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Level 2 Strategic Flood Risk Assessment - Derby City Centre

Final

A1-C01

Prepared for
Derby City Council

Date
June 2026

Derby City Council

Contents

1 Background

This is a Level 2 Strategic Flood Risk Assessment (SFRA) site screening report for land parcels within Derby City Centre. The content of this Level 2 SFRA site screening report assumes the reader has already consulted the Derby City Level 1 SFRA report and read the Derby City Level 2 SFRA report, and is therefore familiar with the terminology used in this report.

This report forms a strategic assessment of 17 proposed development sites within Debry City Centre. For the purpose of this assessment, the land parcels have been split into three sub-areas: 'Derwent', 'Markeaton', and 'Other Sites'.

Within the report, the sources of flooding for each sub area are discussed individually in their own chapters, whilst further considerations, including flood risk management infrastructure, emergency planning, and requirements for drainage control and impact mitigation are assessed together.

1.1 Site details

Derby City Council provided 17 sites within the city centre for consideration within this Level 2 SFRA. Dues to the close proximity of sites, similar flood risk considerations, and the interconnected nature of the allocation plans, these sites are being assessed together as part of this report. A RAG (Red Amber, Green) analysis has been conducted and the sites are shown within Figure 1-1.

For red sites, a high percentage of the site is at risk from fluvial and/or surface water (greater than 20% of the site) in the 0.1% AEP event. A red rating does not mean that a site cannot be developed, but rather there are significant flood risk issues that would need to be addressed in order for the site to be brought forwards safely.

For amber sites, a moderate percentage (between 10% to 20%), of the site is at risk in the 0.1% AEP surface water event or any part of the site is at risk in the 0.1% AEP fluvial event. These sites are generally at low risk of flooding, which is likely to be manageable on site by avoiding the areas at risk and appropriate application of SuDS. They may also have specific considerations such as groundwater risk, access and egress issues, or proximity to defences which will need to be considered as part of a site-specific flood risk assessment.

For green sites, the site is generally at low risk of flooding, with no risk from fluvial sources and less than 10% of the site at risk in the 0.1% AEP surface water event. These sites can generally be developed without further consideration to flood risk, although may still require a flood risk assessment, for example if they are greater than 1 hectare or located within a critical drainage area.

Sub-areas have been separated based on what has the greatest effect to the site from modelled extents -

- River Derwent
- Markeaton Brook

- Other sites (predominantly surface water risk)
- Sites in each sub-area in relation to the city centre are shown in Figure 1-2 and details about each site are shown within Table 1-1.

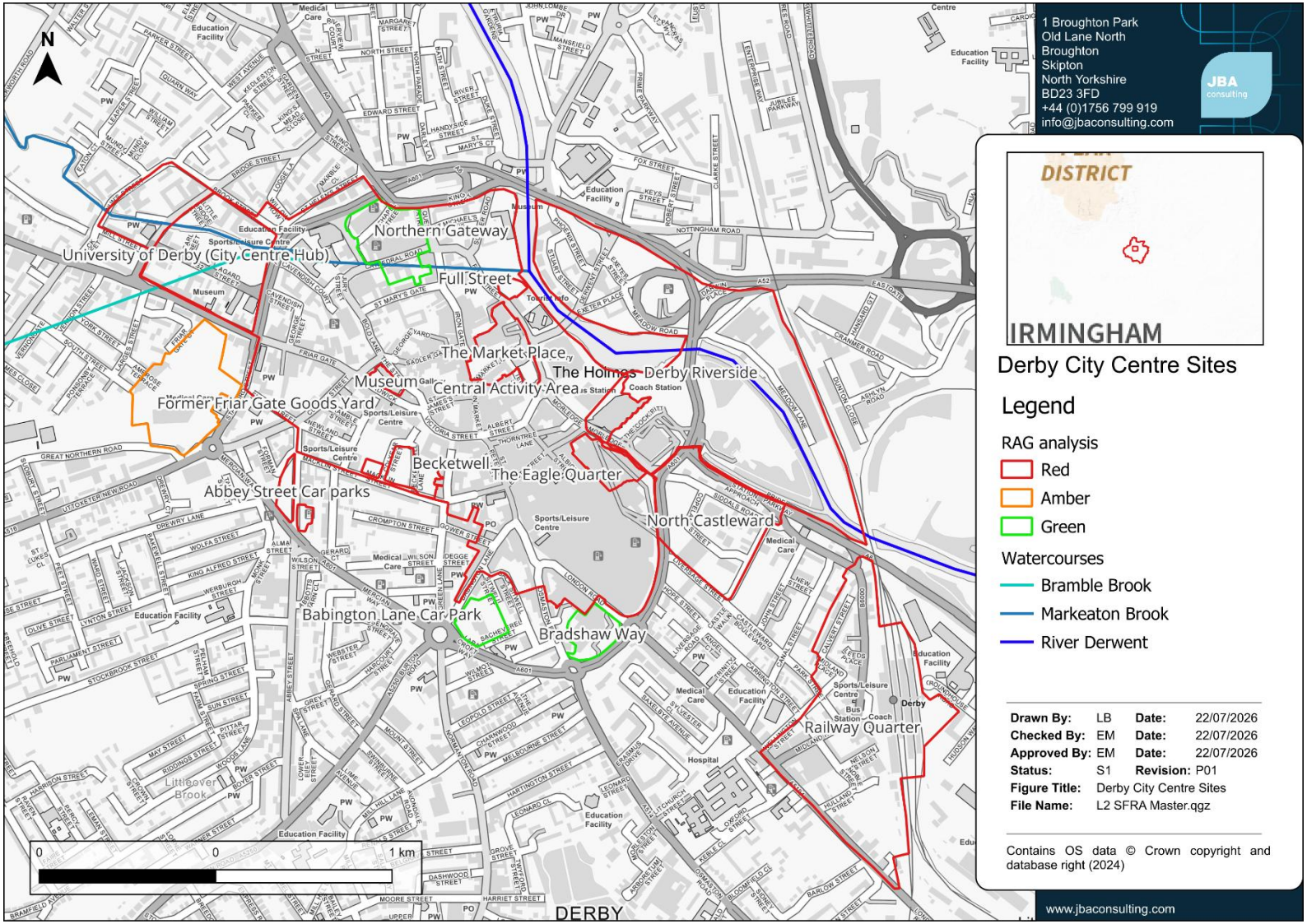

Figure 1-1: RAG analysis and overview of the Derby City Centre sites

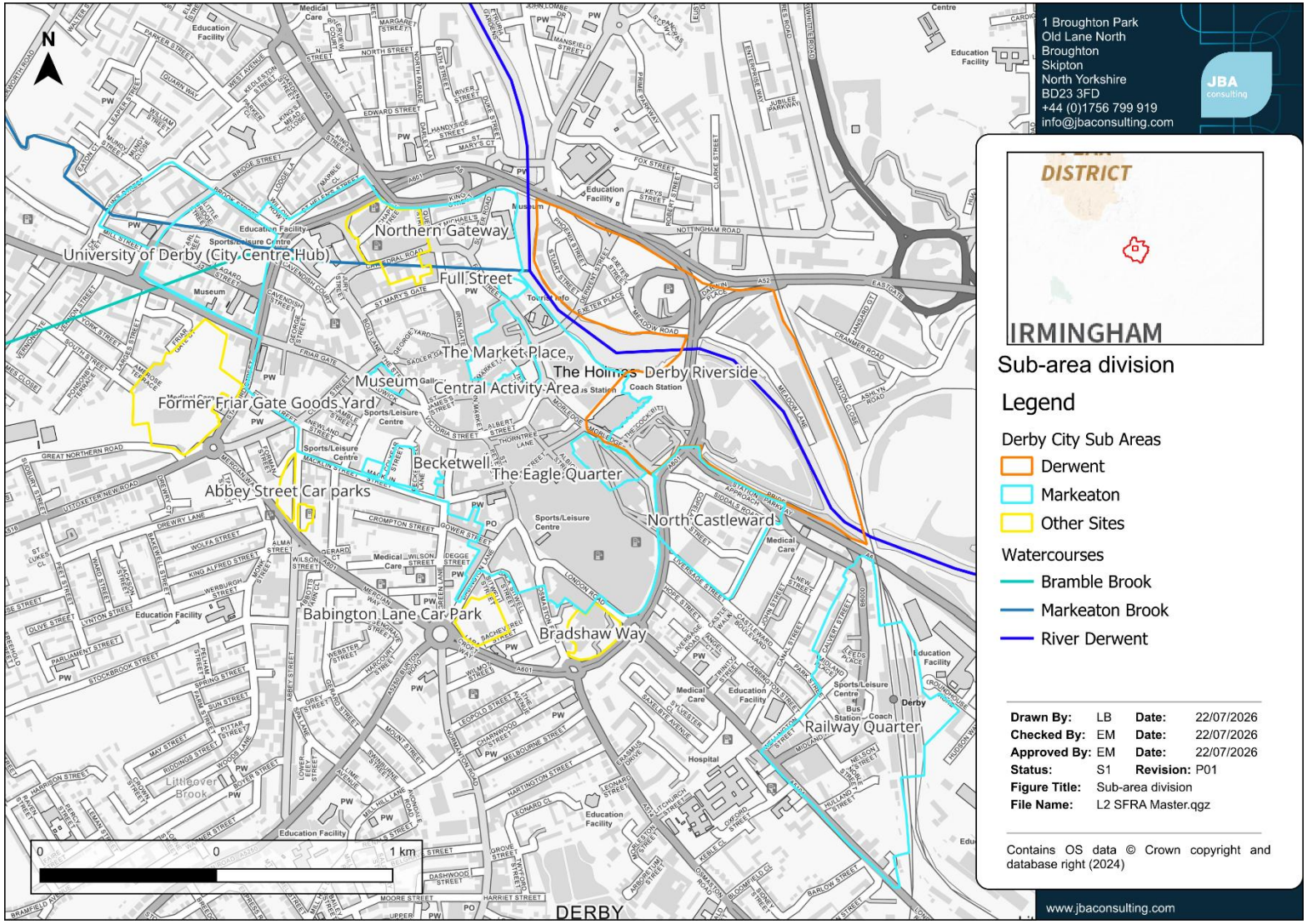

Figure 1-2: Sub-area division

Table 1-1: Site details

Policy Number	Site Name	Proposed Use	Area (ha)	RAG Rating	Sub Area
CC3	Derby Riverside	CC New NH Allocation_2025	24.6	**Red**	Derwent
CC3	North Castleward	CC New NH Allocation_2025	5.78	**Red**	Markeaton
CC3	Railway Station Quarter	CC New NH Allocation_2025	14.9	**Red**	Markeaton
CC4	The Eagle Quarter	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	1.1	**Red**	Markeaton
CC4	Former Full St Police Station	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	0.2	**Red**	Markeaton
CC4	Bradshaw Way	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	1.1	**Green**	Surface water
CC4	Abbey St Carpark (west)	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	0.4	**Red**	Surface water
CC4	Abbey St Carpark (east)	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	0.2	**Green**	Surface water

Policy Number	Site Name	Proposed Use	Area (ha)	RAG Rating	Sub Area
CC4	Former Friar Gate Goods Yard	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	4.8	**Amber**	Surface water
CC4	Babington Lane Carpark	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	0.9	**Green**	Surface water
CC4	Becketwell	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	1.1	**Red**	Markeaton
CC4	Northern Gateway	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	1.8	**Green**	Surface water
CC5	The Market Place	CC Non Resi Regen Opps	1.8	**Red**	Markeaton
CC5	Museum	CC Non Resi Regen Opps	0.3	**Red**	Markeaton
CC5	University of Derby (City Centre Hub)	CC Non Resi Regen Opps	8.3	**Red**	Markeaton
CC7/E4	Central Activity Area	CC Office Locations_2025	48.6	**Red**	Markeaton
CC7/E4	Railway Quarter	CC Office Locations_2025	14.9	**Red**	Markeaton

1.2 Topography

Figure 1-3 shows the topography of the city centre represented by the Environment Agency (EA) 1m resolution LiDAR. The sites fall within the catchments of three watercourses, with a general decreasing trend to the east, with a maximum elevation of 65m AOD in the Babington Lane Carpark site, and a minimum elevation of 42m AOD in the Derby Riverside site.

