Appendix A - Level 2 SFRA Site Screening Assessments – Salford to Wigan

Site S/BEL/002 – Land adjacent to 1 Chaddock Lane, Worsley, Salford	
Location	Brett Road, Salford
Site area (ha)	0.07
Watercourse	Stirrup Brook
EA Model used	Stirrup Ellen Brook 2009 (1D model only)
Existing use	Greenfield – open greenspace
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	0.06

Flood outlines (present day)

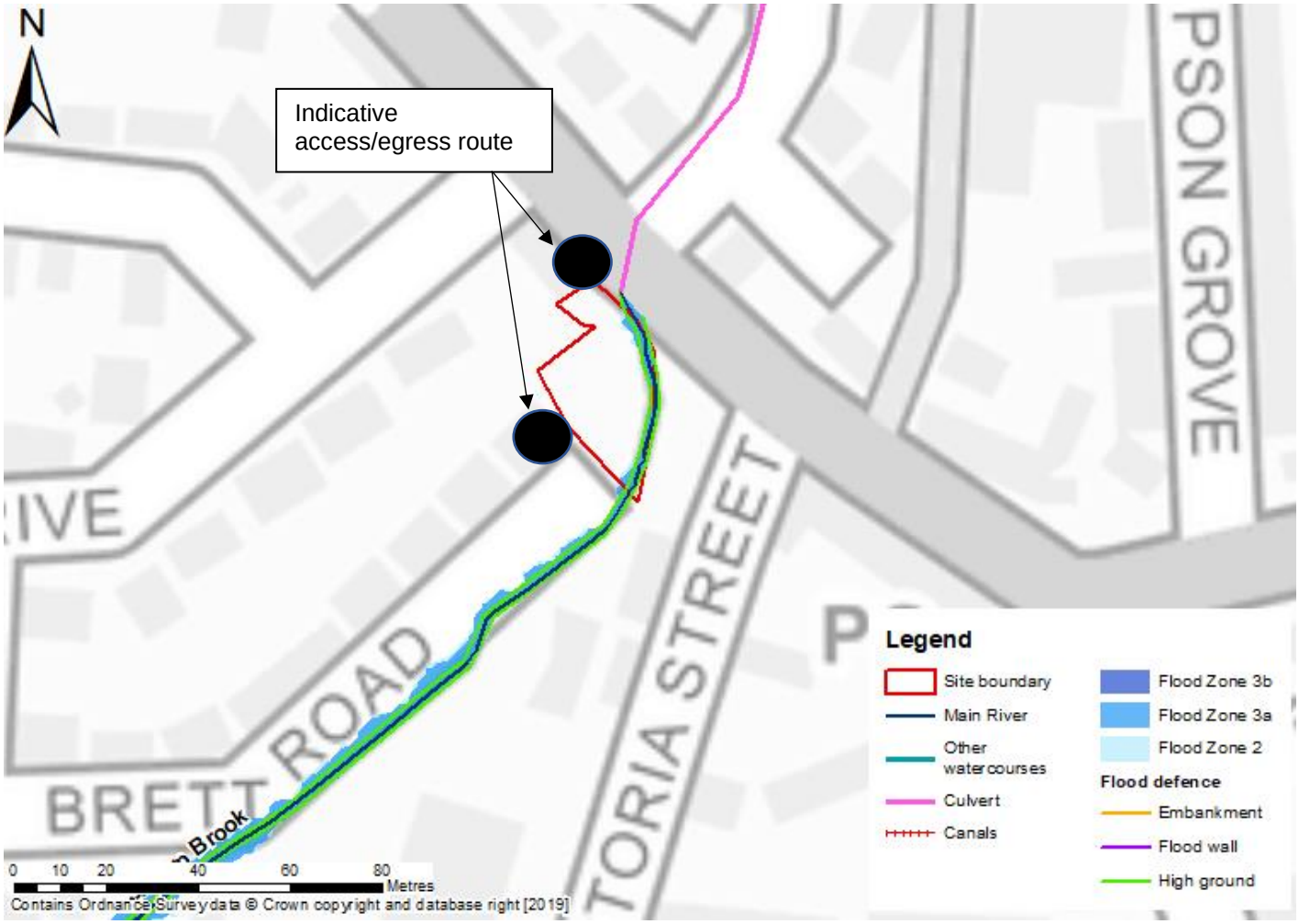


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences

Site S/BEL/002 – Land adjacent to 1 Chaddock Lane, Worsley, Salford

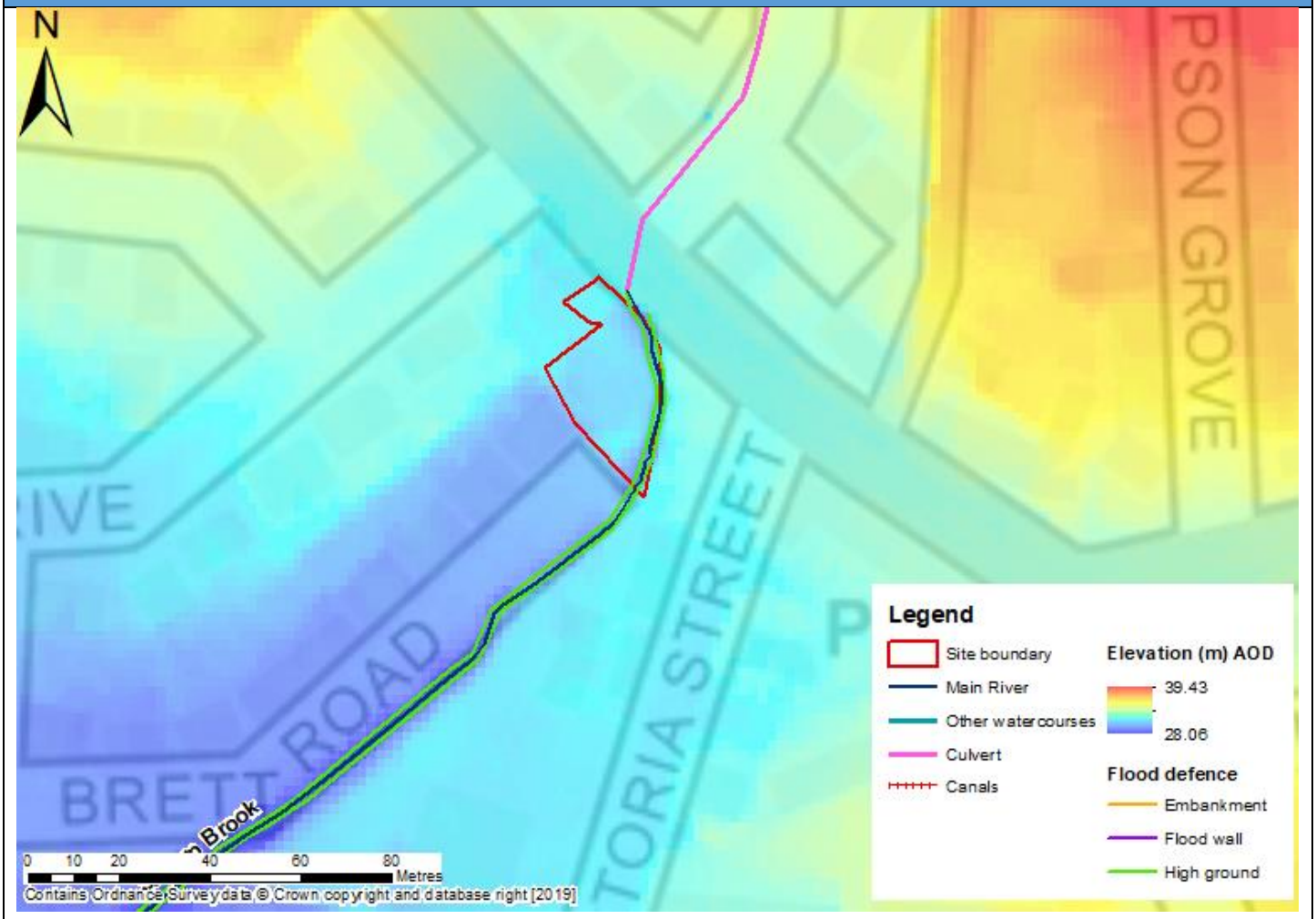


Figure 2: Site with 2m 2017 LIDAR (elevation data)

- The proposed site is located between the end of Brett Road and Leigh Road with the east side of the site being bordered by Stirrup Brook, flowing from north to south.
- Ellen Brook passes through a series of culverts before entering the site as Stirrup Brook.
- The elevation of the site is an average approximate of 32m AOD which is consistent with the elevation of the surrounding area.

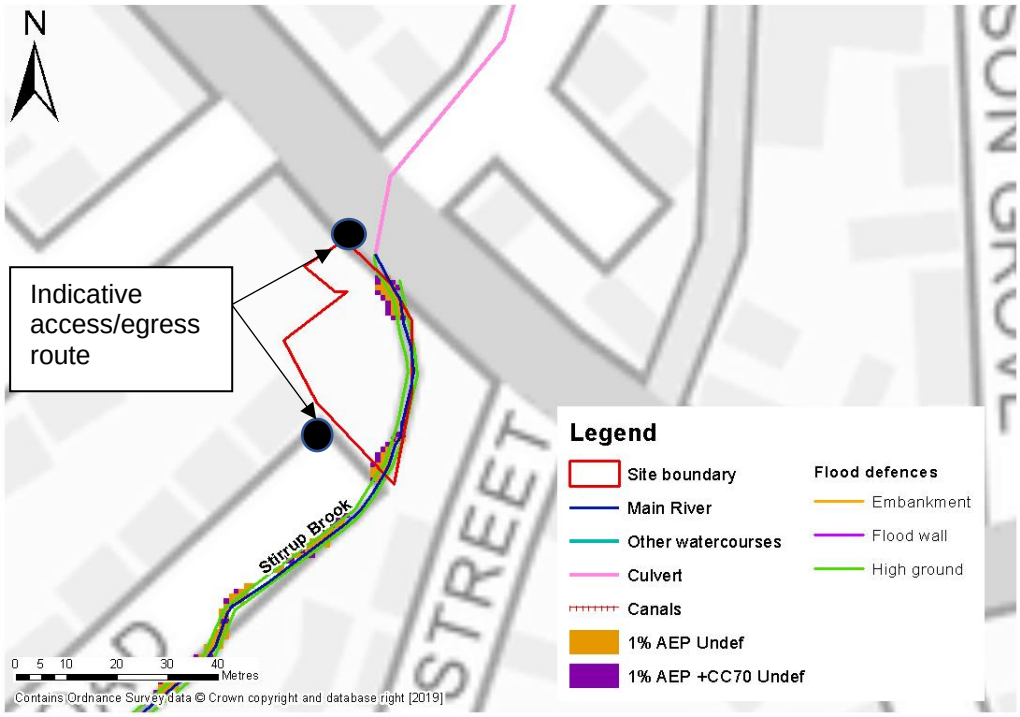
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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	0.00	10.74 (mainly remains in-bank)	1.39 (mainly remains in-bank)	7.10**
Fluvial: depth (m)*	Not applicable	Not available	Not available	Not available
Fluvial: hazard*	Not applicable	Not available	Not available	Not available

*Modelled depth and hazard information are unavailable as the Stirrup Ellen Brook 2009 model is a 1-dimensional model only

**The climate change value is smaller than that for Flood Zone 3a because the Flood Map for Planning is not based on this model data

Site S/BEL/002 – Land adjacent to 1 Chaddock Lane, Worsley, Salford	
Modelled fluvial flood risk and climate change (Stirrup Ellen Brook 2009 model – 1D model only)	 Figure 2: Undefended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% climate change uplift • The 1% AEP present day outline and climate change +70% uplift largely remain in-bank of Stirrup Brook. • Depth and hazard grids were unavailable as the model is 1-dimensional. • Safe access and egress would be achievable via Leigh Road to the north and Brett Road.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, Stirrup Brook is bound by areas of high ground that act as informal defences which are assessed at condition grade 3 meaning 'Fair' (Table 1.1 Condition Assessment Manual[1]).
Flood Warning Area	• The site lies outside of any current EA FWAs.
Natural Flood Management / Working with Natural Process	• The site is not within any NFM or WwNP area.
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the new development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).** • **11% of the site is within Flood Zone 3a, however this is mainly contained in-bank of Stirrup Brook. If the area of Stirrup Brook plus the 8 metre no development buffer advised by the EA for watercourses is excluded from**

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site S/BEL/002 – Land adjacent to 1 Chaddock Lane, Worsley, Salford	
	the site layout, the risk will be very low and residential development would likely be permitted, based on fluvial risk. However, this is based on current information which is limited to 1D modelling and therefore no depth and hazard information. It is recommended that a 2D model is produced in order to assess the depths and hazards associated with this site in order to better inform the Exception Test, as part of an FRA. • **Ellen Brook exits a culvert just north of the site. This culvert is approximately 420 metres long and diverts Ellen Brook under a series of roads. There will be residual risk associated with this culvert which should be assessed at the FRA stage through blockage scenario modelling. Capacity and condition survey would be required to inform the modelling together with ownership and maintenance information. Access to the culvert will be required at all times, therefore development should not obstruct such access.** • **The developer or site owner must also find out which permissions and licences are required to maintain, repair, build or remove anything in or around Stirrup Brook. Without appropriate permissions and licences the developer/site owner may be subject to a fine or imprisonment.** • **Safe access and egress routes must be available at times of flood. Site design and layout should further investigate the indicative locations shown on Figure's 1, 3 and 4 of this Level 2 SFRA. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.**
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to Stirrup Brook, groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and is unlikely to be an issue in this instance.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	•
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• There are no canals in the vicinity of the site.

Site S/BEL/002 – Land adjacent to 1 Chaddock Lane, Worsley, Salford

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

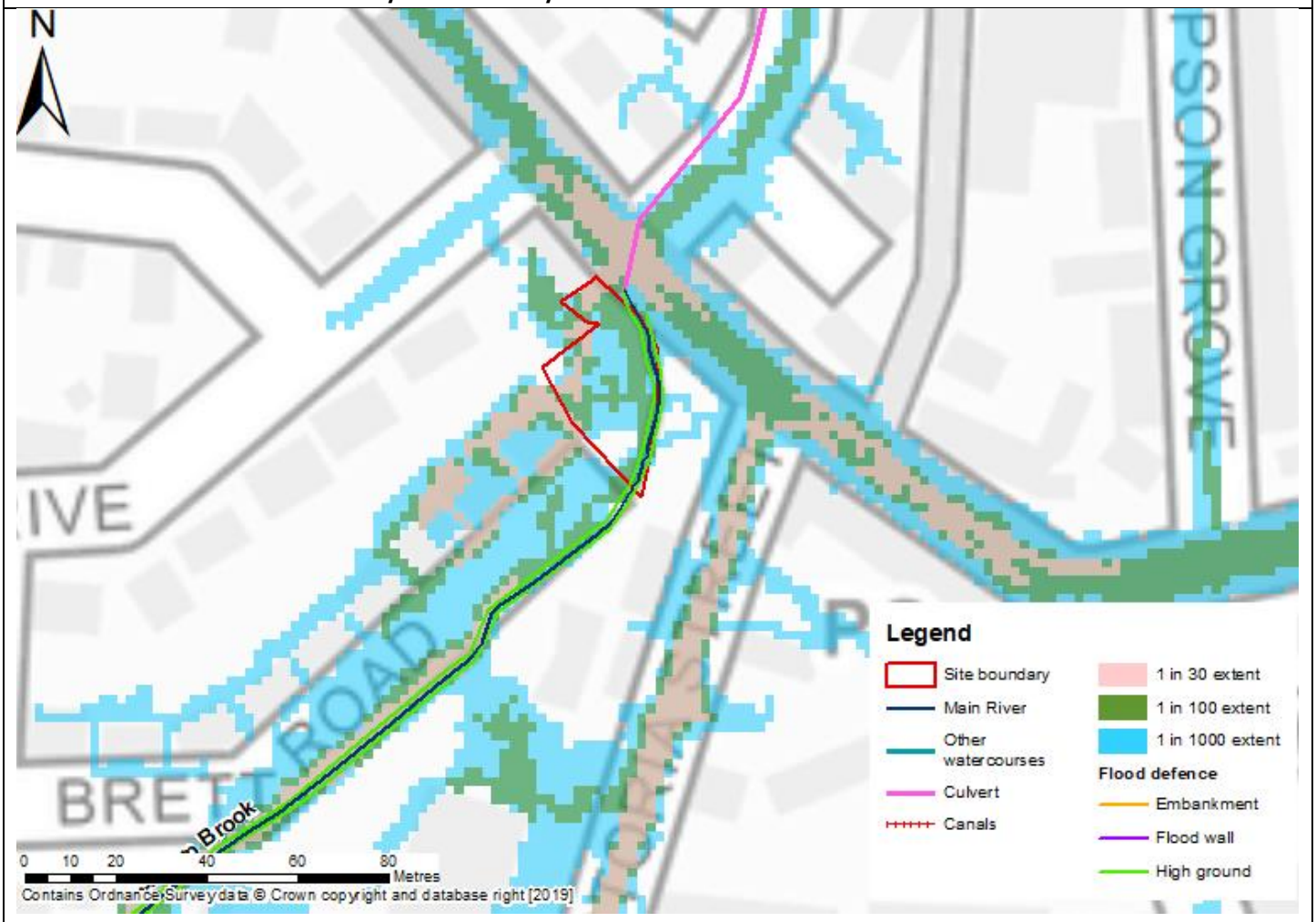


Figure 4: Surface water risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	11.01	57.97	87.65
Surface water flooding depths	Max: 0.30 – 0.60m Mean: 0.00-0.15m	Max: 0.60-0.90m Mean: 0.00-0.15	Max: 0.90-1.20m Mean: 0.30-0.60
Surface water hazards	Max: Moderate Mean: Low	Max: Significant Mean: Low	Max: Significant Mean: Significant
Surface water flood risk to development site	• Approximately 58% of the site is at risk of surface water flooding in the 1% AEP event with significant maximum depths of up to 0.9 m. This depth is isolated close to Stirrup Brook bank and would be avoided by the 8 m no development buffer required along Stirrup Brook. Average depths across the site are low. • There is no current safe access or egress route available due to surface water flooding in the 1% AEP event. Alternative access would be required, as indicated in Figure 4. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.		

Site S/BEL/002 – Land adjacent to 1 Chaddock Lane, Worsley, Salford	
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP event extends to cover almost 88% of the site only leaving a small section of land free from surface water inundation. • Alternative access would be required, as indicated in Figure 4.

Mitigation options & site suitability: surface water	• **According to the Risk of Flooding from Surface Water dataset, surface water risk is significant; ideally the site would not be developed and would remain as open greenspace, with the greenspace possibly designed to hold surface water back from the properties on Brett Road using infiltration SuDS. Site design could look at diverting surface water around the site into the Spodden without increasing existing runoff rates (EA would have to confirm whether this would be acceptable at the site design stage). Given the small size of the site, it would be difficult to implement any mitigation measures onsite.**
	• **However, the above advice should be caveated by the limitations of the RoFSW dataset. The dataset is published with the following statement: '*The map does not contain sufficient information for it to be used to determine flood risk to individual properties, but it does give you an indication of whether your area may be affected by surface water flooding and to what extent*'.**
	• **Detailed surface water modelling should therefore be carried out as part of a drainage strategy to confirm depths and whether it is viable to develop with mitigation. Including for the requirement of safe access and egress routes in times of flood.**
	• **Various local site-specific SuDS techniques should also be investigated. Given the small size of the site, it is unlikely 'green' type SuDS approaches such as green rooves, permeable paving, could provide much attenuation. A specifically designed subsurface attenuation storage tank may be possible given the requirement to make best use of available space on a small site means that providing subsurface attenuation and storage tanks may be the only feasible approach available to managing surface water. Tanks would have to be integrated beneath an area of carparking, hardstanding or open space without significantly impacting available development area.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and minimum flow rate of 5 l/s (in accordance with Rainfall runoff management for developments).**

Site S/BEL/002 – Land adjacent to 1 Chaddock Lane, Worsley, Salford

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Minimum Flow 5 l/s (in accordance with Rainfall runoff management for developments)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall + 20%	0.5	18	6	12	1.0	0.001 ha 1.714 %
30yr Rainfall + 40%	0.75	25	9	15	1.2	0.002 ha 2.143 %
100yr Rainfall + 20%	0.75	29	9	19 ($7m^3$ of exceedance storage)	1.5	0.002 ha 2.714 %
100yr Rainfall + 40%	1	37	13	24 ($9 m^3$of exceedance storage)	1.9	0.002 ha 3.429 %

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1m was included as part of the development. 1m is considered more appropriate in this instance given the relatively low volumes required. It is noted that attenuation may instead be provided in the form of a boundary swale. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.

Overall Site Assessment

Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **Surface water risk onsite and offsite will likely prevent this site from passing the Exception Test, without potentially significant mitigation put in place to ensure the site can be safe for its lifetime without increasing risk elsewhere.**
Recommendations summary	• • • • •

Site S/BEL/002 – Land adjacent to 1 Chaddock Lane, Worsley, Salford	
FRA requirements	• The key aspect of any FRA is a further more detailed assessment of surface water risk and investigations into whether mitigation is possible. • FRA should include emergency planning procedures with particular consideration to ensuring safe access and egress routes in times of flood. • Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. • Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services.
Council decision on development	• **Based on this Level 2 SFRA, the Council is to remove this site from the land supply, given the site is for one dwelling only.**

Site S/BRO/004 – Former Royal Archer Public House, Lower Broughton Road	
Location	Lower Broughton Road, Salford
Site area (ha)	0.48
Watercourse	River Irwell
EA Model used	Lower Irwell 2018
Existing use	Mix of greenfield and brownfield (demolished public house)
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	0.41

Flood outlines (present day)

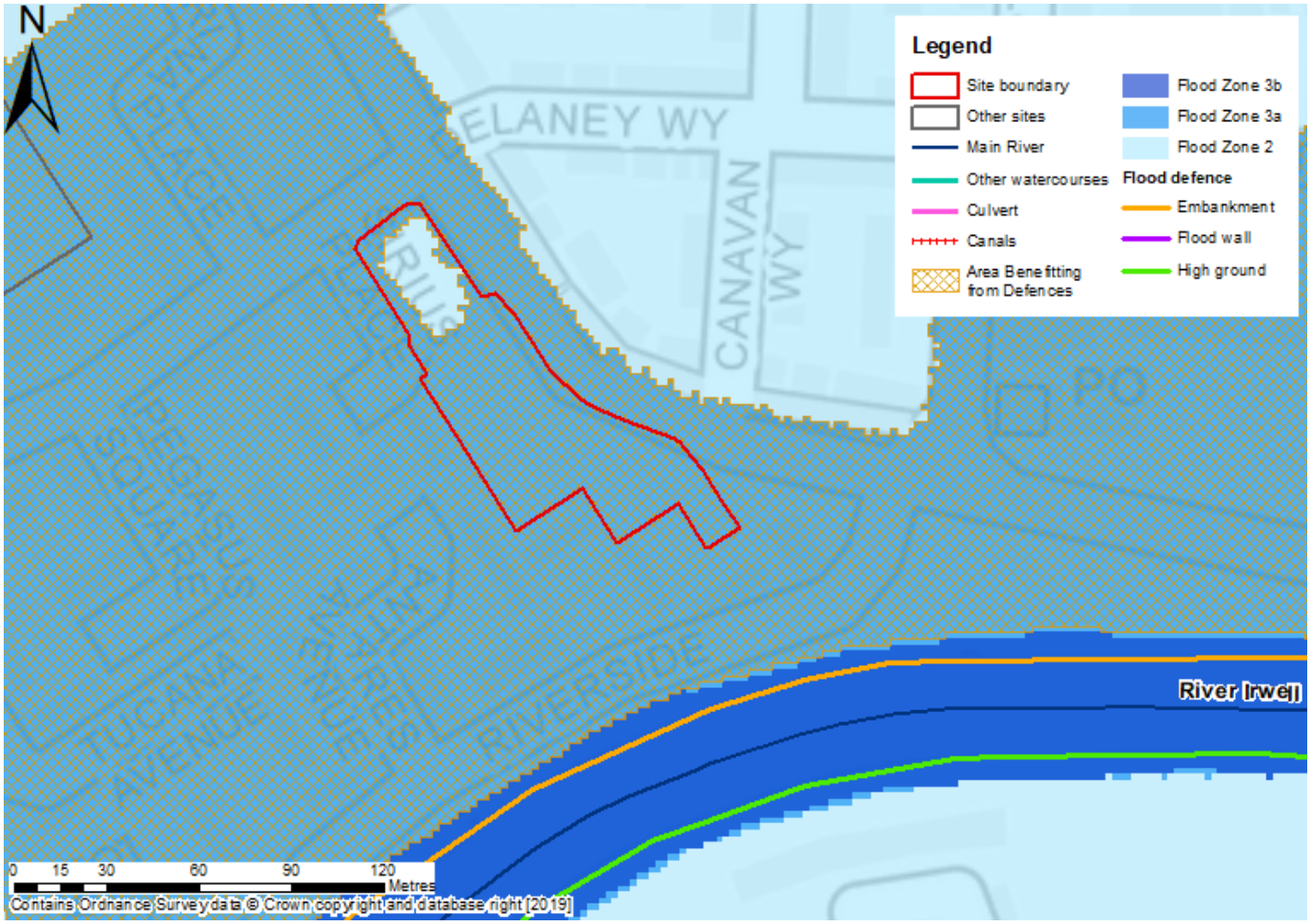


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences

- The site is almost entirely within an Area Benefitting from Defences (ABD). The site is therefore protected from a 1% AEP fluvial flood event by the EA embankment on the left bank of the Irwell.

