



Flood Risk Assessment for development at the Bennett Street, Manchester M15 5NL Rev. 5

Contract Ref: FD019

Kellen Homes

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Quality assurance record

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Limitation of liability and use

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1. INTRODUCTION

1.1 Purpose of this Report

Townsend Water Engineering Ltd. has been appointed by Mr Steve Green at Kellen Homes for a flood risk assessment (FRA) of a development of approximately 272 residential units at land at Bennett Street, Gorton M12 5NL (Grid Ref: 386195, 397049). This report has been prepared in support of the planning permission for the aforementioned development.

The report is based on the available flood risk information for the site detailed in Section 1.2 and prepared in accordance with the planning policy requirements set out in Section 1.3. The scope of the FRA is consistent with the 'Site Specific Flood Risk Assessment Checklist' from the National Planning Policy Framework (NPPF) and accompanying Planning Practice Guidance (PPG):

<https://www.gov.uk/guidance/flood-risk-and-coastal-change#Site-Specific-Flood-Risk-Assessment-checklist-section>

1.2 Sources of Information and Consultation

This Report has been informed by:

- Existing draft Site Plan drawings and respective topographic plan delivered by Kellen Homes;
- EA Product 4 data;
- Modelling undertaken to investigate the flooding of the surrounding area,
- BGS website <http://mapapps.bgs.ac.uk/geologyofbritain/home.html?mode=boreholes>;
- Defra Magic Map <https://magic.defra.gov.uk/magicmap.aspx>;
- Cranfield University Soil Mapping <http://www.landis.org.uk/soilscapes/>;
- The EA online flood maps;
- Flood Zone Map <https://flood-map-for-planning.service.gov.uk/>;
- Flood Risk Map: <https://flood-warning-information.service.gov.uk/long-term-flood-risk/>.

1.3 Policy Context

This report has been prepared in accordance with the relevant national, regional and local planning policy and statutory guidance as follows:

- National policy contained within the National Planning Policy Framework (NPPF) dated July 2021, issued by former Ministry of Housing, Communities and Local Government with reference to Section 14 'Meeting the challenge of climate change, flooding and coastal change';
- The NPPF Planning Practice Guidance (PPG) released in March 2014 ('Flood Risk and Coastal Change' section) and updated in February 2016 to incorporate the EA 'Flood Risk Assessments: Climate Change Allowances' guidance; and,
- Salford City Council, Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA, LEVEL 1 SFRA, March 2010;
- Salford City Council, Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA, LEVEL 2 SFRA, March 2011;
- Strategic Flood Risk Assessment for Greater Manchester March 2011

1.4 Structure of this Report

The Report has been prepared based on the following structure:

- Section 2 refers to spatial planning considerations by reference to the proposed land use, flood zoning and NPPF vulnerability;
- Section 3 presents the assessment of existing flood risk at the site;
- Section 4 presents the proposed development and findings of flooding;
- Section 5 presents the drainage strategy;
- Section 6 provides a summary of the assessments

Additional Appendices are provided that deal with the following:

- Appendix A Flood Data;
- Appendix B Consultation with Manchester City Council.
- Appendix C Microdrainage Results

2. SPATIAL PLANNING CONSIDERATION

2.1 Location and Background

The location of the proposed development site is shown in Figure 1 and Figure 2, with location details found in Table 1. The site is located on Bennett Street, Gorton M12 5NL (Grid Ref: 381962, 399880). (Table 1: Site Details)

The proposed development is for demolition of existing buildings and structures on the site and erection of 272 homes (Use Class C3) and a new community building (Use Class F2(b)), with associated car parking, access, highways, landscaping and new public realm creation, and other associated works. The development site is approximately 5.13ha and will replace the existing warehouse, area for shipping containers and a former demolition yard. There is a culvert that runs east to west running through the site called Corn Brook. There is another culvert that runs north east to south east and confluences with the culvert running east to west near the western boundary. Both of these culverts are ordinary watercourse and are named Black Brook and Corn Brook respectively.

The entrance to the site is from Bennett Street. Bennett Street is to the south of the site. Further south is a residential development. To the north of the site is a railway line and then industrial units. To the west is a railway and then industrial units. Ardwick station is to the north west. To the east is residential development. These are shown in figure 1 and 2.



Figure 1: Site Location (Source: Bing)

Bedrock formed approximately 252 to 272 million years ago in the Permian Period. (Figure 3: Bedrock underneath the Site (Source: BGS Bedrock Geology Mapping)). The superficial geology of the site is described as Till, Devensian.

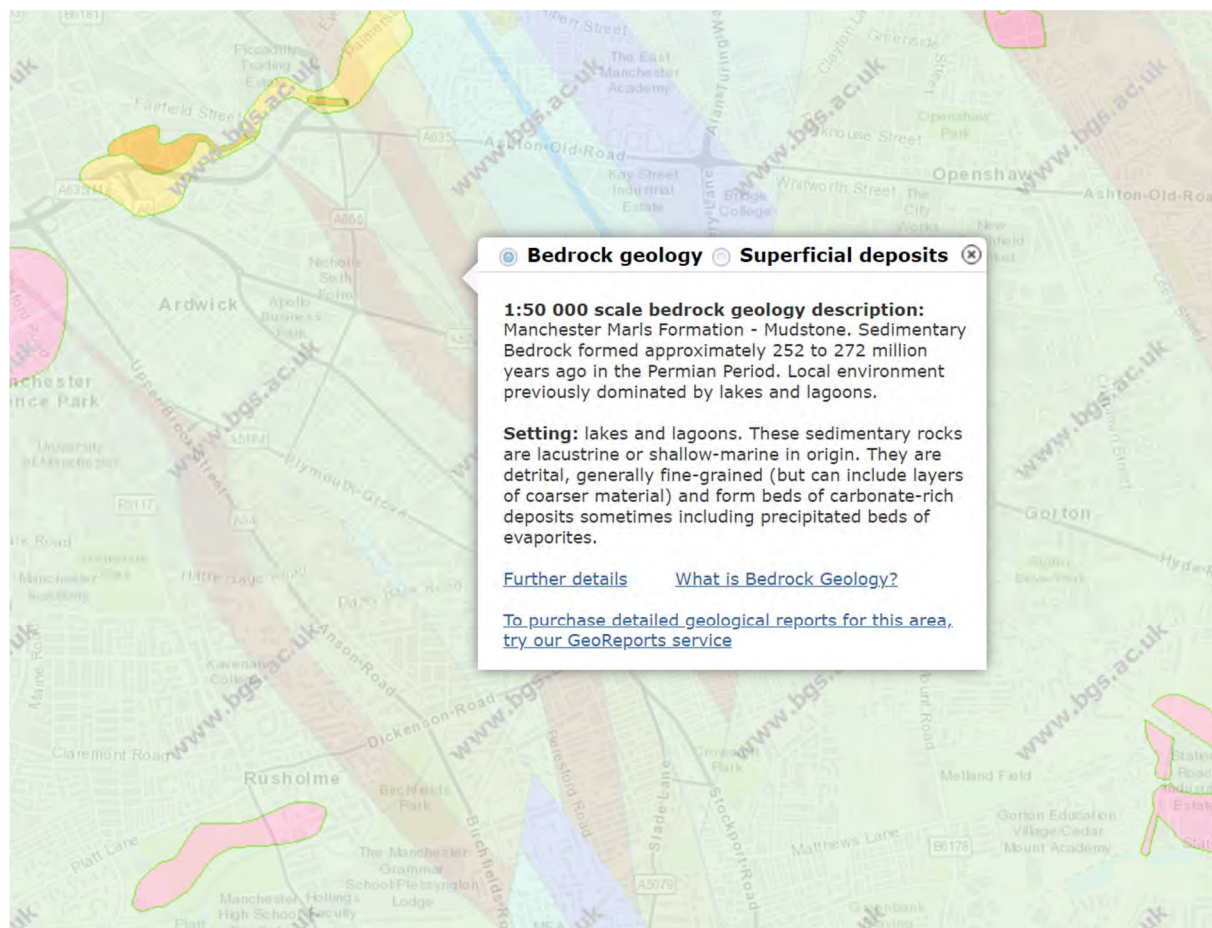


Figure 3: Bedrock underneath the Site (Source: BGS Bedrock Geology Mapping)

Environment Agency's Source Protection Zone shown in Magic Map (Figure 4: Source Protection Zone Map of the Site (Source: Defra Magic Map)) indicates that our site is located 1347m away from Zone 3.



Figure 4: Source Protection Zone Map of the Site (Source: Defra Magic Map)

Bennett Street, Gorton- Geo-Environmental Desk Study Preliminary Risk Assessment suggests the site is polluted and is underlain with Chester Formation sandstones, Manchester Marls Formation mudstones, and Collyhurst sandstone Formation Sandstones.

Due to the pollution and ground type, it is recommended that soakaways are not used.

2.4 Flood Zone

The proposed site is within Flood Zone 2 (area at medium risk of flooding). Flood Zone 2 has a return period of between a 1 in 100 year event and a 1 in 1000 year event. This has been confirmed by the Environment Agency. Below is the map indicating the flood nodes on site (figure 5, 6 and 7).

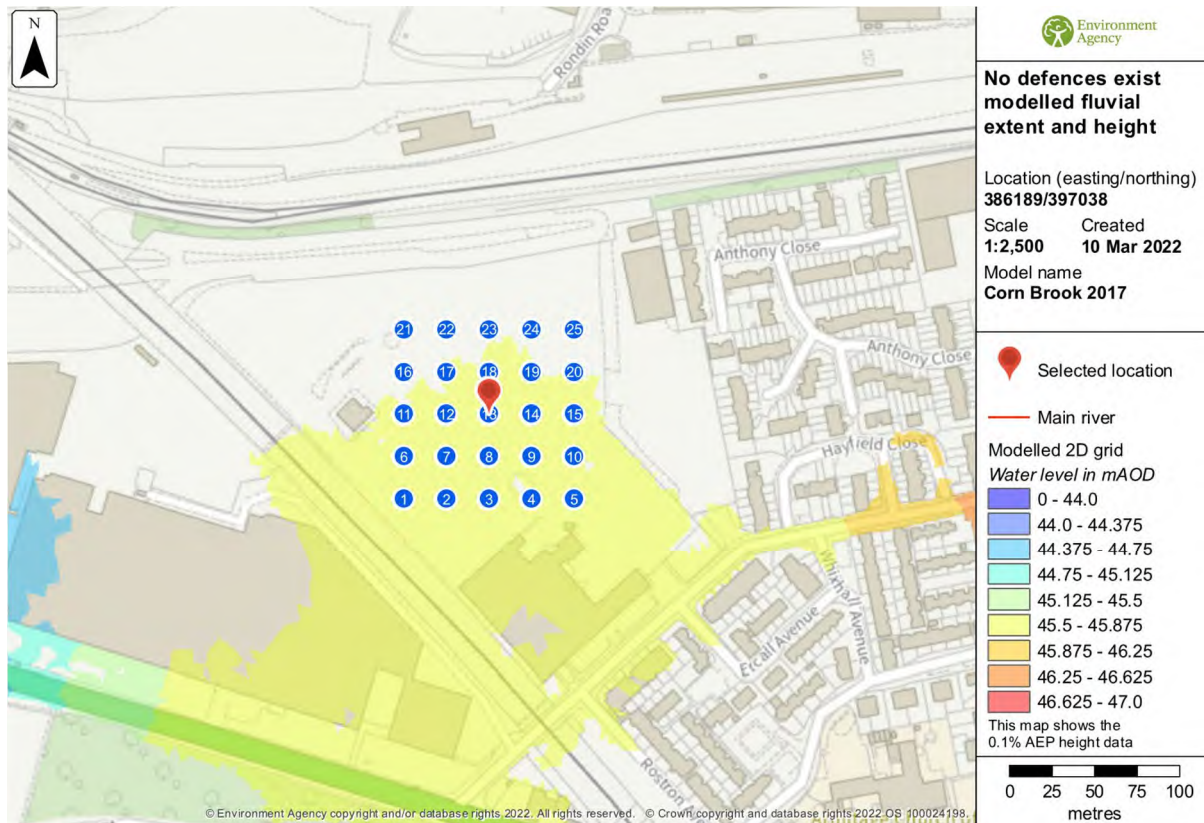


Figure 5: Flood Nodes from the Environment Agency

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	386139	396988	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.44	45.66
2	386164	396988	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.52	45.66
3	386189	396988	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.56	45.66
4	386214	396988	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.42	45.67
5	386239	396988	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.21	45.32	0.56	45.67
6	386139	397013	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.14	45.29	0.51	45.66
7	386164	397013	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.35	45.66
8	386189	397013	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.36	45.67
9	386214	397013	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.39	45.67
10	386239	397013	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.44	45.67
11	386139	397038	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.15	45.66
12	386164	397038	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.29	45.66
13	386189	397038	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.25	45.67
14	386214	397038	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.26	45.67
15	386239	397038	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.42	45.67
16	386139	397063	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Figure 6: Flood Levels for the site without climate change

Label	Easting	Northing	1% AEP (+30%)		1% AEP (+35%)		1% AEP (+70%)		0.1% AEP (+30%)	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height
1	386139	396988	NoData	NoData	NoData	NoData	0.21	45.43	0.58	45.80
2	386164	396988	NoData	NoData	NoData	NoData	0.28	45.44	0.67	45.80
3	386189	396988	NoData	NoData	NoData	NoData	0.34	45.44	0.71	45.81
4	386214	396988	NoData	NoData	NoData	NoData	0.19	45.44	0.56	45.81
5	386239	396988	NoData	NoData	NoData	NoData	0.34	45.45	0.71	45.82
6	386139	397013	NoData	NoData	NoData	NoData	0.29	45.44	0.66	45.80
7	386164	397013	NoData	NoData	NoData	NoData	0.12	45.44	0.49	45.80
8	386189	397013	NoData	NoData	NoData	NoData	0.13	45.44	0.50	45.81
9	386214	397013	NoData	NoData	NoData	NoData	0.19	45.45	0.54	45.81
10	386239	397013	NoData	NoData	NoData	NoData	0.22	45.45	0.59	45.81
11	386139	397038	NoData	NoData	NoData	NoData	NoData	NoData	0.30	45.81
12	386164	397038	NoData	NoData	NoData	NoData	NoData	NoData	0.43	45.81
13	386189	397038	NoData	NoData	NoData	NoData	0.10	45.45	0.47	45.81
14	386214	397038	NoData	NoData	NoData	NoData	NoData	NoData	0.41	45.81
15	386239	397038	NoData	NoData	NoData	NoData	0.19	45.45	0.56	45.82
16	386139	397063	NoData	NoData	NoData	NoData	NoData	NoData	0.13	45.81

Figure 7: Flood Levels for the site climate change

The modelling data was acquired from the Environment Agency. As indicated from the figure above the site does not flood in the 1 in 100 year event plus 35% climate change. It does however flood in the 1 in 1000 year event to 45.67mAOD and 45.45mAOD in the 1 in 100 year event plus 70% climate change.