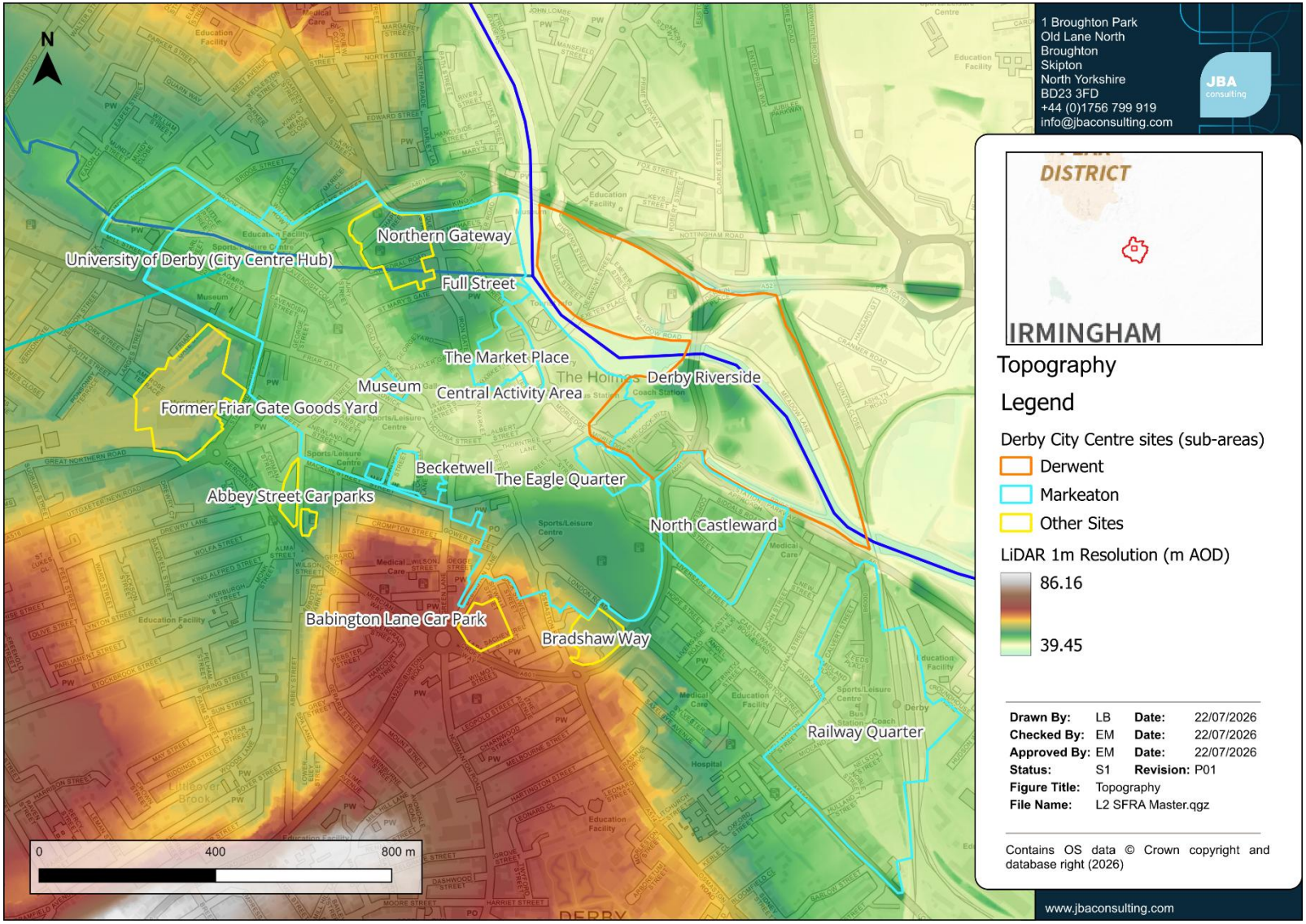

Figure 1-3: Topography of the site.

1.3 Geology and soils

Geology at the site consists of:

- Bedrock geology
  - Mudstone (Gunthorpe Member);
  - Mudstone and siltstone (Tarporley Siltstone Formation);
  - Sandstone (Cotgrave Sandstone Member);
  - Dolomitic sandstone (Edwalton Member);
- Superficial geology
  - Clay, silt, sand, and gravel alluvium;
  - Sand and gravel Allenton terrace deposits;
  - Sand and gravel glaciofluvial deposits.

Soils at the site consist of:

- Loamy and clayey floodplain soils with naturally high groundwater;
- Freely draining slightly acidic loamy soils;
- Slightly acidic loamy and clayey soils with impeded drainage.

2 Sources of Flood Risk - Sub Area 'Derwent'

2.1 Site

The Derwent sub area consists of one site, which is shown in Figure 2-1. The site is located in the Derwent Derbyshire Management Catchment and falls within the catchment of the River Derwent. At the site, the Derwent drains an approximate upstream area of 1117km^2 at the site, flowing through the central area of the site, with a second channel of the Markeaton Brook, named Mill Fleam, flowing along the southeastern boundary. The site currently contains travel infrastructure and employment spaces with a proposed usage of residential housing.

The risk to the site is summarised below.

Policy Number	Site Name	Proposed Use	Area (ha)	RAG Rating	Sub Area
CC3	Derby Riverside	New NH Allocation	24.6	Red	Derwent

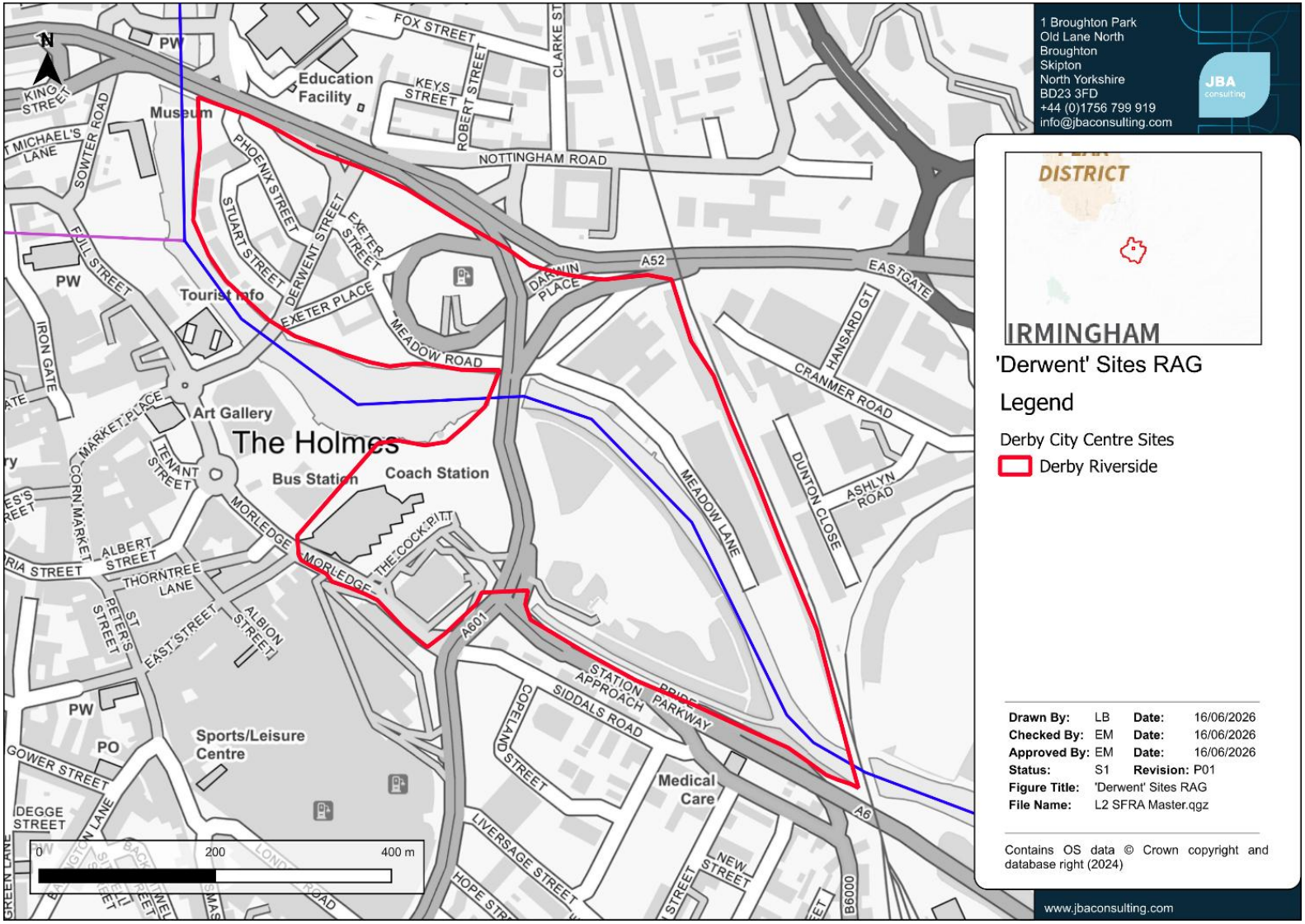

Figure 2-1: Derwent sub-area overview

2.2 Existing drainage features

The River Derwent flows through the central area of the Derby Riverside site. As the site is heavily urbanised, it is likely that there is drainage into the existing surface water sewer network which then likely drains into the River Derwent. It is noted that there is bridge across the River Derwent which if blocked could exacerbate flooding at the site.

2.3 Fluvial

2.3.1 Available data

The EA Flood Maps for Planning (FMfP), the EA's Derby Our City Our River (OCOR) detailed hydraulic model (2023) for the River Derwent and Markeaton Brook detailed hydraulic model (2013 plus 2020 climate change reruns) have been used within this assessment. Fluvial flood risk at the site is associated with extents from the River Derwent and Markeaton Brook at Mill Fleam, which are modelled separately. It is noted that the Environment Agency is currently updating it's modelling of the River Derwent and future extents may differ from those used within this assessment. Developers should contact the Environment Agency to understand the latest available data and ensure that this is used within their site-specific flood risk assessments.

2.3.2 Description of risk to the site

Table 2-1: Existing fluvial flood risk based on the Derby OCOR model, Markeaton Brook model and the EA FMfP.

Site	Flood Zone 1 (%)	Flood Zone 2 (%)	Flood Zone 3a (%)	Flood Zone 3b (%)
Derby Riverside	9.1	41.9	49.0	14.0

**The percentage flood zones quoted show the percentage of the site at flood risk from that particular flood zone or event e.g. Flood Zone 1 is the remaining area outside Flood Zone 2 + Flood Zone 3 = 100%, but Flood Zone 2 does not include Flood Zone 3).*

For this assessment, three events are considered:

- 3.3% AEP defended, equivalent to Flood Zone 3b
- 1% AEP undefended, equivalent to Flood Zone 3a
- 0.1% AEP undefended, equivalent to Flood Zone 2

There are existing defences along the River Derwent which protect much of the sub-area, which will be further improved through the Our City Our River scheme however there is no breach modelling available to inform the risk should defences breach or overtop. The undefended results are therefore used to give an indication of the risk that may be posed to sites in the event of a breach or failure of defences- it will be essential that this is refined as part of a site-specific flood risk assessment as part of any planning application, supported by breach modelling.