Site S/BRO/004 – Former Royal Archer Public House, Lower Broughton Road



Figure 2: Site with 2m 2017 LIDAR (elevation data)

- The proposed site is located on Lower Broughton Road, approximately 80 m north of the River Irwell which is flowing towards the east of the site.
- The elevation of the site is consistent at an average of approximately 26 m AOD with the elevation slightly increasing in the north of the site where it reaches approximately 27m AOD.
- The surrounding area has a consistent elevation with that of the site.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change (undefended)
	0.00	86.58	13.42	100
Fluvial: average depth (m)	Not applicable	0.59	3.61	3.01
Fluvial: maximum depth (m)	Not applicable	1.10	4.23	3.63
Fluvial: average hazard	Not applicable	Moderate	Significant	Significant
Fluvial: maximum hazard	Not applicable	Moderate	Significant	Significant

Site S/BRO/004 – Former Royal Archer Public House, Lower Broughton Road

Modelled fluvial flood risk and climate change (Lower Irwell 2018 model)

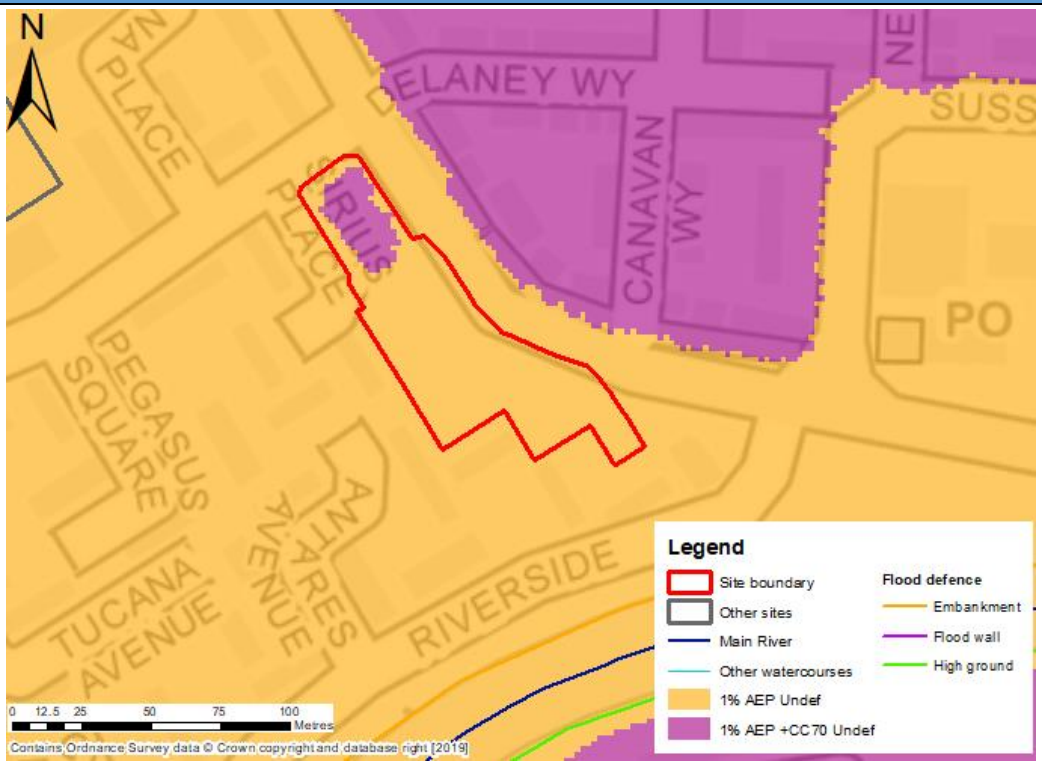


Figure 3: Undefended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% AEP climate change uplift.

- The 1% AEP present day undefended outline covers the majority of the site (approximately 87%) with the 70% climate change uplift increasing to fully cover the site to a maximum depth of 3.6 m.
- The 1% AEP undefended event outline is equivalent to the Flood Map for Planning Flood Zone 3.



Figure 4: Defended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% AEP climate change uplift.

Site S/BRO/004 – Former Royal Archer Public House, Lower Broughton Road	
	• The 1% AEP present day defended fluvial outline remains in-bank. • However, the future 1% AEP with 70% climate change uplift covers the entire site to a maximum depth of 3.2 m, showing significant long-term risk to the site.
Historic flooding	• The site entirely lies within the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, the River Irwell is bounded by a formal flood embankment which is assessed at condition grades of 2 and 3 meaning 'Good' and 'Fair' (Table 1.1 Condition Assessment Manual[1]). • As shown by the ABD, the site is protected from fluvial flooding for a 100 year Standard of Protection.
Flood Warning Area	• The site entirely lies within two EA FWAs; the River Irwell at Salford Area B and the River Irwell at Salford Area C.
Natural Flood Management / Working with Natural Processes	• The site is fully within the Urban Loss Improvement zone of the Irwell NFM dataset. This means that the potential impact of the 'street trees' or 'low density urban tree planting' should be considered as one of many possible SuDS type interventions.
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG).** • **Almost 87% of the site is located within Flood Zone 3 according to the Flood Map for Planning, however the whole of this Flood Zone 3a area of the site is within an ABD, making the risk residual (Figure 1). The modelled 1% AEP undefended event + climate change (Figure 3) and the defended 1% AEP + climate change (Figure 4) cover the whole of the site area with significant depths exceeding 3 metres.** • **It is clear from the modelling that the site is protected by flood defence infrastructure and can therefore be described as being at residual risk of defence failure or overtopping without being at direct risk of fluvial flooding. However, the main issue with this site is the effects of climate change and the fact that the site is not defended in the long term, as shown by the modelled defended climate change outline in Figure 4.** • **Regarding the location of the site within an EA ABD, the EA states that EA defences are there to protect existing communities and are not normally built or maintained to facilitate new development in high flood risk areas, such as this. The EA cannot guarantee how long they will maintain the defences for as this depends on changes to Government funding and priorities.** • **However, it is reasonable to assume that in the middle of a major conurbation, the EA will not allow the current defences to fall into disrepair and will maintain them at their current bank height. In the particular case of Lower Broughton, the second flood basin was partially funded with Growth funding from Government, with the explicit intention of unlocking development potential. This is purely a case of new development benefiting from the defences that are already there to protect existing communities.** • **The EA has stated that further interventions will be required for the Lower Broughton area to address the impacts of climate change if standards of**

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site S/BRO/004 – Former Royal Archer Public House, Lower Broughton Road	
	protection are to be maintained. • **There are a number of development options that may be explored, such as land raising or ensuring finished floor levels are above the 100 year plus climate change flood level plus 600 mm freeboard. Compensatory storage would however have to be found; there is no space onsite or nearby the site to enable this. Stilted development is a further option that has been used for other developments in Salford. However, this is likely to be an expensive design solution.** • **A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at times of flood, even for above ground floor accommodation. Site design and layout would have to determine safe access and egress routes which will be challenging when accounting for climate change and existing residual risk. All such options should be subject to detailed investigation, planning and consultation with the appropriate RMAs. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.** • **Defence breach and overtopping scenarios should be modelled at the FRA stage to ascertain residual risk and to help formulate robust emergency plans for all site users to be aware of in times of flood, including for safe access and egress routes.** • **Ideally, this site would not be developed for residential use. It should be the case that any future development at this site should be considered sustainable without continued reliance on EA flood defence investment and maintenance. Also recommend asset inspection as part of any pre-development plans.**
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to the River Irwell, groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and is unlikely to be an issue in this instance.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	•

Site S/BRO/004 – Former Royal Archer Public House, Lower Broughton Road	
	fail such requirements. United Utilities also notes that the Environment Agency is responsible for ensuring compliance with the highlighted legislation. • United Utilities also wishes to highlight the drive for continued constructive communication with the relevant local authorities to ensure a coordinated approach to the delivery of site allocations. United Utilities are committed to continuing to work with the relevant Local Authorities and the Greater Manchester Combined Authority as site allocations progress further.
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• No canals in the vicinity of the site.
Flood Source: Surface Water	

Surface Water Flood Risk to Proposed Development Site

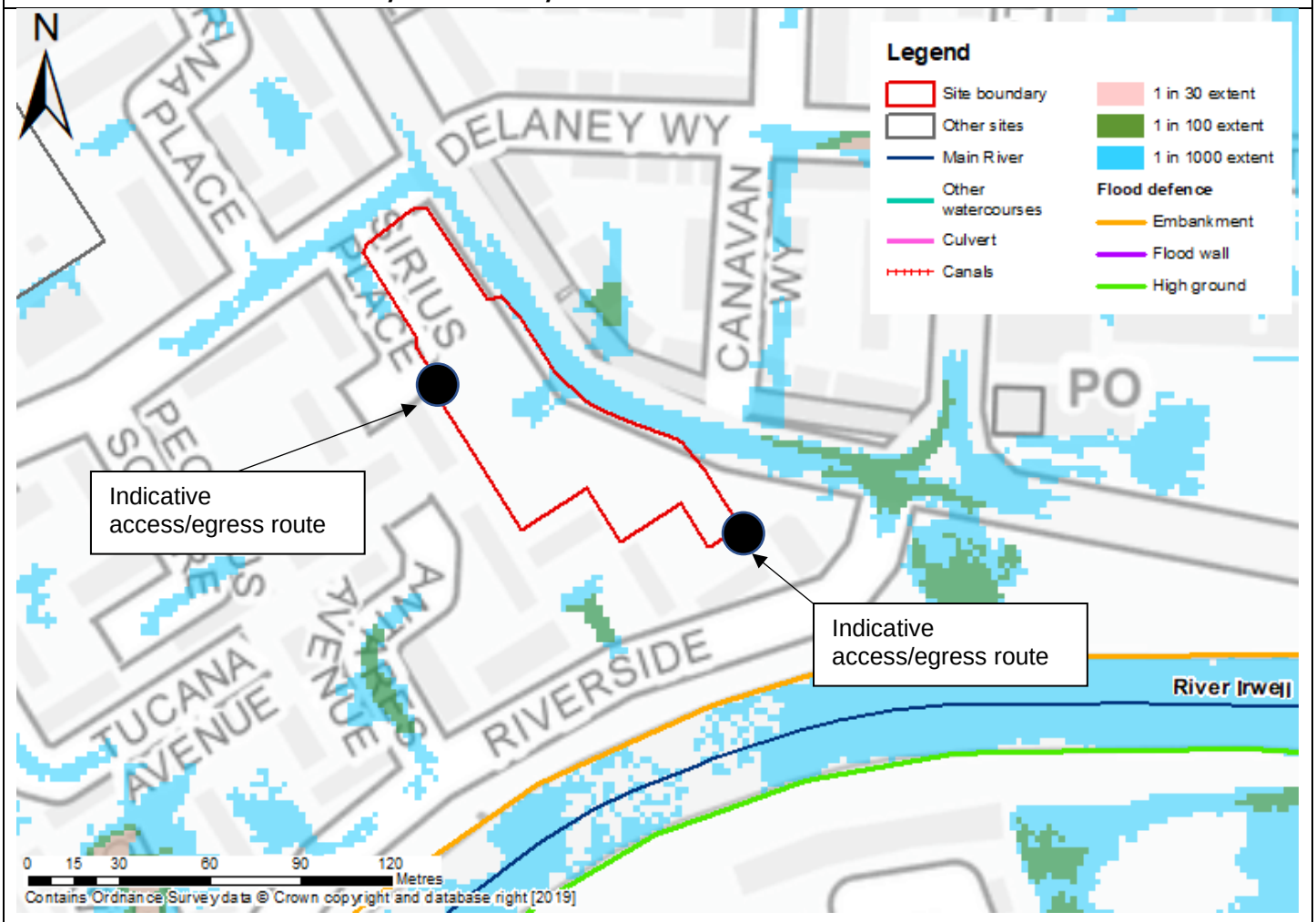


Figure 5: Surface water risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	0.00	0.00	4.16
Surface water flooding depths	Max: N/A	Max: N/A	Max: 0.15 - 0.30m
Surface water hazards	Max: N/A Mean: N/A	Max: N/A Mean: N/A	Max: Low Mean: Very low

Site S/BRO/004 – Former Royal Archer Public House, Lower Broughton Road	
Surface water flood risk to development site	• The site is at low risk from surface water flooding according to the Risk of Flooding from Surface Water map. • Safe access and egress should be possible via Sirius Place and Riverside.
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • A small section of the site (approximately 4%) in the east is affected by the 0.1% AEP outline; the maximum depth does not exceed 300mm and the hazard is classified as 'Low'. • Safe access and egress should be achievable via Riverside.

Mitigation options & site suitability: surface water	• **Surface water poses a low risk to the site and safe access and egress is achievable via the surrounding roads during the 1% AEP event. These routes may be limited in the long term and alternative may be required via Riverside.**
	• **A drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of converting from greenfield to new development.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and minimum flow rate of 5 l/s (in accordance with Rainfall runoff management for developments).**

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Minimum Flow 5 l/s (in accordance with Rainfall runoff management for developments)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	4.75	238	60	178	14.1	0.012 ha 2.472 %
30yr Rainfall+40%	5.5	288	69	218	17.3	0.015 ha 3.028 %
100yr Rainfall+20%	6	343	76	267 (89m^3 of exceedance storage)	21.1	0.018 ha 3.708 %
100yr Rainfall+40%	7.25	417	91	325 (107m^3 of exceedance	25.7	0.022 ha 4.514 %

Site S/BRO/004 – Former Royal Archer Public House, Lower Broughton Road						
				storage)		
Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.					
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.					
Overall Site Assessment						
Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• • •					
Recommendations summary	• • • •					
FRA requirements	• • • • •					
LPA decision on development	• •					

Site S/BRO/004 – Former Royal Archer Public House, Lower Broughton Road	
	not seek to bring forward development on the site in the future, just that they are not relying on the numbers in their housing land supply.

Site S/BRO/053 – Cambridge Riverside	
Location	East of Great Clowes Street, Salford
Site area (ha)	7.63
Watercourse	River Irwell
EA Model used	Lower Irwell 2018
Existing use	Brownfield, existing industrial buildings, wooded areas
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	6.49

Flood outlines (present day)

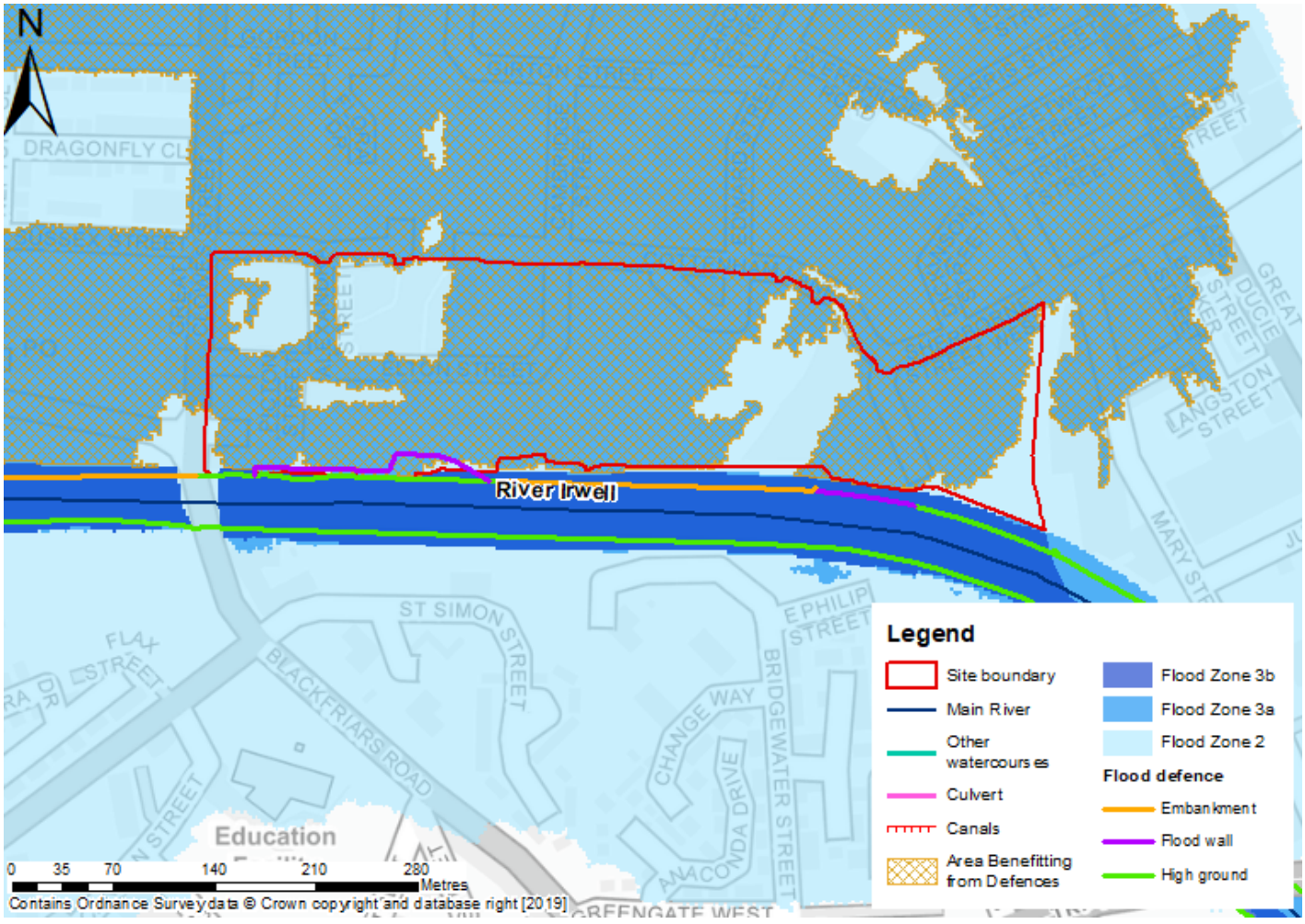


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences.

- The site is almost entirely within an Area Benefitting from Defences (ABD). The site is therefore protected from a 1% AEP fluvial flood event by the EA embankment on the left bank of the Irwell.

Site S/BRO/053 – Cambridge Riverside

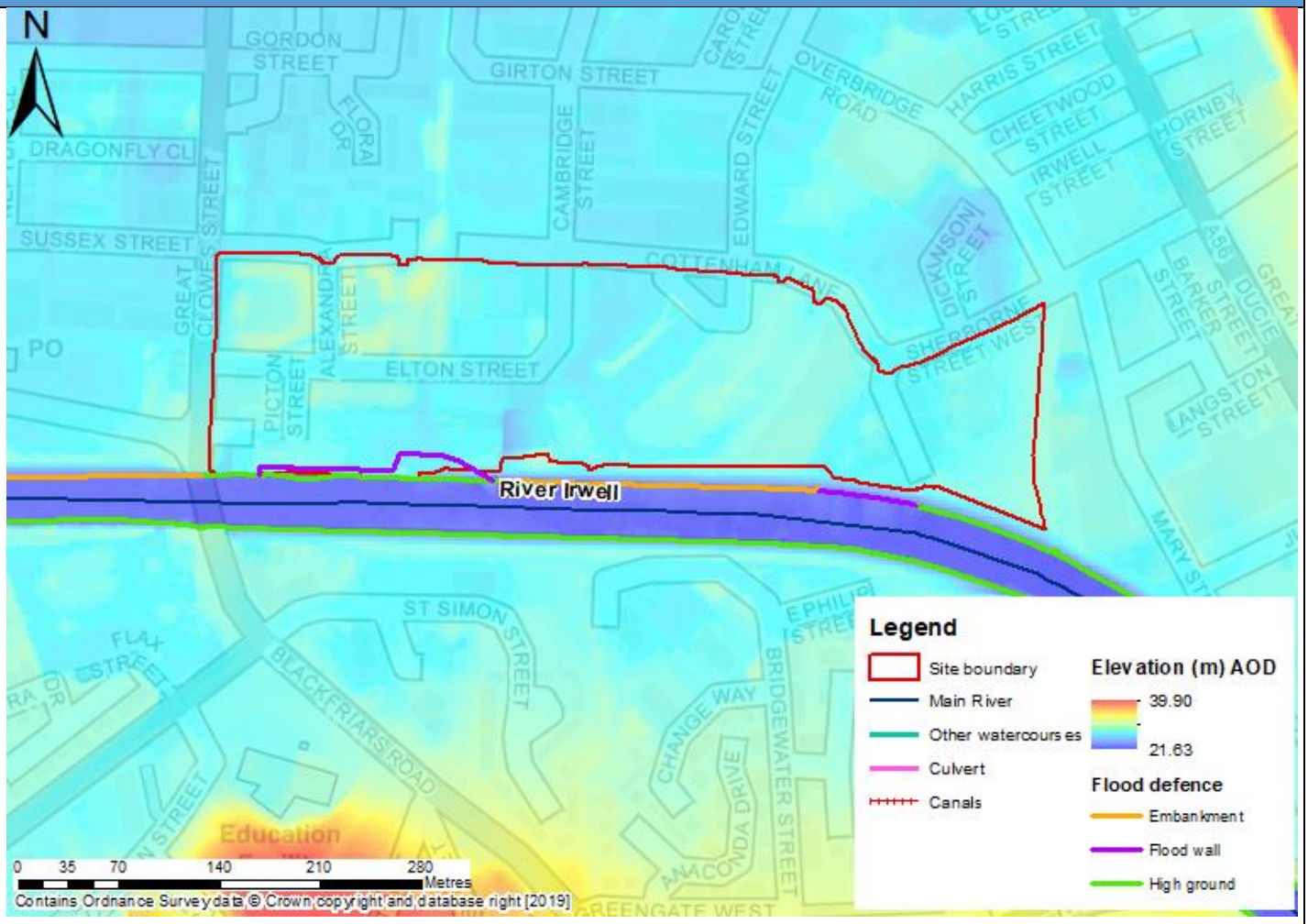


Figure 2: Site with 2m 2017 LIDAR (elevation data)

- The elevation of the site is consistent at an average of approximately 27m AOD; this is the same as the elevation for the surrounding residential areas to the north.
- The elevation slopes down to the left bank of the River Irwell on the south boundary to approximately of 22m AOD. The Irwell is flowing west to east.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	0.21	73.66	26.13	100.0
Fluvial: average depth (m)	Not available	0.57 (undefended)	3.46 (undefended)	2.36 (undefended)
Fluvial: maximum depth (m)	Not available	2.87 (undefended)	6.46 (undefended)	5.27 (undefended)
Fluvial: average hazard	Not available	Significant (undefended)	Significant (undefended)	Significant (undefended)
Fluvial: maximum hazard	Not available	Significant (undefended)	Significant (undefended)	Significant (undefended)

Site S/BRO/053 – Cambridge Riverside

Modelled fluvial flood risk and climate change (Lower Irwell 2018 model)