2.5 NPPF Vulnerability

The development will be classed as 'More Vulnerable' under the NPPF vulnerability classification (Table 2). The flood risk vulnerability and flood zone compatibility are displayed in Table 3: Flood Risk Vulnerability and flood zone compatibility (Source NPPF Technical Guide). As noted in Section 2.4, the site is within Flood Zone 2 according to the EA flood risk map for planning.

Table 2: Flood Risk Vulnerability Classification (Source: NPPF Technical Guide)

More vulnerable (MV)
Hospitals, residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels
Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
Non-residential uses for health services, nurseries and educational establishments.
Landfill and sites used for waste management facilities for hazardous waste.
Sites used for holiday or short let caravans and camping, subject to a specific warning and evacuation plan.

Table 3: Flood Risk Vulnerability and flood zone compatibility (Source NPPF Technical Guide)

Flood Zone	Definition	Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
1	$T > 1,000$	✓	✓	✓	✓	✓
2	$100 < T_{fluv} < 1,000$ $200 < T_{tidal} < 1,000$	✓	✓	Exc. Test	✓	✓
3a	$T_{fluv} < 100$ $T_{tidal} < 200$	Exc. Test	✓	✗	Exc. Test	✓
3b (functional floodplain)	$T_{fluv} < 20$	Exc. Test	✓	✗	✗	✗

As the development refers to dwellings (More Vulnerable) and it is located in Flood Zone 2 according to Table 3: Flood Risk Vulnerability and flood zone compatibility (Source NPPF Technical Guide), the sequential is passed and there is no need for an exception test.

2.6 Climate change allowances

The Environment Agency and NPPF require a consideration of the impacts of climate change in Flood Risk Assessments (FRA). In February 2016, the Environment Agency updated the climate change allowances required in Flood Risk Assessments (last updated 27 May 2022); this advice updates previous climate change allowances to support the NPPF (DCLG, 2012). The advice splits the country into regions and give climate change split into central, high, upper. According to the guidance the development should use 35% for river flows for more vulnerable development. Please see below the exact of the climate change map:

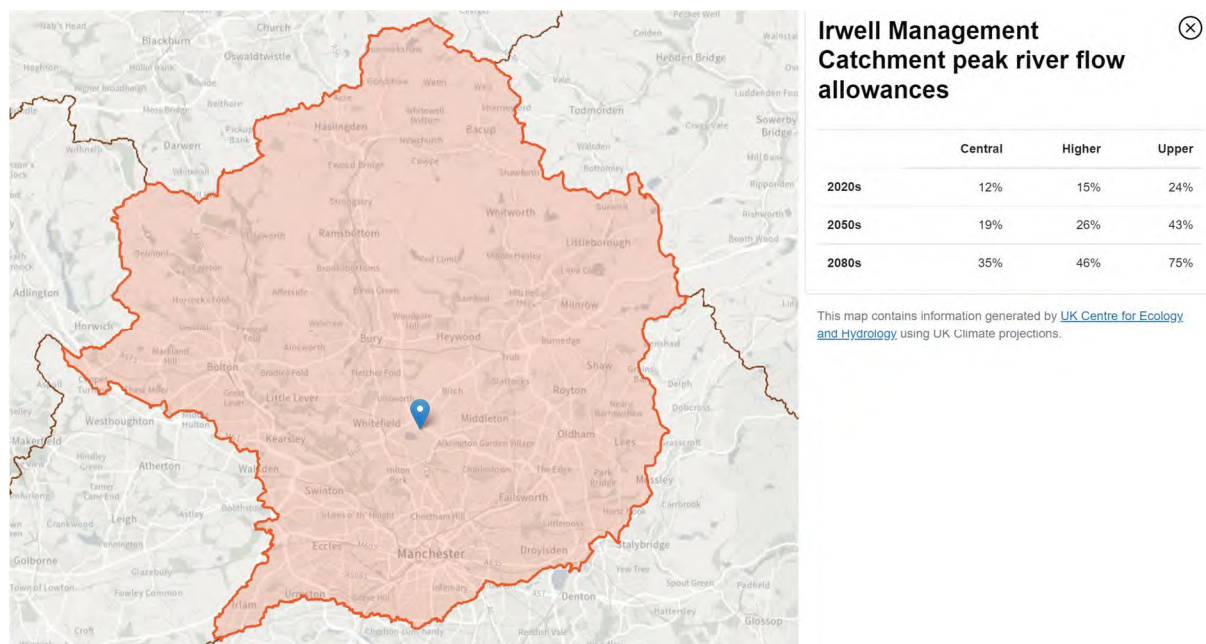


Figure 8: Peak River Flow allowances

As the site does not flood in the 1 in 100 year event plus 35% climate change no compensatory storage or raising finished floors is required.

Figure 9: Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline) shows anticipated changes in small catchments, recommending a progressive increase, reaching 45% for the 'Upper End' allowance by 2125. This allowance would be recommended for this proposed development, which is classified as 'More Vulnerable' and has been taken to have a 100-year design life. The 45% climate change allowance is based on the 90th percentile, meaning that there is a 90% chance that rainfall will not increase by more than the 45% increment.

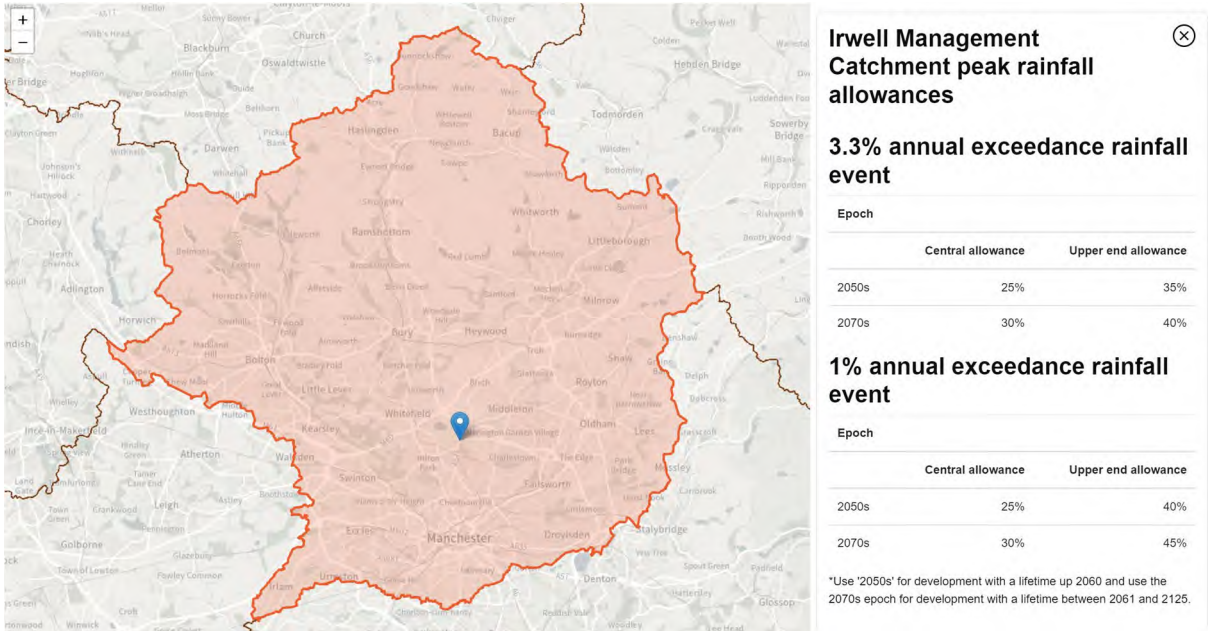


Figure 9: Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

3. FLOOD HAZARD FOR EXISTING SITE

3.1 Source of Flood Risk

Flood sources and their possibilities at the site is listed in Table 4, and further described below.

Table 4: Sources of Flood Risk

Key sources of flooding	Possibility at Site
Fluvial (Rivers) Defended / Undefended	<i>Medium Risk, Flood Zone 2 (confirmed by EA product 4 data)</i>
Tidal	<i>N/A</i>
Groundwater	<i>Low risk</i>
Sewers	<i>Considered to be low.</i>
Surface water	<i>Mostly very low risk with an area in the 1% surface water flood risk, Figure 10, Figure 11: 0.1% AEP Surface Water Depth (Source: EA Open Dataset)</i>
Reservoirs / canals and other artificial sources	<i>Figure 12: Extent of Flooding from Reservoirs (Source; EA Flood Warning Information Service).</i>
Infrastructure failure	<i>No such occurred according to EA Product 4 data</i>

3.1.1 Flood Risk from Cornbrook and Black Brook

As said previously the site is within a Flood Zone 2 and does not flood in the 1 in 100 year event plus climate change event (35%).

However the site does flood in the 1 in 1000 year fluvial event up and including the 45.67mAOD according to the Environment Agency information.

This suggests that parts of the site could flood up to approximately 0.67m in a 1 in 1000 event.

Therefore, parts of the site is considered to be at risk of fluvial flooding

3.1.2 Surface Water

The EA surface flood extents and flood depths (Figure 10 and Figure 11: 0.1% AEP Surface Water Depth (Source: EA Open Dataset)) have been obtained from the EA open dataset. The majority of the development site is at low risk zone (i.e., 0.1% -1% AEP), with flood depths of 0.9m for 0.1% AEP and zero for 1% AEP (Figure 10 and Figure 11). Therefore, surface flooding risk is low flood risk but could be potentially deep.

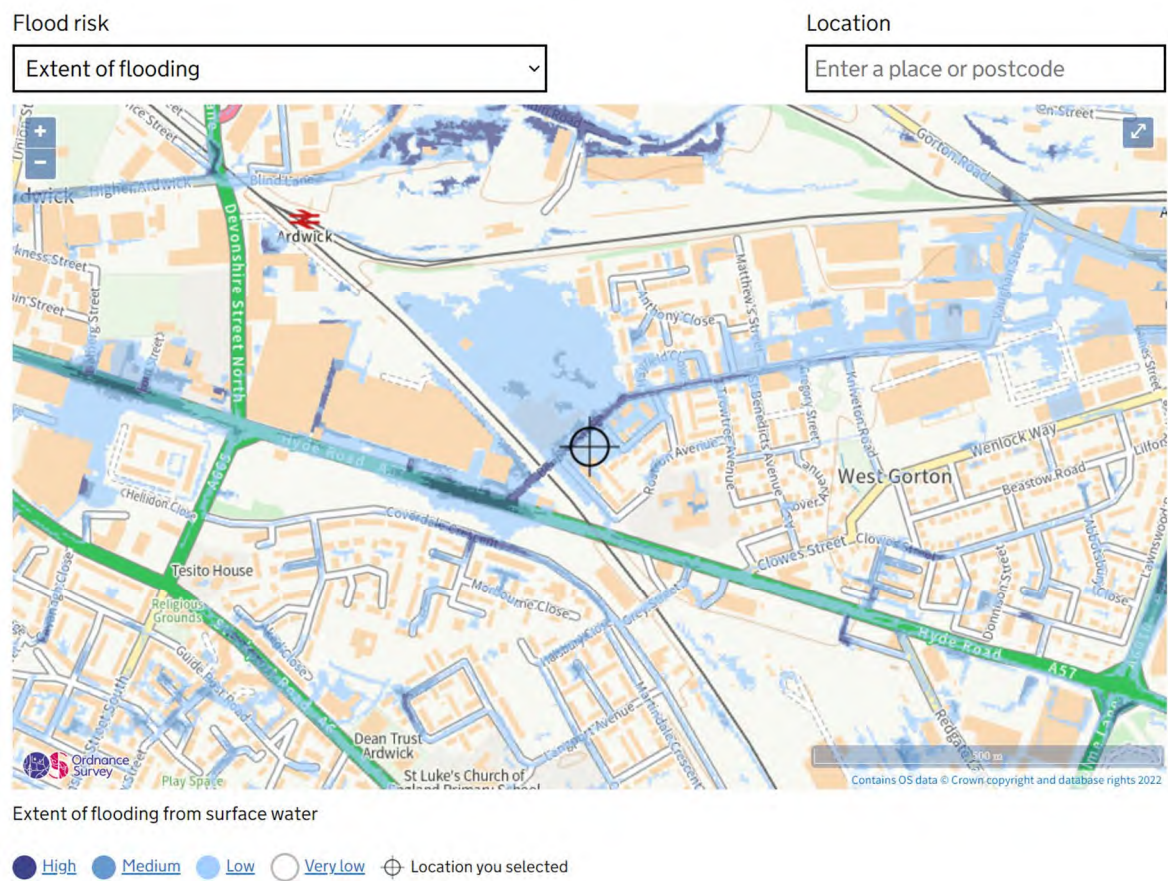


Figure 10: 0.1% AEP Surface Water Depth (Source: EA Open Dataset)

