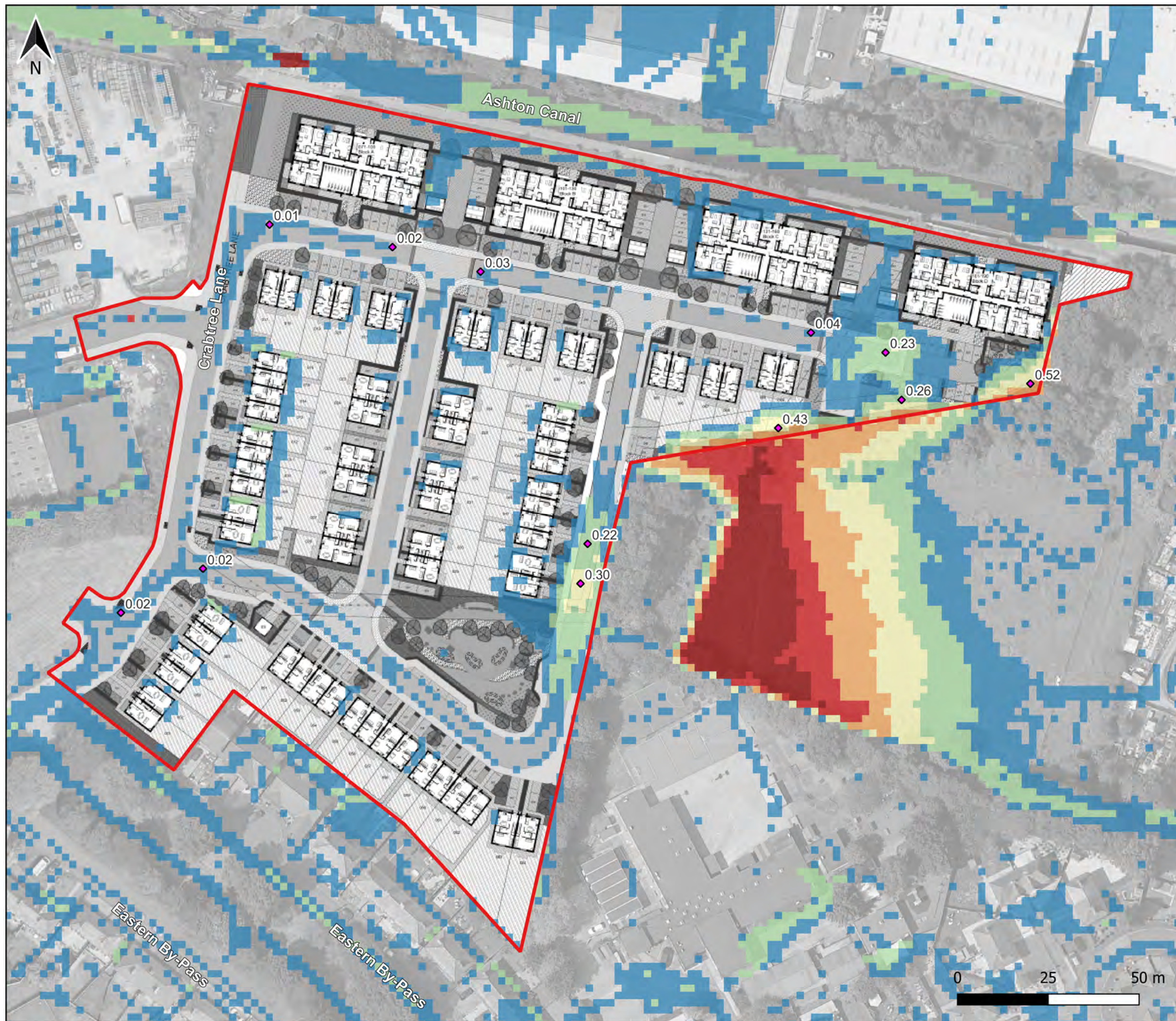


Crabtree Lane, Manchester

Preliminary Drainage Layout

Scale: 1:500		for the original size of A1							
Drawn by: CP	Checked by: NR	Passed by: SR	Date: Jan 2025						
Drawing status:		For Information							
Job No:	Drawing No:	Project	Origin	Volume	Level	Type	Discip.	Number	Revision:
KMH28	CTL	BET	ZZ	xx	DR	C	0101		P04

Do not scale this drawing
4-7 Old Marsh Farm Barns, Weath Road, Salford, M6 6JL
enquiries@betts-associates.co.uk
Chestor 01244 288178 | Altrincham 0161 613331



DO NOT SCALE

Legend:

- Planning Application Boundary
- ◆ Spot Depths (m)

Surface Water Flood Depth (m):