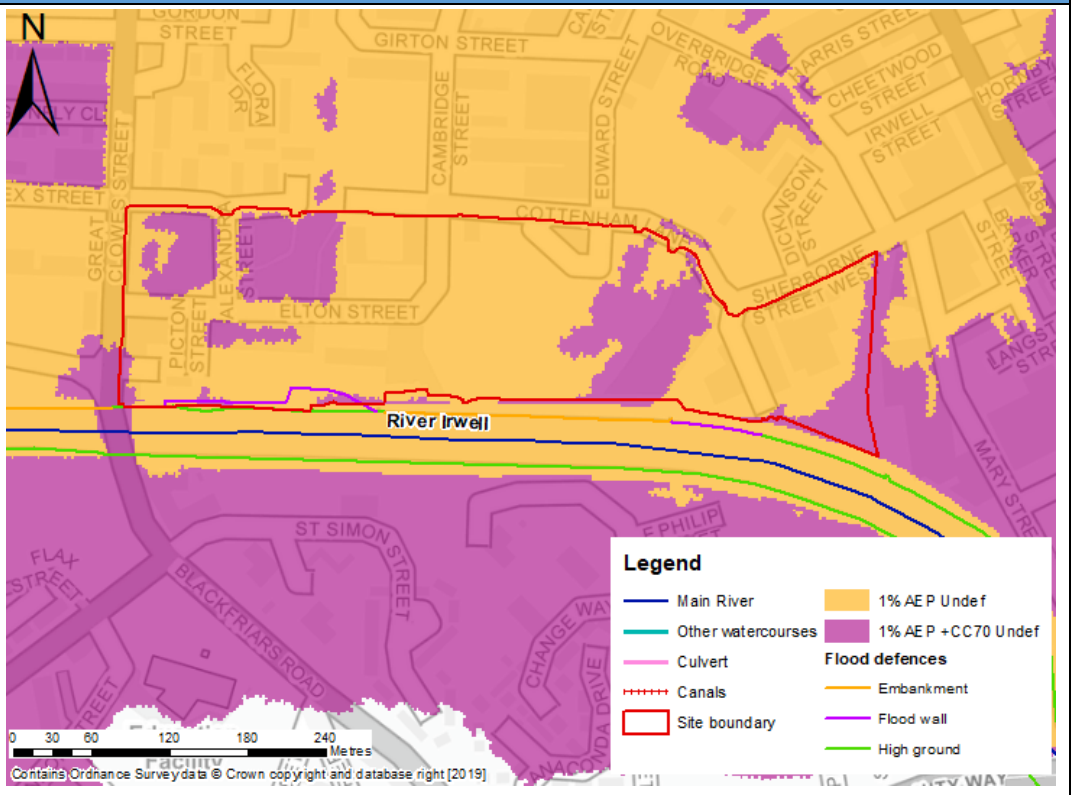
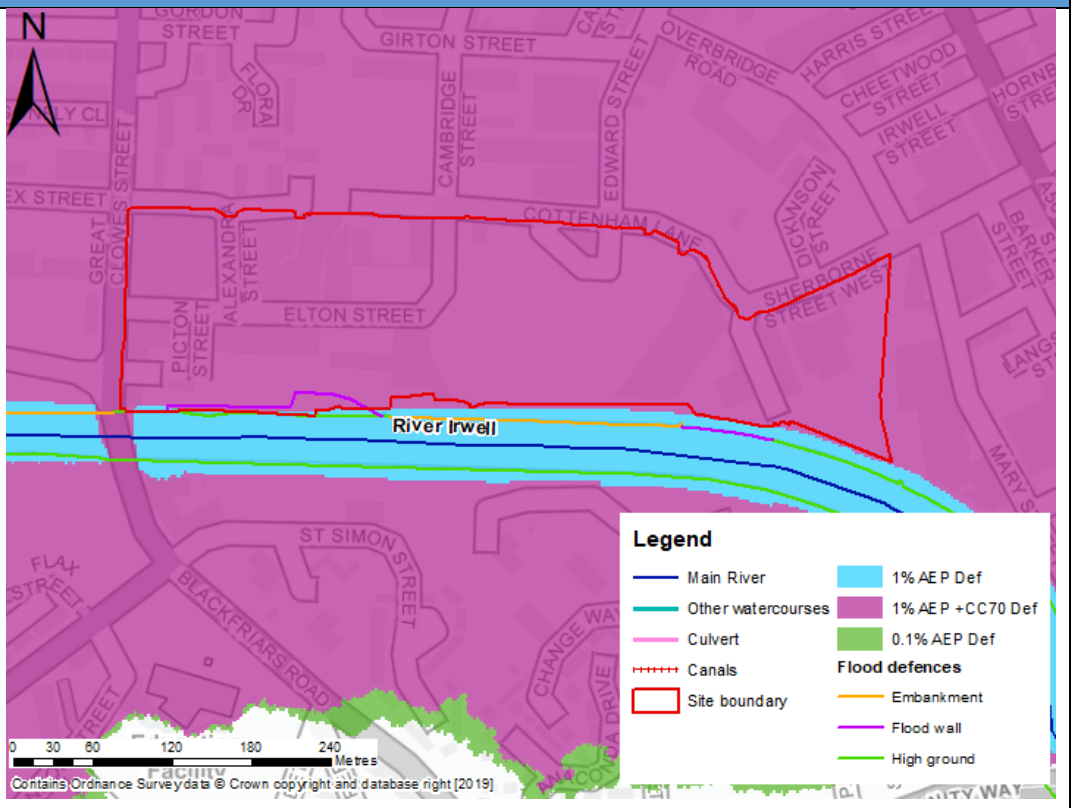


Figure 3: Undefended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% climate change uplift

- The 1% AEP undefended present-day outline is equivalent to the Flood Map for Planning Flood Zone 3.
- Approximately 74% of the site is covered by the 1% AEP event outline with the +70% climate change uplift covering the remaining sections of the site.

Site S/BRO/053 – Cambridge Riverside	
	 Figure 4: Defended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% climate change uplift • The present-day outline for the defended 1% AEP event remains in-bank of the River Irwell. • However, with climate change, the whole site and the surrounding area will be at risk in the long term.
Historic flooding	• The site is entirely within the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, just outside of the southern site boundary to the west is an embankment that has a condition grade of 2 meaning 'Good' (Table 1.1 Condition Assessment Manual[1]). There is also another embankment in the centre of the southern site boundary that has a condition grade of 3 meaning 'Fair'. • There is a flood wall located on the southern boundary to the east that has been assessed at a condition grade of 3. There is also a remote wall located on the southern boundary to the west that has a condition grade of 3. • There are areas of high ground that act as informal defences along the River Irwell that have been assessed at condition grades 2 and 3. • As shown by the ABD, the site is protected from fluvial flooding for a 100 year Standard of Protection.
Flood Warning Area	• The site in its entirety is included within an EA FWA. The River Irwell at Salford Area C FWA is for areas at risk including properties in the Lower Kersal, Lower Broughton, Charlestown and Wallness neighbourhoods including the University area to Adelphi Street and Trinity Way up to the junction of the A6041.
Natural Flood Management / Working	• The entire site is within the Urban Loss Improvement zone of the Irwell NFM dataset. This means that the potential impact of 'street trees' or 'low density urban

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site S/BRO/053 – Cambridge Riverside	
with Natural Process	tree planting' should be considered as one of many possible SuDS type interventions.
Observations, mitigation options & site suitability	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG).** • **Almost 75% of the site is located within Flood Zone 3 according to the Flood Map for Planning, however the whole of this Flood Zone 3a area of the site is within an ABD, making the risk residual (Figure 1). The modelled 1% AEP undefended event + climate change (Figure 3) covers the whole of the site, as does the defended event. It should be noted that the modelled climate change depths are significant, making sustainable development more challenging.** • **It is clear from the modelling that the site is currently protected by flood defence infrastructure and can therefore be described as being at residual risk of defence failure or overtopping without being at direct risk of fluvial flooding. However, the main issue with this site is the effects of climate change and the fact that the site is not defended in the long term, as shown by the modelled defended climate change outline in Figure 4.** • **Regarding the location of the site within an EA ABD, the EA states that EA defences are there to protect existing communities and are not normally built or maintained to facilitate new development in high flood risk areas, such as this. The EA cannot guarantee how long they will maintain the defences for as this depends on changes to Government funding and priorities.** • **However, it is reasonable to assume that in the middle of a major conurbation, the EA will not allow the current defences to fall into disrepair and will maintain them at their current bank height. In the particular case of Lower Broughton, the second flood basin was partially funded with Growth funding from Government, with the explicit intention of unlocking development potential. This is purely a case of new development benefiting from the defences that are already there to protect existing communities.** • **The EA has stated that further interventions will be required for the Lower Broughton area to address the impacts of climate change if standards of protection are to be maintained.** • **There are a number of development options that may be explored, such as land raising or ensuring finished floor levels are above the 100 year plus climate change flood level plus 600 mm freeboard. Compensatory storage would however have to be found; there is no space onsite or nearby the site to enable this. Stilted development is a further option that has been used for other developments in Salford. However, this is likely to be an expensive design solution.** • **A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at times of flood, even for above ground floor accommodation. Site design and layout would have to determine safe access and egress routes which does not appear possible when accounting for climate change and existing residual risk. All such options should be subject to detailed investigation, planning and consultation with the appropriate RMAs. Provision for safe access and egress routes would need to be demonstrated in any planning application**

Site S/BRO/053 – Cambridge Riverside	
	and any associated masterplan. • **Defence breach and overtopping scenarios should be modelled at the FRA stage to ascertain residual risk and to help formulate robust emergency plans for all site users to be aware of in times of flood, including for safe access and egress routes.** • **Ideally, this site would not be developed for residential use. It should be the case that any future development at this site should be considered sustainable without continued reliance on EA flood defence investment and maintenance. Also recommend updated asset inspections as part of any pre-development plans.**
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to the River Irwell, groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and is unlikely to be an issue in this instance.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	• • • • • • • •
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• No canals in the vicinity of the site.

Site S/BRO/053 – Cambridge Riverside

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

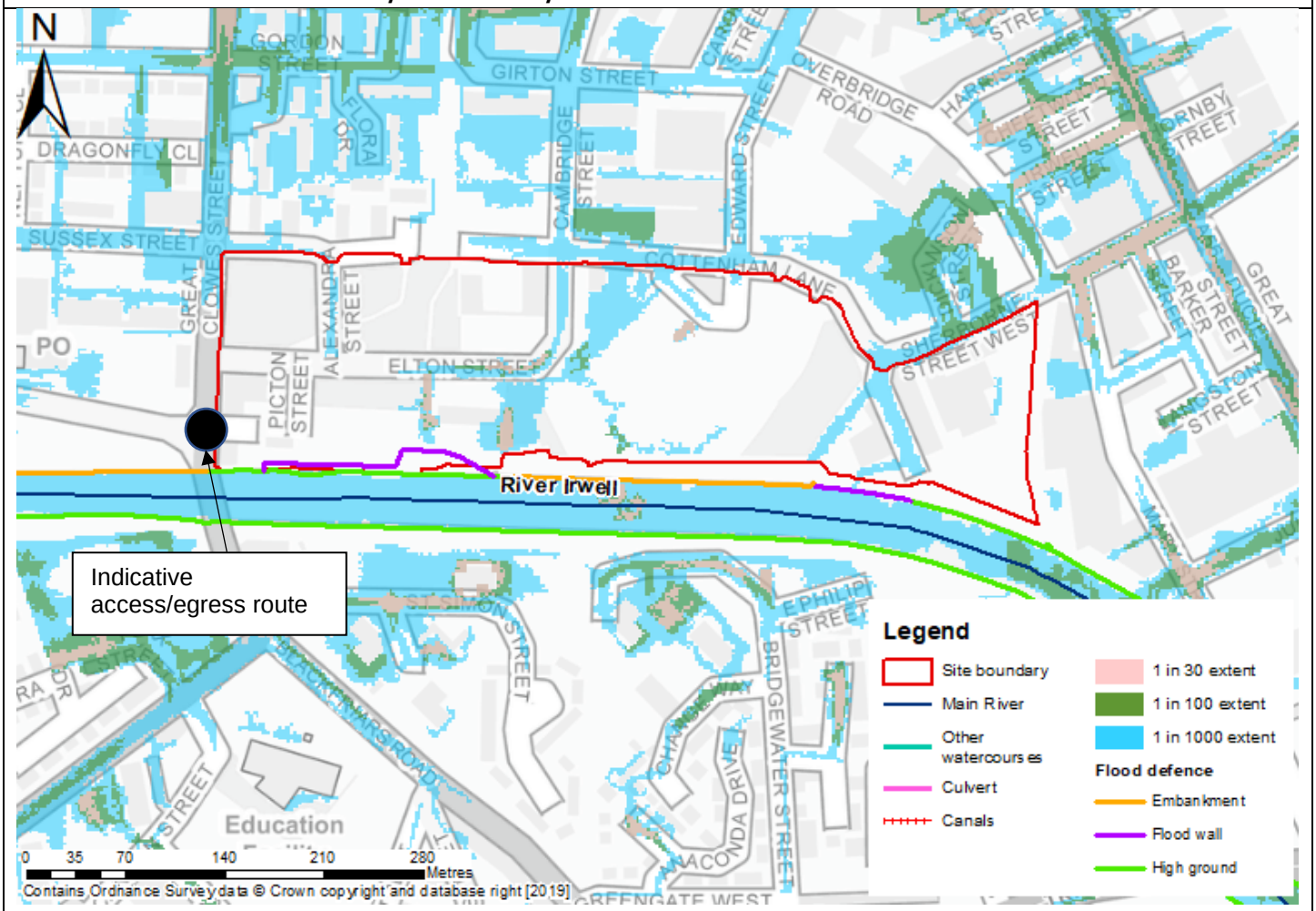


Figure 3: Surface water risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	0.99	1.56	12.08
Surface water flooding depths	Max: 0.60 – 0.90m	Max: 0.60 – 0.90m	Max: >1.20m
Surface water hazards	Max: Significant Mean: Low	Max: Significant Mean: Low	Max: Significant Mean: Moderate
Surface water flood risk to development site	• The site is at low risk from surface water flooding according to the Risk of Flooding from Surface Water map. • There are many road options for safe access and egress to the site.		
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP outline only covers 12% of the site and is localised primarily to the existing onsite roads and buildings. However, flood depths are significant at over 1.2 m and the surface water hazard is Moderate on average.		

Site S/BRO/053 – Cambridge Riverside	
	• Safe access and egress routes should be achievable in the long term via Clowes Street, as indicated on Figure 5.

Mitigation options & site suitability: surface water	• **Overall, surface water poses a low risk to the site and safe access and egress is achievable in the long term.**
	• **Were development to be permitted, despite the residual and long term risk from fluvial flooding, a drainage strategy should assess the current drainage system in place, given the site is partially developed and partially brownfield, to ascertain whether the current system could accommodate residential development or whether further capacity is required. A full drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on proposed layout plans.**
	• **Assuming the site is to be cleared of existing infrastructure, it would be beneficial to carry out surface water modelling to ascertain natural flow paths, post site clearance and pre-development. This would enable the developer to fully incorporate surface water flow paths and ponded areas into the site design through appropriate SuDS. Infiltration SuDS may not be feasible on all the site given the majority is currently or previously developed. Ground investigation and contamination tests would be required.**
	• **Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (l/s).**

Site S/BRO/053 – Cambridge Riverside

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Qbar: 49 l/s (FEH Statistical)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	8.5	4370	1050	3321	26.8	0.221 ha 2.902 %
30yr Rainfall+40%	10.25	5331	1266	4066	32.8	0.271 ha 3.553 %
100yr Rainfall+20%	10.5	6157	1297	4861 ($1540m^3$ of exceedance storage)	39.3	0.324 ha 4.247 %
100yr Rainfall+40%	12	7382	1482	5900 ($1834m^3$ of exceedance storage)	47.6	0.393 ha 5.155 %

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.

Overall Site Assessment

Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• • •
Recommendations summary	• • • •

Site S/BRO/053 – Cambridge Riverside	
	continually updated as and when new information becomes available.
FRA requirements	• Any FRA should include modelling of residual risk from the Irwell (breach, defence overtopping). Condition inspections would be required to assess the defences that line the River Irwell. • Options modelling of site design and layout to assess potential for safe development. • The FRA should include a drainage strategy for the proposed new development layout, assuming development planning is to proceed. UU requirements should be met, as discussed in this Level 2 SFRA. • The FRA must include a suitable emergency plan accounting for the availability of safe access and egress routes. • Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. • Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services.
LPA decision on development	• **Site to be removed from existing land supply.** • **However, taking this site out of the supply does not mean the Council would not seek to bring forward development on the site in the future, just that they are not relying on the numbers in their housing land supply.**

Site S/BRO/062 – 238 Lower Broughton Road, Salford	
Location	Lower Broughton Road, Salford
Site area (ha)	0.01
Watercourse	River Irwell
EA Model used	Lower Irwell 2018
Existing use	Brownfield – hardstanding yard
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	0.01

Flood outlines (present day)

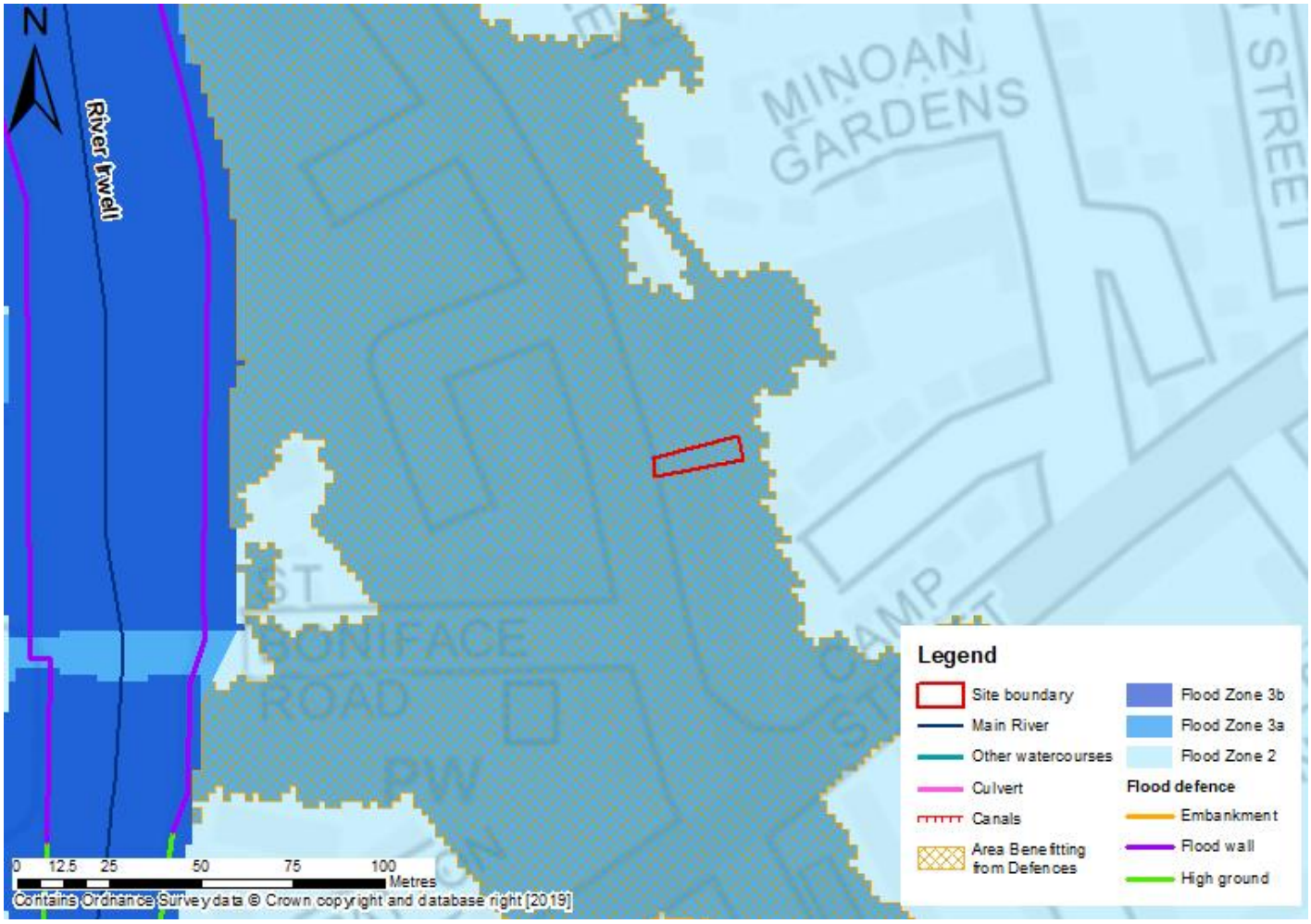


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences

- The site is completely within an EA Area Benefitting from Defences (ABD). The site is therefore protected from a 1% AEP fluvial flood event by the EA embankment on the left bank of the Irwell.

Site S/BRO/062 – 238 Lower Broughton Road, Salford

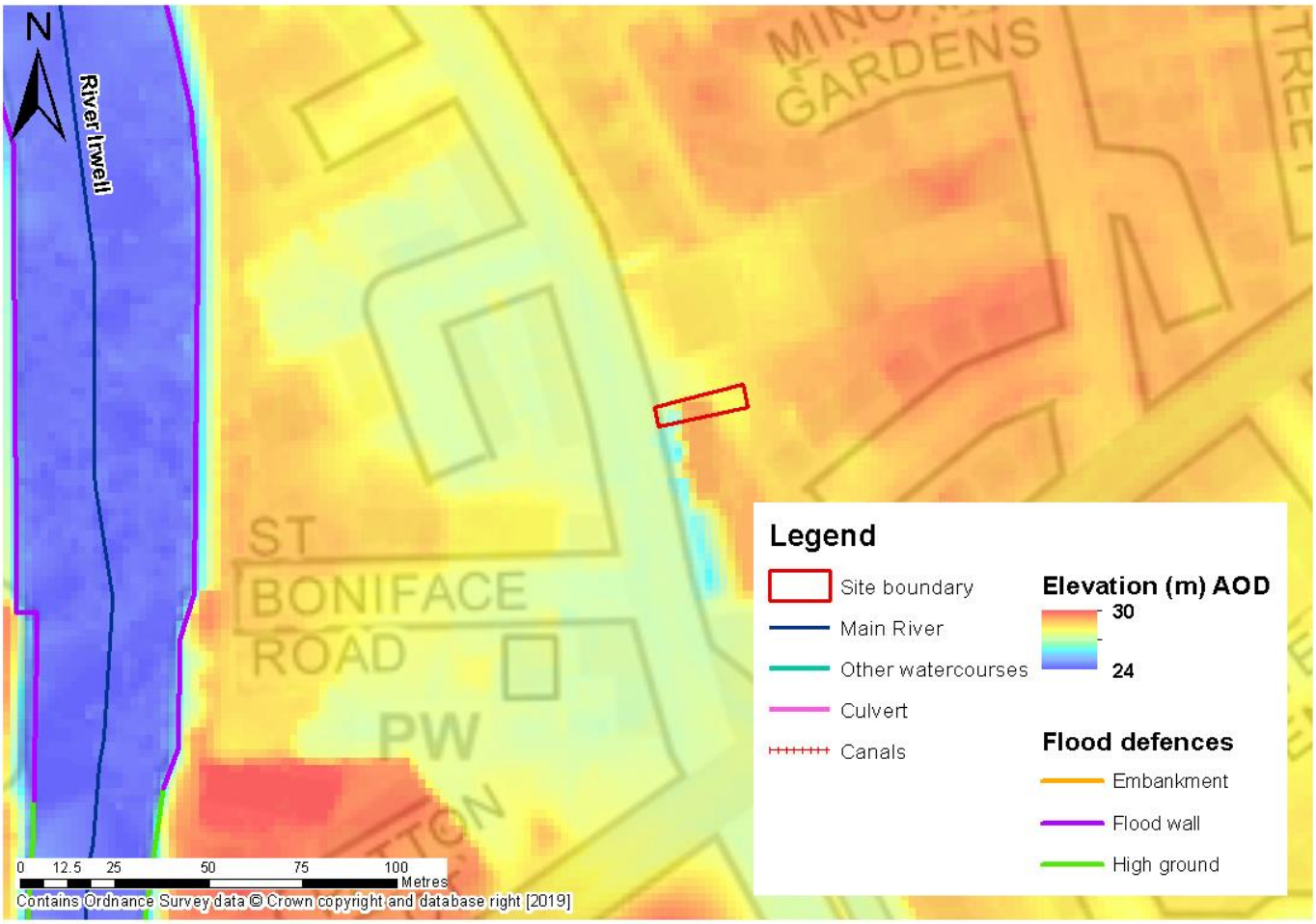


Figure 2: Site with 2m 2017 LIDAR (elevation data)

- The site is located adjacent to Lower Broughton Road and the nearest water course (River Irwell) is 150m to the west.
- The site's peak elevation is in the middle of the site at an approximate elevation of 29m AOD. This then slopes down to approximately 27m AOD in the west and 28m AOD in the east. As the site is small in area, the elevation only slightly fluctuates.
- The surrounding area has the highest elevation in the east at approximately 29m AOD, declining towards the west to approximately 27m AOD.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	0.00	100.00	0.00	100
Fluvial: average undefended depth (m)	Not applicable	0.61	2.63	2.12
Fluvial: maximum undefended depth (m)	Not applicable	0.96	2.97	2.47
Fluvial: average hazard	Not applicable	Significant	Significant	Significant
Fluvial: maximum hazard	Not applicable	Significant	Significant	Significant

Site S/BRO/062 – 238 Lower Broughton Road, Salford

Modelled fluvial flood risk and climate change (Lower Irwell 2018 model)

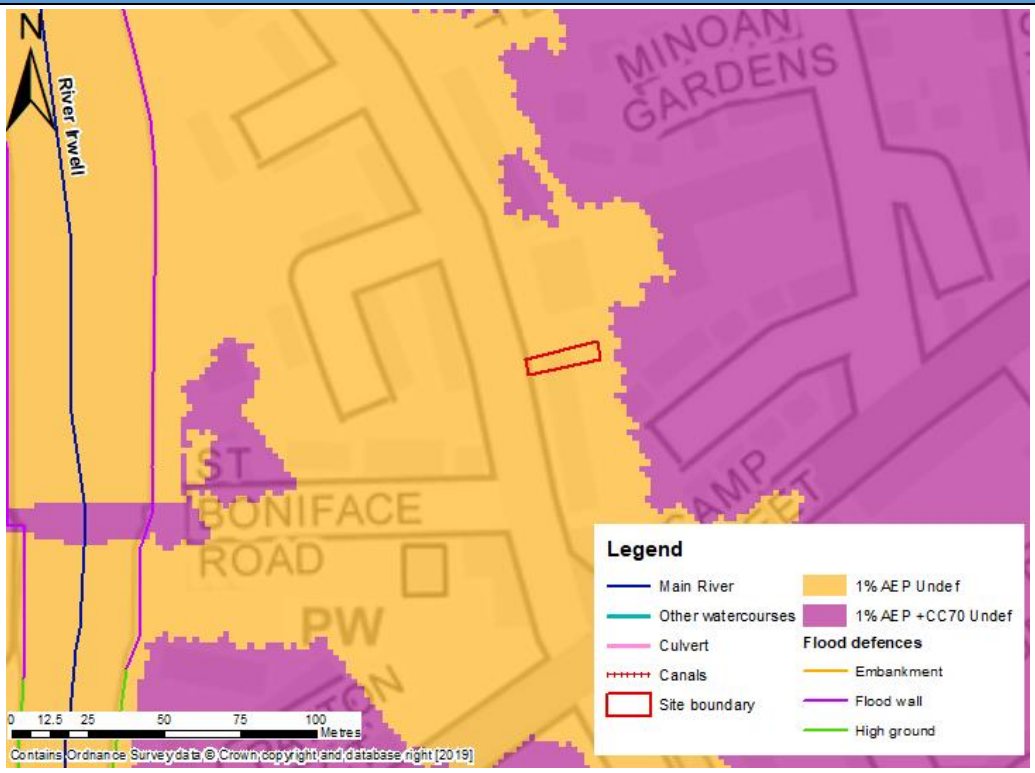


Figure 3: Undefended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% climate change uplift

- The 1% AEP undefended present-day outline covers the site in its entirety.
- The 1% AEP outline is equivalent to the Flood Map for Planning Flood Zone 3.
- Safe access and egress routes are inundated during both present day and in the future.