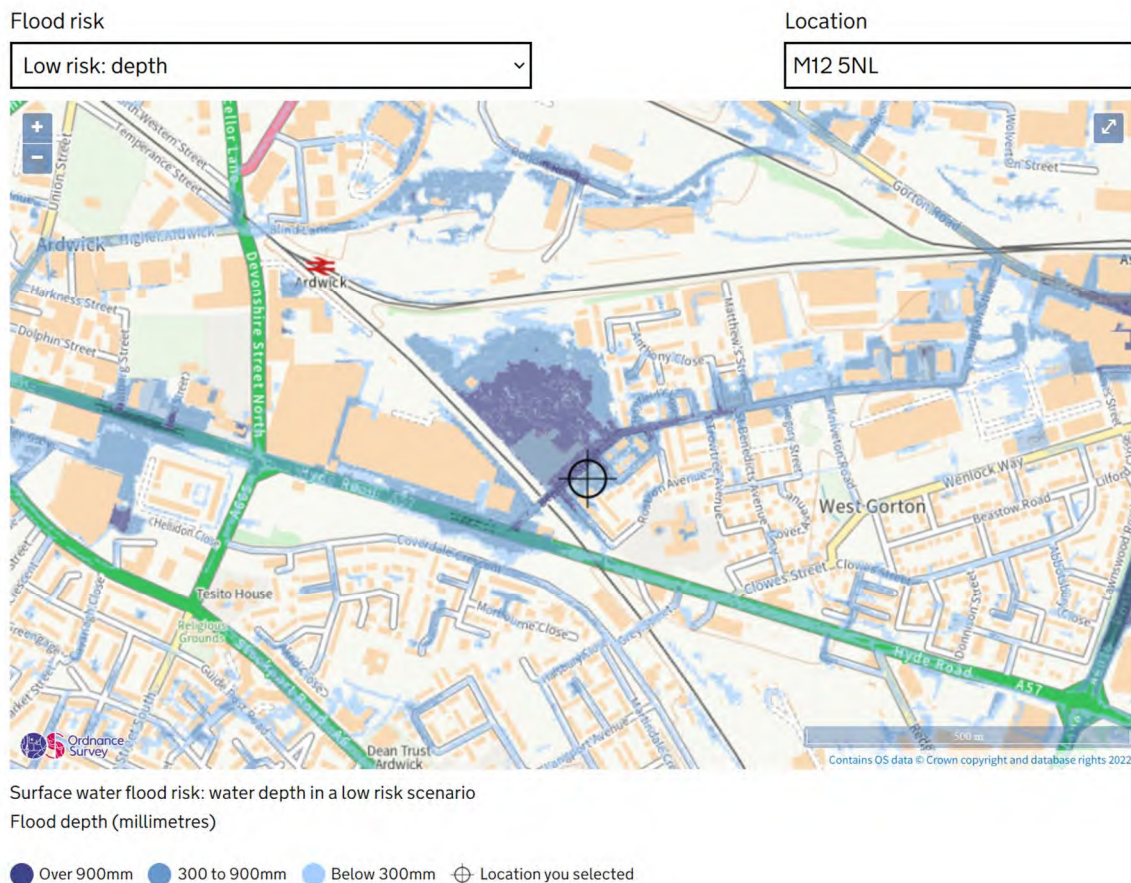


Figure 11: 0.1% AEP Surface Water Depth (Source: EA Open Dataset)

Please note in the 1 in 100 year surface water event the site does not flood, the figures above indicate that the site floods in the 1 in 1000 year event. Parts of the site will flood to 900mm.

This is unlikely to be true as the area that floods is surrounded by buildings and high ground. How the surface water maps are designed is that are lower areas (for example hollows) are filled with water. This site is an example of this, according to the topographical survey the deep area of water is surrounded by buildings and slopes. This area then fills with water. This is the likely reason there is a deep area of water in the 0.1% event

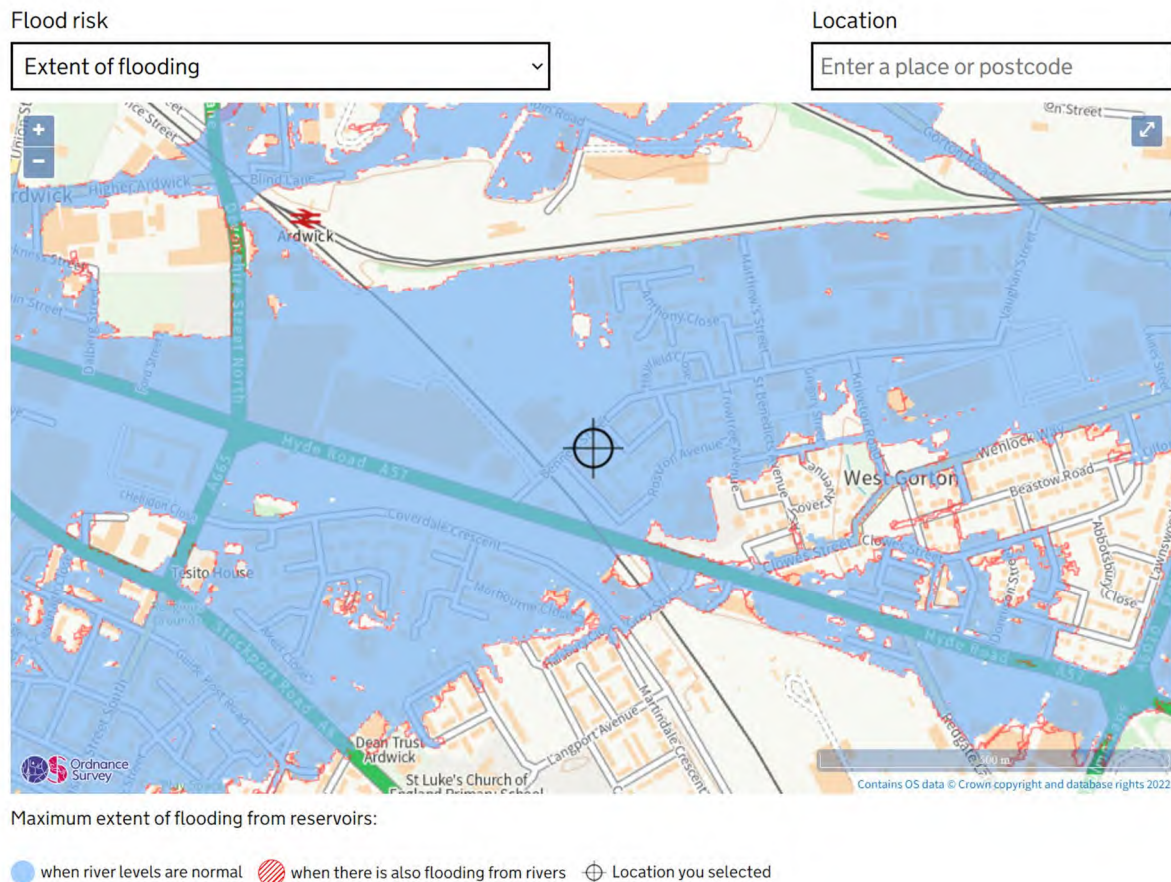
However the finished floor level are being raised by approximately 600-700mm. This should minimise the risk flooding. But there will be a residential risk in events of 1 in 1000 year event of flooding 300mm.

It is believe the risk of flooding from surface water is low.

3.1.3 Flood Risk from Reservoir /Canals / Other Artificial Sources

The EA Extent of Flooding from Reservoirs map (Figure 12:Extent of Flooding from Reservoirs (Source; EA Flood Warning Information Service)), based only on large reservoirs (over 25,000 m³ of water), shows that majority of the site is within potential risk of flooding in the event of a breach from reservoirs. The reservoir that could affect this area is Entwistle (grid reference SD7236017220), which is owned by United Utilities Water plc. Flooding from reservoir is considered to be extremely unlikely and the risk of flooding to the site considered to be low.

There is no flood risk from canals or other artificial sources as there are no canals or artificial sources within the vicinity of the site.



3.1.4 Flood Risk from Groundwater

According to the SFRA Level 1 for Manchester there is no history of sewer flooding in this area

3.1.5 Flood Risk from Sewers

According to the SFRA Level 1 for Manchester there is no history of sewer flooding in this area

3.2 Existing Surface Water Drainage Arrangements

Existing surface runoff from the site is likely managed by onsite sewers. Evidence of this existing private drainage system remains on site.

As said previously there is a culvert running through the middle of the site called Corn Brook with a tributary culvert called Black Brook. According to a survey undertaken in circa around 2008, the main culvert is approximately 1.8m wide and flows from east to west. The Black Brook culvert is approximately 1.2m in diameter and flows from north east to it confluence with Corn Brook in the centre of the site.

The proposed layout and culvert has been amended to ensure the culverts are under public open space and under highways as suggested by the Flood Risk Management team of Manchester. The culvert is not within an individual plot and is acceptable to the local authority.

It is recommended that a full culvert survey is undertaken including a structural survey to investigate if the culvert is working correctly.

According to the public sewer map there is no public sewers crossing the site.

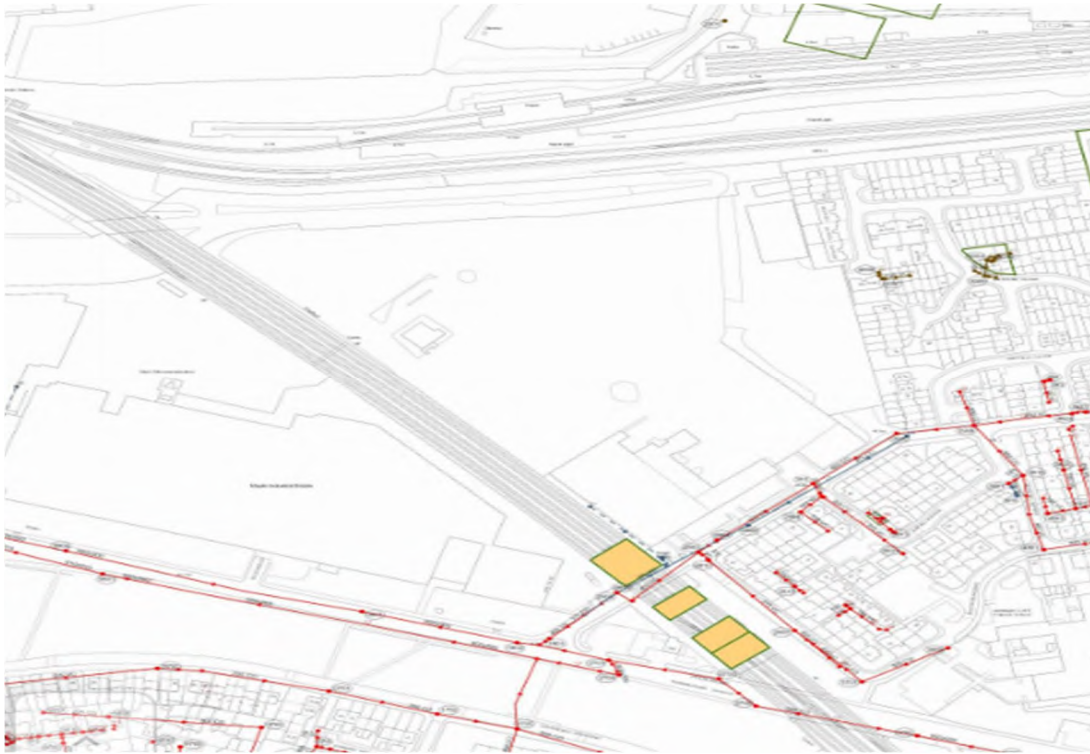


Figure 13: UU sewer records (Source: United Utilities)

4. ASSESSMENT OF FLOOD RISK FOR PROPOSED DEVELOPMENT

4.1 Development Proposals

It is proposed to create 272 dwellings at Land at Bennett Street, Manchester as shown on the indicative masterplan Figure 14. The development will be a mix of 1, 2, 3 bedroom detached and semi-detached housing and 3 apartment blocks and a new community building. Each plot will have a private driveway constructed from impermeable materials, with shared access roads.

The development area is 5.13ha and the impermeable area has been assessed as 3.07ha according to the client.



Manchester City Council guidance is that the finished floor level needs to be set at the 1 in 100 year event plus climate change and then flood proofing up to the 1 in 1000 year event. Therefore the finished floor level has been set at the 1 in 1000 year event at 45.67mAOD.

It is proposed to have a minimal finished floor level of 45.67mAOD which will ensure the site is at minimum risk of flooding. This is the same level as the 1 in 1000 year event and suggests the proposed development is at minimum risk of fluvial flooding.

As the site is not at risk in the 1 in 100 year event plus 35% no compensatory storage is required, nor is emergency access and egress is required.

4.3 Surface Water flooding

The site is not at risk of surface water flooding up to and including the 1 in 100 year event. With the inclusion of a new and working drainage system with attenuation up to and including the 1 in 100 year event plus climate change (75% for rainfall) the site is believed to be at low risk of surface flooding.

5. DRAINAGE STRATEGY

5.1 Existing Drainage Arrangements

5.1.1 Surface Water

It is assumed the existing drainage arrangements is that all the surface water from the existing buildings and hardstanding drain to the culverts on site.

5.1.2 Foul Water

Existing public foul water drainage arrangements on Bennett Street, it is understood the site can drain to the foul sewer unrestricted.

From the pre-planning enquiry with United Utilities Water, it was advised that 'foul flow from this site will be allowed to drain into the public foul water/combined sewer system at an unrestricted rate'.

5.2 Infiltration Rates

It is considered that infiltration is unlikely to be feasible. According to the EP3 geoenvironmental report the presence of shallow Made Ground, into low permeability cohesive deposits, soakaway drainage is likely to be unviable at the site. Therefore it is recommended the site does not use infiltration.

5.3 Run-off

The peak rates have been agreed with the Lead Local Flood Authority and the discharge has been set at 30.3l/s. Please see appendix B

5.4 Surface water drainage strategy

5.4.1 Hierarchy of Discharge

As detailed in section 3.3 infiltration is not feasible at this site. As noted previously there are culverted watercourses running through the site and it is proposed to drain to the two culverts.

5.4.2 Sizing of SUDS features

As discussed in section 4.1 of this report, the proposed impermeable surface area of the dwellings and associated features is 3.07ha. It is intended that the proposed surface water system will be adopted by the United Utilities. Infiltration SUDS systems have been discounted as the ground is pollutes and soakaway. Swales and rain gardens have been placed in the public open spaces. These features will need to be lined as no infiltration should be used on the site. If infiltration is used it is likely to move hydrocarbons in the ground and potential pollute the culvert as there are not lined.

The discharge will be restricted of a total of 30.3l/s via Hydrobreaks up to and including the 1 in 100 year event plus climate change (45%). The storage will be held in attenuation tanks and oversized pipes, rain gardens and swales up to and including the 1 in 100 year event plus 45% climate change.