Within the highest likelihood event, the defended modelled 3.3% AEP event as indicated by Flood Zone 3b, extents from the River Derwent remain in bank. Extents from the Markeaton Brook from the Mill Fleam channel affect the southeastern area of the site. Flood water exceeding the channel capacity spills out along the southern bank of the River Derwent. Maximum depths, velocities, and hazard ratings are unavailable for the Markeaton Brook, and extents associated with the River Derwent are in bank.

During the undefended modelled 1% AEP event, as indicated by Flood Zone 3a, flood extents from the River Derwent spill onto the northern bank within the site at various points, with the eastern area around Meadow Lane more affected than the western area. Flood waters from the Markeaton Brook spill out of bank and flow north towards the southern bank of the River Derwent following the topography. Within the River Derwent flood extents, the maximum depth is 3.1m on Meadow Road in the northwestern area of the site, the maximum velocity 2.6m/s at the northern boundary of the site, and the maximum hazard is 'danger for all'. Across the broader site however depths are generally 0.6-0.9m, with a hazard of classification "caution" to "danger for some". Depths, velocities and hazards are unavailable for the Markeaton Brook model.

During the modelled 0.1% AEP event, as indicated by Flood Zone 2, flood extents from the River Derwent inundate the northern area with the exception of the A601 as it joins the A52 in the northern area of the site. On the southern bank, flood extents follow the topography in the eastern area, similar to the 1% AEP extents of the Markeaton Brook. Flood extents from the Markeaton Brook enter the site from the western boundary and from channel exceedance. Extents flow through the southern area of the site and within the southeastern area of the site, extents follow the local topography to the southern bank of the River Derwent. The maximum depth is 5.3m at Meadow Road near the northern bank of the River Derwent, and a maximum velocity of 4.2m/s at the northern boundary of the site. There is no hazard mapping for the River Derwent in this AEP event, nor are there depths, velocities or hazards are available for the Markeaton Brook.

The above assessment should be revisited as part of a site-specific flood risk assessment to consider the risk to the site following the completion of OCOR and the risk to the site in the event of a breach of defences.

2.3.3 Climate Change

2.3.3.1 Available data

Fluvial climate change extents have been taken from existing detailed models where they are available, where not available the NaFRA2 Flood Zones plus climate change layer has been used this uses the Central allowance for the 2080s epoch (29%). Within the modelling, fluvial climate change is assessed with the 1% AEP plus 29% climate change allowance for the River Derwent and Markeaton Brook.

2.3.3.2 Description of risk to the site

Flood risk from the River Derwent in the 1% AEP plus 29% climate change allowance event increases flood extents by approximately 24%, with extents similar to the 0.1% AEP event, greatly impacting the site. The greatest difference is seen within the northwestern area of the site which is completely inundated.

Fluvial climate change extents for the Markeaton Brook increase by 3%, with flooding on the northern bank of the Mill Fleam however there are no depth, velocity, or hazard values to compare. The Derby Riverside site is sensitive to increased flood risk due to climate change.

Table 2-2: Comparison of fluvial flood risk to the site between the 1% AEP and 1% AEP plus 29% climate change extents from the Derby OCOR Model.

Event	1% AEP	1% AEP plus 29% CC
Percentage of site at risk (%)	35%	59%
Maximum depth (m)	3.1	4.6
Maximum velocity (m/s)	2.6	4.2
Maximum hazard classification	Danger for All	Danger for All

2.4 Surface water

2.4.1 Available data

The EA's Risk of Flooding from Surface Water (RoFSW) map has been used within this assessment.

2.4.2 Description of risk to the site

The site is generally at low risk from surface water, primarily affected by areas of ponding throughout the site in all AEP events. The northern area of the site is more affected by surface water, with the ponding in topographic low points, particularly on the roads. There is slight encroachment from the flow path along the northern boundary in all AEP events, and encroachment in the 0.1% AEP event at the southwestern boundary.

Table 2-3: Existing surface water flood risk based on the RoFSW map

Site	Event	3.3% AEP	1% AEP	0.1% AEP
Derby Riverside	Percentage of site at risk* (%)	3.2	1.2	5.7
	Maximum depth (m)	0.3 to 0.6	0.6 to 0.9	0.9 to 1.2
	Maximum velocity (m/s)	-	-	-
	Maximum hazard classification	Danger to Most	Danger to Most	Danger to Most

** The percentage surface water extents quoted show the percentage of the site at surface water risk from that particular event, excluding the percentage of the site at flood risk at a higher risk zone (e.g. 1% AEP does not include the 3.3% AEP percentage).*

2.4.3 Climate Change

2.4.4 Available data

The design event for rainfall intensities is the 1% AEP event with Upper End climate change (CC) allowance for the 2070s epoch. NaFRA2 data (updated May 2026) for the 2070s epoch have been used within this assessment.

2.4.5 Description of risk to the site

There is a significant increase in extents, similar to extents from the 0.1% AEP event. The Derby Riverside site is sensitive to increased flood risk due to climate change. Within the table below, the 1% AEP event extents include the 3.3% AEP event.

Table 2-4: Comparison of surface water flood risk to the site between the 1% AEP and 1% AEP plus 40% climate change extents.

Event	1% AEP	1% AEP plus 40% CC
Percentage of site at risk (%)	4.4	5.7%
Maximum depth (m)	0.6 to 0.9	Exceed 1.2m to 2.3m
Maximum velocity (m/s)	-	-
Maximum hazard classification	Danger to Most	Danger to all

2.5 Groundwater

The JBA Groundwater Emergence Mapping shows that there is little risk of ground water emergence at the site.

This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific Flood Risk Assessment (FRA) stage.

2.6 Sewers

The sewer flooding risk register provided by Derby City Council shows that there are no instances of flooding within the site's post code(s).

2.7 Flood history

The site has been affected by multiple historic flood events shown within the EA's Recorded Flood Outlines dataset, with events in 1931, 1932, 1947, 1960, two in 1965, 1977 and 2019. There is a Section 19 flood investigation report held by Derby City Council as Lead Local Flood Authority (LLFA) within the area, detailed within the table below. The Chronology of British Hydrological Events (CBHE) notes multiple events from the early

1600s that affect the River Derwent, including the 1932 flood event[1], and would likely have affected the site. It is noted that not all flood events are recorded or reported and thus may not fully represent all flood history at the site.

Event date	Extent comments
8th to 9th November 2019	Section 19 reporting shows that Meadow Lane, Meadow Road, and Exeter Place were affected by flooding in 2019. Source: Investigation Report into November 2019 Derwent Floods in Derby City[2]
January 2021	In January 2021 many areas along the River Derwent experienced flooding, associated with Storm Christoph. Heavy rainfall was also associated with surface water flooding within Derby City.
21st October 2023	On the 21st October 2023, the River Derwent broke its banks in multiple places following 137mm of rain over 33 hrs, associated with Storm Babet.

1 CBHE 1932 flood event - https://www.cbhe.hydrology.org.uk/view.php?id=13442
2 Section 19 Flood Investigation Report - https://www.derby.gov.uk/media/derbycitycouncil/contentassets/documents/environmentandplanning/floodinganddrainage/2022-09-15-derby-section-19-report-p03.pdf

3 Sources of Flood Risk - Sub Area 'Markeaton'

3.1 Sites

The 'Markeaton' sub-area consists of 9 sites, which are shown to be affected by modelled extents from the Markeaton Brook hydraulic model (2013), with sites draining up to approximately 64km^2. The sub area is located within the Derwent Derbyshire Management catchment. Sites within the sub area are of mixed use ranging from car parks to employment and residential dwellings, proposals for the sites range from employment to residential dwellings, as detailed below.

Policy Number	Site Name	Proposed Use	Area (ha)	RAG Rating	Sub Area
CC3	North Castleward	CC New NH Allocation_2025	5.8	Red	Markeaton
CC3, CC7/E4	Railway Station Quarter	CC New NH Allocation_2025/ CC Office Locations_2025	14.9	Red	Markeaton
CC4*	The Eagle Quarter*	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	1.1	Red	Markeaton
CC4*	Former Full St Police Station*	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	0.2	Red	Markeaton
CC4*	Becketwell*	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	1.1	Red	Markeaton
CC5	The Market Place	CC Non Resi Regen Opps	1.8	Red	Markeaton
CC5	Museum	CC Non Resi Regen Opps	0.3	Red	Markeaton
CC5	University of Derby (City Centre Hub)	CC Non Resi Regen Opps	8.3	Red	Markeaton

Policy Number	Site Name	Proposed Use	Area (ha)	RAG Rating	Sub Area
CC7/E4	Central Activity Area	CC Office Locations_2025	48.6	Red	Markeaton

*These sites have been assessed as part of the wider city centre assessment however already have planning permission, and whilst it is recommended that developers follow the recommendations in this assessment for site design and layout it is recognised that these sites do not need to resubmit any additional evidence based on the findings of this assessment to go forwards. Details of permissions for sites can be found on Derby City Council's Website:

- The Eagle Quarter - 25/01315
- Former Full St Police Station - 23/01462
- Becketwell- 19/01245

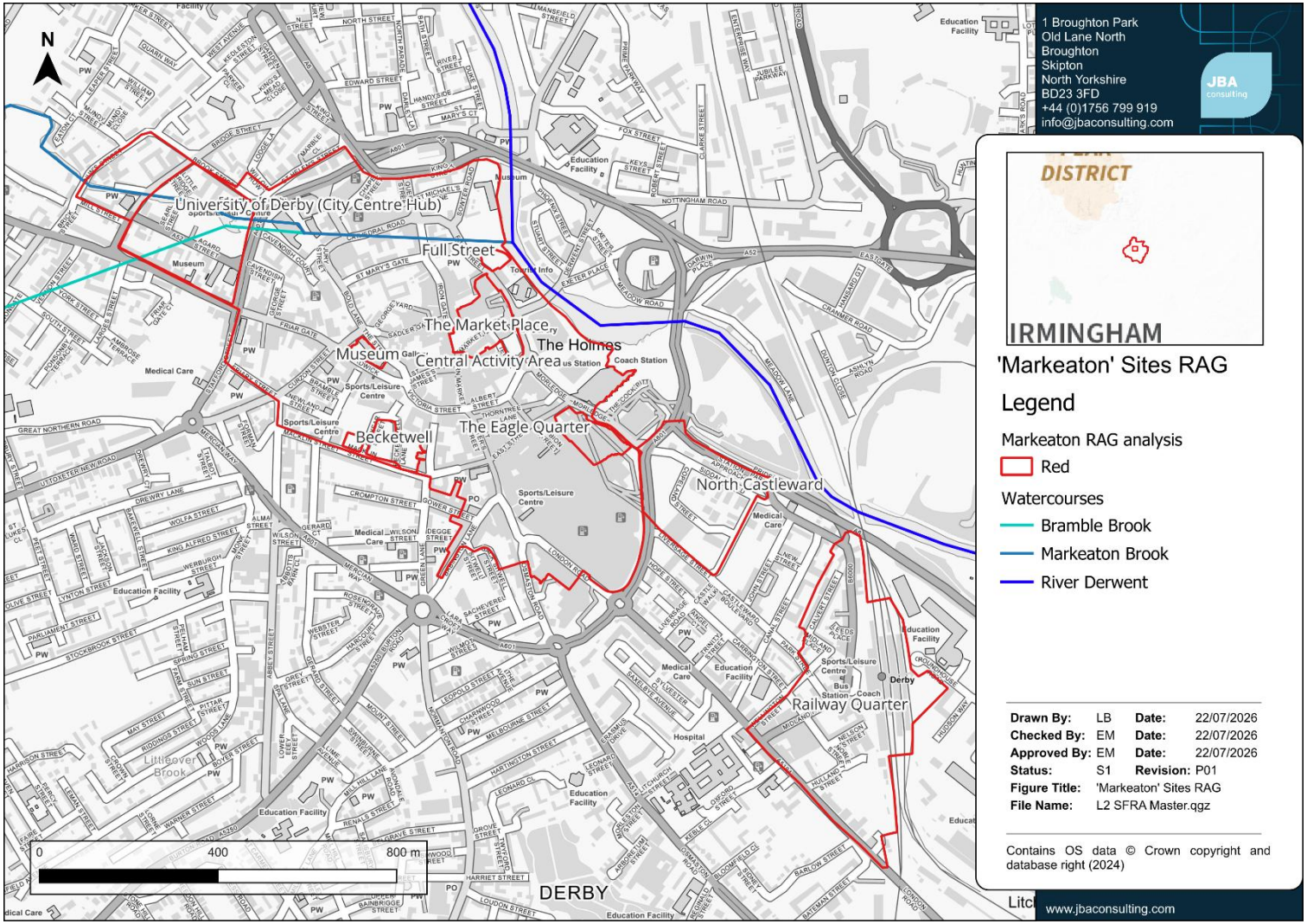

Figure 3-1: RAG analysis of the Markeaton sub area

The risk to Amber and Red sites is summarised below.