Figure 4: Defended fluvial outlines for the present-day 1% AEP and future risk 1% AEP with +70% climate change uplift

Site S/BRO/062 – 238 Lower Broughton Road, Salford	
	• The 1% AEP defended present day outline does not cover the site, safe access and egress achievable via Lower Broughton Road. • The defended 1% AEP with 70% climate change uplift covers the entire site with depths averaging at 1.7m reaching a maximum of approximately 2m, safe access and egress routes become inundated
Historic flooding	• The site lies entirely within the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, the River Irwell is bounded by flood walls which are assessed at condition grade 3 meaning 'Fair' (Table 1.1 Conditions Assessment Manual[1]) that have a design Standard of Protection (SoP) of 75. These defences provided protection the site from the 1% AEP event. • As shown by the ABD, the site is protected from fluvial flooding for a 100 year Standard of Protection.
Flood Warning Area	• The site lies entirely within two EA FWAs; the River Irwell at Salford Area B and the River Irwell at Salford Area C.
Natural Flood Management / Working with Natural Processes	• The site is fully within the Urban Loss Improvement zone of the Irwell NFM dataset. This means that the potential impact of the 'street trees' or 'low density urban tree planting' should be considered as one of many possible SuDS type interventions.
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the new development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).** • **100% of the site is located within Flood Zone 3 according to the Flood Map for Planning, however the whole of this Flood Zone 3a area of the site is within an ABD, making the risk residual (Figure 1). The modelled 1% AEP undefended event + climate change (Figure 3) and the defended 1% AEP + climate change (Figure 4) cover the whole of the site area with significant average depths up to 3 metres.** • **It is clear from the modelling that the site is protected by flood defence infrastructure and can therefore be described as being at residual risk of defence failure or overtopping without being at direct risk of fluvial flooding. However, the main issue with this site is the effects of climate change and the fact that the site is not defended in the long term, as shown by the modelled defended climate change outline in Figure 4.** • **Regarding the location of the site within an EA ABD, the EA states that EA defences are there to protect existing communities and are not normally built or maintained to facilitate new development in high flood risk areas, such as this. The EA cannot guarantee how long they will maintain the defences for as this depends on changes to Government funding and priorities.** • **However, it is reasonable to assume that in the middle of a major conurbation, the EA will not allow the current defences to fall into disrepair and will maintain them at their current bank height. In the particular case of Lower Broughton, the second flood basin was partially funded with Growth funding from Government, with the explicit intention of unlocking development potential. This is purely a case of new development benefiting from the defences that are already there to protect existing communities.**

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site S/BRO/062 – 238 Lower Broughton Road, Salford	
	• **The EA has stated that further interventions will be required for the Lower Broughton area to address the impacts of climate change if standards of protection are to be maintained.** • **There are a number of development options that may be explored, such as land raising or ensuring finished floor levels are above the 100 year plus climate change flood level plus 600 mm freeboard. Compensatory storage would however have to be found; there is no space onsite or nearby the site to enable this. Stilted development is a further option that has been used for other developments in Salford. However, this is likely to be an expensive design solution.** • **A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at times of flood, even for above ground floor accommodation. Site design and layout would have to determine safe access and egress routes which does not appear possible when accounting for climate change and existing residual risk. All such options should be subject to detailed investigation, planning and consultation with the appropriate RMAs. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.** • **Defence breach and overtopping scenarios should be modelled at the FRA stage to ascertain residual risk and to help formulate robust emergency plans for all site users to be aware of in times of flood, including for safe access and egress routes.** • **Ideally, this site would not be developed for residential use. It should be the case that any future development at this site should be considered sustainable without continued reliance on EA flood defence investment and maintenance. Also recommend updated asset inspections as part of any pre-development plans.**
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to the River Irwell, groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and may be prevented from discharging to the watercourse by the raised defence. This possibility should be investigated.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	•

Site S/BRO/062 – 238 Lower Broughton Road, Salford	
	• All United Utilities operated reservoirs are managed in accordance with the Reservoirs Act and relevant Health and Safety legislation to ensure they do not fail such requirements. United Utilities also notes that the Environment Agency is responsible for ensuring compliance with the highlighted legislation. • United Utilities also wishes to highlight the drive for continued constructive communication with the relevant local authorities to ensure a coordinated approach to the delivery of site allocations. United Utilities are committed to continuing to work with the relevant Local Authorities and the Greater Manchester Combined Authority as site allocations progress further
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• No canals in the vicinity of the site.
Flood Source: Surface Water	

Surface Water Flood Risk to Proposed Development Site

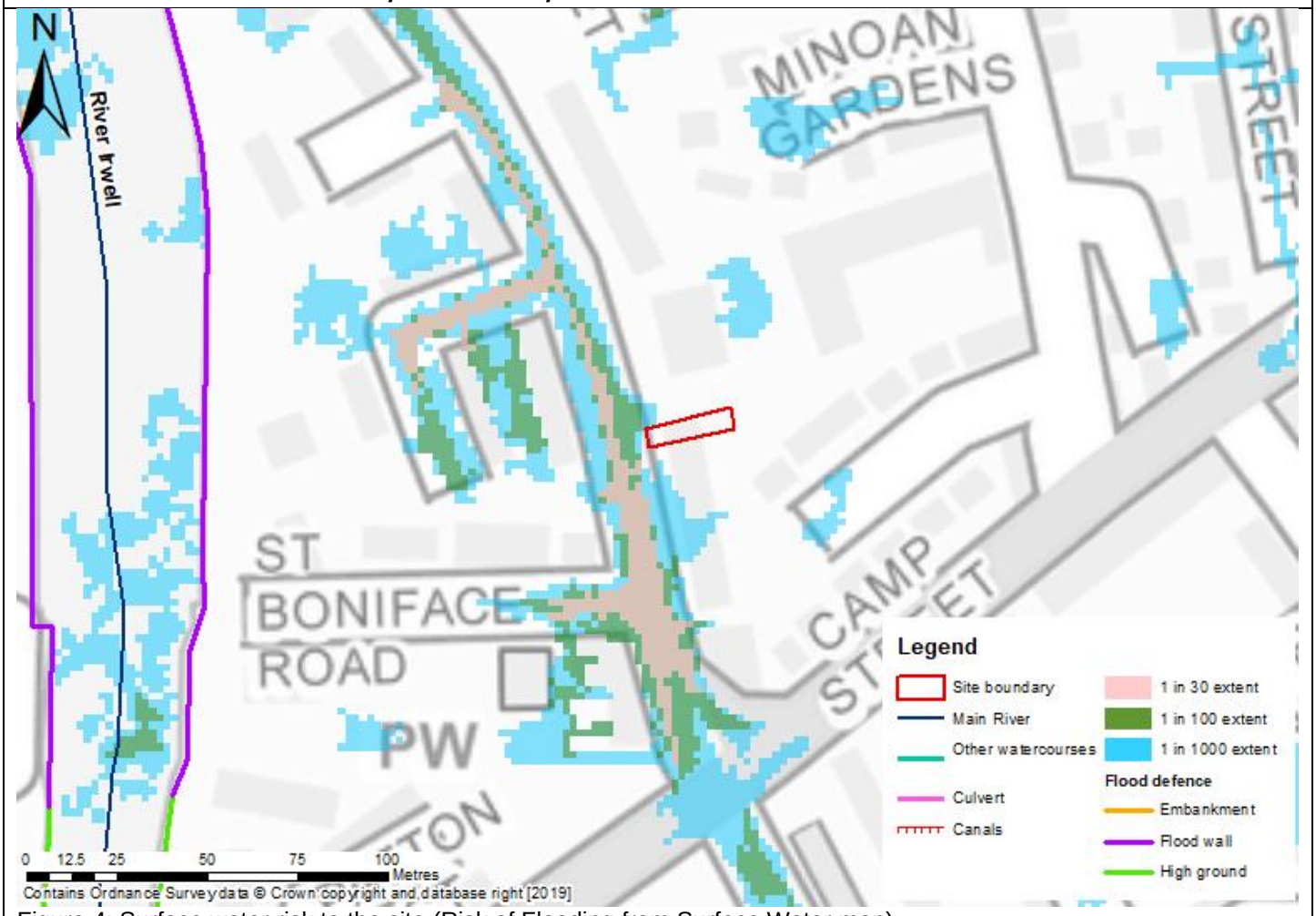


Figure 4: Surface water risk to the site (Risk of Flooding from Surface Water map)

Site S/BRO/062 – 238 Lower Broughton Road, Salford						
Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)		Medium Risk (1 in 100 AEP outline)		Low Risk (1 in 1000 AEP outline)	
	0.00		0.00		0.95	
Surface water flooding depths	Max: N/A		Max: N/A		Max:0.15 - 0.30m	
Surface water hazards	Max: N/A Mean: N/A		Max: N/A Mean: N/A		Max: Low Mean: Very low	
Surface water flood risk to development site	• The site is at very low risk of surface water flooding according to the Risk of Flooding from Surface Water map. • A detailed FRA would be needed to identify locations for safe access and egress as Lower Broughton Road is inundated with surface water floodwaters during the 3.33% and 1% AEP events.					
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The site is at very low risk from the 0.1% AEP event outline and thus climate change will have minimal impact on the proposed site					
Mitigation options & site suitability: surface water	• **Surface water poses a very low risk to the site; however, safe access and egress may be difficult to achieve due to Lower Broughton Road being inundated during the 3.33% and 1% AEP events. A detailed FRA would be required to help identify safe access and egress routes.** • **For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 100% impermeable area and minimum flow rate of 5 l/s (in accordance with Rainfall runoff management for developments). It is noted that greenfield runoff rates and volumes may not be achievable for development of brownfield sites, therefore, values as close as reasonably practicable may be agreed with the LLFA.**					
Surface Water Flood Risk from Proposed Development						
Proposed development limiting runoff rate: (l/sec) Minimum Flow 5 l/s (in accordance with Rainfall runoff management for developments)						
Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	0.25	2	3	N/A	N/A	N/A
30yr Rainfall+40%	0.25	3	3	0	N/A	N/A
100yr Rainfall+20%	0.25	3	3	0	N/A	N/A
100yr Rainfall+40%	0.25	4	3	1	0.0	N/A
Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.					
Surface water: flood risk impacts from development site, mitigation & SuDS	• Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.					
Overall Site Assessment						
Can the second part of the Exception Test be	• **To pass the Exception Test, it must be proven that the development will be safe for its lifetime, without increasing flood risk elsewhere and where**					

Site S/BRO/062 – 238 Lower Broughton Road, Salford	
satisfied as part of a site-specific FRA?	• •
Recommendations summary	• • • •
FRA requirements	• • • • •
LPA decision on development	• •

Site S/BRO/067 – Former Harry Hall Gardens, land off Heath Avenue	
Location	Heath Avenue, Salford
Site area (ha)	0.36
Watercourse	River Irwell
EA Model used	Lower Irwell 2018
Existing use	Greenfield
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	0.31

Flood outlines (present day)

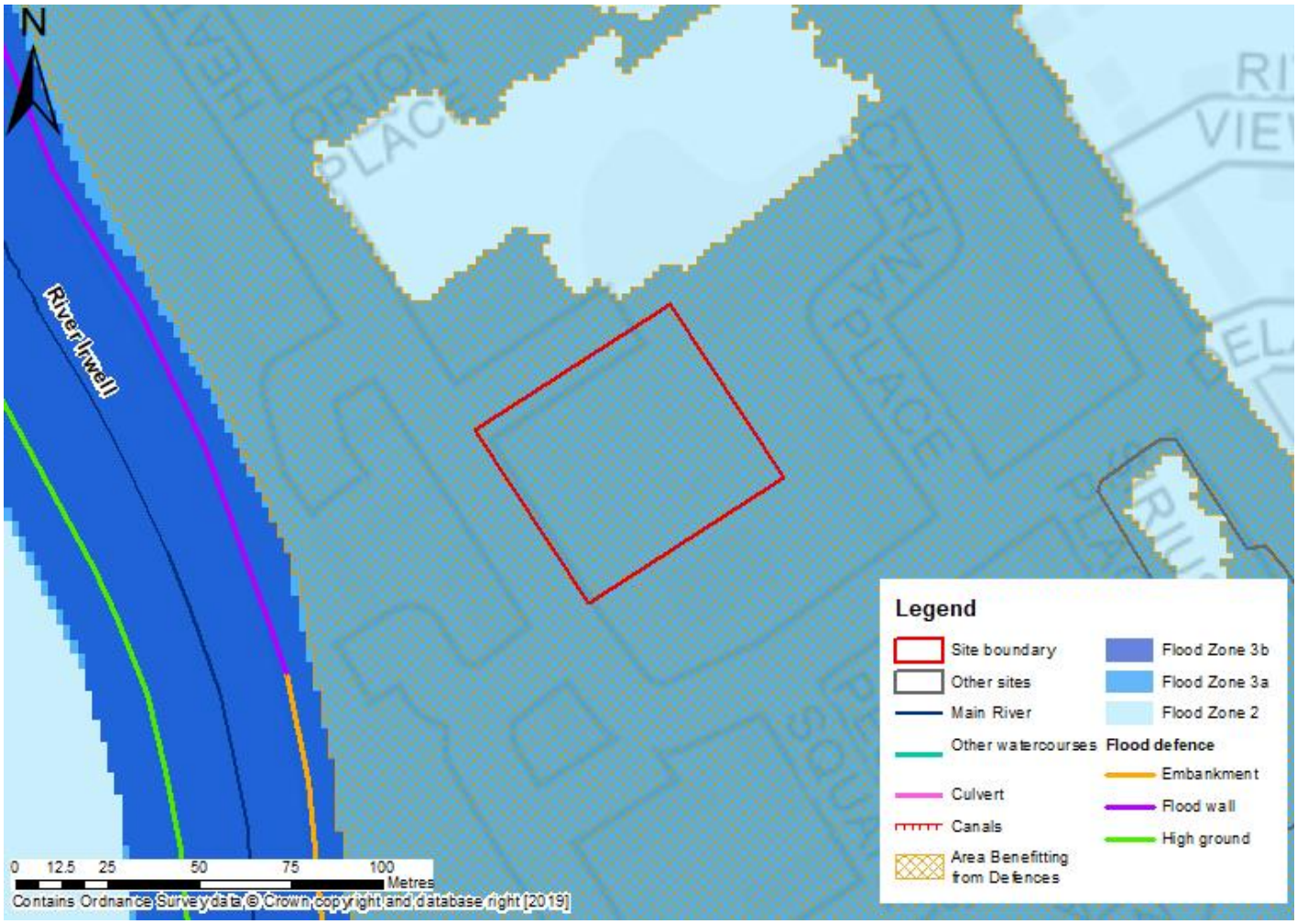


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences

- The site is entirely within an Area Benefitting from Defences (ABD). The site is therefore fully protected from a 1% AEP fluvial flood event by the EA embankment on the left bank of the Irwell.

Site S/BRO/067 – Former Harry Hall Gardens, land off Heath Avenue

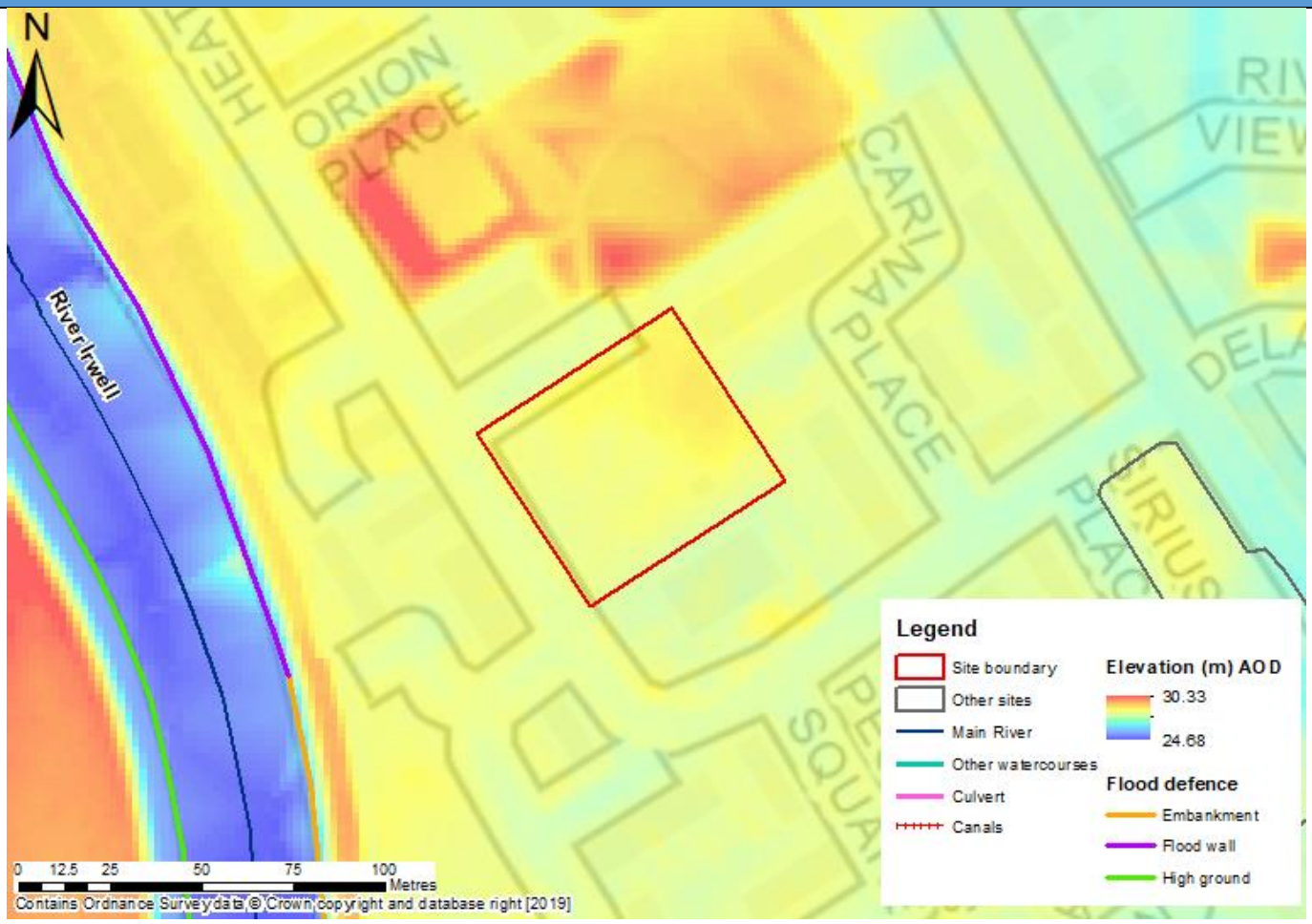


Figure 2: Site with 2m 2017 LIDAR (elevation data)

- The site is located on Heath Avenue and the River Irwell is 60 m to the west of the site flowing in a southerly direction past the site.
- The average elevation of the site is around 28 m AOD with an area of slightly increased elevation towards the north of the site.
- The surrounding areas to the west, south and east have an average elevation consistent with the proposed site, but there is a slightly higher area to the north of the site at around 29 m AOD.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	0.00	100.00	0.00 (undefended)	100.00
Fluvial: average depth (m)	Not applicable	0.34 (undefended)	2.76 (undefended)	2.10
Fluvial: maximum depth (m)	Not applicable	0.71 (undefended)	3.24 (undefended)	2.55
Fluvial: average hazard	Not applicable	Moderate (undefended)	Significant (undefended)	Significant (undefended)
Fluvial: maximum hazard	Not applicable	Significant (undefended)	Significant (undefended)	Significant (undefended)

Site S/BRO/067 – Former Harry Hall Gardens, land off Heath Avenue

Modelled fluvial flood risk and climate change (Lower Irwell 2018 model)

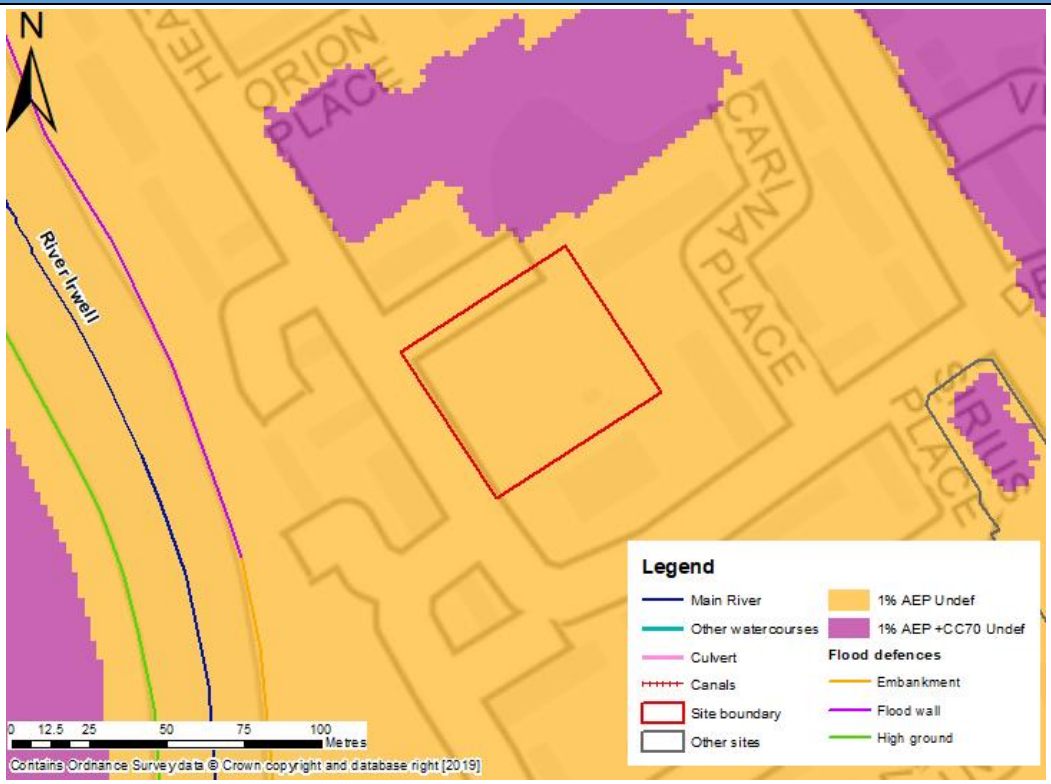


Figure 3: Undefended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% climate change uplift.

- The entire site is covered by the present day 1% AEP outline.
- The 1% AEP outline is equivalent to the Flood Map for Planning Flood Zone 3.



Figure 4: Defended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% climate change uplift

- The entire site lies outside of the present day 1% AEP defended outline, and only experiences inundation during the +70% climate change uplift.