The site has been split into 4 catchments and the discharge has been pro-rated for each catchment.

Modelling of the surface water runoff to the design parameters was carried out using the Source Control of Micro Drainage, an industry leading software which allows design and analysis of SuDS features. Micro Drainage modelling results. Appendix C The following conservative assumptions and design parameters have been set within the Hydraulic model:

- Dwellings, walkways, parking spaces and access roads area equals 3.07ha.
- Rainfall intensity was obtained using the Flood Studies Report (FSR) methodology, and increased by 45%, the upper end allowance for climate change over the 100 years design life of the proposed residential development, in line with the requirements of the NPPF;
- No runoff loss have been assumed in the modelling, therefore all the design rainfall landing on the impermeable surfaces is expected to reach the detention basin;
- As per the conclusions in Section 3.3, the soil has been modelled with an infiltration rate of zero (0.0) m/hr;
- A Hydro-Breaks have been used to restrict the total discharge from the site to 30l/s.

Please see a table of the discharges and the required storage need for each catchment.

Table 5: Summary of the Drainage

Catchment	m ²	Ha	Impermeable	%	Discharge based on area	Rounded up discharge	Required storage in 1 in 30 year plus 45% (m3)	Required storage in 1 in 100 plus 45% (m3)
1	16,408.00	1.641	0.98	32%	9.69	10	357-538	509 to 739
2	6,894.00	0.689	0.41	13%	4.07	5	140-212	202 to 294
3	17,406.00	1.741	1.04	34%	10.28	10	387-581	551 to 799
4	10,593.00	1.059	0.64	21%	6.26	5	256-383	363 to 520

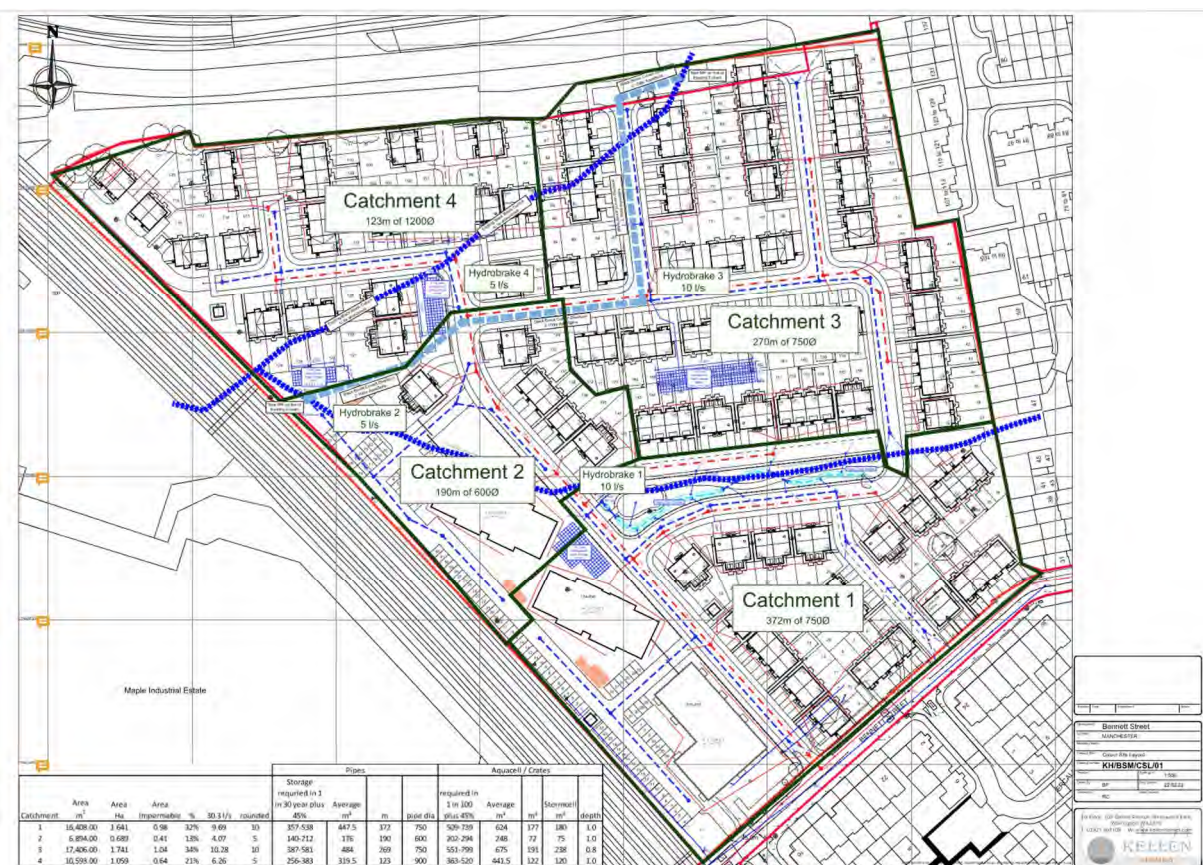


Figure 15: Proposed Drainage Strategy

5.4.3 Maintenance Plan

Structures which manage surface water runoff require little maintenance, however a regular maintenance schedule e.g., after heavy rainfall, should be established by the site owners to reduce the risk of blockage within the drainage system and ensure the design remains in good working order. It is proposed to offer this up for adoption:

Table 6: Operation and Maintenance Requirements for pipes and geocellular tanks

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

Table 7: Operation and Maintenance Requirements for rainwater gardens and swales

TABLE 17.1 Operation and maintenance requirements for swales		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseed	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

6. SUMMARY & CONCLUSIONS

A summary of the main conclusions for the FRA is presented below:

- The proposed development is for demolition of existing buildings and structures on the site and erection of 272 homes (use Class C3) and a new community building (Use Class F2(b)), with associated car parking, access, highways, landscaping and new public realm creation, and other associated works.
- Development proposals are for a development of approximately 272 residential units at land at Bennett Street, Gorton M12 5NL (381962, 399880);
- The development site is approximately 5.13ha and will replace the existing warehouses, area for shipping containers and a former demolition yard;
- There is a culvert that runs west to east. There is another culvert that runs north west to south east and confluences with the culvert running east to west near the western boundary. Both of these culverts are ordinary watercourses and are named Black Brook and Corn Brook respectively.
- The site lays at a Medium Risk of fluvial flooding, Flood Zone 2 (confirmed by EA product 4 data) for both Defended and Undefined 'scenario';
- According to the Environment Agency data the site does not flood in a 1 in 100 year event plus climate change (35%) and is only at risk of flooding in the 1 in 1000 year event.
- As the site is outside the 1 in 100 year event plus climate change event no compensatory storage is required.
- The 1 in 1000 year event is 45.67mAOD. This is higher than the 1 in 100 year plus 70% climate change.
- The finished floor levels have been set at 45.67mAOD.
- Manchester City Council guidance is that the finished floor level needs to be set at the 1 in 100 year event plus climate change and then flood proofing up to the 1 in 1000 year event. Therefore the finished floor level has been set at the 1 in 1000 year event at 45.67mAOD.
- It is recommended that a structural condition survey and topographical survey of the culvert is undertaken. To ensure that the culvert is structurally sound and is in the position it is believed to be.
- There is a risk of surface water flooding on the site in the 1 in 1000 year event. The levels could be up to 900mm deep in parts of the site. However it is likely that with further topographical survey data, it will be proved that it is not as significant as this.
- It appears infiltration will not be feasible on this site due to the pollution of site.
- It is proposed to discharge the surface water into Corn Brook or Black Brook.
- The site will be required to have attenuation up to and including the 1 in 100 year event plus climate change of 45% for the surface water. This will be kept in attenuation tanks, oversized pipes, swales and rainwater gardens. The swales and the rainwater gardens will need to be lined due to the site being polluted.

7. REFERENCES

Author	Date	Title/Description
Department for Communities and Local Government	Mar 2012	Technical Guidance to the National Planning Policy Framework
Ministry of Housing, Communities and Local Government.	July 2021	National Planning Policy Framework
Manchester City Council	Mar 2010	Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA, LEVEL 1 SFRA
Manchester City Council	Mar 2011	Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA, LEVEL 2 SFRA
Manchester City Council	May 2015	Salford Local Flood Risk Management Strategy
Environment Agency	May 2022	Climate Change Guidance for Flood Risk Assessment

Appendix A: Flood Data from the Environment Agency

Flood risk assessment data

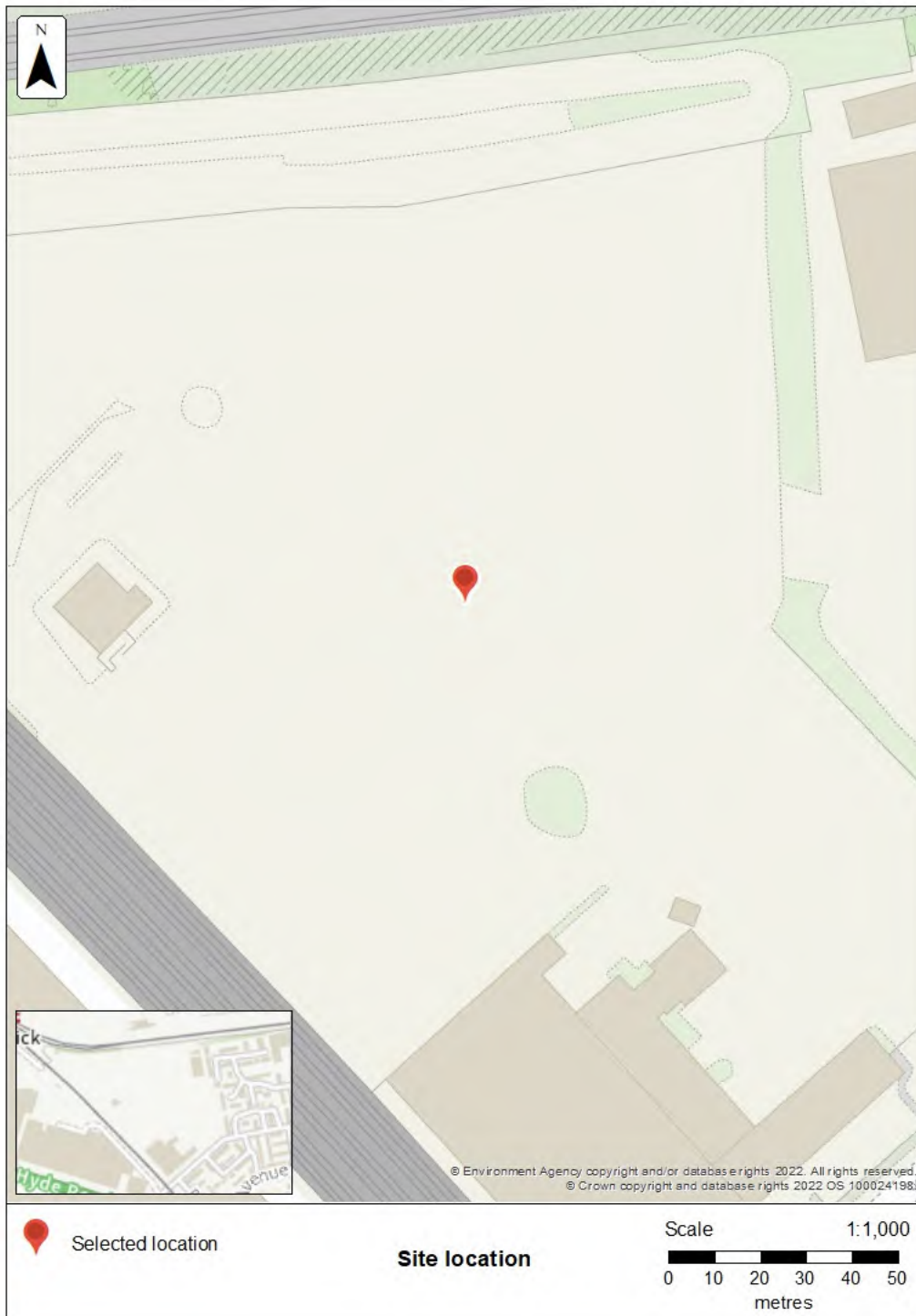
Location of site: 386189 / 397038 (shown as easting and northing coordinates)

Document created on: 10 March 2022

This information was previously known as a product 4.

Customer reference number: GMMC252881SW

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)
- 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:

- historic flooding
- flood defences and attributes

We do not have historic flooding data for this location. You can 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.

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: Corn Brook 2017

Scenario(s): No defences exist fluvial, no defences exist climate change fluvial

Date: 31 December 2017

This model 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 2.