3.2 Existing drainage features

The Markeaton Brook rises near Mercaston approximately 10km northwest of Derby, draining an area of approximately 64km^2 at its confluence with the Derwent. Within the city, the Brook flows though the University of Derby site where it enters the inlet for a culvert where with then flows eastwards through the Central Activity Area site to its confluence with the River Derwent. Through most of the city centre, the Brook is integrated into the surface water drainage network. The River Derwent is adjacent to the Central Activity Area, Former Full Street Police Station, and The Railway Station Quarter. The Bramble Brook is culverted under the Central Activity Area, where it enters the culverted reach of the Markeaton Brook. As the sub area is heavily urbanised, it is likely that any surface water drains into the sewer network which then ultimately discharges into the River Derwent.

3.3 Fluvial

3.3.1 Available data

The EA's FMfP, the Markeaton Brook detailed hydraulic model (2013), and the Derby OCOR detailed hydraulic model (2023) have been used within this assessment. It is noted that modelling of the Derwent is currently being updated, and future extents may differ from those used within this assessment.

3.3.2 Description of risk to the site

Table 3-1: Existing fluvial flood risk based on the Derby OCOR model, Markeaton Brook model and the EA FMfP.

Site	Flood Zone 1 (%)	Flood Zone 2 (%)	Flood Zone 3a (%)	Flood Zone 3b (%)
North Castleward	74.2	14.6	11.2	9.1
Railway Station Quarter	75.6	23.9	0.5	0.3
The Eagle Quarter	16.7	83.3	0.0	-
Former Full St Police Station	57.8	41.3	0.9	0.9
Becketwell	66.3	33.7	0.0	-
The Market Place	20.3	79.7	0.0	-
Museum	0.0	100.0	0.0	-
University of Derby (City Centre Hub)	71.5	15.7	12.7	6.6

Site	Flood Zone 1 (%)	Flood Zone 2 (%)	Flood Zone 3a (%)	Flood Zone 3b (%)
Central Activity Area	47.5	48.7	3.8	1.3

**The percentage flood zones quoted show the percentage of the site at flood risk from that particular flood zone or event e.g. Flood Zone 1 is the remaining area outside Flood Zone 2 and Flood Zone 3).*

There are existing defences along the River Derwent which protect much of the sub-area, which will be further improved through the Our City Our River scheme however there is no breach modelling available to inform the risk should defences breach or overtop. Much of the sub area is shown to be in area that not at risk during the defended present day 1% AEP event, but is at risk in undefended events. The undefended results are therefore used to give an indication of the risk that may be posed to sites in the event of a breach or failure of defences- it will be essential that this is refined as part of a site-specific flood risk assessment as part of any planning application, supported by breach modelling.

Within the highest likelihood event, the modelled defended 3.3% AEP event as indicated by Flood Zone 3b, the Markeaton Brook remains in bank, while there is slight channel exceedance of the River Derwent within the Central Activity area in land adjacent Sowter Road and Full Street. The maximum depth of this extent is 3.3m, a maximum velocity of 1.2m/s, and a maximum hazard rating of 'danger for all'.

During the modelled undefended 1% AEP event, as indicated by Flood Zone 3a, extents from the Markeaton Brook are present in the University of Derby site spilling onto the northern bank of the brook, where the brook enters a culvert. There are also extents encroaching from the northern boundary of the North Castleward site and the northern area of Railway Station Quarter. Depths, velocities and hazard ratings are unavailable for the Markeaton Brook. Extents from the River Derwent encroach into the Central Activity Area and Former Full Street Police Station sites along their eastern boundaries. There is slight encroachment in the northern area of the Railway Station Quarter site. The maximum depth of the River Derwent extents is 3.6m, the maximum velocity is 1.4m/s, and a maximum hazard rating is 'danger for all', all of which are located in land adjacent Sowter Road and Full Street, however the vast majority of the sub area is not affected by the Derwent extents.

During the modelled 0.1% AEP event, as indicated by Flood Zone 2, extents from the Markeaton Brook affect the:

- Central Activity Area - a flow path originating from where the Markeaton Brook enters the culvert, flows from the northwest of the site through the central area to the eastern area where it either connects with the River Derwent at the eastern boundary or flows south-eastwards;
- University of Derby site - extents spill onto the northern bank of the brook inundating the northern half of the site. Extents are also present near the culvert entrance on the southern bank at the eastern boundary on Agard Street and land north of it;

- Museum site, fully inundating it;
- The Market Place - extents are present in the majority of the site with the exception of the northwestern area and the most northern area of the site;
- Former Full Street Police Station - extents enter from the southeastern boundary into the central area of the site;
- Becketwell - extents enter from the northern boundary into the western half of the site;
- The Eagle Quarter - extents are present in the northwestern half of the site;
- North Caslteward - extents encroach the site from the northern and eastern boundaries, and present;
- Railway Station Quarter - extents encroach the site from the northern and western boundaries and primarily occupies land surrounding Calvert Street, Midland Place and Midland Road.

Maximum depths, velocities and hazard ratings are unavailable for the Markeaton Brook.

Extents from the River Derwent in the 0.1% AEP event encroach into the Central Activity Area, Former Full Street Police Station sites along their eastern boundaries, and North Castleward at its northern boundary. Within the Central Activity Area extents are also present in the northeastern area along Sowter Road. There is slight encroachment in the northern area of the Railway Station Quarter site. The maximum depth is 4.2m and the maximum velocity is 2.1 m/s, both of which are at land located between Sowter Road and Full Street, though again this is limited to areas in the immediate vicinity of the watercourse with most flooding associated with Markeaton Brook. There are no hazard ratings available for this event.

3.3.3 Climate Change

3.3.3.1 Available data

Fluvial climate change extents have been taken from existing detailed models where they are available, where not available the NaFRA2 Flood Zones plus climate change layer has been used this uses the Central allowance for the 2080s epoch (29%). Within the modelling, fluvial climate change is assessed with the 1% AEP plus 29% climate change allowance for the River Derwent and the Markeaton Brook.

3.3.3.2 Description of risk to the site

Flood risk from the River Derwent in the 1% AEP plus 29% climate change allowance event increases flood extents in the North Castleward and Central Activity area sites by approximately 5.5% and 0.8% respectively. The extents similar to the 0.1% AEP event, greatly impacting the site.

Fluvial climate change extents for the Markeaton Brook affect North Castleward (increasing by 2%), Central Activity Area (increasing by 3.5%) and University of Derby (increasing by 14.5%). Extents at North Castleward are comparable to the 1% AEP event, while in the University of Derby site has a significant increase in extents within the site.

The aforementioned sites are sensitive to increased flood risk due to climate change.

Table 3-2: Comparison of fluvial flood risk to the site between the 1% AEP and 1% AEP plus 29% climate change extents from the Derby OCOR model.

Location	Event	1% AEP	1% AEP plus 40% CC
North Castleward	Percentage of site at risk (%)	0.0	5.5
	Maximum depth (m)	-	0.3
	Maximum velocity (m/s)	-	0.3
	Maximum hazard classification	-	Caution
Central Activity Area	Percentage of site at risk (%)	0.9	1.7
	Maximum depth (m)	3.6	4.6
	Maximum velocity (m/s)	1.4	1.8
	Maximum hazard classification	-	Danger to All

Table 3-3: Comparison of fluvial flood risk to the site between the 1% AEP and 1% AEP plus 29% climate change extents from the Markeaton Brook model.

Location	Event	1% AEP	1% AEP plus 40% CC
Railway Quarter	Percentage of site at risk (%)	0.4	0.6
Central Activity Area	Percentage of site at risk (%)	1.9	5.5
University of Derby	Percentage of site at risk (%)	12.4	26.9
Derby Riverside	Percentage of site at risk (%)	10.2	13.8
North Castleward	Percentage of site at risk (%)	10.7	12.8

3.4 Surface water

3.4.1 Available data

The EA's Risk of Flooding from Surface Water (RoFSW) map has been used within this assessment.

3.4.2 Description of risk to the site

Each site within this sub area encounters surface water flood risk. The most affected site is the Museum site, which is completely inundated in the 1% AEP and 0.1% AEP events, with extents in the 3.3% AEP event located at the north-western corner of the site. The Former Full Street Police Station, Becketwell and The Eagle Quarter sites are only affected in the

0.1% AEP event, with significant extents in the eastern area of the former police station, the western half of the Becketwell site, and the central and western areas of The Eagle Quarter site.

In The Market Place site, there is ponding in the southern area of the site in the 3.3% AEP event, a flow path though the southern area and south-western boundary of the site in the 1% AEP event. In the 0.1% AEP event, there is a flow path through the southern half of the site.

In the University of Derby site, there are areas of ponding throughout the site in the 3.3% AEP event. In the 1% AEP event, there is an increase to the ponding within the southern half of the site with a flow path in the northern half, encroaching along the northern boundary into the western half of the site, flowing towards the Markeaton Brook. In the 0.1% AEP the northern half of the site is inundated, while there is a flow path in the south-eastern are flowing towards the Markeaton Brook and the eastern boundary of the site.

In the Central Activity Area, there are numerous instances of ponding in the 3.3% AEP event across the site, with a flow path in the southwest area of the site entering from the southwestern boundary. In the 1% AEP event, there is a flow path present across the southern area of the site, entering the site from the south-western boundary, then flowing east to meet the River Derwent. There is also a flow path along the boundary in the northwestern corner at the site. In the 0.1% AEP, there are two converging flow paths, one enters from the northwestern boundary and the other from the southwestern boundary. These converge in the central area of the site and flow toward the River Derwent.