Site S/BRO/067 – Former Harry Hall Gardens, land off Heath Avenue	
Historic flooding	• The entire site lies within the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, the River Irwell is bounded by a flood wall and an embankment which are assessed at condition grade 3 meaning 'Fair' (Table 1.1 Condition Assessment Manual[1]). • As shown by the ABD, the site is protected from fluvial flooding for a 100 year Standard of Protection.
Flood Warning Area	• The entire site lies within an EA FWA; the FWA is for the River Irwell at Salford, Area B.
Natural Flood Management / Working with Natural Processes	• The site is fully within the Urban Loss Improvement zone of the Irwell NFM dataset. This means that the potential impact of the 'street trees' or 'low density urban tree planting' should be considered as one of many possible SuDS type interventions.
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG).** • **100% of the site is located within Flood Zone 3 according to the Flood Map for Planning, however the whole of this Flood Zone 3a area of the site is within an ABD, making the risk residual (Figure 1). The modelled 1% AEP undefended event + climate change (Figure 3) and the defended 1% AEP + climate change (Figure 4) cover the whole of the site area with average depths of 2.1 m.** • **It is clear from the modelling that the site is protected by flood defence infrastructure and can therefore be described as being at residual risk of defence failure or overtopping without being at direct risk of fluvial flooding. However, the main issue with this site is the effects of climate change and the fact that the site is not defended in the long term, as shown by the modelled defended climate change outline in Figure 4. Flood depths are also significant and may be difficult to mitigate.** • **Regarding the location of the site within an EA ABD, the EA states that EA defences are there to protect existing communities and are not normally built or maintained to facilitate new development in high flood risk areas, such as this. The EA cannot guarantee how long they will maintain the defences for as this depends on changes to Government funding and priorities.** • **However, it is reasonable to assume that in the middle of a major conurbation, the EA will not allow the current defences to fall into disrepair and will maintain them at their current bank height. In the particular case of Lower Broughton, the second flood basin was partially funded with Growth funding from Government, with the explicit intention of unlocking development potential. This is purely a case of new development benefiting from the defences that are already there to protect existing communities.** • **The EA has stated that further interventions will be required for the Lower Broughton area to address the impacts of climate change if standards of protection are to be maintained.** • **There are a number of development options that may be explored, such as land raising or ensuring finished floor levels are above the 100 year plus**

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site S/BRO/067 – Former Harry Hall Gardens, land off Heath Avenue	
	climate change flood level plus 600 mm freeboard. Compensatory storage would however have to be found; there is no space onsite or nearby the site to enable this. Stilted development is a further option that has been used for other developments in Salford. However, this is likely to be an expensive design solution. • **A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at times of flood, even for above ground floor accommodation. Site design and layout would have to determine safe access and egress routes which does not appear possible when accounting for climate change and existing residual risk. All such options should be subject to detailed investigation, planning and consultation with the appropriate RMAs.** • **Defence breach and overtopping scenarios should be modelled at the FRA stage to ascertain residual risk and to help formulate robust emergency plans for all site users to be aware of in times of flood, including for safe access and egress routes.** • **Ideally, this site would not be developed for residential use. It should be the case that any future development at this site should be considered sustainable without continued reliance on EA flood defence investment and maintenance. Also recommend updated asset inspections as part of any pre-development plans.**
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the proximity to the River Irwell, the groundwater levels are likely to be similar to the corresponding levels in the river. Groundwater will follow topography and is unlikely to be an issue in this instance.

Site S/BRO/067 – Former Harry Hall Gardens, land off Heath Avenue	
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	•
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• No canals in the vicinity of the site.

Site S/BRO/067 – Former Harry Hall Gardens, land off Heath Avenue

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

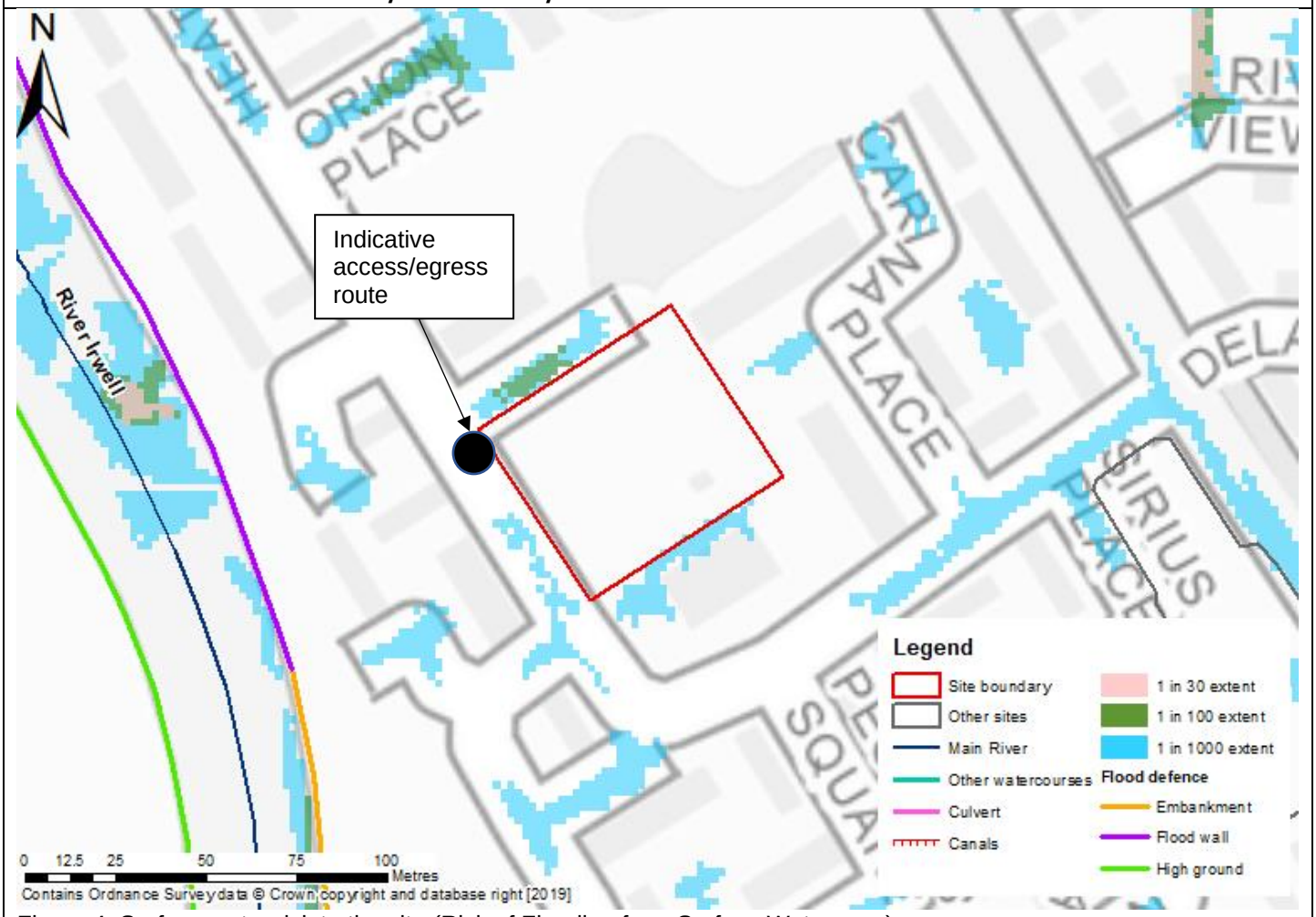


Figure 4: Surface water risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	0.00	0.00	0.32
Surface water flooding depths	Max: N/A	Max: N/A	Max: 0.15 - 0.30m
Surface water hazards	Max: N/A Mean: N/A	Max: N/A Mean: N/A	Max: Low Mean: Low
Surface water flood risk to development site	• The site is at very low risk of surface water flooding according to the Risk of Flooding from Surface Water map. • Safe access and egress is possible via Heath Avenue.		
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The site continues to be at very low risk from surface water flooding with safe access and egress remaining via Heath Avenue.		

Site S/BRO/067 – Former Harry Hall Gardens, land off Heath Avenue

Mitigation options & site suitability: surface water

- **Surface water poses a very low risk to the site and safe access and egress is achievable via the surrounding roads during the 1% AEP event and in the long term.**
- **Any development should include a drainage strategy ensuring runoff rates do not exceed current rates and if possible, betterment of existing rates should be aimed for. UU's requirements are as follows:**
  - **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
  - **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
- **For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and minimum flow rate of 5 l/s (in accordance with Rainfall runoff management for developments).**

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Minimum Flow 5 l/s (in accordance with Rainfall runoff management for developments)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	3.25	163	41	122	9.7	0.008 ha 2.259 %
30yr Rainfall+40%	4	201	50	151	11.9	0.010 ha 2.796 %
100yr Rainfall+20%	4.5	243	57	186 (64m^3 of exceedance storage)	14.7	0.012 ha 3.444 %
100yr Rainfall+40%	5.25	293	66	227 (76m^3 of exceedance storage)	18.0	0.015 ha 4.204 %

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.

Site S/BRO/067 – Former Harry Hall Gardens, land off Heath Avenue	
Overall Site Assessment	
Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• • •
Recommendations summary	• • • • •
FRA requirements	• • • • •
LPA decision on development	• •

Site S/CAD/060 – Irlam Locks Tower Site	
Location	Cadishead Way, Salford
Site area (ha)	0.69
Watercourse	Manchester Ship Canal
EA Model used	Manchester Ship Canal 1D only model, 2010
Existing use	Brownfield – previously industrial
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	0.59

Flood outlines (present day)

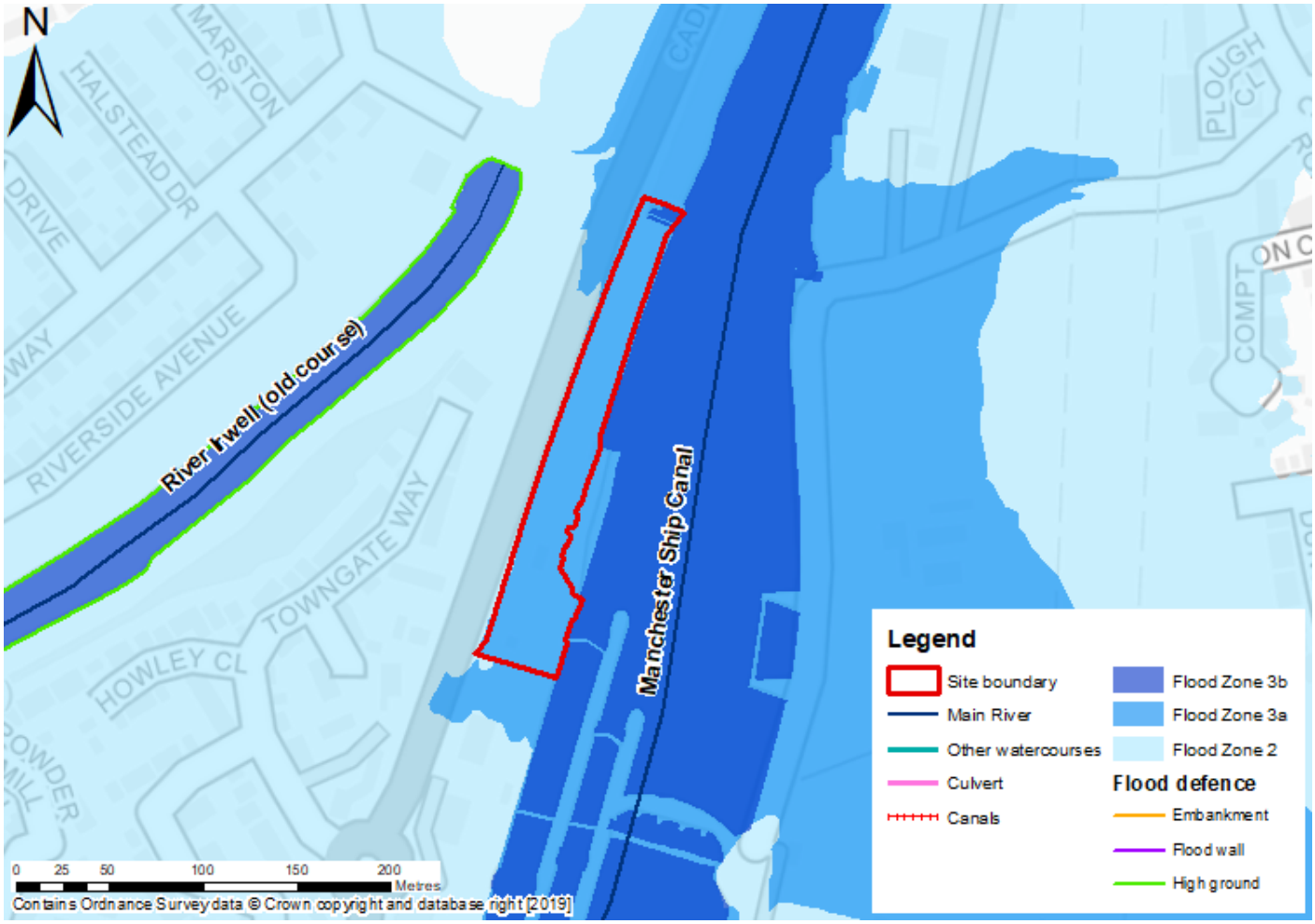


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences. At the time of writing, the Ship Canal is being remodelled and the Flood Map will be subject to change in the near future

Site S/CAD/060 – Irlam Locks Tower Site



Figure 2: Site with 2m 2017 LIDAR (elevation data)

- The site is located east of Cadishead Way and the eastern boundary of the site runs along the right bank of the Manchester Ship Canal. The old course of the River Irwell is to the west of the site. Both the Ship Canal and the River Irwell flow in a southerly direction.
- The site appears relatively flat with an average elevation of approximately 15 m AOD. There is a low area to the south east of the site with a much lower elevation of 8 m AOD which, judging from satellite imagery, appears to be a lock on the Canal.
- The residential estate to the west of the site on Townsgate Way is situated on an area of higher land at approximately 19m AOD.

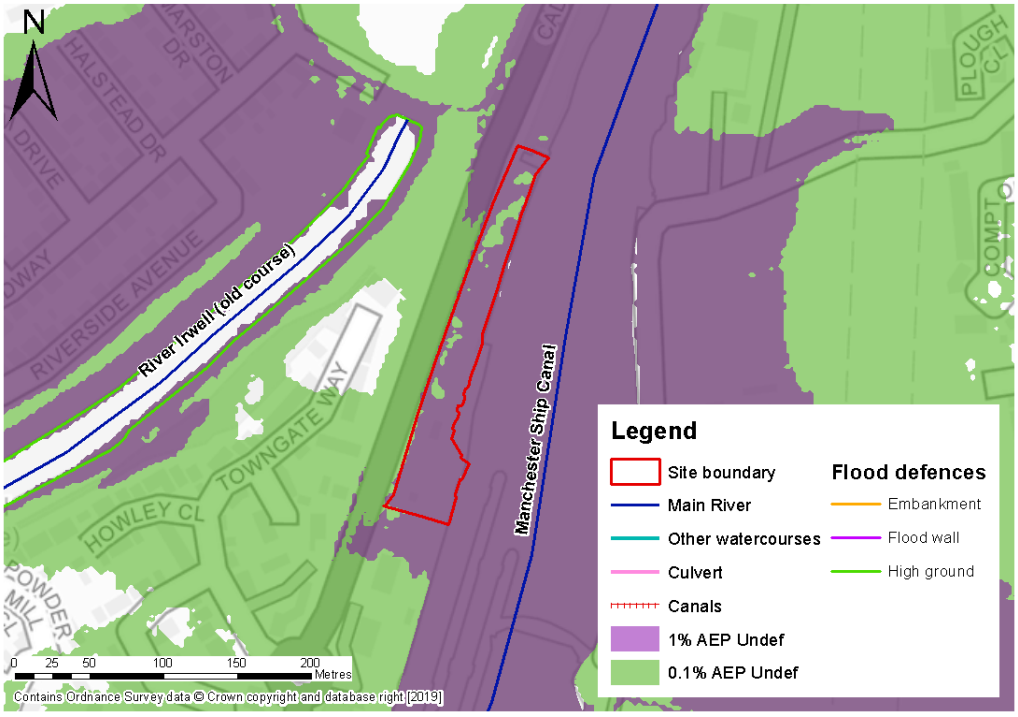
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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	1.84	97.01	1.15	Not available
Fluvial: average depth* (m)	Not applicable	Not available	Not available	Not available
Fluvial: maximum depth* (m)	Not applicable	Not available	Not available	Not available
Fluvial: average hazard*	Not applicable	Not available	Not available	Not available
Fluvial: maximum hazard*	Not applicable	Not available	Not available	Not available

Site S/CAD/060 – Irlam Locks Tower Site

*Depth and hazard information unavailable due to model being 1D. 2D domain exists further upstream though stops around Urmston and does not cover the site

Modelled fluvial risk and climate change (Manchester Ship Canal 1D only model, 2010)	 Figure 2: Undefended fluvial outlines for the present day 1% and 0.1% AEP events. • The 1% AEP present day outline covers the majority of the site, with the entire site being covered in the 0.1% AEP event. • There are some inconsistencies between the 1% AEP outline and current Flood Zone 3 of the Flood Map for Planning. These are most likely a product of modelled flood extents being 'cleaned' (removal of small holes in the outlines, smoothing any geometry errors) before being used to update the Flood Map. However, there is not a significant difference in the outlines to affect the assessment of risk at the site. • At the time of writing, the 2010 model is consistent with the Flood Map for Planning. The updated 2019 MSC model is due to update the Flood Map in late-2020. This Level 2 assessment should be revisited then. • Provision for safe access and egress routes will prove challenging in both events. • The 2010 model did include climate change modelling of +20% uplifts. Due to the requirements of 1D mapping and the channelised form of the canal, it was deemed too assumptive to both remodel and produce outlines from climate change scenarios. As the 1% AEP + 70% climate change is often similar in flows and outlines to the 0.1% AEP extent, a decision was made not to model climate change rather to use the existing 0.1% AEP event as proxy. The updated 2019 MSC model will include climate change outlines.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• There are no defences on the MSC according to the EA's Spatial Flood Defences dataset.
Flood Warning Area	• The site lies outside of any current EA FWAs.
Natural Flood Management / Working with Natural	• The site lies within areas highlighted for tree planting in the WwNP dataset. These areas can significantly delay the timing of peak runoff.

Site S/CAD/060 – Irlam Locks Tower Site	
Processes	
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the new development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).** • **It is understood that, at the time of writing, the Ship Canal is being remodelled by the EA. It is expected that this model will be completed and used to update the Flood Map for Planning by late-2020.** • **97% of the site is within Flood Zone 3a however, as the current model is 1D only, depths, velocities and hazards cannot be determined as required.** • **Once the updated model is made available by the EA, this Level 2 assessment should be revisited and updated.** • **Based on the current, limited information, ideally, the areas within Flood Zone 3 should remain as open greenspace and allowed to flood naturally, providing flood storage and continued social/amenity value for the local community.** • **As the MSC is not classified as 'Main River' there is no EA requirement for a no-development buffer zone of 8 metres along the left bank of the Canal. However, this is still considered good practice with any further advice should be given from the Peel Group.** • **Consultation should be had between the LPA, the EA, the developer and Peel Ports regarding any development at this site. Peel Ports is the owner and operator of the Ship Canal and also owns land around the Canal.** • **To consider development in Flood Zone 3a, the developer would need to find room for compensatory storage which is not available onsite. The developer may consider placing development on stilts to raise the development out of the flood zone. This would however be a costly solution. A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards.** • **Safe access and egress routes must be available at times of flood, even for above ground floor accommodation. This may prove challenging for this site as the existing main route (Cadishead Way) is affected by fluvial flooding in the 1% AEP event. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.**
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity with the Manchester Ship Canal and River Irwell (old course), groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and is unlikely to be an issue in this instance.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	•

Site S/CAD/060 – Irlam Locks Tower Site	
	• The extent shows the worst credible area that is susceptible to dam breach flooding. The map should be used to prioritise areas for evacuation/early warning. • The extent of reservoir inundation comes from two reservoirs owned by United Utilities (Entwistle and Woodhead) and one owned by Lee (Shore Top). • Much of the reservoir network is owned and managed by United Utilities who monitor and maintain reservoirs as required. United Utilities own 43 reservoirs within Greater Manchester. • The chance of reservoir failure is very rare and there is an extremely good safety record in the UK with no loss of life due to reservoir flooding since 1925. • United Utilities' ongoing management of reservoirs ensures they do not cause flooding as their presence within the network of surrounding watercourses actually reduces the impact of excess rainfall. • All United Utilities operated reservoirs are managed in accordance with the Reservoirs Act and relevant Health and Safety legislation to ensure they do not fail such requirements. United Utilities also notes that the Environment Agency is responsible for ensuring compliance with the highlighted legislation. • United Utilities also wishes to highlight the drive for continued constructive communication with the relevant local authorities to ensure a coordinated approach to the delivery of site allocations. United Utilities are committed to continuing to work with the relevant Local Authorities and the Greater Manchester Combined Authority as site allocations progress further.

Site S/CAD/060 – Irlam Locks Tower Site

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

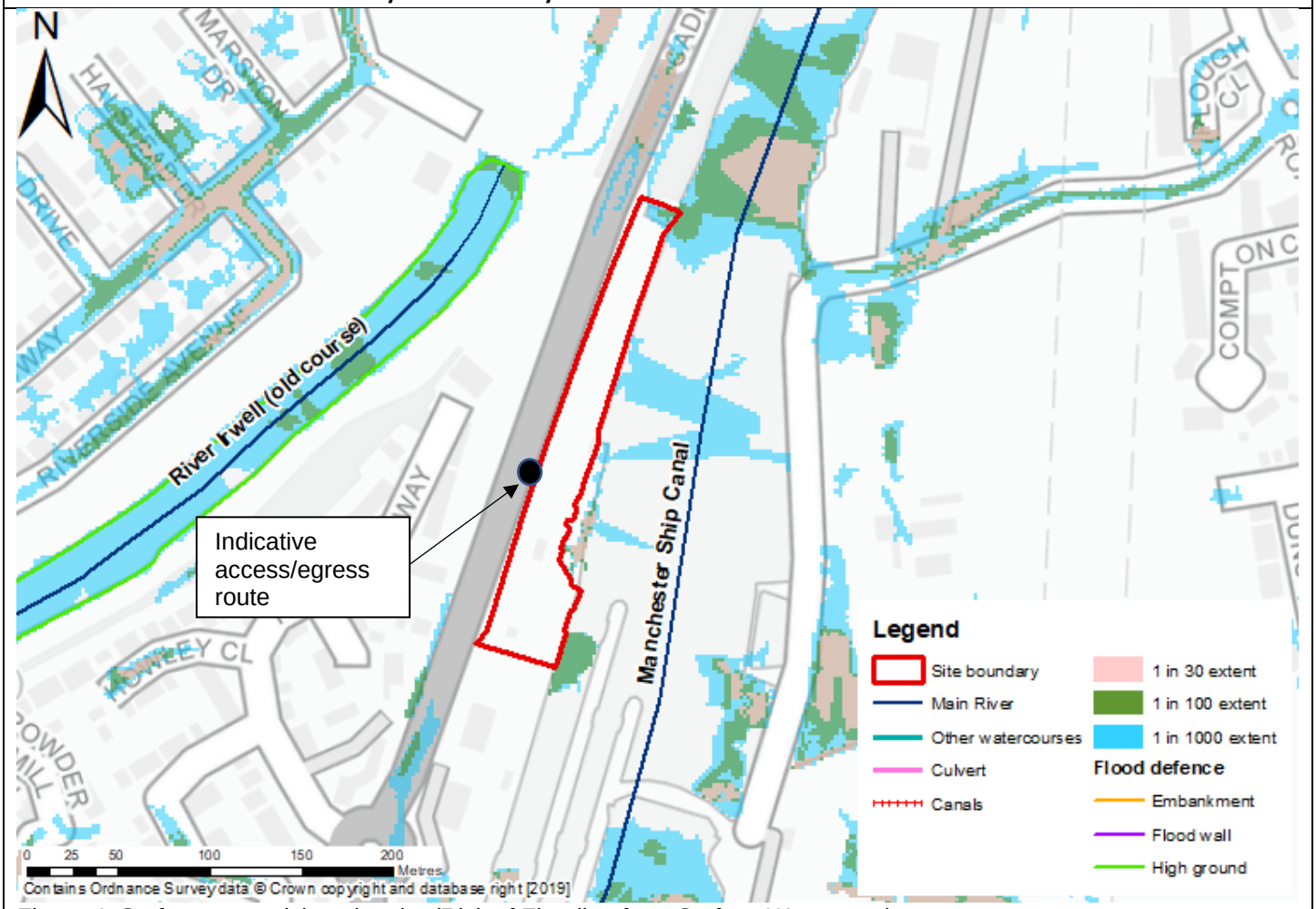


Figure 4: Surface water risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	0.00	0.68	2.39
Surface water flooding depths	Max: N/A	Max: 0.15 – 0.30m	Max: 0.30 – 0.60m
Surface water hazards	Max: N/A Mean: N/A	Max: Moderate Mean: Low	Max: Significant Mean: Low
Surface water flood risk to development site	• Less than 1% of the site is at risk of surface water flooding in the 1% AEP event. This is located in the north tip of the site. • Safe access and egress should be achievable via Cadishead Way.		
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP outline covers just over 2% of the site focussed in the north of the site boundary. • Safe access and egress should be achievable via Cadishead Way on the western boundary of the site.		

Site S/CAD/060 – Irlam Locks Tower Site

Mitigation options & site suitability: surface water	• **Surface water risk is considered to be nominal.** • **However, for the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and minimum flow rate of 5 l/s (in accordance with Rainfall runoff management for developments).**

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Minimum Flow 5 l/s (in accordance with Rainfall runoff management for developments)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	5.75	340	72	267	21.2	0.018 ha 2.580 %
30yr Rainfall+40%	6.75	410	85	325	25.7	0.022 ha 3.140 %
100yr Rainfall+20%	7	481	88	392 (125m^3 of exceedance storage)	31.1	0.026 ha 3.787 %
100yr Rainfall+40%	8.25	578	104	474 (149m^3 of exceedance storage)	37.5	0.032 ha 4.580 %

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.