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

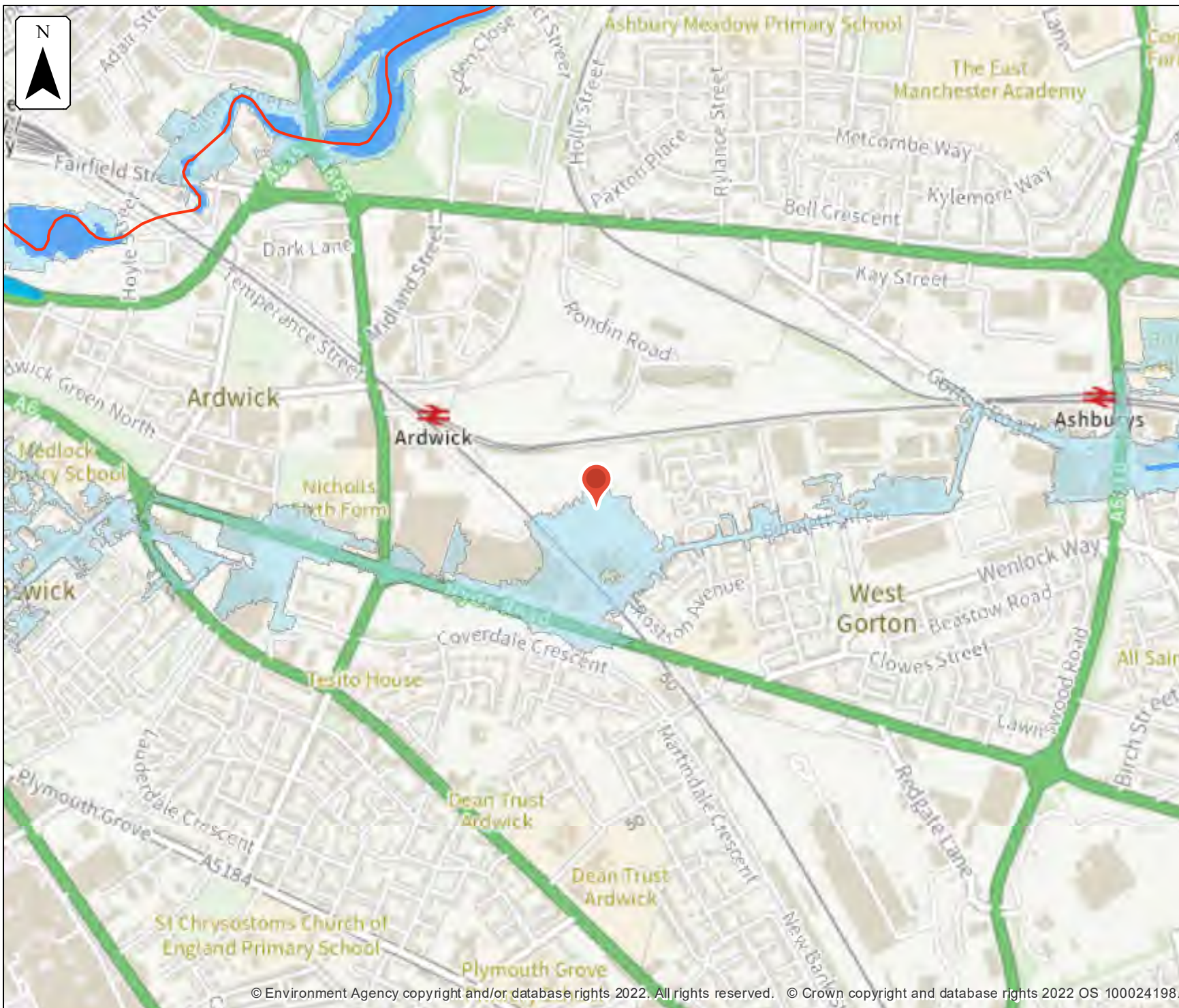
Flood zone 2 shows the area at risk of flooding for an undefended flood event with:

- 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.



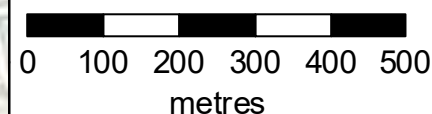
Flood map for planning

Location (easting/northing)
386189/397038

Scale
1:10,000

Created
10 Mar 2022

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



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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

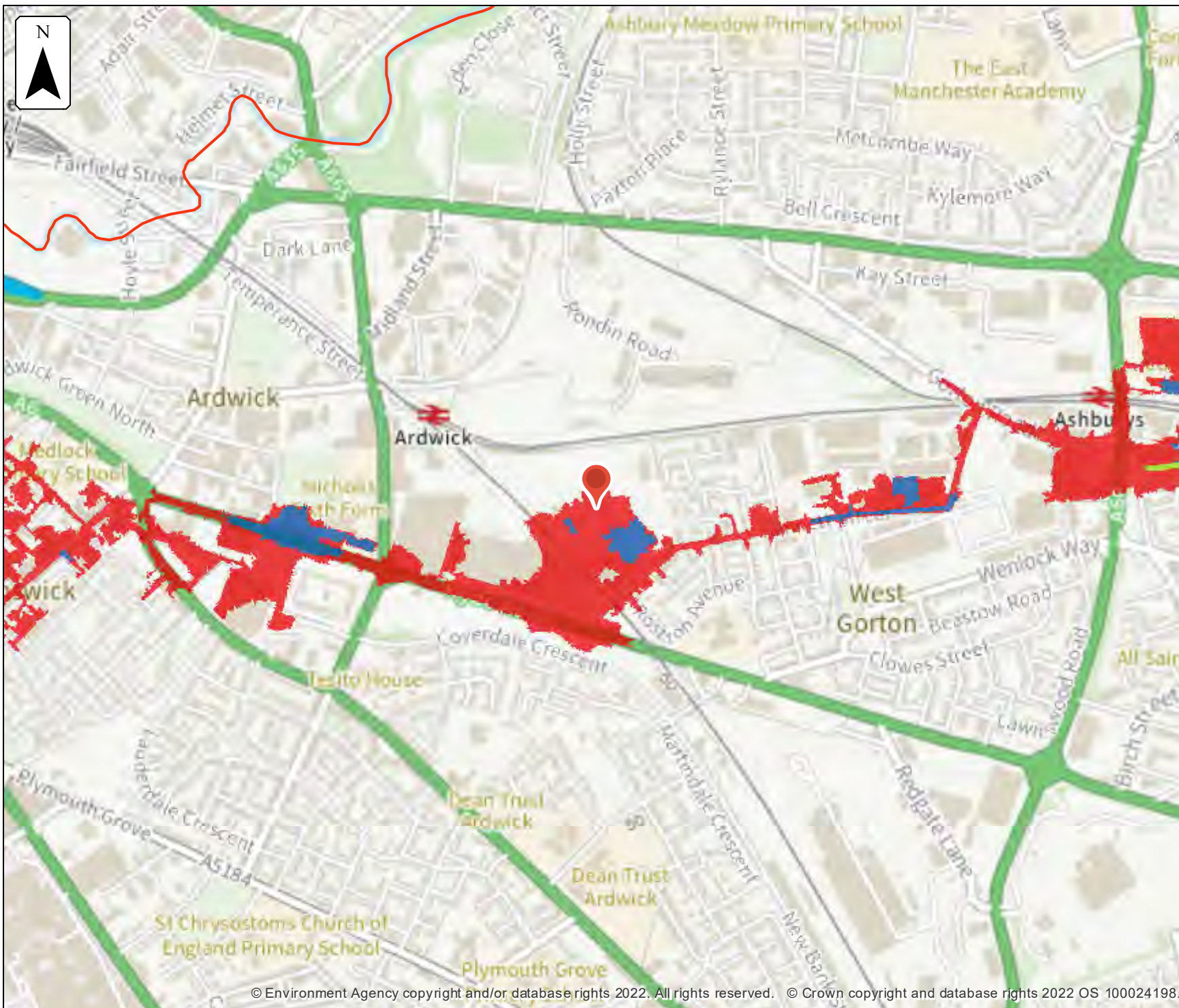
The climate change data included in the models may not include the latest [flood risk assessment climate change allowances](#). Where the new allowances are not available you will need to consider this data and factor in the new allowances to demonstrate the development will be safe from flooding.

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:

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



No defences exist modelled fluvial extent

Location (easting/northing)
386189/397038

Scale Created
1:10,000 10 Mar 2022

Model name
Corn Brook 2017

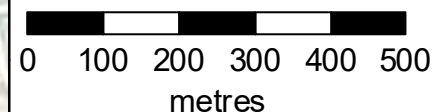
 Selected location

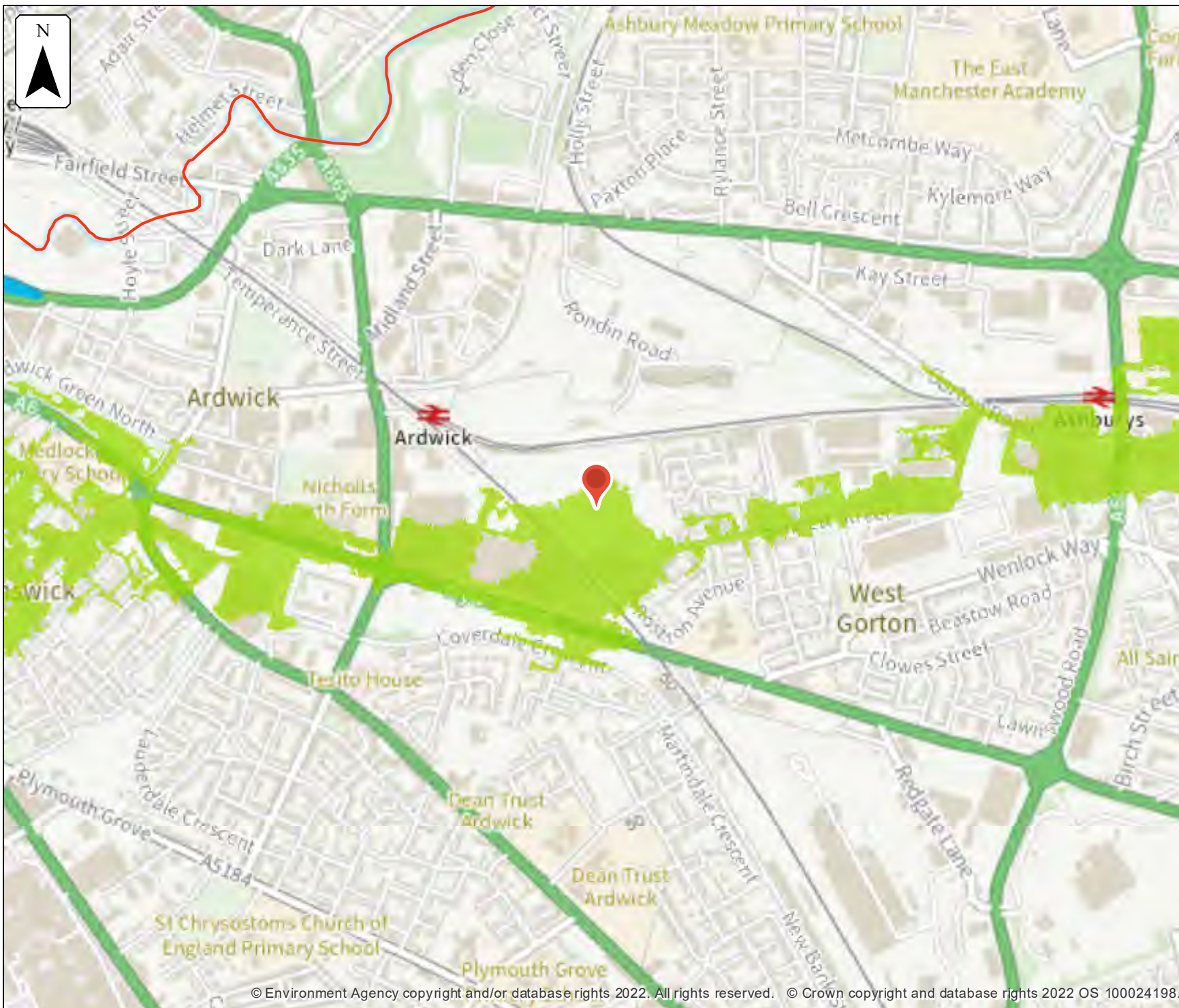
 Main river

Modelled flood extent

-  0.1% AEP
-  0.5% AEP
-  1% AEP
-  1.33% AEP
-  2% AEP
-  5% AEP

Flood extents may not be visible where they overlap other return periods





No defences exist climate change modelled fluvial extent

Location (easting/northing)
386189/397038

Scale Created
1:10,000 10 Mar 2022

Model name
Corn Brook 2017

 Selected location

 Main river

Modelled flood extent

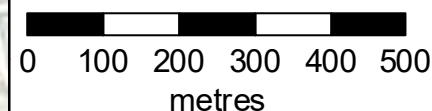
 0.1% AEP (+30%)

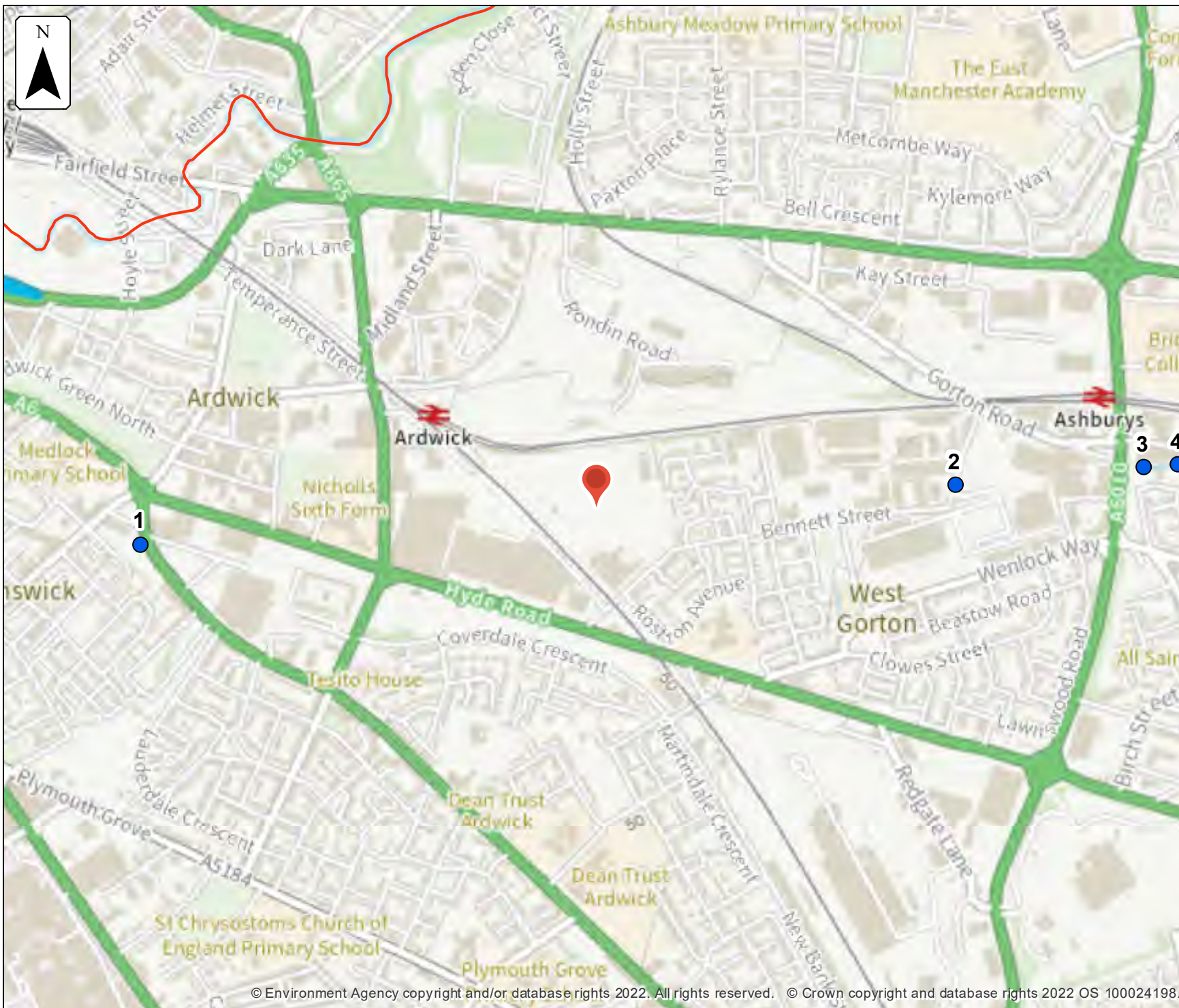
 1.0% AEP (+30%)