Table 3-4: Existing surface water flood risk based on the RoFSW map

Site	Event	3.3% AEP	1% AEP	0.1% AEP
North Castleward	Percentage of site at risk* (%)	4.1	0.3	2.0
	Maximum depth (m)	0.2 to 0.3	0.2 to 0.3	0.2 to 0.3
	Maximum velocity (m/s)	-	-	-
	Maximum hazard classification	Little risk	Little risk	Caution
Railway Station Quarter	Percentage of site at risk* (%)	4.1	4.9	18.7
	Maximum depth (m)	0.2 to 0.3	0.3 to 0.6	0.3 to 0.6
	Maximum velocity (m/s)	-	-	-
	Maximum hazard classification	Caution	Caution	Caution
The Eagle Quarter	Percentage of site at risk* (%)	0	0	76.0
	Maximum depth (m)	0	0	0.3 to 0.6
	Maximum velocity (m/s)	-	-	-
	Maximum hazard classification	Little risk	Little risk	Danger to most
Former Full St Police Station	Percentage of site at risk* (%)	0	0	17.3
	Maximum depth (m)	0	0	0.3 to 0.6
	Maximum velocity (m/s)	-	-	-
	Maximum hazard classification	Little risk	Little risk	Caution

Site	Event	3.3% AEP	1% AEP	0.1% AEP
Becketwell	Percentage of site at risk* (%)	0	0	31.0
	Maximum depth (m)	0	0	0.3 to 0.6
	Maximum velocity (m/s)	-	-	-
	Maximum hazard classification	Little risk	Little risk	Caution
The Market Place	Percentage of site at risk* (%)	3.8	12.9	28.6
	Maximum depth (m)	0.2 to 0.3	0.9 to 1.2	>1.2
	Maximum velocity (m/s)	-	-	-
	Maximum hazard classification	Caution	Danger to most	Danger to all
Museum	Percentage of site at risk* (%)	5.3	85.8	8.9
	Maximum depth (m)	Less than 0.2	0.2 to 0.3	0.9 to 1.2
	Maximum velocity (m/s)	-	-	-
	Maximum hazard classification	Little risk	Danger to most	Danger to most
University of Derby (City Centre Hub)	Percentage of site at risk* (%)	6.3	11.1	39.6
	Maximum depth (m)	0.2 to 0.3	0.3 to 0.6	0.9 to 1.2
	Maximum velocity (m/s)	-	-	-
	Maximum hazard classification	Caution	Danger to most	Danger to all
Central Activity Area	Percentage of site at risk* (%)	5.6	12.6	34.8
	Maximum depth (m)	0.2 to 0.3	0.9 to 1.2	>1.2
	Maximum velocity (m/s)	-	-	-
	Maximum hazard classification	Caution	Danger to most	Danger to all

** The percentage surface water extents quoted show the percentage of the site at surface water risk from that particular event, excluding the percentage of the site at flood risk at a higher risk zone (e.g. 1% AEP does not include the 3.3% AEP percentage).*

3.4.3 Climate Change

3.4.4 Available data

The design event for rainfall intensities is the 1% AEP event with Upper End climate change (CC) allowance for the 2070s epoch. NaFRA2 data (updated May 2026) for the 2070s epoch have been used within this assessment.

3.4.5 Description of risk to the site

Surface water climate change extents are similar to that of the 0.1% AEP event if not marginally larger in some areas and sites. The following sites are shown to be at no risk in

the present day 1% AEP events but have between 15% to 80% of the site affected in the 1% AEP plus climate change event: Eagle Quarter, Former Full Street Police Station, and Becketwell. These sites are very sensitive to increased flood risk due to climate change, and a site specific flood risk assessment will need to use detailed modelling to demonstrate that users of the site will be safe for the life time of the development without increasing risk off site.. As a sub area, the climate change extents are generally similar to the 0.1% AEP event, thus the sub-area is sensitive to increased surface water flood risk due to climate change.

Table 3-5: Comparison of surface water flood risk to the site between the 1% AEP and 1% AEP plus 40% climate change extents.

Location	Event	1% AEP	1% AEP plus 40% CC
North Castleward	Percentage of site at risk (%)	0.3	1.8
	Maximum depth (m)	0.2 to 0.3	0.15 to 0.3
Railway Station Quarter	Percentage of site at risk (%)	4.9	22
	Maximum depth (m)	0.3 to 0.6	0.3 to 0.6
The Eagle Quarter	Percentage of site at risk (%)	0	76.0
	Maximum depth (m)	0	0.15 to 0.3
Former Full St Police Station	Percentage of site at risk (%)	0	17.3
	Maximum depth (m)	0	0.15 to 0.3
Becketwell	Percentage of site at risk (%)	0	31.0
	Maximum depth (m)	0	0.3 to 0.6
The Market Place	Percentage of site at risk (%)	12.9	41.7
	Maximum depth (m)	0.9 to 1.2	1.2 to 2.3
Museum	Percentage of site at risk (%)	85.8	100
	Maximum depth (m)	0.2 to 0.3	0.6 to 0.9
University of Derby (City Centre Hub)	Percentage of site at risk (%)	11.1	50.6
	Maximum depth (m)	0.3 to 0.6	Exceeds 2.3
Central Activity Area	Percentage of site at risk (%)	12.6	47.3
	Maximum depth (m)	0.9 to 1.2	Exceeds 2.3

3.5 Groundwater

The JBA Groundwater Emergence Mapping shows that there are pockets of groundwater within 0.025m of the grounds surface is present beneath the Central Activity Area (20%), University of Derby (45%), The Market Place (85%), and The Eagle Quarter (16%) sites. Groundwater between 0.025m to 0.5m of the grounds surface is present within the Central Activity Area (11%), North Castleward (30%), and Railway Station Quarter (35%) sites. Groundwater levels between 0.5 to 5.0m of the grounds surface are found across the majority of these sites.

In sites where groundwater levels are indicated to be at or very near (within 0.025m) ground level and there is a risk of groundwater flooding at the surface during a 1% AEP event, which may flow to and pool within topographic low spots. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity.

Additional site investigation work may be required to support the detailed design of the drainage system. This may include groundwater monitoring to demonstrate that a sufficient unsaturated zone has been provided above the highest occurring groundwater level. Below ground development such as basements are not appropriate in these areas.

This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific Flood Risk Assessment (FRA) stage.

3.6 Sewers

The sewer flooding risk register provided by Derby City Council shows that there are four instances of flooding within the postcodes for the following sites: Central Activity Area, Becketwell, Museum, The Market Place, Former Full Street Police Station, and the University of Derby.

3.7 Flood history

The sites have been affected by multiple historic flood events shown within the EA's Recorded Flood Outlines dataset, as outlined in the table below. There is a Section 19 flood investigation reports held by Derby City Council as Lead Local Flood Authority (LLFA) within the area, detailed within the table below. The Chronology of British Hydrological Events (CBHE) notes multiple events from the early 1600s that affect the River Derwent and Markeaton Brook, including the 1932 flood event detailed below[3].It is noted that not all flood events are recorded or reported and thus may not fully represent all flood history at the site.

Table 3-6: Historical events within the Sub-area

3 1932 flood event CBHE entry - https://www.cbhe.hydrology.org.uk/view.php?id=13442

Event date	Extent comments
September 1931	Flooding of the River Derwent predominantly affected the southeastern area of the Central Activity Area Source: EA Recorded Flood Outlines
May 1932	Flood extents of the Markeaton Brook are present across the city centre, extending in a woutheastern direction to meet the River Derwent. Extents inundated the Museum site, and affected the University of Derby, Central Activity Area, The Market Place and North Castleward. Source: EA Recorded Flood Outlines, CBHE[3]
December 1960	Extents from the River Derwent are present within the southwestern area of the Central Activity Area and along the northern boundary of North Castleward. Source: EA Recorded Flood Outlines
1965	No month provided, extents from the Lower Trent encroach at the Northeastern boundary of the Central Activity Area. Source: EA Recorded Flood Outlines
December 1965	Flood extents from the River Derwent are present in the eastern area of the Central Activity Area and along the northern boundary of North Castleward. Source: EA Recorded Flood Outlines
8th to 9th November 2019	Section 19 reporting shows that Sowter Road in the Central Activity Area were affected by flooding in 2019. Source: Investigation Report into November 2919 Derwent Floods in Derby City[2].
January 2021	In January 2021 many areas along the River Derwent experienced flooding, associated with Storm Christoph. Heavy rainfall was also associated with surface water flooding within Derby City.
20th February 2022	On the 20th-21st February 2022, flooding occurred along the Rivers Derwent and Wye, associated with Storm Franklin. Derby city centre was recorded to have experienced fluvial flooding.
21st October 2023	On the 21st October 2023, the River Derwent broke its banks in multiple places following 137mm of rain over 33 hrs, associated with Storm Babet.

4 Sources of Flood Risk - Sub Area 'Other Sites'

4.1 Sites

The Other Sites sub area consitsis of six sites which are spread throughout the city centre, these sites are grouped together as they are not affected by extents from either the River Derwent or the Markeaton Brook. The sites are located within the catchments for the Markeaton Brook, River Derwent, and a culverted ordinary watercourse. The sub area is located within the Derwent Derbyshire Management catchment. Sites within the sub area are of mixed use ranging from car parks to employment and residential dwellings, proposals for the sites range from employment to residential dwellings, as detailed below.

Table 4-1: Sube area sites

Policy Number	Site Name	Proposed Use	Area (ha)	RAG Rating	Sub Area
CC4*	Bradshaw Way*	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	1.1	**Green**	**Surface water**
CC4	Abbey St Carpark (West)	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	0.4	**Red**	**Surface water**
CC4	Abbey St Carpark (East)	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	0.2	**Green**	**Surface water**
CC4*	Former Friar Gate Goods Yard*	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	4.8	**Amber**	**Surface water**
CC4	Babington Lane Carpark	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	0.9	**Green**	**Surface water**
CC4	Northern Gateway	CC Resi Led Site Allocations/ CC Resi Led Mixed Use 2025	1.8	**Green**	**Surface water**

*These sites have been assessed as part of the wider city centre assessment however already have planning permission, and whilst it is recommended that developers follow the recommendations in this assessment for site design and layout it is recognised that these

sites do not need to resubmit any additional evidence based on the findings of this assessment to go forwards. Details of permissions for sites can be found on Derby City Council's Website:

- Bradshaw Way - 24/01738
- Former Friar Gate Goods Yard - 23/01102

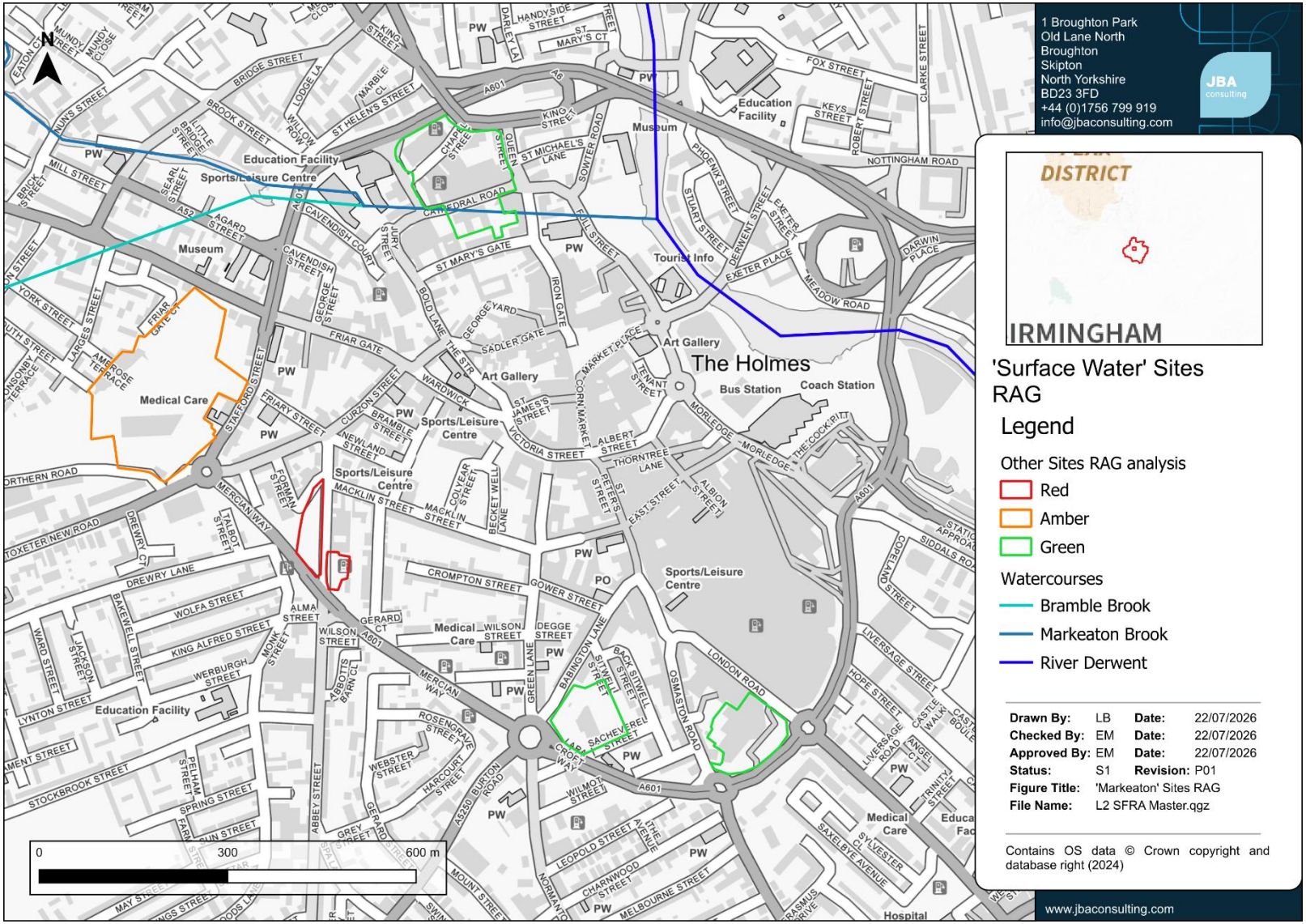

Figure 4-1: RAG analysis of the Other Site sub-area

The Abbey St Carpark (east), Babington Lane Carpark, and Bradshaw Way sites are green and can be developed without further consideration to flood risk.