Overall Site Assessment

Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **Based on existing information this site should not be developed for residential use and is unlikely to pass the Exception Test.** • **However, this Level 2 assessment must be revisited once updated modelling of the Ship Canal becomes available from the EA.**
Recommendation summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed]) or by emailing the local office SPPlanning.RFH@environment-agency.gov.uk The site should be reassessed once the Manchester Ship Canal 2019 model becomes available (late-2020). • Any FRA should include emergency planning procedures with particular consideration to safe access and egress routes in times of flood. A fully detailed emergency plan must be included and consulted on with Peel Ports.
FRA requirements	•

Site S/CAD/060 – Irlam Locks Tower Site	
	• Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. • Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services.
LPA decision on development	• **The Council is to leave this site in the land supply but for the longer term (10+ years), pending the updated MSC modelling.**

Site S/KER/018 - Land at Kersal Way	
Location	Kersal Way, Salford
Site area (ha)	4.66
Watercourse	River Irwell
EA Model used	Lower Irwell 2018
Existing use	Majority Greenfield
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	4.66

Flood outlines (present day)

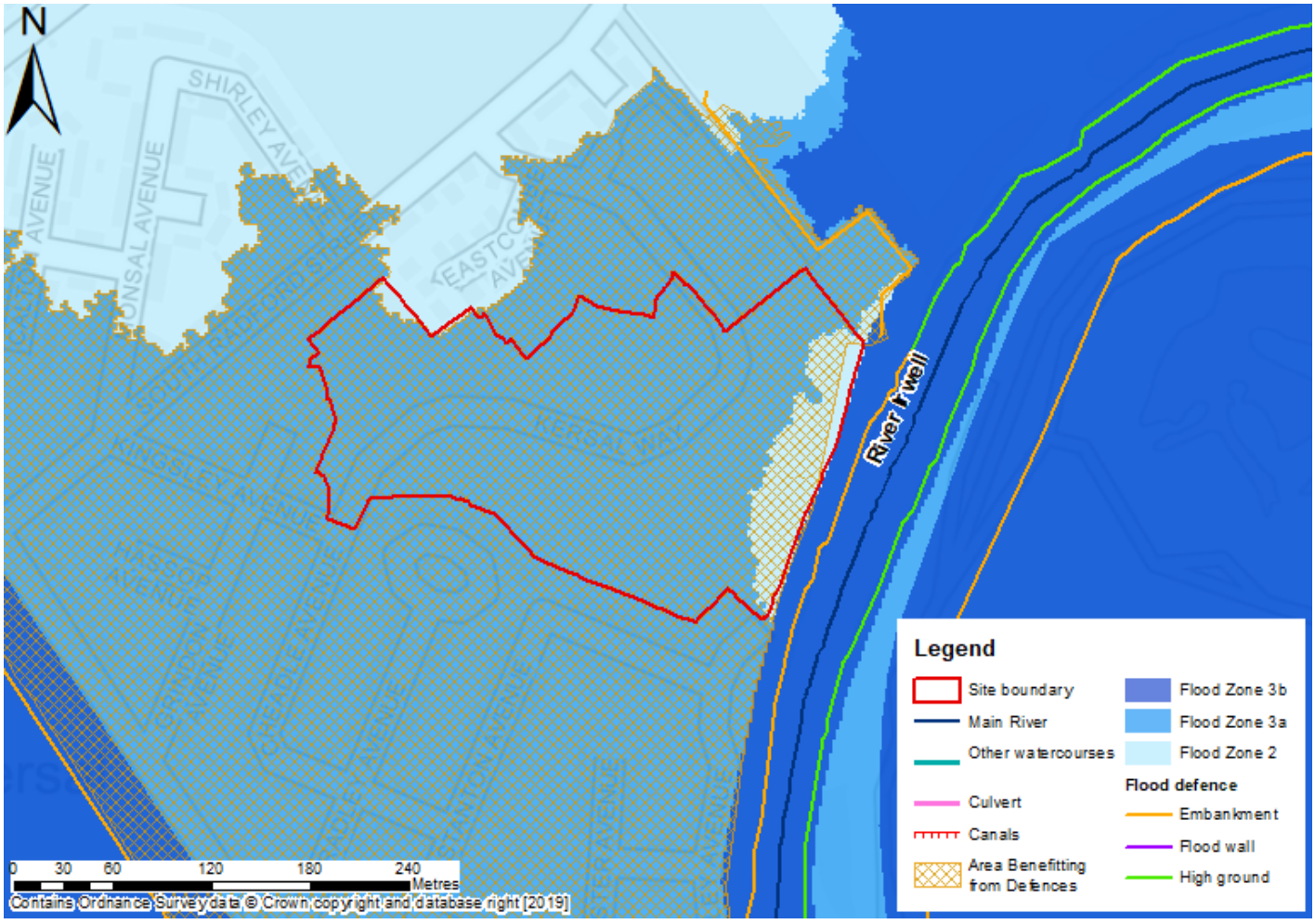


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences

- The site is almost wholly within an Area Benefitting from Defences (ABD). The site is therefore protected from a 1% AEP fluvial flood event by the EA embankment on the left bank of the Irwell.

Site S/KER/018 - Land at Kersal Way



Figure 2: Site with 2m 2017 LIDAR (elevation data)

- The proposed site is located at Kersal Way, bordering the River Irwell to the east. The Irwell is flowing in a northerly direction before flowing south as part of a large meander.
- The site has an average elevation of approximately 31m AOD. Kersal Way is generally inset half a metre lower than surrounding site levels.
- There is a strip of higher ground adjacent to the Irwell on the east boundary at approximately 37m AOD. This is reflected in the Flood Map for Planning in Figure 1.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	0.00	89.14	10.86	97.53
Fluvial: average depth (m)	Not applicable	0.83	1.65	1.13
Fluvial: maximum depth (m)	Not applicable	1.90	3.25	2.70
Fluvial: average hazard	Not applicable	Significant	Significant	Significant
Fluvial: maximum hazard	Not applicable	Significant	Significant	Significant

Site S/KER/018 - Land at Kersal Way

Modelled fluvial risk and climate change (Lower Irwell 2018 model).

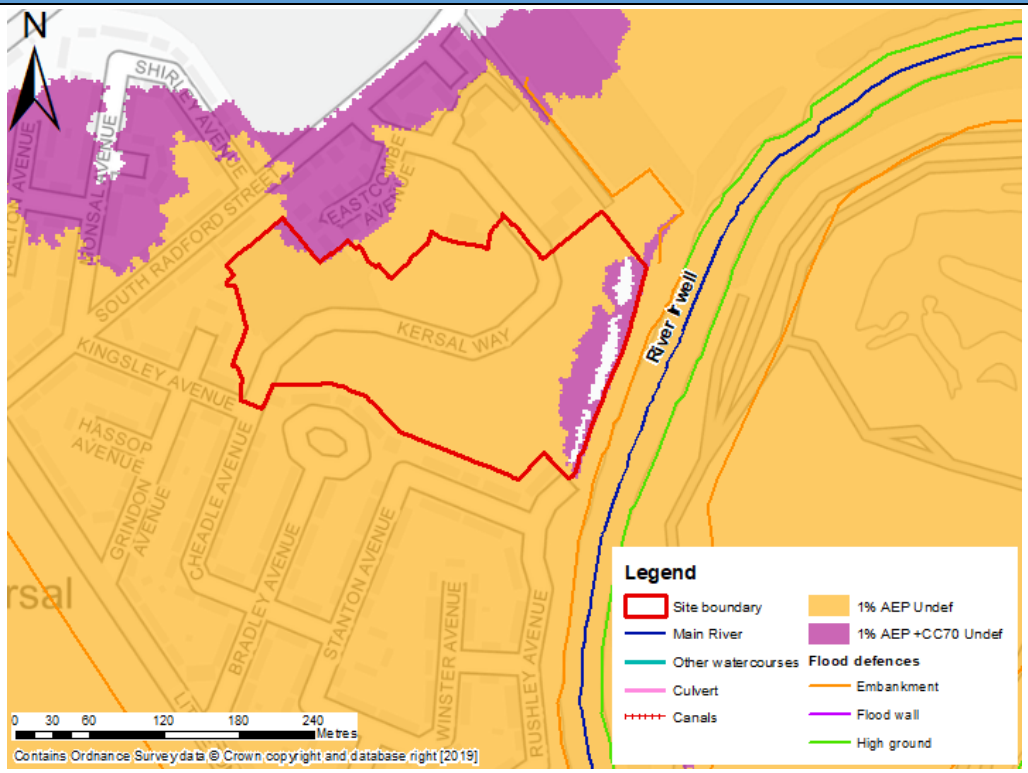
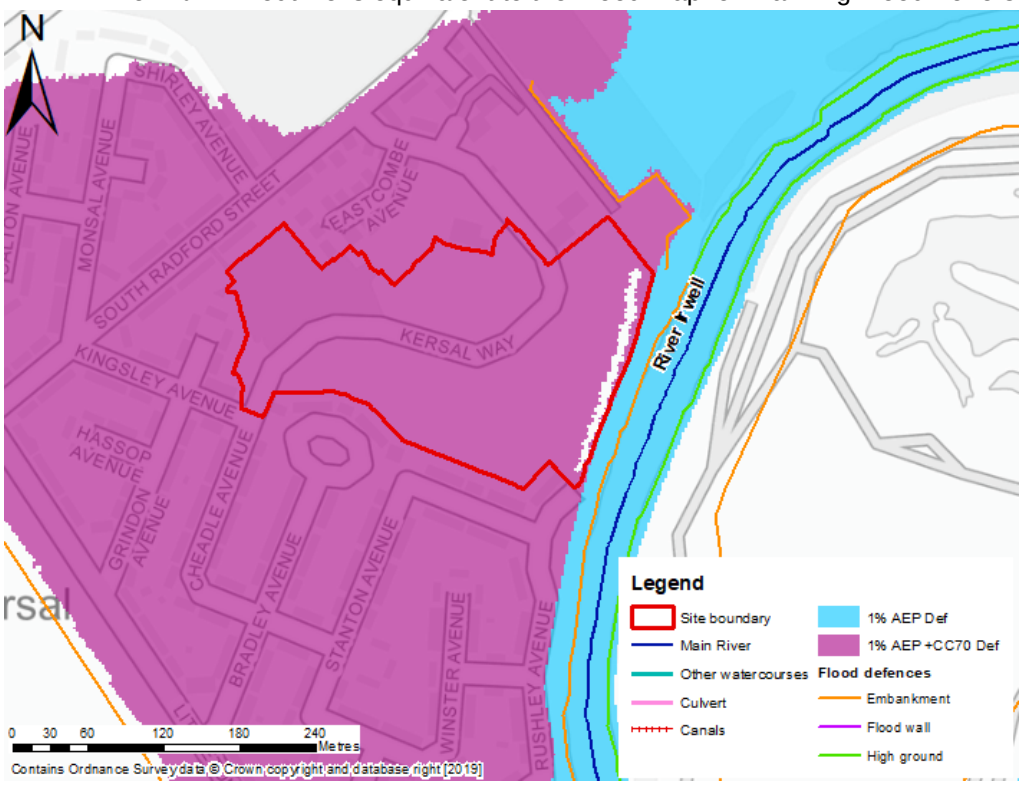


Figure 3: Undefended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% climate change uplift.

- Almost 90% of the site is covered by the present day 1% AEP increasing to approximately 97% coverage from the 70% climate change uplift.
- In a 1% AEP +70% event, flood depths across the site reach up to 2.7 metres above the lowest parts of the site.
- The 1% AEP outline is equivalent to the Flood Map for Planning Flood Zone 3.



Site S/KER/018 - Land at Kersal Way	
	Figure 4: Defended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% climate change uplift • The entire site lies outside of the present day 1% AEP defended outline, and only experiences inundation during the 70% climate change uplift.
Historic flooding	• The entire site lies within the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defence dataset, the River Irwell is bounded by a formal flood embankment which is assessed at condition grade 2 and 3 meaning 'Good' and 'Fair' respectively (Table 1.1 Conditions Assessment Manual[1]). • As shown by the ABD, the site is protected from fluvial flooding for a 100 year Standard of Protection
Flood Warning Area	• The entire site lies within two EA FWAs; the FWAs are for the River Irwell at Salford, Area B, and River Irwell at Salford, Area C.
Natural Flood Management / Working with Natural Processes	• The majority of the site is within the Urban Loss Improvement zone of the Irwell NFM dataset. This means that the potential impact of the 'street trees' or 'low density urban tree planting' should be considered as one of many possible SuDS type interventions.
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG).** • **The Council states that the HELAA assumes 60 houses but not before 2029. This low density (site is 4.6ha) is to allow for compensatory flood storage. It is unknown where this storage area would be located.** • **89% of the site is located within Flood Zone 3 according to the Flood Map for Planning, however the whole of this Flood Zone 3a area of the site is within an ABD, making the risk residual (Figure 1). The modelled 1% AEP undefended event + climate change (Figure 3) and the defended 1% AEP + climate change (Figure 4) cover virtually the whole site, with the exception of the strip of high ground adjacent to the Irwell.** • **It is clear from the modelling that the site is protected by flood defence infrastructure and can therefore be described as being at residual risk of defence failure or overtopping without being at direct risk of fluvial flooding. However, the main issue with this site is the effects of climate change and the fact that the site is not defended in the long term, as shown by the modelled defended climate change outline in Figure 4. Flood depths are also significant (up to 2.7 m with climate change (+70%)) and will be difficult to mitigate.** • **Regarding the location of the site within an EA ABD, the EA states that EA defences are there to protect existing communities and are not normally built or maintained to facilitate new development in high flood risk areas, such as this. The EA cannot guarantee how long they will maintain the defences for as this depends on changes to Government funding and priorities.** • **However, it is reasonable to assume that in the middle of a major conurbation, the EA will not allow the current defences to fall into disrepair**

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site S/KER/018 - Land at Kersal Way	
	and will maintain them at their current bank height. In the particular case of Lower Broughton, the second flood basin was partially funded with Growth funding from Government, with the explicit intention of unlocking development potential. This is purely a case of new development benefiting from the defences that are already there to protect existing communities. • **The EA has stated that further interventions will be required for the Lower Broughton area to address the impacts of climate change if standards of protection are to be maintained.** • **There are a number of development options that may be explored, such as land raising or ensuring finished floor levels are above the 100 year plus climate change flood level plus 600 mm freeboard. Compensatory storage would however have to be found; there is no space onsite or nearby the site to enable this. Stilted development is a further option that has been used for other developments in Salford. However, this is likely to be an expensive design solution.** • **A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at times of flood, even for above ground floor accommodation. Site design and layout would have to determine safe access and egress routes which does not appear possible when accounting for climate change and existing residual risk. All such options should be subject to detailed investigation, planning and consultation with the appropriate RMAs. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.** • **Defence breach and overtopping scenarios should be modelled at the FRA stage to ascertain residual risk and to help formulate robust emergency plans for all site users to be aware of in times of flood, including for safe access and egress routes.** • **Ideally, this site would not be developed for residential use. It should be the case that any future development at this site should be considered sustainable without continued reliance on EA flood defence investment and maintenance. Also recommend updated asset inspections as part of any pre-development plans.**
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the proximity of the site to the River Irwell, it is likely that the groundwater levels will be similar to the corresponding levels in the river. Groundwater will follow topography and is unlikely to be an issue in this instance.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	• • •

Site S/KER/018 - Land at Kersal Way	
	• Much of the reservoir network is owned and managed by United Utilities who monitor and maintain reservoirs as required. United Utilities own 43 reservoirs within Greater Manchester. • The chance of reservoir failure is very rare and there is an extremely good safety record in the UK with no loss of life due to reservoir flooding since 1925. • United Utilities' ongoing management of reservoirs ensures they do not cause flooding as their presence within the network of surrounding watercourses actually reduces the impact of excess rainfall. • All United Utilities operated reservoirs are managed in accordance with the Reservoirs Act and relevant Health and Safety legislation to ensure they do not fail such requirements. United Utilities also notes that the Environment Agency is responsible for ensuring compliance with the highlighted legislation. • United Utilities also wishes to highlight the drive for continued constructive communication with the relevant local authorities to ensure a coordinated approach to the delivery of site allocations. United Utilities are committed to continuing to work with the relevant Local Authorities and the Greater Manchester Combined Authority as site allocations progress further.
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• No canals in the vicinity of the site.
Flood Source: Surface Water	

Surface Water Flood Risk to Proposed Development Site

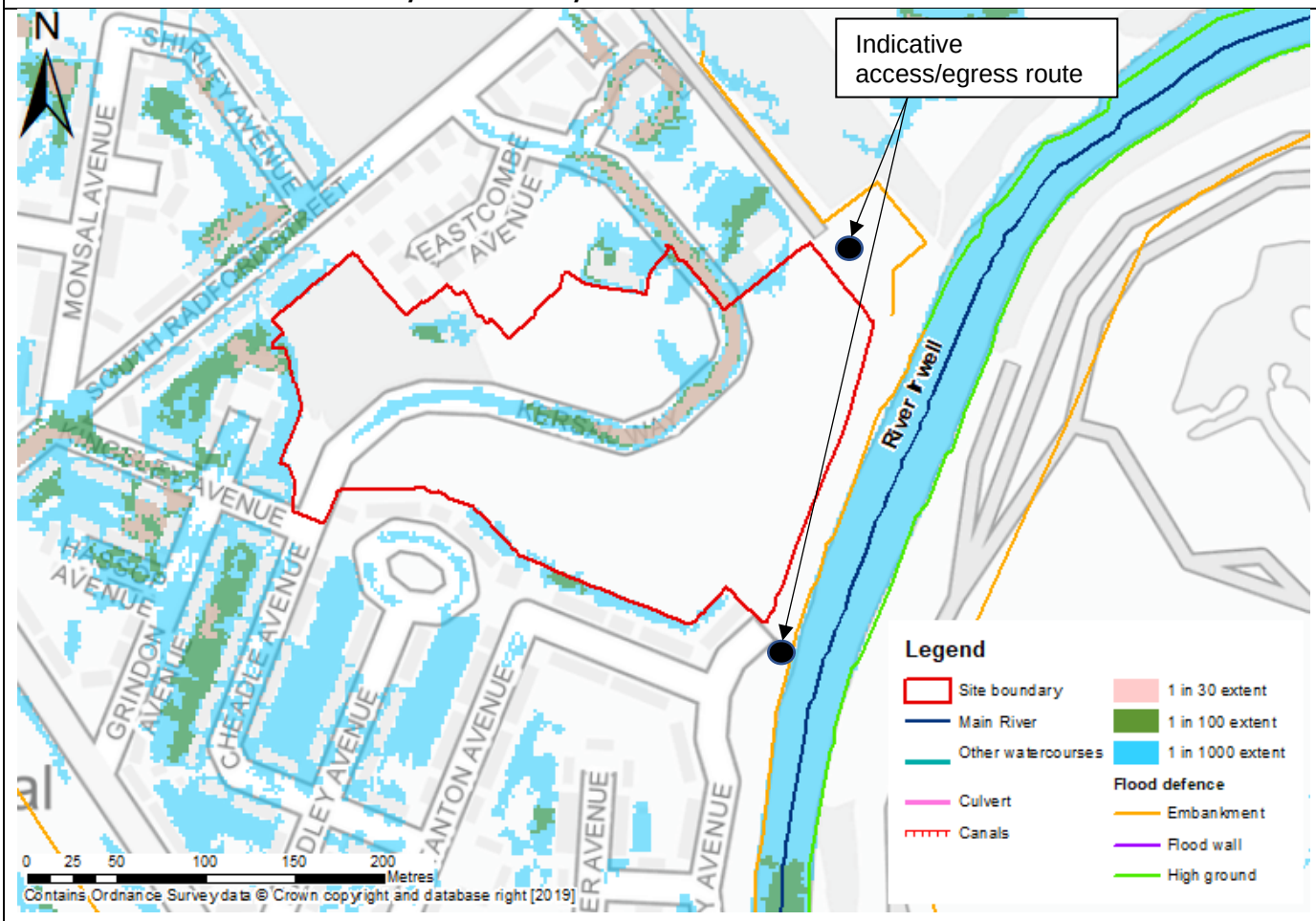


Figure 2: Surface water risk to the site (Risk of Flooding from Surface Water map)

Site S/KER/018 - Land at Kersal Way			
Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	1.97	3.34	10.09
Surface water flooding depths	Max: 0.30 – 0.60m	Max: 0.30 – 0.60m	Max: 0.60 – 0.90m
Surface water hazards	Max: Moderate Mean: Moderate	Max: Moderate Mean: Moderate	Max: Significant Mean: Moderate
Surface water flood risk to development site	• Surface water flood risk during the 3.33% and 1% AEP events is mainly constrained to the Kersal Way road to the north and centre of the site. • Safe access and egress should be achievable via Rushley Avenue to the south and via a footpath to the north.		
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP extent is mainly constrained to the Kersal Way road with small pools of inundation within the site. • Safe access and egress should be achievable in the longer term via the routes annotated in Figure 5.		

Mitigation options & site suitability: surface water	• **Surface water risk is not considered significant. Development is achievable throughout the majority of the site based on surface water risk only.**
	• **However, any new development should include a drainage strategy ensuring runoff rates do not exceed current rates and if possible, betterment of existing rates should be aimed for.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (l/s).**		

Site S/KER/018 - Land at Kersal Way

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Qbar: 29 l/s (FEH Statistical)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	8.75	2677	639	2037	27.8	0.136 ha 2.914 %
30yr Rainfall+40%	10.75	3281	786	2495	34.0	0.166 ha 3.569 %
100yr Rainfall+20%	11	3778	804	2974 (937m^3 of exceedance storage)	40.6	0.198 ha 4.255 %
100yr Rainfall+40%	12**	4488	877	3611 (1116m^3 of exceedance storage)	49.3	0.241 ha 5.166 %

**limited to 12 hour critical storm duration

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.