 1.0% AEP (+35%)

 1.0% AEP (+70%)

Flood extents may not be
visible where they overlap
other return periods





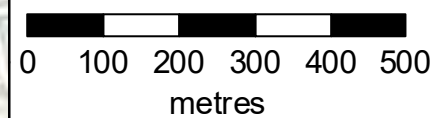
No defences exist modelled fluvial node locations

Location (easting/northing)
386189/397038

Scale Created
1:10,000 10 Mar 2022

Model name
Corn Brook 2017

-  Selected location
-  Modelled location
-  Main river



Modelled node locations data

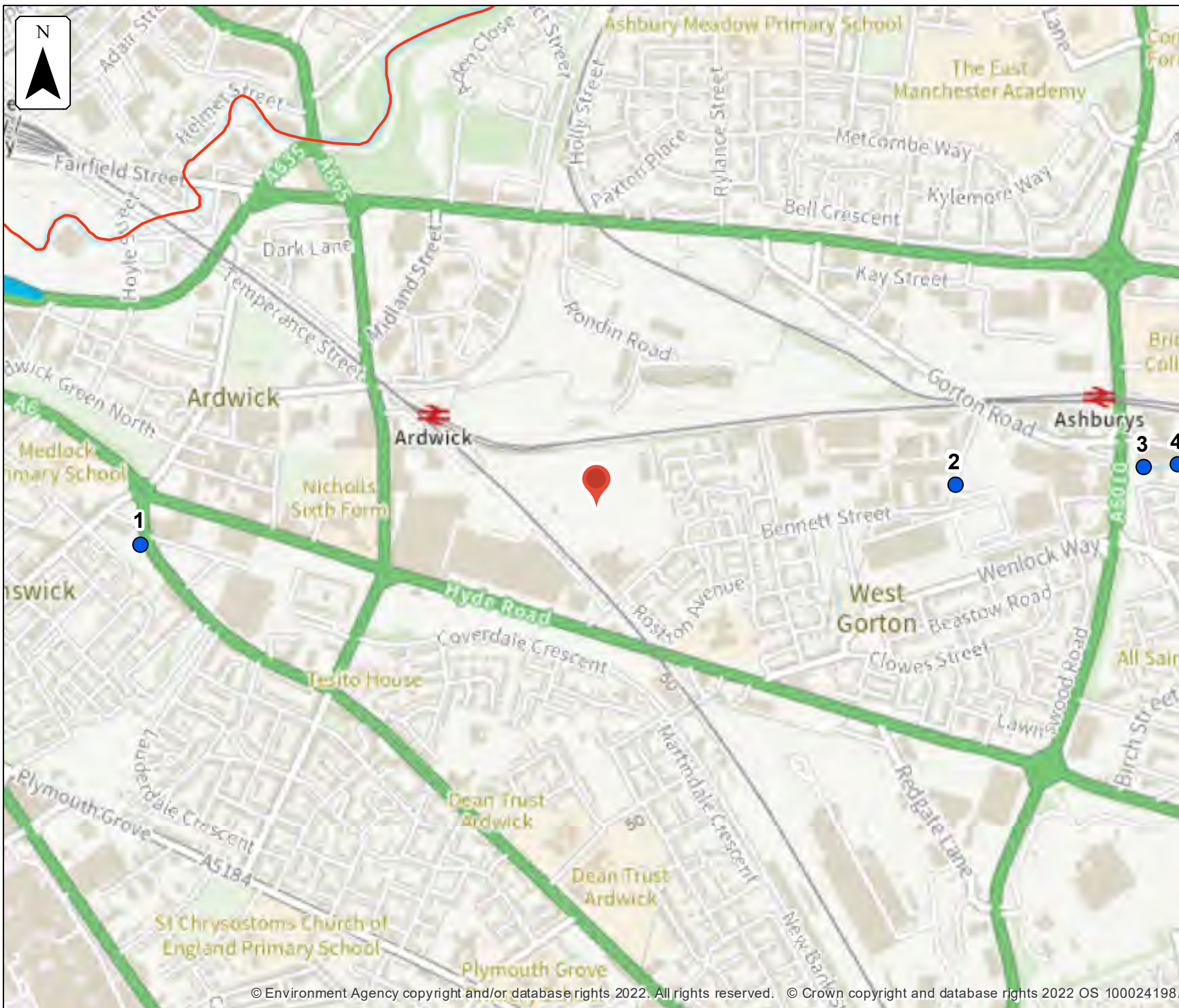
No defences exist

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	952453	385305	396966	38.80	0.95	39.03	1.78	39.65	2.26	40.33	2.66	40.80	3.78	41.42	7.77
2	952459	386888	397082	46.25	0.66	46.57	1.24	46.80	1.55	47.95	1.81	49.66	2.54	50.23	5.15
3	952461	387253	397116	49.31	2.68	49.66	4.52	49.84	5.58	49.93	6.10	50.82	8.26		
4	952460	387319	397120	49.39	2.68	49.69	4.52	49.87	5.58	49.95	6.10	50.84	9.79		

Data in this table comes from the Corn Brook 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.



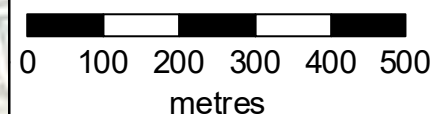
No defences exist climate change modelled fluvial node locations

Location (easting/northing)
386189/397038

Scale Created
1:10,000 10 Mar 2022

Model name
Corn Brook 2017

-  Selected location
-  Modelled location
-  Main river



Modelled node locations data

No defences exist climate change

Label	Modelled location ID	Easting	Northing	1.0% AEP (+30%)		1.0% AEP (+35%)		1.0% AEP (+70%)		0.1% AEP (+30%)	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	952453	385305	396966	40.73	3.46	40.76	3.59	40.94	4.52	41.65	10.10
2	952459	386888	397082	49.54	2.35	49.61	2.44	49.89	3.08	50.43	6.69
3	952461	387253	397116	50.57	7.77	50.70	8.03				
4	952460	387319	397120	50.58	8.07	50.73	8.78				

Data in this table comes from the Corn Brook 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.



**No defences exist
modelled fluvial
extent and height**

Location (easting/northing)
386189/397038

Scale Created
1:2,500 10 Mar 2022

Model name
Corn Brook 2017

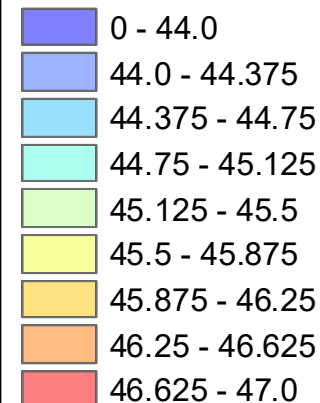


Selected location

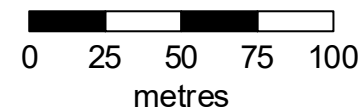
— Main river

Modelled 2D grid

Water level in mAOD



This map shows the
0.1% AEP height data



Sample point data

No defences exist

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	386139	396988	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.44	45.66
2	386164	396988	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.52	45.66
3	386189	396988	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.56	45.66
4	386214	396988	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.42	45.67
5	386239	396988	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.21	45.32	0.56	45.67
6	386139	397013	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.14	45.29	0.51	45.66
7	386164	397013	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.35	45.66
8	386189	397013	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.36	45.67
9	386214	397013	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.39	45.67
10	386239	397013	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.44	45.67
11	386139	397038	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.15	45.66
12	386164	397038	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.29	45.66
13	386189	397038	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.25	45.67
14	386214	397038	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.26	45.67
15	386239	397038	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.42	45.67
16	386139	397063	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	386164	397063	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.11	45.67
18	386189	397063	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.20	45.67
19	386214	397063	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.18	45.67
20	386239	397063	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.14	45.67
21	386139	397088	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
22	386164	397088	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
23	386189	397088	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
24	386214	397088	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
25	386239	397088	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Data in this table comes from the Corn Brook 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.



**No defences exist
climate change
modelled fluvial
extent and height**

Location (easting/northing)
386189/397038

Scale Created
1:2,500 10 Mar 2022

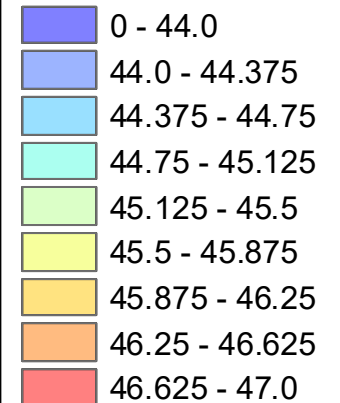
Model name
Corn Brook 2017



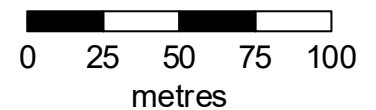
Selected location

— Main river

Modelled 2D grid
Water level in mAOD



This map shows the
0.1% AEP +30% height data



Sample point data

No defences exist climate change

Label	Easting	Northing	1% AEP (+30%)		1% AEP (+35%)		1% AEP (+70%)		0.1% AEP (+30%)	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height
1	386139	396988	NoData	NoData	NoData	NoData	0.21	45.43	0.58	45.80
2	386164	396988	NoData	NoData	NoData	NoData	0.28	45.44	0.67	45.80
3	386189	396988	NoData	NoData	NoData	NoData	0.34	45.44	0.71	45.81
4	386214	396988	NoData	NoData	NoData	NoData	0.19	45.44	0.56	45.81
5	386239	396988	NoData	NoData	NoData	NoData	0.34	45.45	0.71	45.82
6	386139	397013	NoData	NoData	NoData	NoData	0.29	45.44	0.66	45.80
7	386164	397013	NoData	NoData	NoData	NoData	0.12	45.44	0.49	45.80
8	386189	397013	NoData	NoData	NoData	NoData	0.13	45.44	0.50	45.81
9	386214	397013	NoData	NoData	NoData	NoData	0.19	45.45	0.54	45.81
10	386239	397013	NoData	NoData	NoData	NoData	0.22	45.45	0.59	45.81
11	386139	397038	NoData	NoData	NoData	NoData	NoData	NoData	0.30	45.81
12	386164	397038	NoData	NoData	NoData	NoData	NoData	NoData	0.43	45.81
13	386189	397038	NoData	NoData	NoData	NoData	0.10	45.45	0.47	45.81
14	386214	397038	NoData	NoData	NoData	NoData	NoData	NoData	0.41	45.81
15	386239	397038	NoData	NoData	NoData	NoData	0.19	45.45	0.56	45.82
16	386139	397063	NoData	NoData	NoData	NoData	NoData	NoData	0.13	45.81

Label	Easting	Northing	1% AEP (+30%)		1% AEP (+35%)		1% AEP (+70%)		0.1% AEP (+30%)	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height
17	386164	397063	NoData	NoData	NoData	NoData	NoData	NoData	0.25	45.81
18	386189	397063	NoData	NoData	NoData	NoData	NoData	NoData	0.31	45.81
19	386214	397063	NoData	NoData	NoData	NoData	NoData	NoData	0.32	45.81
20	386239	397063	NoData	NoData	NoData	NoData	NoData	NoData	0.29	45.82
21	386139	397088	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
22	386164	397088	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
23	386189	397088	NoData	NoData	NoData	NoData	NoData	NoData	0.15	45.81
24	386214	397088	NoData	NoData	NoData	NoData	NoData	NoData	0.21	45.81
25	386239	397088	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Data in this table comes from the Corn Brook 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 Greater Manchester Merseyside and Cheshire Environment Agency team at inforequests.gmmc@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

Appendix B: Agreements with Manchester City Council

Charles Townsend

From: Flood Risk Management <floodriskmanagement@manchester.gov.uk>
Sent: 11 April 2022 12:54
To: Charles Townsend
Subject: RE: Bennett Street Discharge rates.

Good afternoon Charles,

Thank you for email and the review of the guidance.

We can offer you your previously quoted Qbar if this will assist your strategy, but any rate higher than that will unfortunately not be appropriate.

We need to apply caution with the ordinary culverted watercourse network to balance sustainability objectives with flood risk. Managing the risk from these assets falls under our duty as the risk management authority, and this is where our discretion with greenfield discharge rates comes in.

Kind Regards,
Laura

From: Charles Townsend <charles@townsendwaterengineering.co.uk>
Sent: 06 April 2022 10:47
To: Flood Risk Management <floodriskmanagement@manchester.gov.uk>
Cc: Andy Brown <andybrown@kellenhomes.com>; Steven Green <StevenGreen@kellenhomes.com>
Subject: RE: Bennett Street Discharge rates.

Hi Laura, no problems at all. I was actually quite impressed with the speed of the reply, as I thought it was going to be 28 days.

So I think no problems with the easements. The easement touches some of the garden however, as previously said the development will be owned by a private rental company and an housing association. This means there are two owners for the entire site and there will be private plots. I agree with the structural engineering report for the culvert and indeed had recommended this before you asked.

In regards to the greenfield runoff rates, I have reviewed the guidance documents quoted within Manchester City Council- SuDS requirement for developers 2019. Please find below what each of the documents say:

Non-technical advice for SuDS suggests brownfield rates site should be as close as practical for brownfield sites. For greenfield sites, greenfield rates for the 1 in 1 and up to the 1 in 100 year event.