The risk to Amber and Red sites is summarised below.

4.2 Existing drainage features

Sites within this sub-area lie outside of fluvial flood extents associated with the Markeaton Brook and River Derwent and are predominantly serviced by the surface water sewer network, which ultimately drains into the River Derwent.

4.3 Fluvial

4.3.1 Available data

The EA's FMfP dataset has been used within this assessment.

4.3.2 Description of risk to the site

Table 4-2: Existing fluvial flood risk based on the EA FMfP

Site	Flood Zone 1 (%)	Flood Zone 2 (%)	Flood Zone 3a (%)	Flood Zone 3b (%)
Abbey St Carpark (West)	91.6	5.2	3.2	0.0

**The percentage flood zones quoted show the percentage of the site at flood risk from that particular flood zone or event e.g. Flood Zone 1 is the remaining area outside Flood Zone 2 and Flood Zone 3).*

Within the highest likelihood event, the 3.3% AEP event as indicated by Flood Zone 3b, no sites within the sub area are at fluvial flood risk.

During the 1% AEP event, as indicated by Flood Zone 3a, there is slight encroachment along the western boundary of Abbey St Carpark (West), the remaining sites are unaffected.

During the 0.1% AEP event, as indicated by Flood Zone 2, there is slight encroachment along the western boundary of Abbey St Carpark (West), the remaining sites are unaffected.

Maximum depths, velocities, and hazard ratings are unavailable as there are no models for this sub-area.

4.3.3 Climate Change

4.3.3.1 Available data

Fluvial climate change extents have been taken from existing detailed models where they are available, where not available the NaFRA2 Flood Zones plus climate change layer has

been used. For this sub-area, the NaFRA2 Flood Zones plus climate change layer has been used.

4.3.3.2 Description of risk to the site

Within the sub-area, climate change extents are marginally larger than the 0.1% AEP event, however, there is a minimal increase and the only site affected is the Abbey Street Carpark (west) site. Mot sites withing this sub area are not sensitive to increased fluvial flood risk due to climate change; however, the Abbey St Carpark (west) site is.

Table 4-3: Comparison of fluvial flood risk to the site between the 1% AEP and 1% AEP 29% climate change extents.

Location	Event	1% AEP	1% AEP plus 29% CC
Abbey Street Carpark (west)	Percentage of site at risk (%)	3.2	25

4.4 Surface water

4.4.1 Available data

The EA's Risk of Flooding from Surface Water (RoFSW) map has been used within this assessment.

4.4.2 Description of risk to the site

Within the sub-area, only the Abbey St Carpark (west) and Friar gate sites were flagged to be red or amber in the RAG Analysis and encounter surface water extents.

In the 3,3% AEP event, ponding occurs at the western boundary and northern corner of the Abbey St Carpark (west) site, and five instances of ponding in the Friar Gate site. There is also encroachment at the south-western boundary to the Friar Gate site.

In the 1% AEP event, there is a slight increase in the size of ponding that occurs within the Friar Gate site, there is also encroachment from ponding at the northwestern boundary, and from a flow path along the southwestern boundary. At the Abbey St Carpark (west) site, a flow path encroaches along the western boundary.

In the 0.1% AEP event, ponding within the Friar Gate site increases, as does the extents encroaching from the northwestern and southwestern boundaries. At the Abbey St Carpark (west) site, a flow path is present within the western and northern areas of the site.

Table 4-4: Existing surface water flood risk based on the RoFSW map

Site	Event	3.3% AEP	1% AEP	0.1% AEP
Abbey St Carpark (West)	Percentage of site at risk* (%)	4.4	17.0	36.2
	Maximum depth (m)	0.0	0.3 to 0.6	0.3 to 0.6
	Maximum velocity (m/s)	-	-	-
	Maximum hazard classification	Caution	Danger to most	Danger to most
Former Friar Gate Goods Yard	Percentage of site at risk* (%)	1.5	2.7	5.1
	Maximum depth (m)	0.3 to 0.6	0.6 to 0.9	0.9 to 1.2
	Maximum velocity (m/s)	-	-	-
	Maximum hazard classification	Caution	Danger to most	Danger to most

** The percentage surface water extents quoted show the percentage of the site at surface water risk from that particular event, excluding the percentage of the site at flood risk at a higher risk zone (e.g. 1% AEP does not include the 3.3% AEP percentage).*

4.4.3 Climate Change

The design event for rainfall intensities is the 1% AEP event with Upper End climate change (CC) allowance for the 2070s epoch. NaFRA2 data (updated May 2026) for the 2070s epoch have been used within this assessment.

4.4.4 Available data

The design event for rainfall intensities is the 1% AEP event with Upper End climate change (CC) allowance for the 2070s epoch. NaFRA2 data (updated May 2026) for the 2070s epoch have been used within this assessment.

4.4.5 Description of risk to the site

Surface water climate change extents are similar to that of the 0.1% AEP event if not marginally larger in some areas and sites. Within the Amber and Red sites, the Friar Gate site is not sensitive to increased flooding due to climate change, while the Abbey St Carpark (west) is.

Table 4-5: Comparison of surface water flood risk to the site between the 1% AEP and 1% AEP plus 40% climate change extents.

Location	Event	1% AEP	1% AEP plus 40% CC
Abbey St Carpark (west)	Percentage of site at risk (%)	17.0	36.0
	Maximum depth (m)	0.6 to 0.9	0.3 to 0.6
Friar Gate	Percentage of site at risk (%)	2.7	4.8
	Maximum depth (m)	0.9 to 1.2	1.2 to 2.3

4.5 Groundwater

The JBA Groundwater Emergence Map shows that the entirety of the Babington Lane Carpark site had groundwater levels between 0.5m to 5.0m below the grounds surface. The eastern area of the Northern Gateway site has ground water levels that range from within 0.025m of the grounds surface to between 0.5m to 5.0m with the remainder of the site unaffected. Within the northern area of the Friar Gate site, groundwater levels range between within 0.025m of the grounds surface to between 0.025m to 0.5m, with the southern half of the site unaffected. Remaining sites are generally at low risk of groundwater emergence.

Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity.

Additional site investigation work may be required to support the detailed design of the drainage system. This may include groundwater monitoring to demonstrate that a sufficient unsaturated zone has been provided above the highest occurring groundwater level. Below ground development such as basements are not appropriate at this site.

This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific Flood Risk Assessment (FRA) stage.

4.6 Sewers

The sewer flooding risk register provided by Derby City Council shows that there are six instances of flooding within the postcodes for the following sites: Northern Gateway, Friar Gate, and both Abbey Street Carparks (east and west).

4.7 Flood history

The EA's Recorded Flood Outlines shows that there are no flood extents within any sites in this sub-area, nor is a site named within a Section 19 report held by Derby City Council.

5 Flood risk management infrastructure

5.1 Defences

5.1.1 Derwent sub-area

The EA AIMS dataset shows that there are numerous flood defences along the River Derwent which comprise of walls, bridge abutments, embankments, and engineered high ground. Defence structures have a design standard of protection (SoP) ranging from the 10% AEP event to the 1% AEP event, however not SoPs are detailed within the dataset. Named structures are the St Alkmund's Way Right Bank, Meadow Lane Flood Wall, Meadow Road Flood Wall, Stuart Street Left Bank Integrated Wall, Pheonix St Bank, and Our City Our River (OCOR)Defences.

The OCOR project aims to deliver defences along the River Derwent in three phases between 2015 and 2027. Package 1 consists of works between Alfreton Road Industrial Estate and Sowter Road, excluding Darley Abbey Mills Bridge. Package 2 consists of works at Breadsall, Darley Abbey Mills Bridge, and sites between North Riverside and River Lane, and sites at Derby Junction Railway Bridge, Pride Park, Ambaston, and Shardlow. Package 3 consists of works from Chaddesden Sidings and Triangle and Raynesway, and Alvaston Park.

The OCOR project has currently completed the first phase (Package 1) of the project, with Package 2 in progress, part of which is located on the Derby Riverside site where there are currently flood walls in place. The proposal consists of a raised line of defence set back from the north bank of the Derwent, formed of a combination of walls, ground raising, embankments and landscape features, with an area of green space in front of the line to be left to allow space to flood during an extreme event.

5.1.2 Markeaton sub-area

The AIMS dataset shows that there are numerous flood defences along the River Derwent which comprise of walls, bridge abutments, embankments, and engineered high ground. Defence structures have a design standard of protection (SoP) ranging from the 10% AEP event to the 1% AEP event, however not SoPs are detailed within the dataset. Named structures are the Cathedral View Wall, Causey Bridge, Council House Wall, Markeaton Brook entrance to culvert of Bridge St, Exeter Bridge Right Bank, and the OCOR Defences. There is also the Markeaton Receptor[4] that forms an underground flood relief tunnel which diverts excess water from the Markeaton Brook.

4 Markeaton Receptor - https://www.gronkue.com/report/markeaton-interceptor

The Central Activity Area is defended by the OCOR programme defences formed of flood walls.

5.1.3 Other Sites sub-area

There are no formal defence structures within the sub-area shown within the AIMS dataset. It is noted that there is an ordinary watercourse that is culverted beneath the urban extents of the city centre.

5.2 Reservoirs

The EA reservoir flood mapping shows that the city centre area has the potential to be affected by Dry Day and Wet Day flood extents from several reservoirs. Within the Dry Day scenario, the Kedleston Park No.1 and No.2 lakes (The National Trust), the Markeaton Reservoir Mill Pond (Derby City Council), the Ladybower (Severn Trent Water), and the Ogston reservoir (Severn Trent Water) affect all but the following sites: Northern Gateway, Friar Gate, Babington Lane Crapark, Bradshaw Way, and the two Abbey St Carparks. Extents from these are predominantly similar to the 0.1% fluvial flood event extents.

In the Wet Day scenario, all the aforementioned reservoirs with the addition of the Derwent and Howden reservoirs (Sevent Trent Water) inundate the majority of the sites, excluding: Friar Gate, Abbey St Carpark (east), Babington Lane Carpark, and Bradshaw Way. Extents in affected sites are similar to that of the 0.1% fluvial and surface water events.

The Wet Day event seeks to estimate the effect of a breach at the same time as a 0.1% AEP fluvial flood event is occurring. The extents suggest the consequences of such a breach are similar to that of the modelled 0.1% AEP fluvial flood events for the Markeaton Brook and River Derwent.

5.3 Residual risk

Defences within the sub-areas are predominantly located along the River Derwent and the Markeaton Brook. As such, there is the residual risk of defence breaches or overtopping from structures at these watercourses.