Overall Site Assessment

Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **To pass the Exception Test, it must be proven that the development will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.** • **Due to the location of this site being within an existing community that already benefits from built defences, it is not seen as the same level of risk as if the site was on a newly allocated development area. Residual risk to the site remains due to it being within an area benefiting from** • **defences. Options discussed in this Level 2 SFRA should be explored through appropriate options modelling to assess the likelihood of the site passing the Exception Test.**
Recommendation summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed]) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk It is recommended that this site is not developed for residential use, given the existing residual risk and long-term risk from climate change. • However, options modelling should be carried out to assess potential safe development. •

Site S/KER/018 - Land at Kersal Way	
	• Were development to proceed, detailed emergency plans must be developed and be in place for all site users for the lifetime of the development and they must be continually updated as and when new information becomes available.
FRA requirements	• Any FRA should include modelling of residual risk from the Irwell (breach, defence overtopping). Condition inspections would be required to assess the defences that line the River Irwell. • Options modelling of site design and layout to assess potential for safe development. • The FRA should include a drainage strategy for the proposed new development layout, assuming development planning is to proceed. UU requirements should be met, as discussed in this Level 2 SFRA. Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. • Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services.
LPA decision on development	• **Site to remain in the longer term (10+ years) land supply.** • **The anticipated density on this site based on figures in the HELAA is approximately 13 dwellings per hectare – about 50% down on what expected densities, in order to leave space to design compensatory flood storage.**

Site S/ORD/087 – Land bounded by Ordsall Lane, Dyer Street and Worrall Street	
Location	Worrall Street, Salford
Site area (ha)	1.29
Watercourse	Manchester Ship Canal
EA Model used	Manchester Ship Canal 2D model, 2011
Existing use	Industrial estate, existing buildings
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	1.29

Flood outlines (present day)

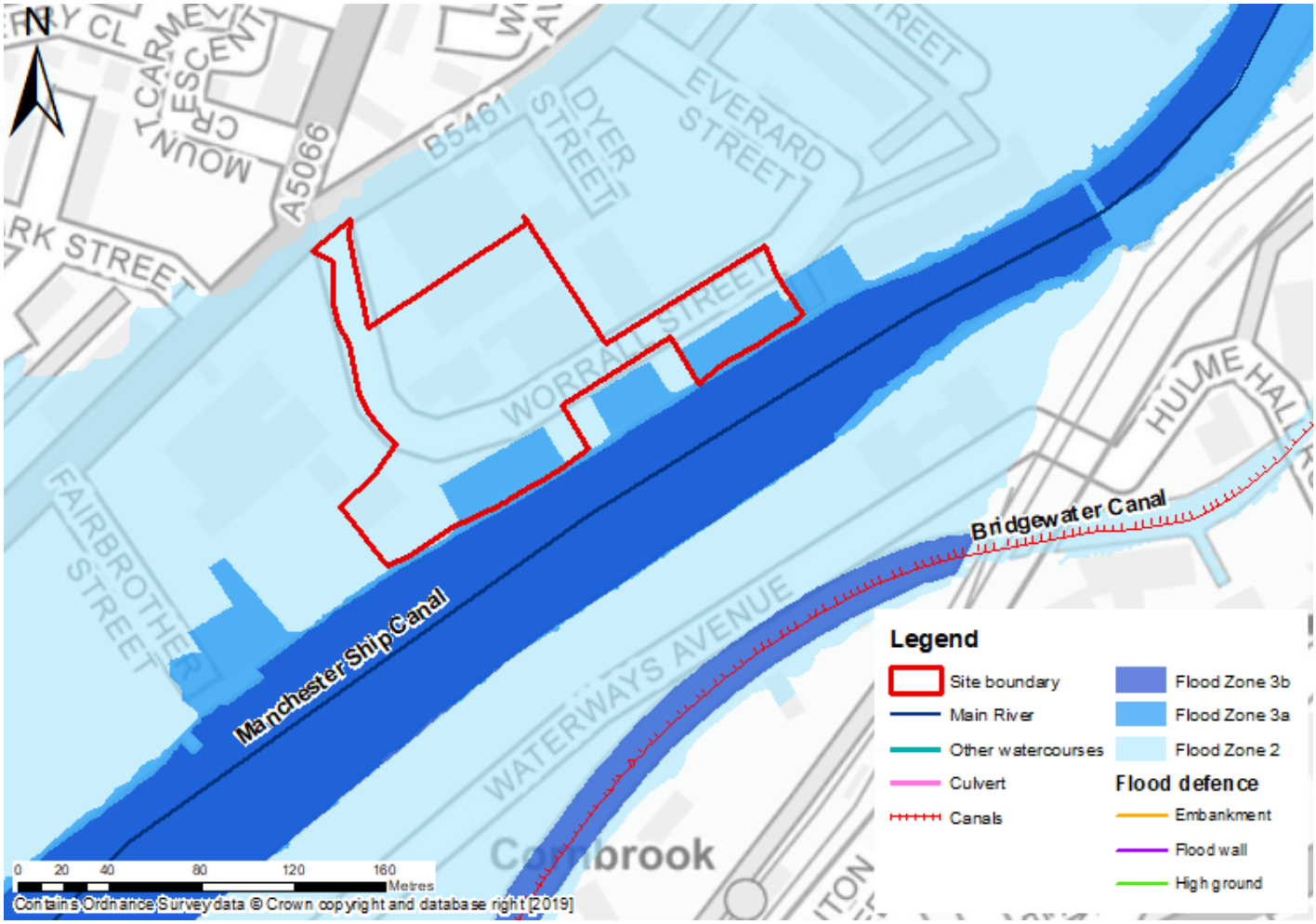


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning)

Note: Flood Map for Planning subject to change once Manchester Ship Canal model has been updated by the EA

Site S/ORD/087 – Land bounded by Ordsall Lane, Dyer Street and Worrall Street

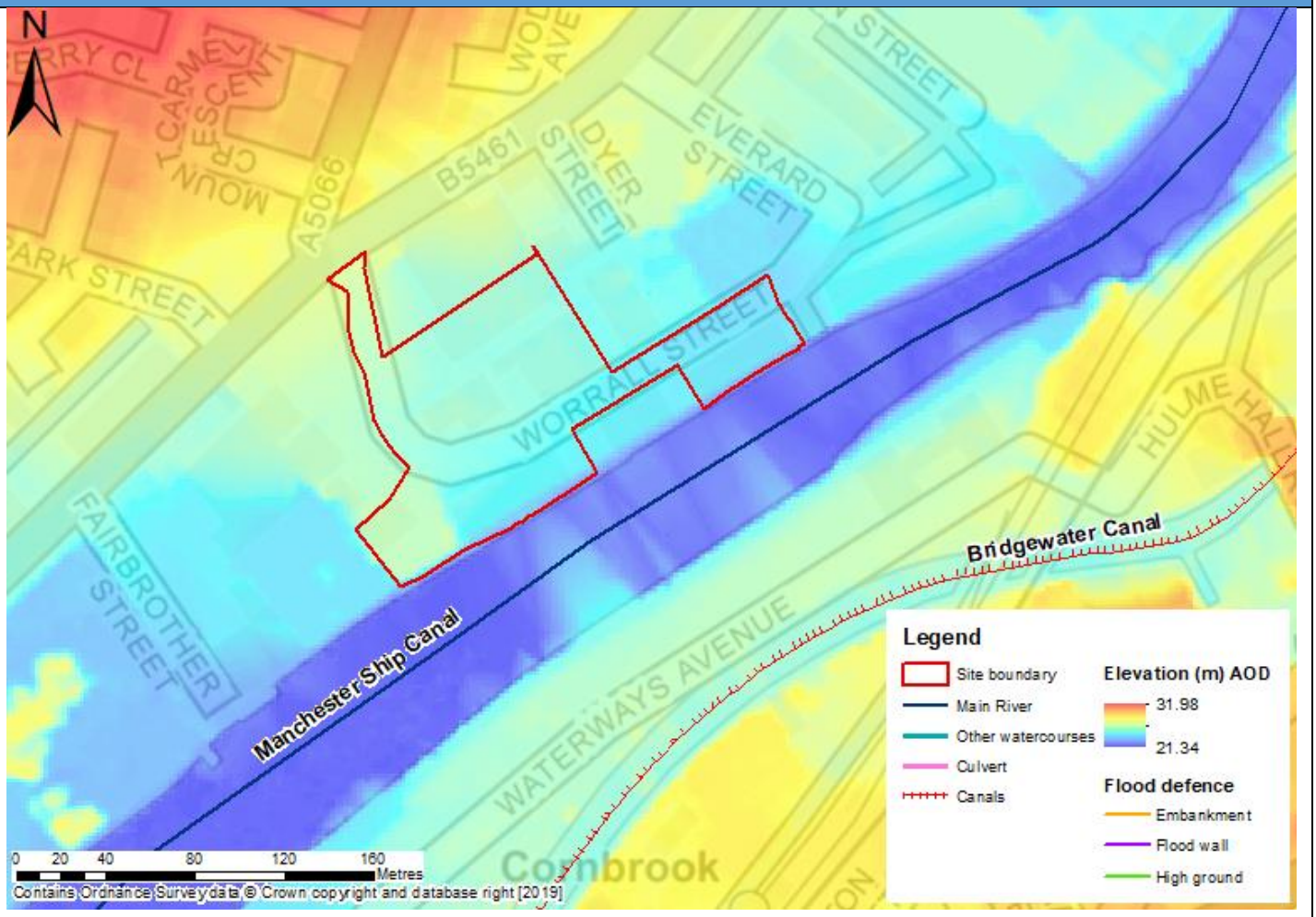


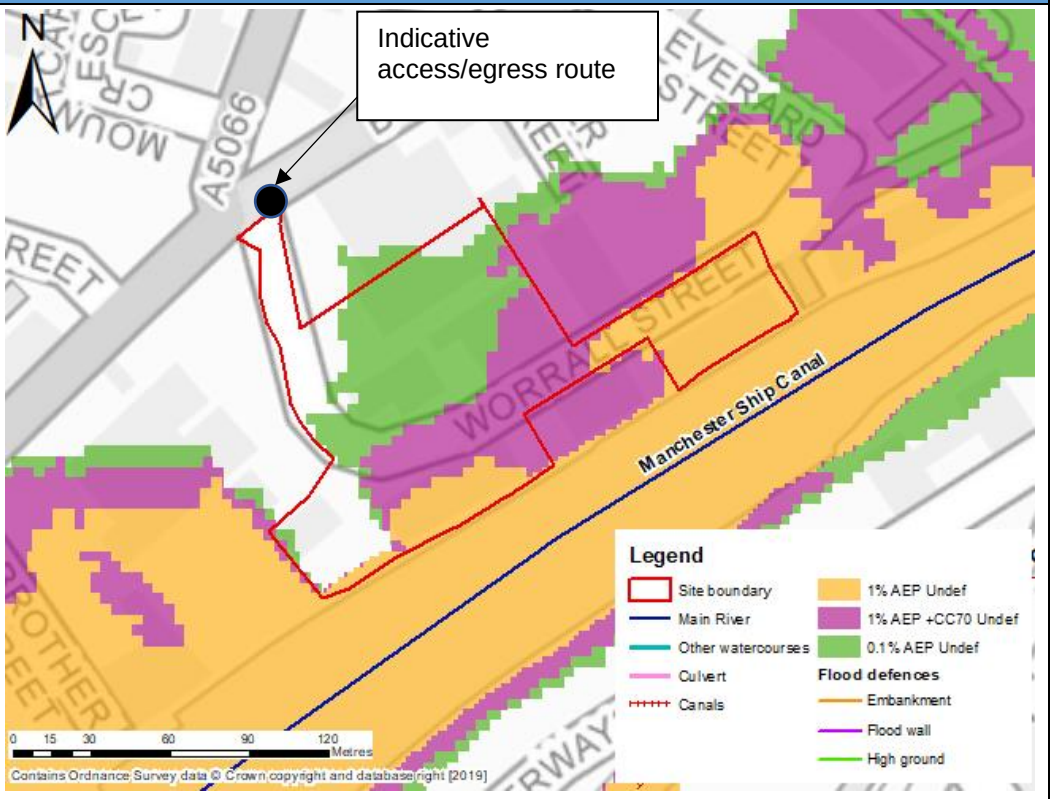
Figure 2: Site with 2m 2017 LIDAR (elevation data)

- The elevation of the site is highest in the west at approximately 26 m AOD sloping down towards the east to approximately 25 m AOD.
- The Manchester Ship Canal to the south of the site is at a lower elevation of approximately 22 m AOD and the residential area in the north is at approximately 30 m AOD.
- The Manchester Ship Canal flows from the north east in a south westerly direction along the southern site boundary.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	0.00	14.53	85.47	47.28
Fluvial: average depth (m)	Not applicable	0.46	0.71	0.76
Fluvial: maximum depth (m)	Not applicable	2.20	3.25	2.93
Fluvial: average hazard	Not applicable	Moderate	Significant	Significant
Fluvial: maximum hazard	Not applicable	Significant	Significant	Significant

Site S/ORD/087 – Land bounded by Ordsall Lane, Dyer Street and Worrall Street	
Modelled fluvial risk and climate change (Manchester Ship Canal, 2011)	 Figure 4: modelled undefended outlines for the present day 1% and 0.1% AEP events, and future risk 1% AEP +70% climate change uplift • The modelled flood outlines are not consistent with the Flood Map for Planning e.g. Flood Zone 3 is different to the 1% AEP undefended event outline. It appears Flood Zone 3 has been manually edited to fully cover the three existing buildings along the southern boundary of the site. Flood Zone 2 is entirely different to the modelled undefended 1% AEP event. The MSC is, at the time of writing, being updated by the EA. The Flood Map is due for subsequent updates mid-2020. • Just over 24% of the site is located within the 1% AEP event outline with the climate change +70% outline extending to cover over 47% of the site. Maximum depths reach just under 3 metres and averaging around 750 mm. • Safe access and egress should be possible via B5461 to the north of the site.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, there are no formal defences located close to the site.
Flood Warning Area	• The site does not lie within any current EA FWAs.
Natural Flood Management / Working with Natural Processes	• This site lies outside any areas in the WwNP or NFM datasets.
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the new development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).**

Site S/ORD/087 – Land bounded by Ordsall Lane, Dyer Street and Worrall Street	
	• **The Council states that the HELAA assumes development of 200 apartments.** • **It is understood that, at the time of writing, the Ship Canal is being remodelled by the EA. It is expected that this model will be completed and used to update the Flood Map for Planning in late-2020. Once the updated model is made available by the EA, this Level 2 assessment should be revisited and updated.** • **The current Flood Map uses outlines from the 2010 MSC model which would provide some explanation towards the discrepancies between the modelled outlines and published mapping.** • **Based on current information, approximately 15% of the site is within Flood Zone 3a. According to the 2011 model, maximum flood depths within the 1% AEP (equivalent to Flood Zone 3a) are significant at over 2 m and the maximum flood hazard to people rating[1] is 'Significant'. Residential development should not be permitted in Flood Zone 3a. Climate change depths are considerable with maximums of just under 3 m and an average of around 750 mm.** • **Flood Zone 3a is isolated to the south of the site where it borders with Manchester Ship Canal. Development should be directed north of this area and should also avoid the areas at risk from climate change given the significant flood depths. This will significantly reduce the developable area.** • **As the MSC is not classified as 'Main River' there is no EA requirement to leave an 8 metre easement alongside the left bank of the canal. Though this can still be considered good practice to maintain, any further information on this should be procured from the Peel Group.** • **The risk area is currently industrial developments and open carparks. It is recommended that this area is converted to open greenspace to provide multiple benefits including flood storage, ecological value and social/amenity value for the community.** • **Consultation should be had between the LPA, the EA, the developer and Peel Ports regarding any development at this site. Peel Ports is the owner and operator of the Ship Canal and also owns land around the Canal.** • **To consider development in Flood Zone 3a, the developer would need to find room for compensatory storage which is not available onsite. The developer may consider placing development on stilts to raise the development out of the flood zone. This would however be a costly solution. A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards.** • **Safe access and egress routes must be available at times of flood, even for above ground floor accommodation. Site design and layout should further investigate the indicative locations shown on Figure's 1 and 3 of this Level 2 SFRA. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.**
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to the Manchester Ship Canal and River Irwell further upstream, groundwater levels are expected to be similar to the corresponding levels of the watercourses. Groundwater will follow topography and is unlikely to be an issue in this instance.

[1] Table 3.2, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR1 The Flood Risks to People Methodology, Defra, Environment Agency, March 2006

Site S/ORD/087 – Land bounded by Ordsall Lane, Dyer Street and Worrall Street	
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	•

Site S/ORD/087 – Land bounded by Ordsall Lane, Dyer Street and Worrall Street

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

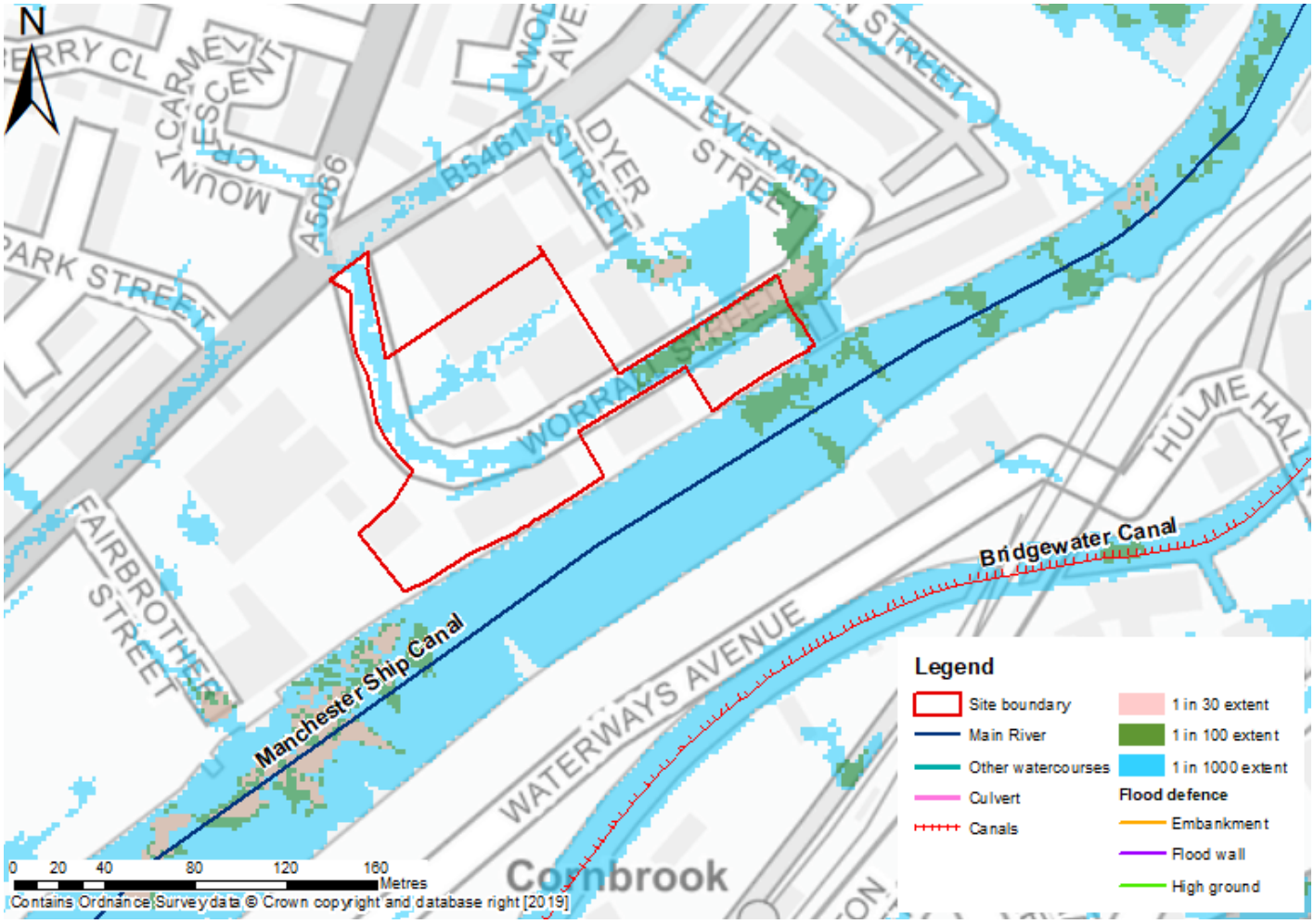


Figure 4: Surface water risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	2.54	7.23	26.89
Surface water flooding depths	Max: 0.30 – 0.60m	Max: 0.30 – 0.60m	Max: 0.60 – 0.90m
Surface water hazards	Max: Moderate Mean: Low	Max: Significant Mean: Moderate	Max: Significant Mean: Significant
Surface water flood risk to development site	• Approximately 7% of the total site area is at risk of surface water flooding in the 1% AEP event to a maximum depth of 900 mm. Risk is confined to a flow route along the existing road (Worrall Street) and constrained by existing buildings. • Safe access and egress do not appear to be achievable when taking the extreme 0.1% AEP event into account.		
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP outline covers approximately 27% of the site, which is mainly isolated to Worrall Street and constrained by existing buildings.		

Site S/ORD/087 – Land bounded by Ordsall Lane, Dyer Street and Worrall Street

	• Safe access and egress routes are not identifiable based on current layout.

Mitigation options & site suitability: surface water	• **It is assumed the current buildings on this site will be demolished to make way for new dwellings. This may significantly change the way surface water behaves on the site. A drainage strategy is required to ascertain flow routes once the site has been cleared and whether these can be attenuated onsite. The strategy should ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on proposed layout plans.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **The current drainage system should be assessed to ascertain whether the current system can accommodate residential development or whether further capacity is required. It is recommended that the current access road, Worrall Street, remains in place and is assessed for its current drainage capacity.**
	• **For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 100% impermeable area and limiting greenfield runoff rate of Qbar (l/s). It is noted that greenfield runoff rates and volumes may not be achievable for development of brownfield sites, therefore, values as close as reasonably practicable may be agreed with the LLFA.**

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Qbar: 7 l/s (FEH Statistical)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	11.75	912	207	705	39.9	0.047 ha 3.643 %
30yr Rainfall+40%	12	1069	212	858	48.5	0.057 ha 4.434 %
100yr Rainfall+20%	11.75*	1219	207	1012 ($307m^3$ of exceedance storage)	57.2	0.067 ha 5.230 %
100yr Rainfall+40%	12*	1428	212	1217 ($359m^3$ of exceedance storage)	68.8	0.081 ha 6.289 %

*limited to corresponding 30yr Rainfall critical storm duration

Site S/ORD/087 – Land bounded by Ordsall Lane, Dyer Street and Worrall Street	
Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.
Overall Site Assessment	
Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **It is likely this site can pass the Exception Test assuming development densities can be significantly reduced by directing development to flood Zones 1 and 2. However, the site should be reassessed once the 2019 MSC model becomes available.**
Recommendation summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed] or by emailing the local office SPPlanning.RFH@environment-agency.gov.uk The site should be reassessed once the Manchester Ship Canal 2019 model becomes available (late-2020). • Any FRA should include emergency planning procedures with consideration to safe access and egress routes in times of flood.
FRA requirements	• Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; • GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; • UU; the highways authorities; and emergency services. **The Council is to leave this site in the land supply but for the longer term (10+ years), pending the updated MSC modelling.**
LPA decision on development	•

Site SKH17067 – Factories at Compstall Village, Andrew Street, Romiley, Stockport	
Location	Andrew Street, Stockport
Site area (ha)	3.33
Watercourse	River Etherow
EA Model used	2004 Broadscale JFlow model
Existing use	Industrial
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	3.33

Flood outlines (present day)

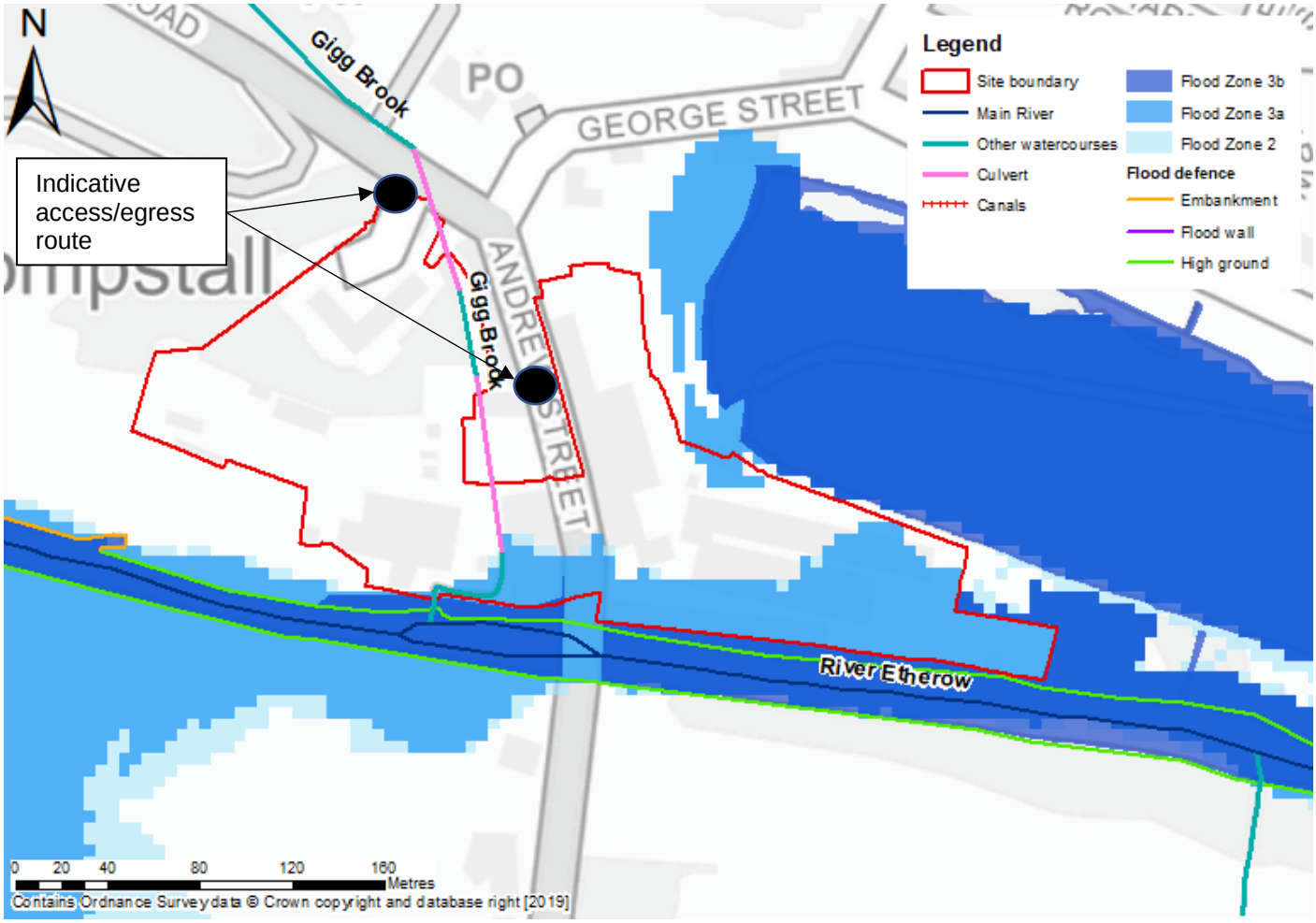


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences

Site SKH17067 – Factories at Compstall Village, Andrew Street, Romiley, Stockport