- 0.02 - 0.15
- 0.15 - 0.30
- 0.30 - 0.45
- 0.45 - 0.60
- 0.60 - 0.75
- 0.75 <=

* Excludes flood depths below 0.02m

A	13/05/25	JT	PRELIMINARY FOR ISSUE	PT
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

PROJECT:
**CRABTREE LANE
MANCHESTER**

TITLE:
**PROPOSED DIRECT RAINFALL MODELLING
1 IN 30 (1.3% AEP)
PLUS 40% CLIMATE CHANGE ALLOWANCE
DEPTH PLAN**

DATE: MAY '25	SCALE @ SIZE: 1:1000@A3	DRAWN: JT	CHECKED: PT
PROJECT No: HYD1015	DRAWING No: 710	REV: A	



DO NOT SCALE

Legend:

 Planning Application Boundary

◆ Spot Velocity (m/s)

Surface Water Velocity (m/s):

≤ 0.10

$0.10 - 0.25$

$0.25 - 0.40$

$0.40 - 0.55$

$0.55 - 0.70$

> 0.70

* Includes flood extent where depths are below 0.02m

A	13/05/25	JT	PRELIMINARY FOR ISSUE	PT
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



BETTS HYDRO
CONSULTING ENGINEERS

Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

PROJECT:

CRABTREE LANE
MANCHESTER

TITLE:

PROPOSED DIRECT RAINFALL MODELLING
1 IN 30 (1.33% AEP)
PLUS 40% CLIMATE CHANGE ALLOWANCE
VELOCITY PLAN

DATE: MAY '25	SCALE @ SIZE: 1:1000@A3	DRAWN: JT	CHECKED: PT
PROJECT No: HYD1015	DRAWING No: 711	REV: A	



DO NOT SCALE

Legend:

 Planning Application Boundary

FD2320 Hazard Classification

Very low hazard

Danger for some

Danger for most

Danger for all

Showing composite output in which for depths above 0.25m a debris factor of 1 is applied. For depths below 0.25m a debris factor of 0.5m is applied.

A	13/05/25	JT	PRELIMINARY FOR ISSUE	PT
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

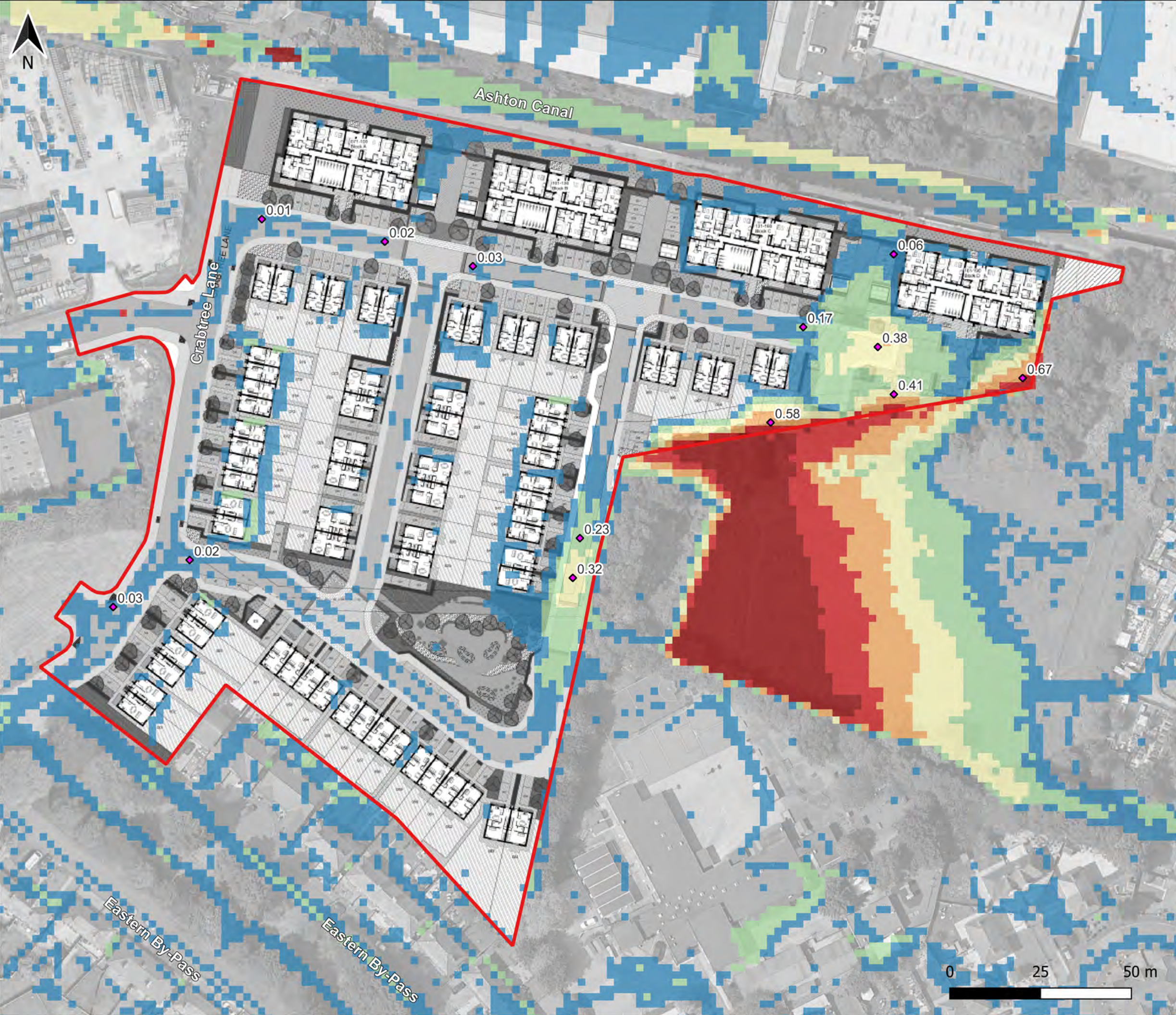
PROJECT:

CRABTREE LANE
MANCHESTER

TITLE:

PROPOSED DIRECT RAINFALL MODELLING
1 IN 30 (1.33% AEP)
PLUS 40% CLIMATE CHANGE ALLOWANCE
HAZARD PLAN

DATE: MAY '25	SCALE @ SIZE: 1:1000@A3	DRAWN: JT	CHECKED: PT
PROJECT No: HYD1015	DRAWING No: 712	REV: A	



DO NOT SCALE

Legend:

- Planning Application Boundary
- Spot Depths (m)

Surface Water Flood Depth (m):

- 0.02 - 0.15
- 0.15 - 0.30
- 0.30 - 0.45
- 0.45 - 0.60
- 0.60 - 0.75
- 0.75 <=

* Excludes flood depths below 0.02m

B	13/05/25	JT	UPDATED LEVELS	PT
A	21/03/25	JT	PRELIMINARY FOR ISSUE	PT
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



BETTS HYDRO
CONSULTING ENGINEERS

Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

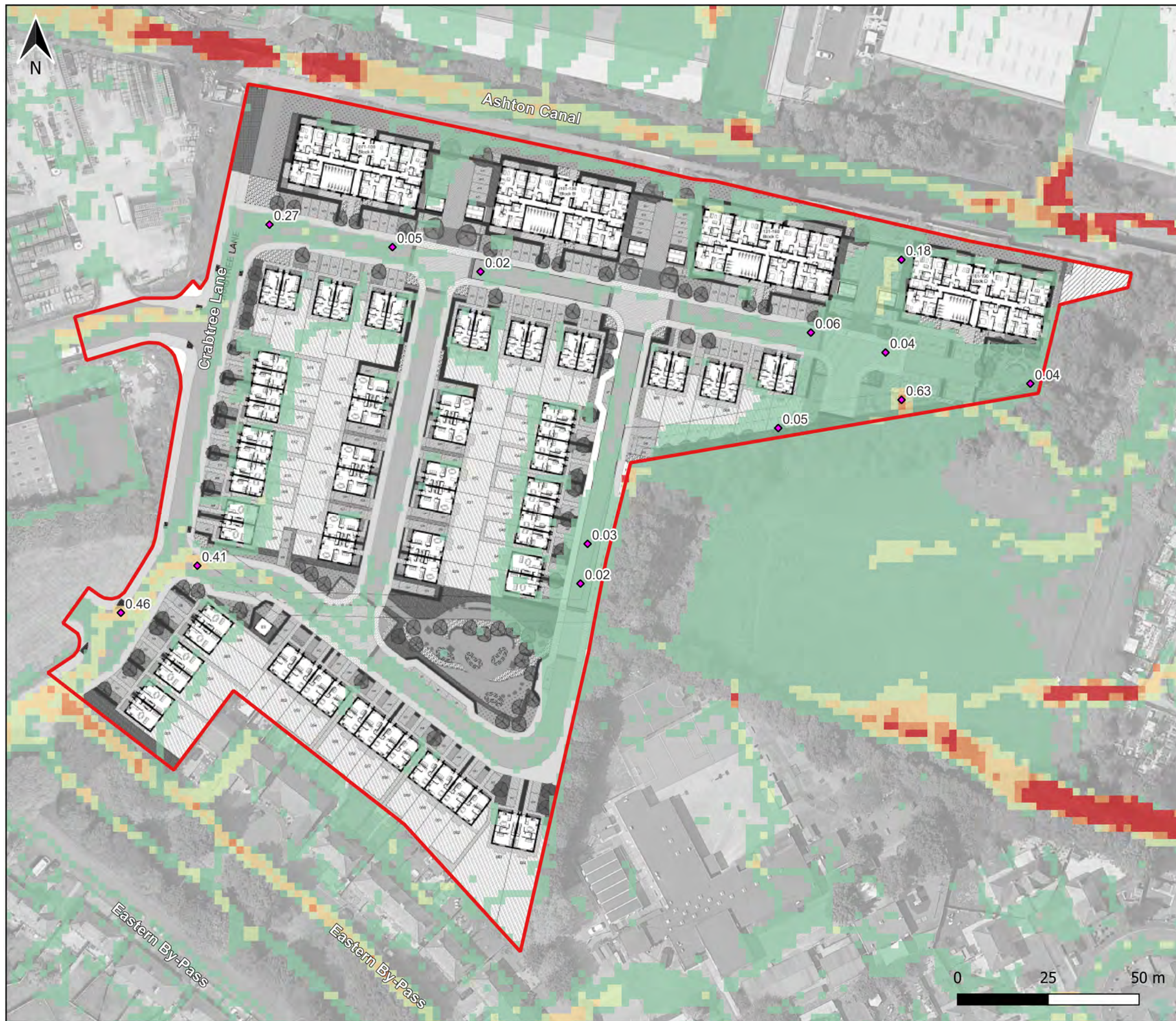
PROJECT:

CRABTREE LANE
MANCHESTER

TITLE:

DIRECT RAINFALL MODELLING
1 IN 100 (1% AEP)
PLUS 45% CLIMATE CHANGE ALLOWANCE
DEPTH PLAN

DATE: MAY '25	SCALE @ SIZE: 1:1000@A3	DRAWN: JT	CHECKED: PT
PROJECT No: HYD1015	DRAWING No: 713	REV: B	



DO NOT SCALE

Legend:

Planning Application Boundary

◆ Spot Velocity (m/s)

Surface Water Velocity (m/s):

<= 0.10

0.10 - 0.25

0.25 - 0.40

0.40 - 0.55

0.55 - 0.70

> 0.70

* Includes flood extent where depths are below 0.02m

B	13/05/25	JT	UPDATED LEVELS	PT
A	21/03/25	JT	PRELIMINARY FOR ISSUE	PT
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



BETTS HYDRO
CONSULTING ENGINEERS

Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

PROJECT:

CRABTREE LANE
MANCHESTER

TITLE:

PROPOSED DIRECT RAINFALL MODELLING
1 IN 100 (1% AEP)
PLUS 45% CLIMATE CHANGE ALLOWANCE
VELOCITY PLAN

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
MAY '25	1:1000@A3	JT	PT

PROJECT No:	DRAWING No:	REV:
HYD1015	714	B



DO NOT SCALE

Legend:

Planning Application Boundary

FD2320 Hazard Classification

Very low hazard

Danger for some

Danger for most

Danger for all

Showing composite output in which for depths above 0.25m a debris factor of 1 is applied. For depths below 0.25m a debris factor of 0.5m is applied.

B	13/05/25	JT	UPDATED LEVELS	PT
A	21/03/25	JT	PRELIMINARY FOR ISSUE	PT
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS:



Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178enquiries@betts-associates.co.uk

KEEPMOAT HOMES

PROJECT:

CRABTREE LANE
MANCHESTER

TITLE:

PROPOSED DIRECT RAINFALL MODELLING
1 IN 100 (1% AEP)
PLUS 45% CLIMATE CHANGE ALLOWANCE
HAZARD PLAN

DATE: MAY '25	SCALE @ SIZE: 1:1000@A3	DRAWN: JT	CHECKED: PT
PROJECT No: HYD1015	DRAWING No: 715	REV: B	

APPENDIX E: NOTES OF LIMITATIONS

The data essentially comprised a study of available documented information from various sources together with discussions with relevant authorities and other interested parties. There may also be circumstances at the site that are not documented. The information reviewed is not exhaustive and has been accepted in good faith as providing representative and true data pertaining to site conditions. If additional information becomes available which might impact our conclusions, we request the opportunity to review the information, reassess the potential concerns and modify our opinion if warranted.

It should be noted that any risks identified in this report are perceived risks based on the available information.

This report was prepared by Betts Hydro Ltd for the sole and exclusive use of the titled client in response to instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

This document has been prepared for the titled project only and should any third party wish to use or rely upon the contents of the report, written approval from Betts Associates Ltd must be sought.

Betts Associates Ltd accepts no responsibility or liability for the consequences of this document being used for the purpose other than that for which it was commissioned and for this document to any other party other than the person by whom it was commissioned.