The following dites are shown to contain areas which would not flood in the defended scenario, but are at risk in the undefended scenario, ie there is the potential for these sites to be at risk if defences were breached or overtopped during an extreme event:

- Derby Riverside,
- Central Activity Area,
- Former Full Street Police Station,
- University of Derby.

For these sites, a site-specific flood risk assessment supported by detailed modelling (including breach modelling) should be conducted to demonstrate that users of the site will be safe throughout it's lifetime. These sites are likely to require a Flood Warning and Evacuation Plan, although this may be provided by existing warning/evacuation procedures for the wider city centre area.

The Markeaton Brook enters a culvert within the University of Derby site and shares a confluence with the culverted Bramble Brook. There is residual risk of blockages of these exacerbating flooding at the culvert entrance, or surcharges along the culvert reach. Sites that would most likely be affected by a blockage or surcharging of the culvert are the Central Activity Area and the University of Derby. There are other culverted watercourses beneath the city centre area, which if blocked or surcharged, may affect sites within the city centre.

The majority of sites are at residual risk from reservoir flooding in the Dry Day and Wet Day scenarios. Extents associated with each scenario are detailed within Section 5.2.

6 Emergency planning

6.1 Flood warnings and alerts

6.1.1 Derwent

The Derby Riverside site is located within two Flood Alert Areas:

- Tributaries in South Derbyshire (034WAF411) on the southern bank of the River Derwent within the site, and is for the Black Brook, Coppice Brook, Markeaton Brook, Chaddeston Brook, Wilne Drain, Cuttle Brook, Doles Brook, Ramsley Brook, and Carr Brook.
- Lower Derwent in Darbyshire (024WAF409) which covers the entirety of the site and is for the River Derwent.

The site is within two Flood Warning Areas:

- River Derwent at Little Chester, Eastgate, and Cattlemarket (034FWFDELITTLECH) on the northern bank of the site.
- River Derwent at Derby City (034FWFDEDERCITY) on the southern bank of the site.

6.1.2 Markeaton

All sites within the sub-area are located within either the following two Flood Alert Areas

- Tributaries in South Derbyshire (034WAF411) - all sites
- Lower Derwent in Darbyshire (024WAF409) - all sites with the exception of the Univsersity of Derby

Sites within the sub-area are located within three Flood Warning Areas:

- River Derwent at Little Chester, Eastgate, and Cattlemarket (034FWFDELITTLECH) - Central Activity Area and Former Full Street Police Station
- River Derwent at Derby City (034FWFDEDERCITY) - All sites with the exception of the Univsersity of Derby
- Markeaton and Bramble Brooks at Derby City (034FWFMBMRKEAT) Central Activity Area and the University of Derby

6.1.3 Other Sites

The Friar Gate site falls in its entirety within the Tributaries in South Derbyshire (034WAF411) Flood Alert Area and the Markeaton and Bramble Brooks at Derby City (034FWFMBMRKEAT) Flood Warning Area. The remaining sites are not within a Flood Alert or Warning Area.

6.2 Access and escape

Safe access and escape will need to be demonstrated in the 1% AEP plus climate change fluvial and surface water events. Site drainage proposals should address the requirements for access routes, avoid impeding surface water flows and preserve the storage of surface water to avoid exacerbation of flood risk elsewhere on the site and in the wider catchment.

6.2.1 Potential access

6.2.1.1 Derwent

The Derby Riverside site is accessed through numerous roads within the site (St Alkmunds Way A601), and is bounded by Station Approach (A6), Eastgate (A52). Main roads within the site are The Cockpitt, Meadow Lane, Meadow Road, Phoenix Street, Stuart Street, Derwent Street, Exeter Place, Exeter Street, and Darwin Place.

6.2.1.2 Markeaton and Other Sites

Sites within the sub-areas are accessed through numerous roads within and around the sites, most notably the A601, A6, and A6000 which surround the sites. It is noted that there are smaller roads within each site of the sub-areas which allow for access in all directions.

6.2.2 Fluvial

6.2.2.1 Derwent

In the 3.3% AEP event, access and escape is maintained to and within the site, however access from Station Parkway eastwards is impeded. In the 1% and 0.1% AEP events, access and escape is impeded both within the site and from the wider area.

6.2.2.2 Markeaton

In the 3.3% AEP event, access and escape is maintained to and within all sites within the sub-area, however it is noted that North Castleward is inaccessible from the northern boundary (Station Parkway). In the 1% AEP event, access is maintained in all sites, however there is partial impediment from extents for the following sites:

- Museum from Wardwick, impeding access from the southern boundary;
- North Castleward from Station Parkway across the northern boundary
- Central Activity area extents are present across Curzon Street, Wardwick, Sowter Road, and Brook Street.

In the 0.1% AEP event, access and escape is impeded within the museum site, with limited accessibility to the remaining sites within the sub area, the most affected sites are as follows:

- Becketwell is only accessible through Macklin Street and the southern half of Becketwell Lane;
- Eagle Quarter is only accessible through the northern private road;

- Market Place accessible though a private road off of Full street or access from Iron Gate'
- Former Full Street Police Station is only accessible from Full St in a northwestern direction;
- University of Derby is only accessible from the south and west of the site, predominantly through Bridge Street, Nun's Street, and the A52.

It is noted that access within the Central Activity Area is severely impeded, but access to the site from the north, south, and west remain.

6.2.2.3 Other Sites

In the 3.3% AEP event, access and escape is maintained across all sites. In the 1% and 0.1% AEP events, access and escape is maintained across all sites, however, access from west of the Abbey Street Carpark (west) is impeded.

6.2.3 Surface water

6.2.3.1 Derwent

In all AEP events, access and escape routes are maintained within and to the site, however in all events there is a flow path at one of the exit/entry points to the site on the northern boundary.

6.2.3.2 Markeaton

In the 3.3% AEP event, access and escape is maintained across all sites within the sub-area. In the 1% AEP event, access and escape is maintained for the majority of the sites. Access and escape are impeded within and to the museum site, and access between the northern and south areas of the Central Activity Area is impeded.

In the 0.1% AEP event, access and escape is impeded for the museum site, as access between the northern, southern, and western areas of the Central Activity Area and University of Derby sites. For the Becketwell, Marketplace, and Eagle Quarter sites, access and escape are partially maintained.

6.2.3.3 Other Sites

In all AEP events, access and escape are maintained for the Babington Lane Carpark, Bradshaw Way, and Abbet St Carpark (east) sites. In the 3.3% and 1% AEP event, access and escape are maintained for all sites, however there is limited access to the Abbey Street Carpark (west) site from the western boundary and the Friar Gate site from the northwestern and southwestern boundaries.

In the 0.1% AEP event, access and escape are maintained to all sites. However, there is limited access to the Friar Gate site with extents along the north-western and southern boundaries, and extents along the western boundary for the Abbey Street Carpark (west) site.

6.3 Dry islands

6.3.1 Derwent

There are dry islands in the 1% AEP and 0.1% AEP fluvial events in the southeastern and central areas of the Derby Riverside site. Within the site-specific FRA, developers will need to demonstrate safe access and egress from all areas of the site - given the significant flood extents associated with the River Derwent, a shelter in situ policy is unlikely to be appropriate for development on these dry islands.

6.3.2 Markeaton

The sub area contains no dry islands.

6.3.3 Other Sites

The sub-area contains no dry islands.

7 Requirements for drainage control and impact mitigation

7.1 Broadscale assessment of possible SuDS

Considerations detailed below are generalised recommendations for all sites.

- For sites within Flood Zone 2 and 3 extents greater than or equal to 50%, where possible, proposed attenuation features such as basins, ponds and tanks should be located outside of Flood Zone 2 and 3to avoid the potential risks to the hydraulic capacity or structural integrity of these features. Surface water outfalls that discharge into the Markeaton Brook, Bramble Brook, and River Derwent may be susceptible to surcharging due to water levels in these watercourses, particularly as the Brooks are culverted. The impacts of flood flows will need to be considered in terms of the attenuation storage requirements of the site and placement of the outfalls.
- Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates as reasonably practical in consultation with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.
- The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 1% AEP and 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.
- If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
- Wherever possible SuDS should consider the city centre sites collectively, identifying opportunities for drainage features for individual sites to be integrated into one overall strategy, also considering opportunities to provide wider benefit through improvement to drainage systems and/or the retrofitting of SuDS outside of red line boundaries.

Sites with specific recommendations are as follows:

- Where groundwater levels are indicated to be either within 0.025m or between 0.025m to 0,5m of the grounds level, there is a risk of groundwater flooding at the surface during a 1% AEP event, which may flow to and pool within topographic low spots. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Additional site investigation work may be required to support the detailed design of the drainage system. This may include groundwater monitoring to demonstrate that a sufficient unsaturated zone has been provided above the highest occurring groundwater level. Below ground development such as basements are not

appropriate at this site. This affects the following sites: The Market Place, Central Activity Area, University of Derby, Eagle Quarter, and Railway Station Quarter.

- Where groundwater levels are indicated to be within 0.5m to 5m of the ground level, there is a risk of flooding to subsurface assets and below ground development such as basements. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system: Central Activity Area, Northern Gateway, Babington Lane Carpark, Eagle Quarter, North Castleward, Railway Station Quarter.
- The Railway Station Quarter site is partially located within Groundwater Source Protection Zone (SPZ) 1 (and subsequent zones 2 and 3). infiltration techniques may not appropriate for anything other than clean roof drainage. If infiltration is proposed for anything other than clean roof drainage in SPZ 1, a hydrogeological risk assessment should be undertaken to ensure that the system does not pose an unacceptable risk to the source of supply. Infiltration techniques should only be used following the granting of any required environmental permits from the Environment Agency for Zones 2, 3 and 4 although it is possible that infiltration may not be permitted. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible opportunities and constraints.

7.2 Opportunities for wider sustainability benefits and integrated flood risk management

- Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (Local Planning Authority, Lead Local Flood Authority, and the EA) at an early stage to understand possible constraints.
- Wherever possible, existing watercourses should be integrated into the site drainage strategy, with consideration given to the nature of the receiving watercourse. Ideally culverts should be opened up as part of drainage strategies, but the options for such integration may be limited due to the small, urbanised nature of many of the sites.
- Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development, particularly for sites near the River Derwent and Markeaton Brook.
- Opportunities to incorporate filtration techniques such as filter strips and filter drains must be considered.
- Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of

multistage SuDS treatment will improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies.

- Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
- The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.

8 NPPF and planning implications

8.1 Exception Test requirements

The Local Planning Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied. Table 8-1 below details whether a site requires the Exception Test and why. The below classifications assume that the whole site is proposed for the most vulnerable planned use, however if development is steered away from areas at risk the Exception Test may not be required.