NPPF suggests you should mirror the rates and the chapter are 159 to 169 and then for coastal 170 to 173.

Within the Level 2 SFRA pg 120 paragraph 3 which deals with this site (West Gorton M0011) it says 'For all sites, development proposals should look at opportunities to incorporate SuDS to reduce the risk of surface water flooding. Surface water run-off from these sites should not increase as a result of development (reduced run-off should be sought if possible in some areas) and not discharge to the combined sewer system.'

Policy DM1: Flood risk and drainage makes no comment on discharge rates.

EM08 says 'minimisation of flood risks by appropriate siting, drainage, and treatment of surface areas to ensure rainwater permeability.'

EM14 says 'All new development should minimise surface water run-off including SuDS and the appropriate use of green infrastructure. Developers should have regard to the surface water run-off rates in the SFRA User guide. In CDAs, evidence to justify the surface water run-off approach/rates will be required.'

EM17: Development should minimise surface water run-off from development and associated roads, and maximise the use of appropriate SuDS to minimise groundwater contamination.

IN the final MST SFRA User Guide May 2010 on pg 32 it says:

In the interim, and based on the technical work undertaken for the SFRA, the following guidance is provided:

Development should aim to deliver greenfield runoff or on greenfield sites up to Greenfield sites up to a 1 in 100 year storm event considering climate change.

Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100 year storm event, considering climate change.

Development should be designed so that there is no flooding to the development in a 1 in 30 year event and so that there is no property flooding in a 1 in 100 year plus climate change event.

So all the legalisation up to this point should aim for mirroring the existing situation (or 50% less) for brownfield sites or aim for greenfield rates up to the 1 in 100 year event plus climate change.

Manchester City Council-SuDS requirement for developers 2019 says:

Where surface water is connected to the ordinary watercourse, agreement in principle from Manchester City Council as Lead Local Flood Authority is required. Please note that all new connections to the watercourses shall comply with reduction of flows to Greenfield runoff rates. An email of acceptance of proposed flows and/or new connection will suffice.

It does not say to 1 in 1 greenfield rate, its say greenfield runoff rates.

Therefore please can we drain to viable greenfield discharge rates up to and including the 1 in 100 year event plus climate change.

If you have any queries please do not hesitate to contact me.

Kind regards
Charles

Charles Townsend BSc (Hons) CIWEM CSci
Townsend Water Engineering
charles@townsendwaterengineering.co.uk
Tel: 07786912617

From: Flood Risk Management <floodriskmanagement@manchester.gov.uk>
Sent: 05 April 2022 17:26
To: Charles Townsend <charles@townsendwaterengineering.co.uk>
Subject: RE: Bennett Street Draft Layout

Charles,

Thanks for your patience while I consulted with the LPA. Further to my earlier email, I have responded to the queries I believe are outstanding.

Culvert easements – We would expect a minimum easement of 3m from culvert edge, in which no buildings should be placed. Please note the easement should be appropriate to the culvert, therefore a structural engineer should be consulted to confirm the easement is suitable to protect both buildings and culvert assets.

Culvert in private plots – We would expect a sequential approach to locate the culvert preferentially under highway/open space. You have advised that this is your strategy and provided a supporting masterplan, but you also advise that you may propose to run the culvert through some individual plots. We would advise the LPA not to allow culverts within individual plots, due to the burden of riparian ownership and the concern for maintenance over whole development lifetime. We would suggest you discuss this early with the LPA if you foresee any complication.

Discharge rate – In the event that SI proves infiltration infeasible, we would in principle accept drainage to the ordinary watercourse culverts at 1 in 1 year greenfield rate for this site. You would need to obtain Land Drainage Consent from us (as per attached email). Assuming results of culvert survey prove 2 culverts onsite, we would like to see the strategy explore 2 discharge via connection points (1 to each culvert) to spread the discharge more sustainably.

Culvert details – We advise that your proposals to date would need survey of the existing culverts to support feasibility and define the baseline. Significant realignment/alteration may require detailed study. Please note that some pertinent information may be found on Public Access for the other planning application associated with this site. There is also our data screening service which would provide any data held by the LLFA, details of which are in attached email should you wish to commission one.

I've also reattached our earlier advice for ease of reference.

Should you have further queries, please do not hesitate to contact us.

Kind Regards,
Laura

From: Flood Risk Management <floodriskmanagement@manchester.gov.uk>
Sent: 05 April 2022 12:08
To: Charles Townsend <charles@townsendwaterengineering.co.uk>
Subject: RE: Bennett Street Draft Layout

Good afternoon Charles,

Thank you for your follow-up emails and the masterplan details,

I have today been able to speak with Planning colleagues. I am drafting a response to your outstanding queries now.

Kind Regards,
Laura

From: Charles Townsend <charles@townsendwaterengineering.co.uk>
Sent: 04 April 2022 12:46
To: Flood Risk Management <floodriskmanagement@manchester.gov.uk>
Subject: RE: Bennett Street Draft Layout

Hi Laura,

Have you had chance to discuss with your client?

If you have any queries please do not hesitate to contact me.

Kind regards
Charles

Charles Townsend BSc (Hons) CIWEM CSci
Townsend Water Engineering
charles@townsendwaterengineering.co.uk
Tel: 07786912617

From: Charles Townsend
Sent: 30 March 2022 08:38
To: Flood Risk Management <floodriskmanagement@manchester.gov.uk>
Subject: Bennett Street Draft Layout

Dear Laura, hope you are well.

Please find attached the layout for Bennett Street. As you can see the culverts have mainly been placed under Public Open Space. Please can you confirm this is acceptable. The proposed site is intended to be used for social housing so the culvert will be in one ownership or in open land. Please see the draft layout, please can you confirm this is acceptable.

When do you believe we will have an answer to our queries.

If you have any queries please do not hesitate to contact me.

Kind regards
Charles

Charles Townsend BSc (Hons) CIWEM CSci
Townsend Water Engineering
charles@townsendwaterengineering.co.uk
Tel: 07786912617

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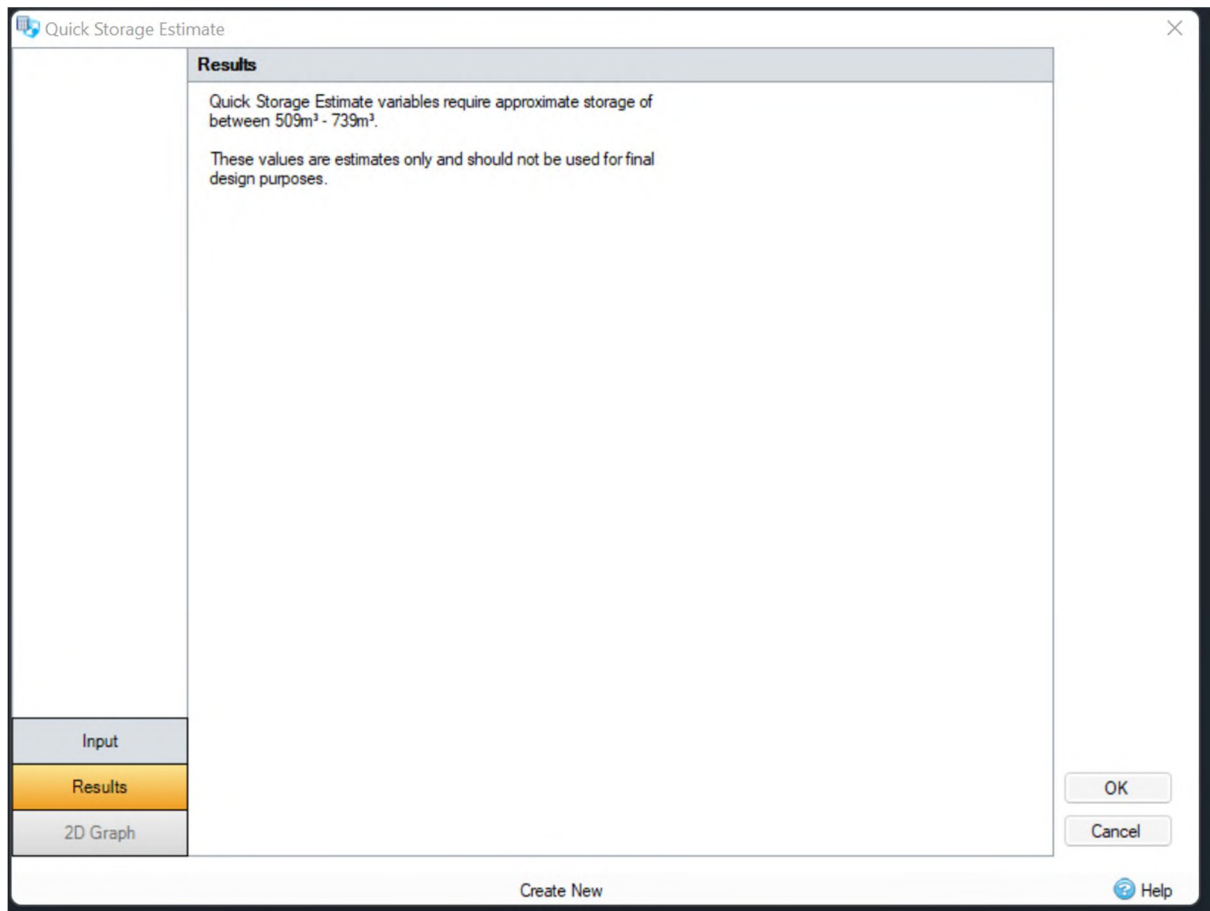
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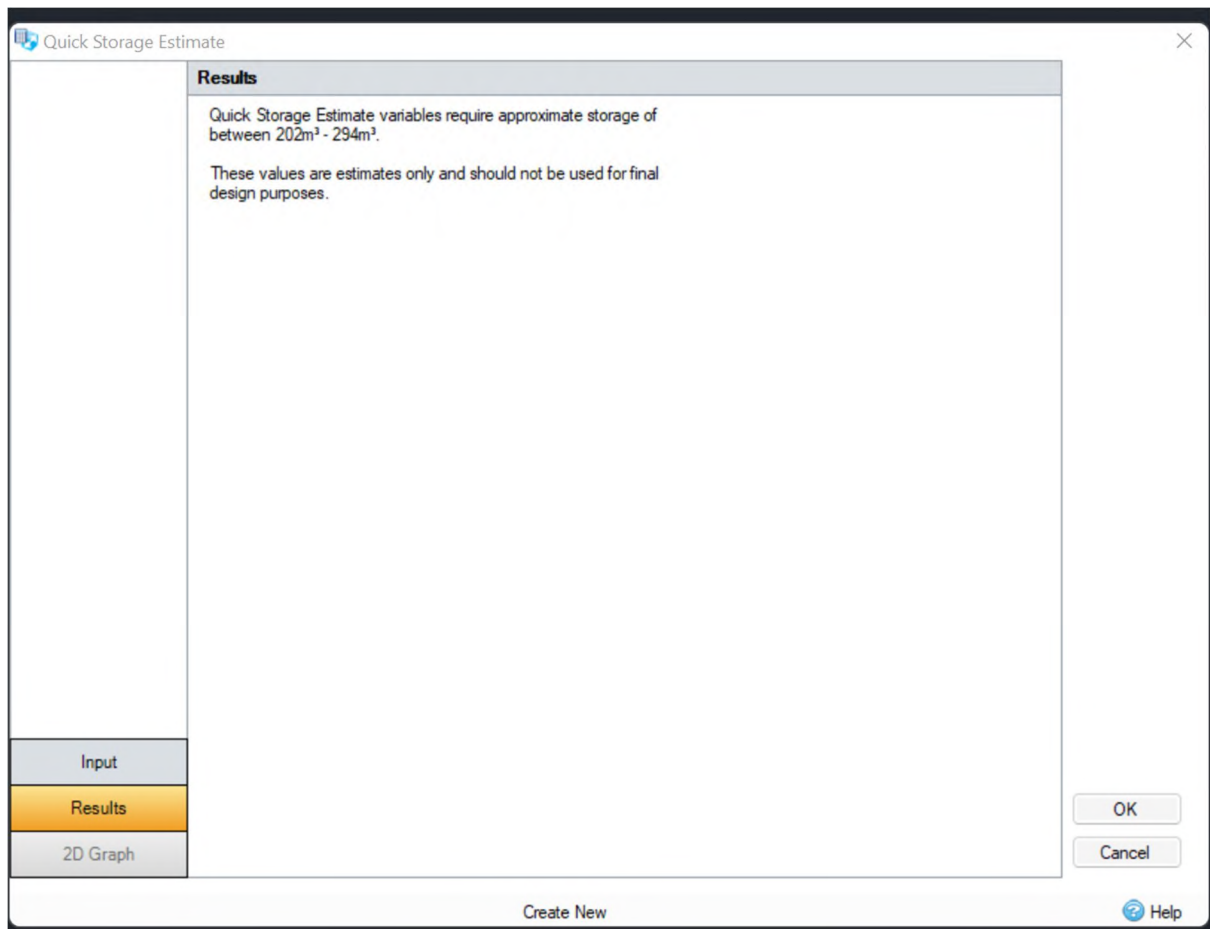
Appendix C: Microdrainage Calculations

Catchments for Bennett Street

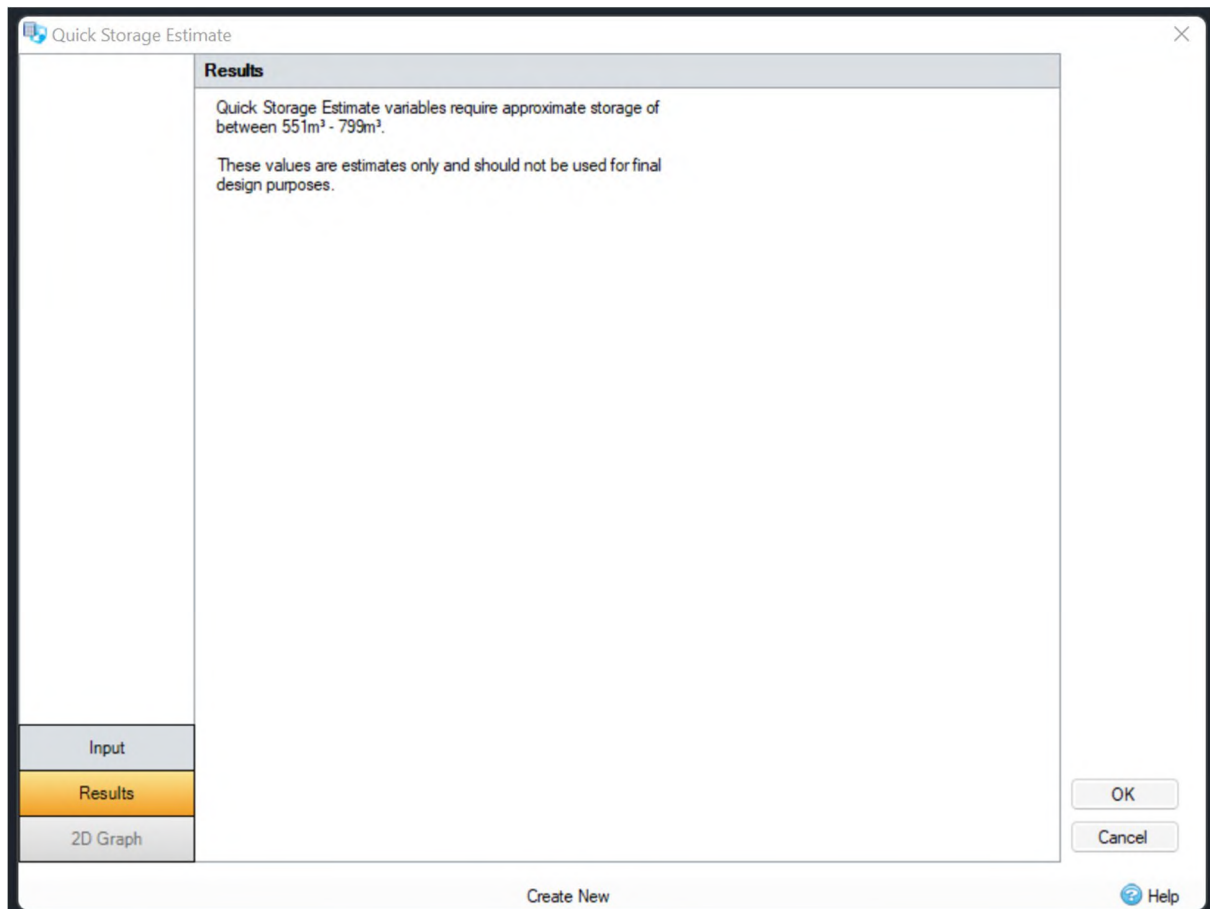
Catchment 1 in 1 in 100 year event plus 45%



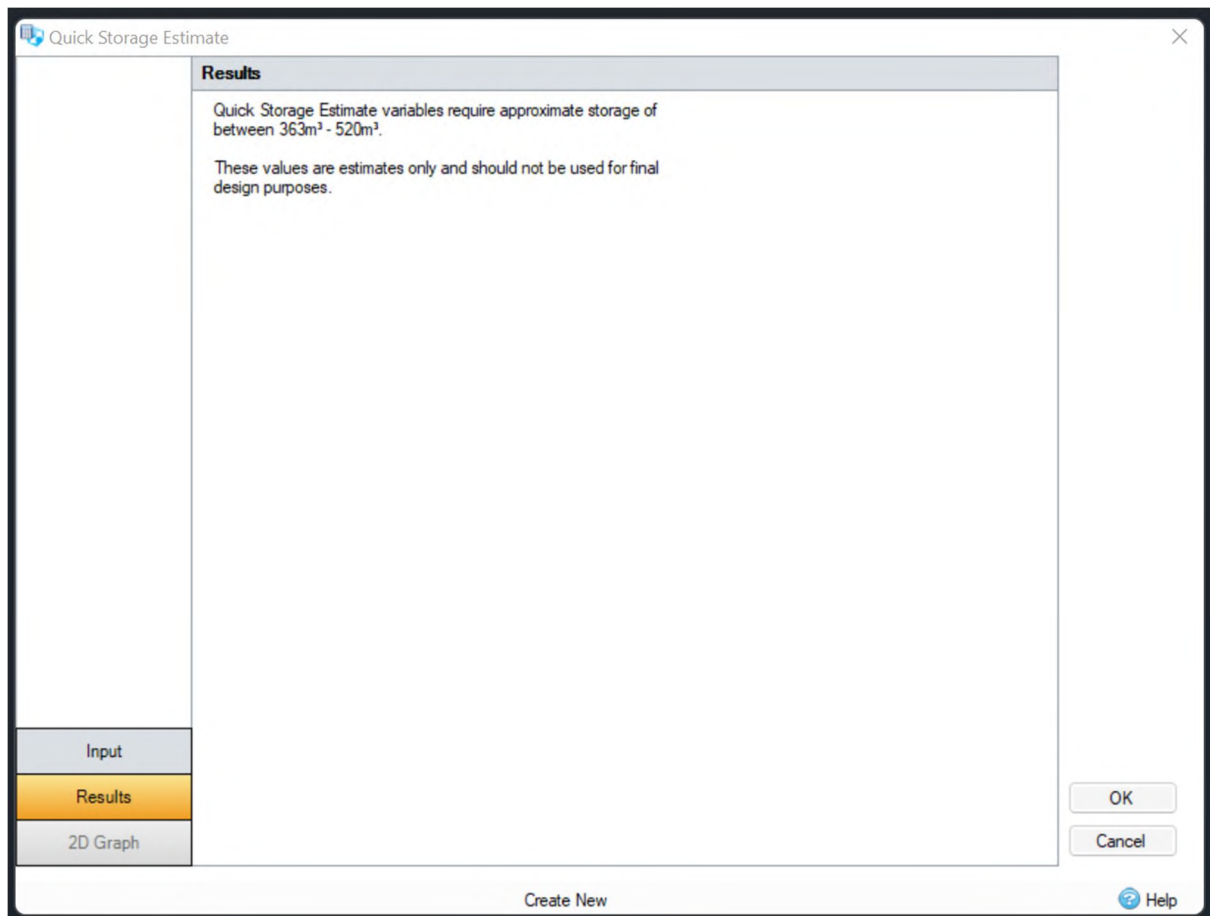
Catchment 2 in 1 in 100 year event plus 45% flood event



Catchment 3 for 1 in 100 year event plus 45%



Catchment 4 for 1 in 100 year event plus 45% climate change



Catchment 4 for the 1 in 30 event plus 45%

Quick Storage Estimate

Input

Results

2D Graph

Results

Quick Storage Estimate variables require approximate storage of between 256m³ - 383m³.

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

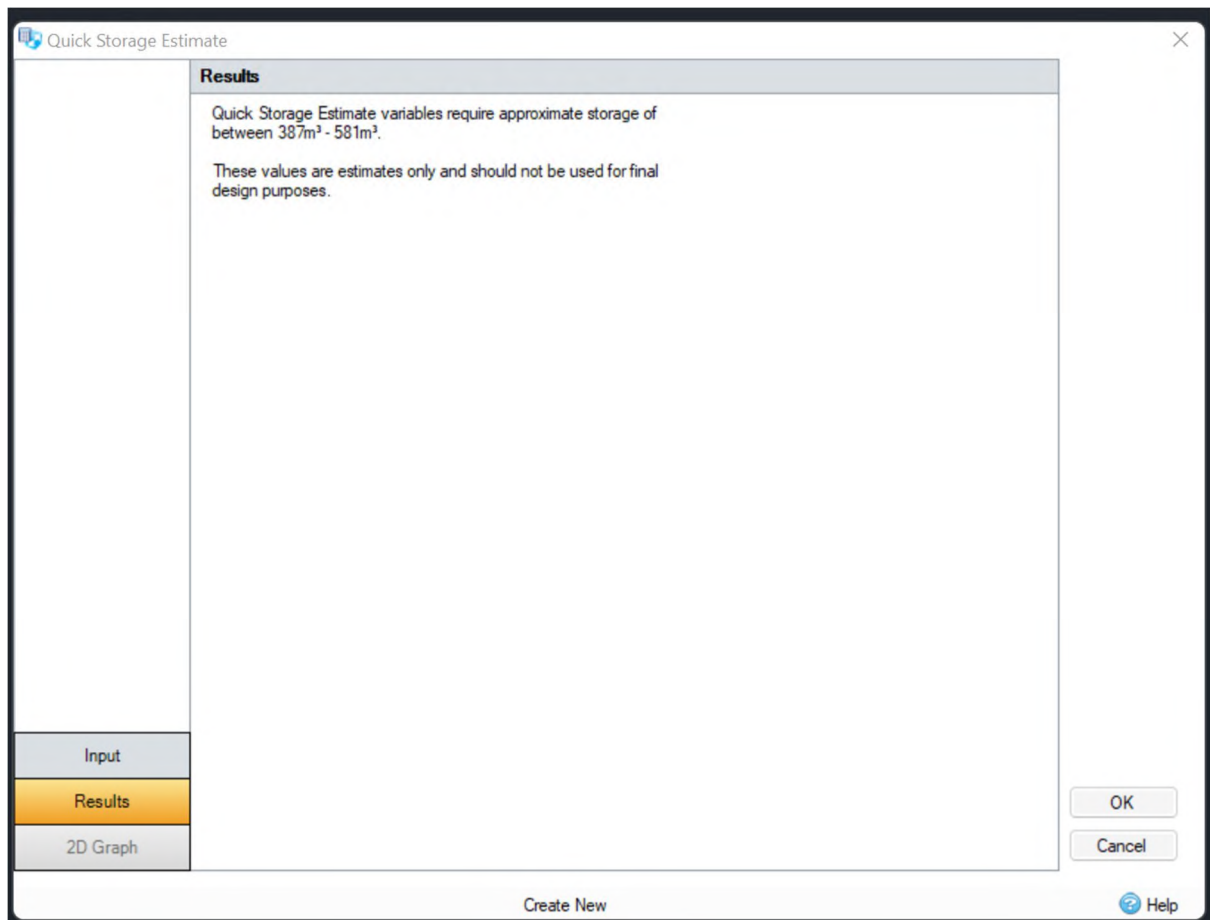
OK

Cancel

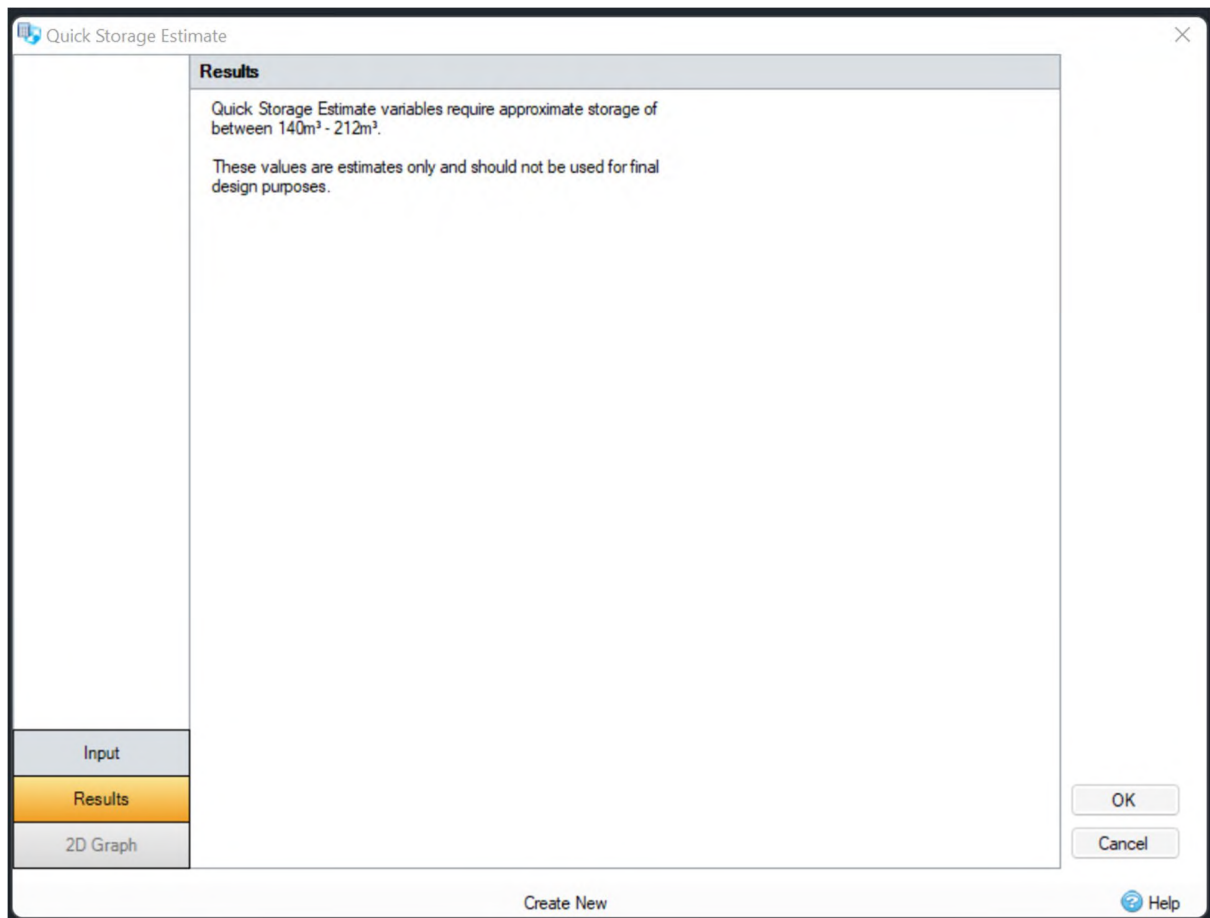
Create New

Help

Catchment 3 1 in 30 year event plus 45%



Catchment 2 for the 1 in 30 year event plus 45%



Catchment 1 for the 1 in 30 year event plus 45% for climate change

Quick Storage Estimate

Results

Quick Storage Estimate variables require approximate storage of between 357m³ - 538m³.

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Input

Results

2D Graph

OK

Cancel

Create New

Help