Table 8-1: Exception Test requirements

Location	Exception Test Required (Yes/No)	Comments
Derby Riverside	Yes	The majority of the site lies within Flood Zone 3a, within the southern bank containing Flood Zone 3b extents, and the site's proposed use is classified as 'More Vulnerable'.
North Castleward	Yes	The site lies within Flood Zone 3a and Flood Zone 3b at the northeastern boundary, with the site's proposed use is classified as 'More Vulnerable'.
Railway Station Quarter	Yes	The site's highest risk classification is 'Essential Infrastructure' and there are Flood Zones 2 and 3a extents within the northern area of the site.
Museum	Yes	The site's proposed use is classed as 'Less Vulnerable' and is covered in its entirety by Flood Zones 2 and 3a, as well as surface water extents which cannot be developed around.
University of Derby (City Centre Hub)	Yes	The site's proposed use is 'Less Vulnerable', however it is located within Flood Zone 3b extents (which appear to be in bank), The Exception Test must be passed for the application of SuDS or other structures within the site. There is also high risk of surface water flooding in all AEP

Location	Exception Test Required (Yes/No)	Comments
		events which it is unlikely to be developed around.
Central Activity Area	Yes	The site's proposed use is 'Less Vulnerable', is partly within Flood Zones 2, 3a, and 3b, and has significant areas of surface water flooding risk, with significant extents in lower probability events, however there are areas that can be developed safely. Parts of the site are within Flood Zone 3b extents, predominantly contained within the watercourses. The Exception Test must be passed for any essential infrastructure proposed within Flood Zone 3b.
The Eagle Quarter	No	The site's highest risk classification is 'More Vulnerable' completely outside Flood Zone 3a,but partly within Flood Zone 2 .
Former Full St Police Station	No	The site's highest risk classification is 'More Vulnerable' but does not contain Flood Zone 3a extents, only Flood Zone 2 extents.
Bradshaw Way	No	The site's highest risk classification is 'More Vulnerable' but does not contain Flood Zone extents or surface water flood extents.
Abbey St Carpark (west)	No	The site's highest risk classification is 'More Vulnerable', and while there are significant surface water extents in the 0.1% AEP event, there are no 3.3% AEP or 1% AEP event extents within the site.
Abbey St Carpark (east)	No	The site's highest risk classification is 'More Vulnerable' but does not contain Flood Zone extents or surface water flood extents.

Location	Exception Test Required (Yes/No)	Comments
Former Friar Gate Goods Yard	No	The site's highest risk classification is 'More Vulnerable'
Babington Lane Carpark	No	The site's highest risk classification is 'More Vulnerable' and does not contain Flood Zone extents or surface water flood extents.
Becketwell	No	The site's highest risk classification is 'More Vulnerable' and does not contain Flood Zones 3a or 3b. While there are surface water extents in the 0.1% AEP event, there are no extents associated with higher probability events.
Northern Gateway	No	The site's highest risk classification is 'More Vulnerable' and does not contain Flood Zone extents or surface water flood extents.
The Market Place	No	The site is classed as 'Less Vulnerable', there are surface water extents within the southern area of the site but can be developed around.

8.2 Requirements and guidance for site-specific Flood Risk Assessment

At the planning application stage, a site-specific FRA will be required if a proposed development site is:

- Within Flood Zones 2 and 3, (Derwent and Markeaton sub-area sites);
- Within Flood Zone 3b (Central Activity Area, University of Derby, Derby Riverside);
- Within Flood Zone 1 and greater than 1ha in area (Derby Riverside, North Castleward, Eagle Quarter, Bradshaw Way, Friar Gate, Northern Gateway, Becketwell, Market Place, University of Derby, Central Activity Area, and Railway Station Quarter);
- Within Flood Zone 1 and at risk from flooding from surface water (Derby Riverside, Castle Northward, Railway Station Quarter, Market Place, Museum, University of Derby, Abbey Street Carpark (west), and Friar Gate).

Where sites are at risk of fluvial flooding (all sites within the Derwent and Markeaton subareas, and the Abbey St Carpark [west]), the FRA should be supported by detailed

modelling to support an FRA. Developers should consult the EA in the first instance to understand the latest available modelling, noting that at time of writing a new model of the River Derwent is currently being built.

For sites with significant surface water flood risks, developers should consult the EA and Derby City Council as LLFA for existing surface water modelling or if modelling needs to be conducted. Additionally, developers should confirm groundwater levels through ground investigations at the following sites: Friar Gate. University of Derby, Northern Gateway, Former Full Street Police Station, Market Place, Central Activity Area, Eagle Quarter, North Castleward, Railway Station Quarter, and Babington Lane.

Consultation with the Local Authority and Lead Local Flood Authority (Derby City Council), Water Company (Severn Trent Water), and the EA should be undertaken at an early stage.

Any FRA should be carried out in line with latest guidance including the National Planning Policy Framework (NPPF), Flood Risk and Coastal Change Planning Practice Guidance (PPG), and any Derby City Council Local Plan Policies.

The development should be designed with mitigation measures in place where required.

8.3 Guidance for site design and making development safe

The site layout should adopt a sequential approach by steering the most vulnerable aspects of the development outside of Flood Zone 2, 3a and 3b as well as areas at risk of surface water flooding. Employment or residential development is not permitted within Flood Zone 3b.

Developers should use detailed hydraulic modelling for the River Derwent, Markeaton Brook, and the Bramble Brook at the FRA stage to accurately represent the risk from the watercourses and set the height of any mitigation measures.

The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to pre-development greenfield rates, with areas of surface water ponding used as open space and SuDS or water compatible/essential infrastructure uses only.

Wherever possible the drainage strategy should consider the city centre sites collectively, identifying opportunities for drainage features for individual sites to be integrated into one overall strategy, also considering opportunities to provide wider benefit through improvement to drainage systems and/or the retrofitting of SuDS outside of red line boundaries.

Arrangements for safe access and escape will need to be provided for the 1% AEP fluvial and surface water events with an appropriate allowance for climate change, considering depth, velocity, and hazard. Design and access arrangements will need to incorporate measures, so development and occupants are safe. Additionally, breach modelling with

flood warning and evacuation planning will need to be conducted for the Derby Riverside, Central Activity Area and North Castleward sites

Provisions for safe access and escape should not impact on surface water flow routes or contribute to loss of floodplain storage. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.

9 Conclusions

9.1 Derwent sub-area

The following points should be considered in development of the Derwent sub-area:

- The Derby Riverside site sits on the banks of the River Derwent and is at high risk of fluvial flooding with the majority of the site located within Flood Zones 2 and 3. As such, the Exception Test will be required should any highly vulnerable development be proposed within Flood Zone 2 or more vulnerable/infrastructure development be proposed in Flood Zone 3.
- Site layout should adopt a sequential approach by steering the most vulnerable aspects of the development outside of Flood Zone 2, 3a and 3b. Residential and employment developments are not permitted in Flood Zone 3b;
- There is also some risk from surface water flood extents, and there is risk from groundwater emergence in the 1% AEP flood event;
- Development in the Derby Riverside site will require developers to undertake a site-specific Flood Risk Assessment (FRA), supported by detailed modelling of the Markeaton Brook (at Mill Fleam) and the River Derwent, and any surface water modelling;
- The Derby Riverside site is proposed to be incorporated into the OCOR scheme and the site-specific FRA will need to consider the risk to users of the site in the event of failure/breach/overtopping of any defences, and the site is likely to require a flood warning and evacuation plan.
- Development plans for the Derby Riverside site should including a detailed surface water management plan, that includes SuDS features and the consideration of NFM techniques throughout the site to include watercourses within the site as part of wider blue-green infrastructure;

9.2 Markeaton sub-area

The following points should be considered in development of the Markeaton sub-area:

- All sites within the sub-area are generally at high risk of fluvial flooding, being at least partially within Flood Zones 2 and 3a, associated with Markeaton Brook. The Exception Test will be required for the Central Activity Area, University of Derby, North Castleward, and Railway Station Quarter sites.
- The North Castleward, Railway Station Quarter, Former Full Street Police Station, University of Deby, and Central Activity Area are also partly within Flood Zone 3b.
- All sites are at risk from surface water flooding, and the Central Activity Area, University of Derby, The Market Place, The Eagle Quarter, North Castleward, and Railway Station Quarter sites are at risk of groundwater emergence in the 1% AEP flood event.

- Site layout should adopt a sequential approach by steering the most vulnerable aspects of the development outside of Flood Zone 2, 3a and 3b. Residential and employment developments are not permitted in Flood Zone 3b.
- Development for all sites within the sub-area will require developers to undertake a site-specific FRA for each individual site. The FRA will need to be supported by detailed modelling of the Markeaton Brook (at Mill Fleam) and the River Derwent, and any surface water modelling.

9.3 Other sites

The following points should be considered in development of the other city centre sites:

- All other sites are at low risk of fluvial flooding, and the Exception Test is not required for any sites in this group.
- Only the Abbey St Carpark (west) and Friars Gate sites have significant flood risk issues, with the predominant source of risk being surface water in all AEP events
- The Abbey St Carpark (west) is slightly within Flood Zone 2 and 3a, and extents appear to be associated with a culverted unnamed ordinary watercourse;
- Surface water climate change extents are larger than the 0.1% AEP event within the Northern Gateway, Friar Gate, and Bradshaw Way sites, and equivalent to the 0.1% AEP extents in the Abbey Street Carpark (west). The majority of sites are very sensitive to increased surface water flooding due to climate change;
- The Frair Gate, Northern Gateway, and Babington Lae Carpark sites are at risk of groundwater emergence in the 1% AEP event.
- Development for the Abbey Street Carpark and Friar Gate sites within the sub-area will require developers to undertake a site-specific FRA for each individual site. The FRA will need to be supported by detailed surface water modelling.
- Development at the sites should integrate a detailed surface water management plan, including SuDS features within the sites as part of wider blue-green infrastructure.

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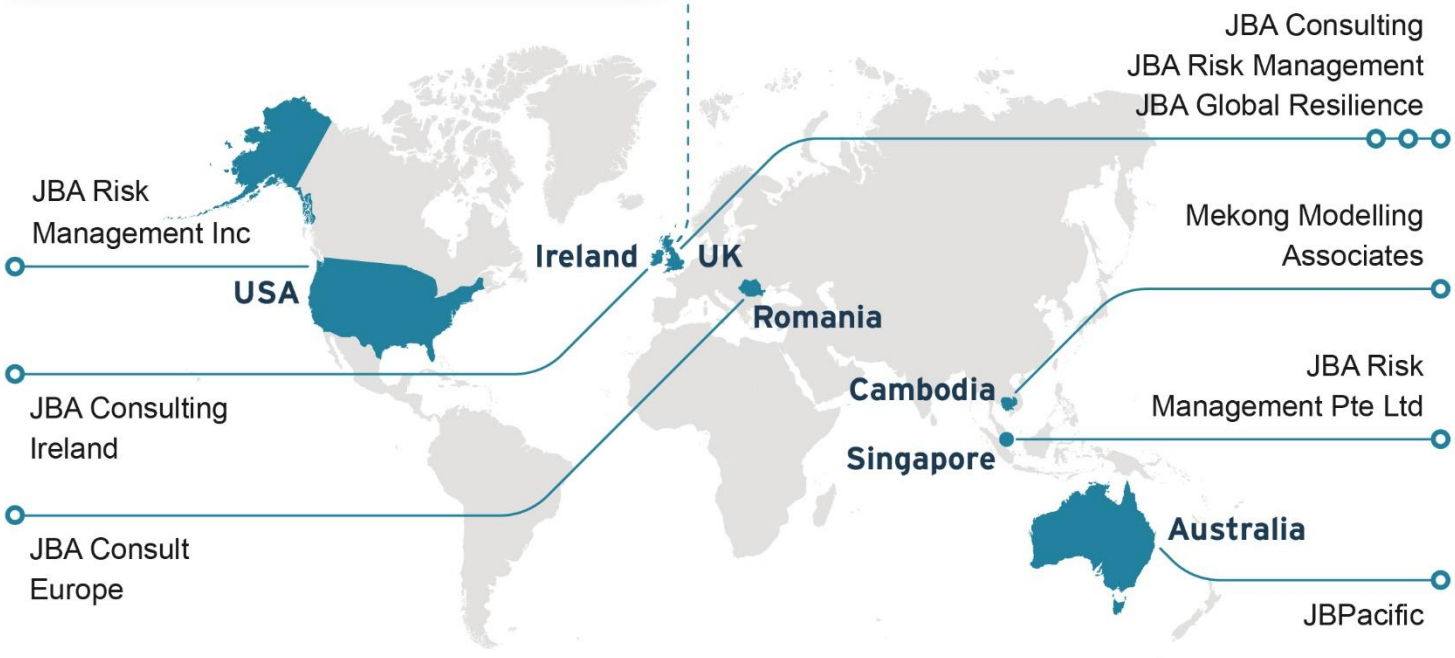

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