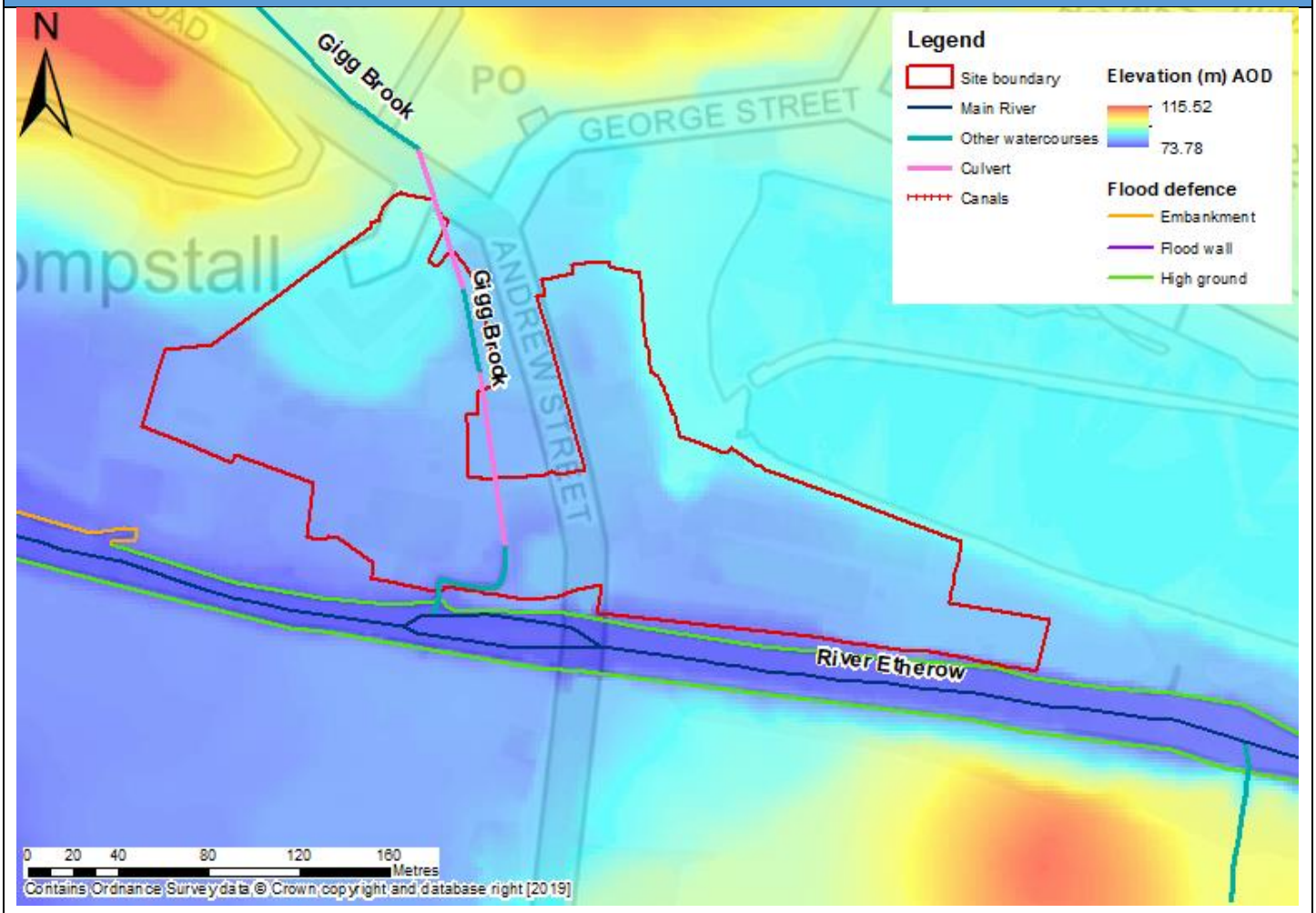


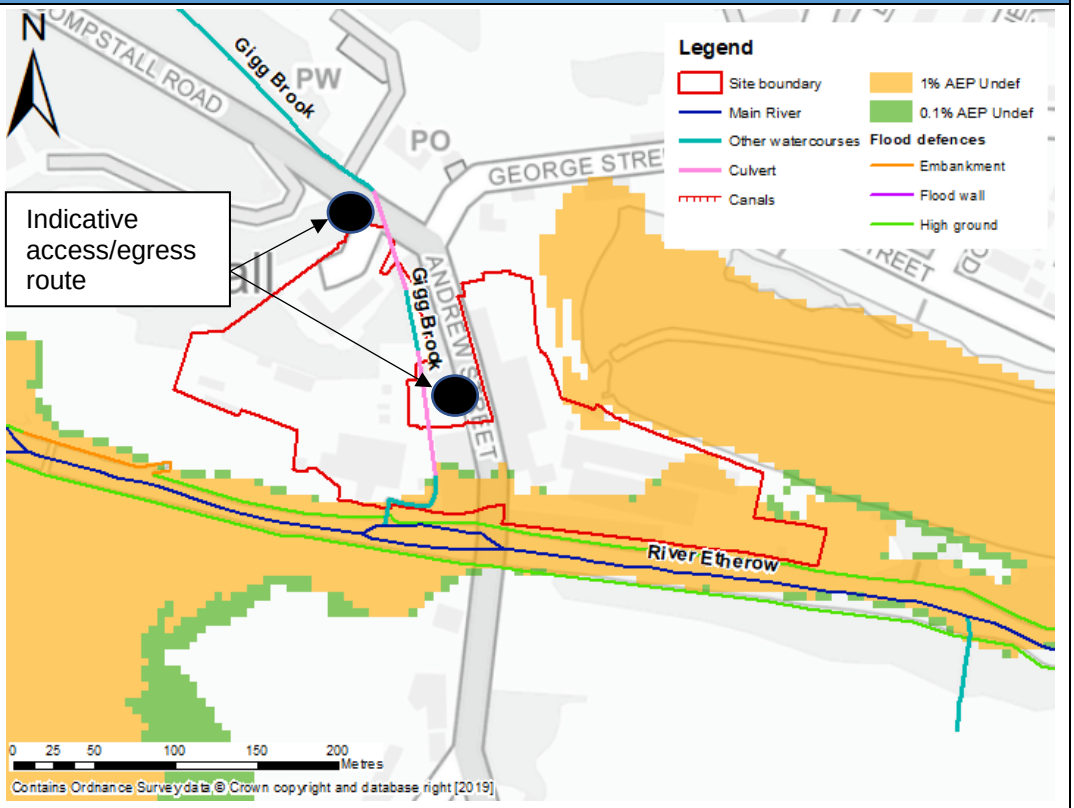
Figure 2: Site with 2m 2017 LIDAR (elevation data)

- The site is located either side of Andrew Street and the River Etherow (Main River) flows westward along the southern border.
- Gigg Brook (Ordinary Watercourse) flows southward through the site and joins the River Etherow at the south of the site after passing through two culverts.
- There is a lake to the east of the site.
- The site elevation is highest at the north of the site at an average elevation of approximately 90m AOD. The site then slopes down towards River Etherow in the south where the elevation is approximately 75m AOD.
- The surrounding area in the north-west has a much higher elevation of approximately 108m AOD.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change (unavailable from broadscale, FZ2 used as proxy)
	0.35	22.89	0.75	Not available
Fluvial: average depth (m)	Not applicable	0.98	1.08	Not available
Fluvial: maximum depth (m)	Not applicable	2.47	2.52	Not available
Fluvial: average hazard	Not applicable	Not available	Not available	Not available
Fluvial: maximum hazard	Not applicable	Not available	Not available	Not available

Site SKH17067 – Factories at Compstall Village, Andrew Street, Romiley, Stockport	
Modelled fluvial flood risk and climate change (2004 Broadscale JFlow model)	 Figure 2: Undefended fluvial outlines for the present day 1% AEP and 0.1% AEP event • The 1% AEP present day outline covers 23% of the site in the south; there were no climate change outlines produced as this model is broadscale JFlow modelling at a national scale. The EA has stated that it is unlikely that this area will be remodelled in the near future. • The modelled flood outlines are consistent with the Flood Map for Planning, so the 1% AEP outline is equivalent to Flood Zone 3. • Safe access and egress would be achievable to the centre of the site via Andrew Street and to the north west via Compstall Road.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, the river is bounded by areas of high ground which act as informal defences which are assessed at condition grade 3 meaning 'Fair' (Table 1.1 Conditions Assessment Manual[1]). • Towards the south-west, the site is defended by an embankment which is assessed at condition grade 3.
Flood Warning Area	• The eastern part of the site lies within an EA FWA; the FWA is for the River Etherow at Compstall.
Natural Flood Management / Working with Natural Processes	• The site lies almost wholly within areas of tree planting in the WwNP dataset. These areas can significantly delay the peak runoff in catchments.

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site SKH17067 – Factories at Compstall Village, Andrew Street, Romiley, Stockport	
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the new development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).** • **23% of the site is within Flood Zone 3a with significant average depths of almost 1 metre. Residential development should not be permitted in Flood Zone 3a. Flood Zone 3a is mainly isolated to the banks of the Etherow.** • **This site should be able to pass the Exception Test, based on current information, if development is directed to Flood Zone 1, mainly to the west of Gigg Brook. This should be possible though development yields may be impacted.** • **Any development in Flood Zone 3a or the climate change risk area would have to be constructed with finished floor levels above the 100 year plus climate change flood level plus 600 mm freeboard. Compensatory storage would however have to be found. There may be space onsite to be able to do this, however, compensatory storage options would have to modelled appropriately. Stilted development is a further option though is likely to be an expensive design solution.** • **A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at times of flood, even for above ground floor accommodation. Site design and layout should further investigate the indicative locations shown on Figure's 1, 3 and 4 of this Level 2 SFRA. All such options should be subject to detailed investigation, planning and consultation with the appropriate RMAs.** • **The effects of climate change have not been modelled, however by using Flood Zone 2 as a proxy, climate change may not cause significant additional fluvial risk to the site. This is most likely as a result of the topography which slopes down from the north of the site to the Etherow in the south. However, it is recommended that climate change is modelled as an update to this Level 2 SFRA. The EA agrees that an FRA will need to be supported by a hydraulic study to determine flood risk level with climate change allowances to set finished floor levels and compensatory flood storage where required. JFlow levels are not suitable to use in FRAs especially for major developments.** • **Gigg Brook is currently unmodelled. Risk from this watercourse and its culverted sections must be quantified before this site can be allocated. This should involve fluvial modelling, including for climate change. The outcomes of this modelling may further restrict development. The EA agrees with the need to model Gigg Brook. This should be carried out as part of an update to this Level 2 SFRA.** • **The culvert at the northern boundary of the site is approximately 65 metres long and the culvert in the centre of the site is approximately 78 metres long. The EA has agreed there will be residual risk associated with these culverts which should also be assessed at the FRA stage through blockage scenario modelling. Capacity and condition survey would be required to inform the modelling together with ownership and maintenance information. Access to the culverts will be required at all times, therefore development should not obstruct such access. Due to the 'ordinary watercourse' status, Stockport LLFA would be the consenting authority on whether to allow development over the culvert. The developer or site owner**

Site SKH17067 – Factories at Compstall Village, Andrew Street, Romiley, Stockport	
	must find out which permissions and licences are required to maintain, repair, build or remove anything in or around the culverts on Gigg Brook. Without appropriate permissions and licences the developer/site owner may be subject to a fine or imprisonment. • **Site layout and design must account for the onsite Gigg Brook watercourse which is both open channel and culverted. Maintenance details and procedures must be in place to avoid residual risk from possible blockages. Site design and planning should look into opening up parts of the culverts where possible and creating an open channel to reduce flood risk and improve WFD status. As the Etherow at this location is classified as 'ordinary watercourse' there is no requirement to include the 8 metre no development buffer. Though this is good common practice to keep as is recommended by the EA for watercourse access and maintenance purposes. This should be in place along Gigg Brook and the River Etherow.** • **The risk area from the Etherow should be converted to open greenspace in the form of a blue/green corridor to provide multiple benefits including flood storage, ecological value and social/amenity value for the community. The same should be considered for Gigg Brook once risk is defined.** • **The River Etherow flows through a bridge under Compstall Road to the south of the site boundary. The bridge contains a central pillar within the watercourse. This bridge should be subject to a condition survey and also blockage scenario modelling. This bridge will have significant influence on flood risk at the proposed site.** • **It is assumed that the lake at the eastern boundary of the site has been modelled as part of the 2009 Etherow model, judging by the flood outlines. It also appears the lake is fed by the Etherow upstream. Details on level controls, controlled releases and maintenance procedures should be ascertained.** • **Safe access and egress routes must be available at times of flood, as indicated in Figures 1 and 3. Routes should be confirmed at the site design stage. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.**
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity with the River Etherow, it is expected that the groundwater levels will be similar to the corresponding levels in the river. Groundwater will follow topography and is unlikely to be an issue in this instance.

Site SKH17067 – Factories at Compstall Village, Andrew Street, Romiley, Stockport	
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	• • • • • • • •
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• There are no canals in the vicinity of this site.

Site SKH17067 – Factories at Compstall Village, Andrew Street, Romiley, Stockport

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

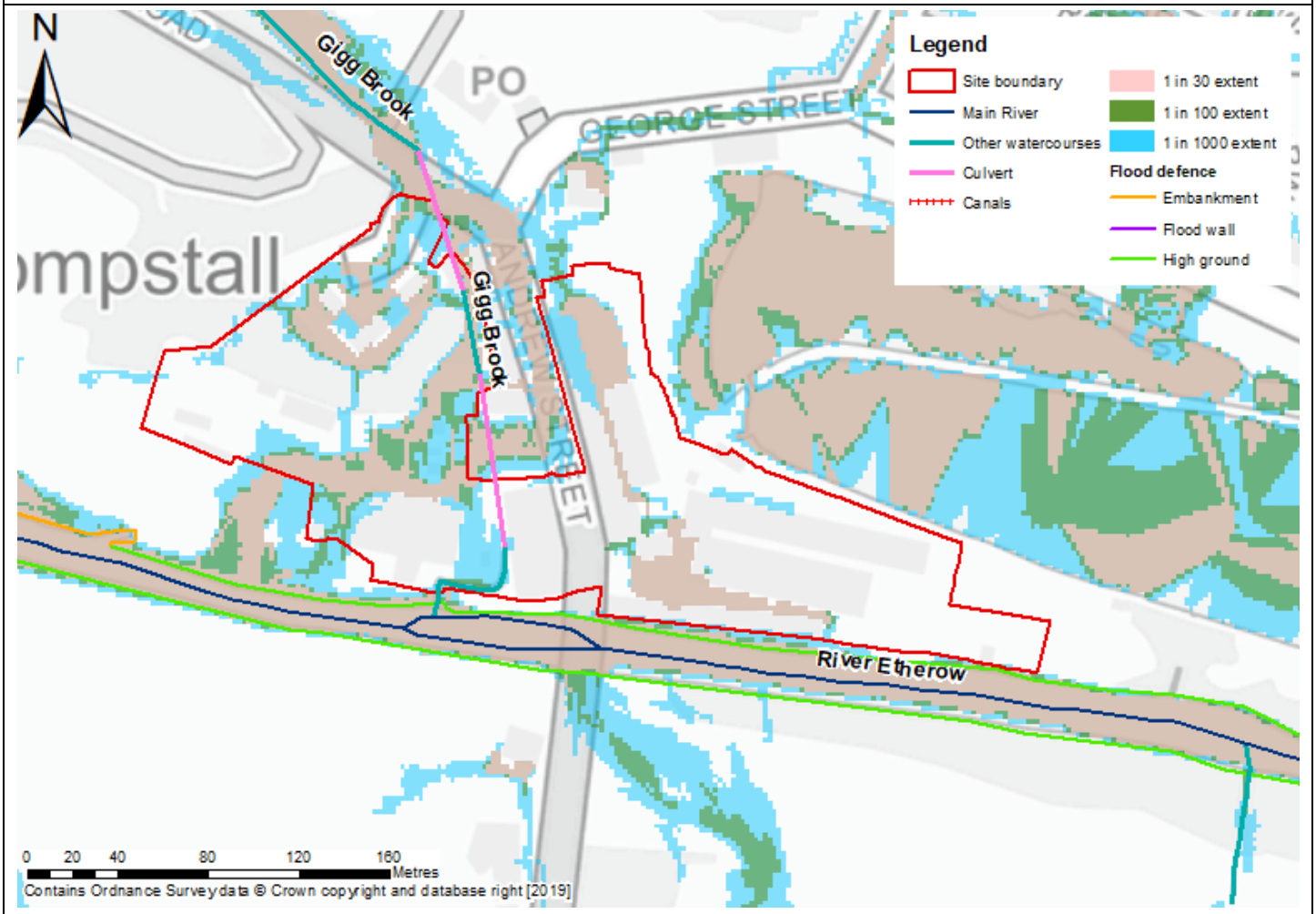


Figure 4: Surface water flood risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	15.88	20.72	33.39
Surface water flooding depths	Max: >1.20m	Max: >1.20m	Max: >1.20m
Surface water hazards	Max: Significant Mean: Low	Max: Significant Mean: Low	Max: Significant Mean: Moderate
Surface water flood risk to development site	• Almost 21% of the total site area is at risk of surface water flooding in the 1% AEP event with maximum depths exceeding 1.2 m. This is primarily to the west of Andrew Street though there is also a significant flow path to the east. • There are several surface water flow paths onsite that originate offsite to the north and follow topography down to the River Etherow. The flow routes are constrained by current development therefore any change to site layout may significantly alter the behaviour of surface water. • The most significant flow route is along the course of the unmodelled Gigg Brook. Fluvial modelling of Gigg Brook may reflect the surface water flood zones, which		

Site SKH17067 – Factories at Compstall Village, Andrew Street, Romiley, Stockport	
	may compromise future development. • Provision of safe access and egress routes will be challenging, giving there is considerable risk from the 3.33% AEP event.
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP outline covers over a third of the site, mainly in the west; the maximum hazard has been classified as Significant. Again, the risk is constrained by current development.

Mitigation options & site suitability: surface water	• **Development should attempt to avoid the 1% AEP event surface water outline, given the significant depths. Avoidance however does not appear possible based on the Risk of Flooding from Surface Water dataset.**
	• **However, the RoFSW dataset is caveated with the following statement: '*the map does not contain sufficient information for it to be used to determine flood risk to individual properties, but it does give you an indication of whether your area may be affected by surface water flooding and to what extent'*.**
	• **Although broad level, the RoFSW does indicate that surface water could potentially be a significant issue for the site and that mitigation in the form of major storage facilities could be required on site.**
	• **Detailed surface water modelling would have to be carried out onsite and offsite given the number of flow paths originating north of the site. However, it is assumed that existing buildings will be removed, and the layout changed significantly. Surface water modelling should be carried out post site clearance and predevelopment to ascertain natural flow paths. Ideally, development would then not obstruct these flow paths. Site design should ensure flow paths are incorporated into site layout, through attenuation basins, or diverted to the Etherow without increasing existing runoff rates (EA must confirm whether this would be acceptable).**
	• **Appropriate use of SuDS should be included in site design; however, infiltration SuDS may not be feasible onsite given the site is currently developed though ground investigations and contamination assessments should be carried out to confirm.**
	• **Were development to proceed, the current drainage system in place should be assessed to ascertain whether the current system can accommodate residential development or whether further capacity is required. A full drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require further surface water modelling based on proposed layout plans.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for.**
	• **For the purposes of this assessment, the required volumes of attenuation**

Site SKH17067 – Factories at Compstall Village, Andrew Street, Romiley, Stockport						
	have been calculated below based on an assumed 100% impermeable area and limiting greenfield runoff rate of Qbar (l/s). It is noted that greenfield runoff rates and volumes may not be achievable for development of brownfield sites, therefore, values as close as reasonably practicable may be agreed with the LLFA.					
Surface Water Flood Risk from Proposed Development						
Proposed development limiting runoff rate: (l/sec) Qbar: 26 l/s (FEH Statistical)						
Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	9.75	2346	639	1708	26.0	0.11 ha 3.4 %
30yr Rainfall+40%	11.75	2878	770	2108	32.1	0.14 ha 4.2 %
100yr Rainfall+20%	12	3289	786	2503 ($795m^3$ of exceedance storage)	38.1	0.17 ha 5.0 %
100yr Rainfall+40%	11.75*	3818	770	3048 ($940m^3$ of exceedance storage)	46.4	0.20 ha 6.1 %
*limited to corresponding 30yr Rainfall critical storm duration						
Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.					
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.					
Overall Site Assessment						
Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **If the recommendations of this Level 2 SFRA are followed, it is likely that the site will be able to pass the Exception Test, assuming it can be proven that surface water can be controlled for the lifetime of the development.**					
Recommendations summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed]) or by emailing the local office SPPlanning.RFH@environment-agency.gov.uk • Detailed drainage strategy at the FRA stage, required to inform surface water attenuation requirements. • Updated modelling on the River Etherow to update the broadscale 2004 national mapping plus climate change modelling to be undertaken as an update to this Level 2					

Site SKH17067 – Factories at Compstall Village, Andrew Street, Romiley, Stockport	
	• Fluvial modelling of Gigg Brook including residual risk from culverts as part of this Level 2 SFRA. • Incorporation of blue/green corridors for both watercourses to attenuate fluvial risk.
FRA requirements	• The FRA should account for updated modelling discussed above. • The FRA should include emergency planning procedures with particular consideration to safety around the onsite watercourses in a residential area and safe access and egress routes in times of flood. • Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. • Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services.

Site H-DUKSTB-002 – Sandy Lane, Dukinfield	
Location	102-128 Sandy Lane, Dukinfield, Tameside
Site area (ha)	0.40
Watercourse	River Tame
EA Model used	River Tame 2018 (not yet signed off by EA)
Existing use	Brownfield – industrial and open car park
Existing site flood risk vulnerability classification (NPPF)	Less Vulnerable
Proposed use	Residential development of 28 dwellings
Proposed development flood risk vulnerability classification (NPPF)	More Vulnerable
Proposed development impermeable area (ha)	0.40

Flood outlines (present day)

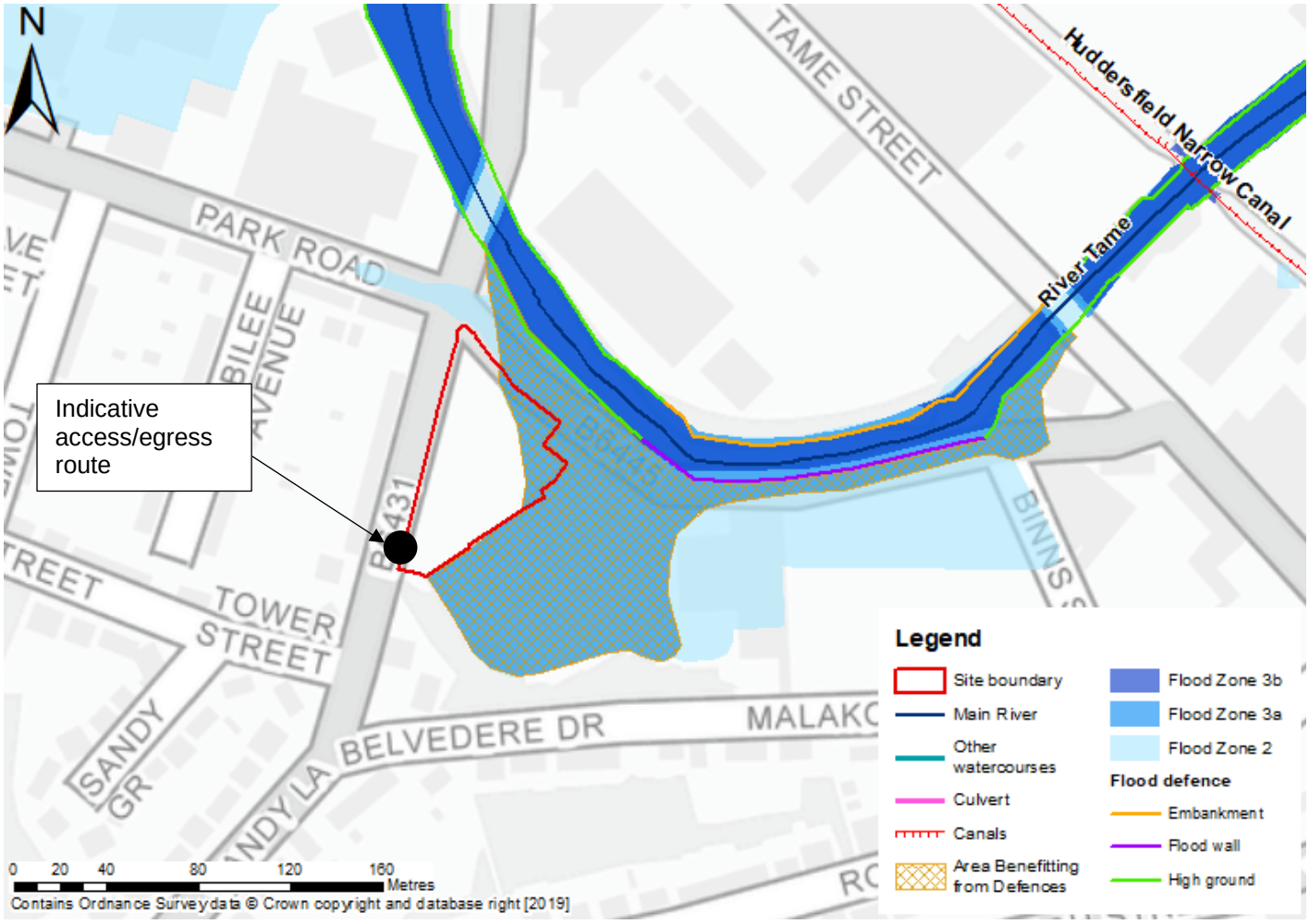


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences (Note: the Flood Map for Planning is subject to change based on the River Tame 2018 modelling)

- The site is protected from Flood Zone 3 by a flood wall with the associated Area Benefitting from Defences (ABD) shown above. The wall however is not a purpose-built flood defence

Site H-DUKSTB-002 – Sandy Lane, Dukinfield

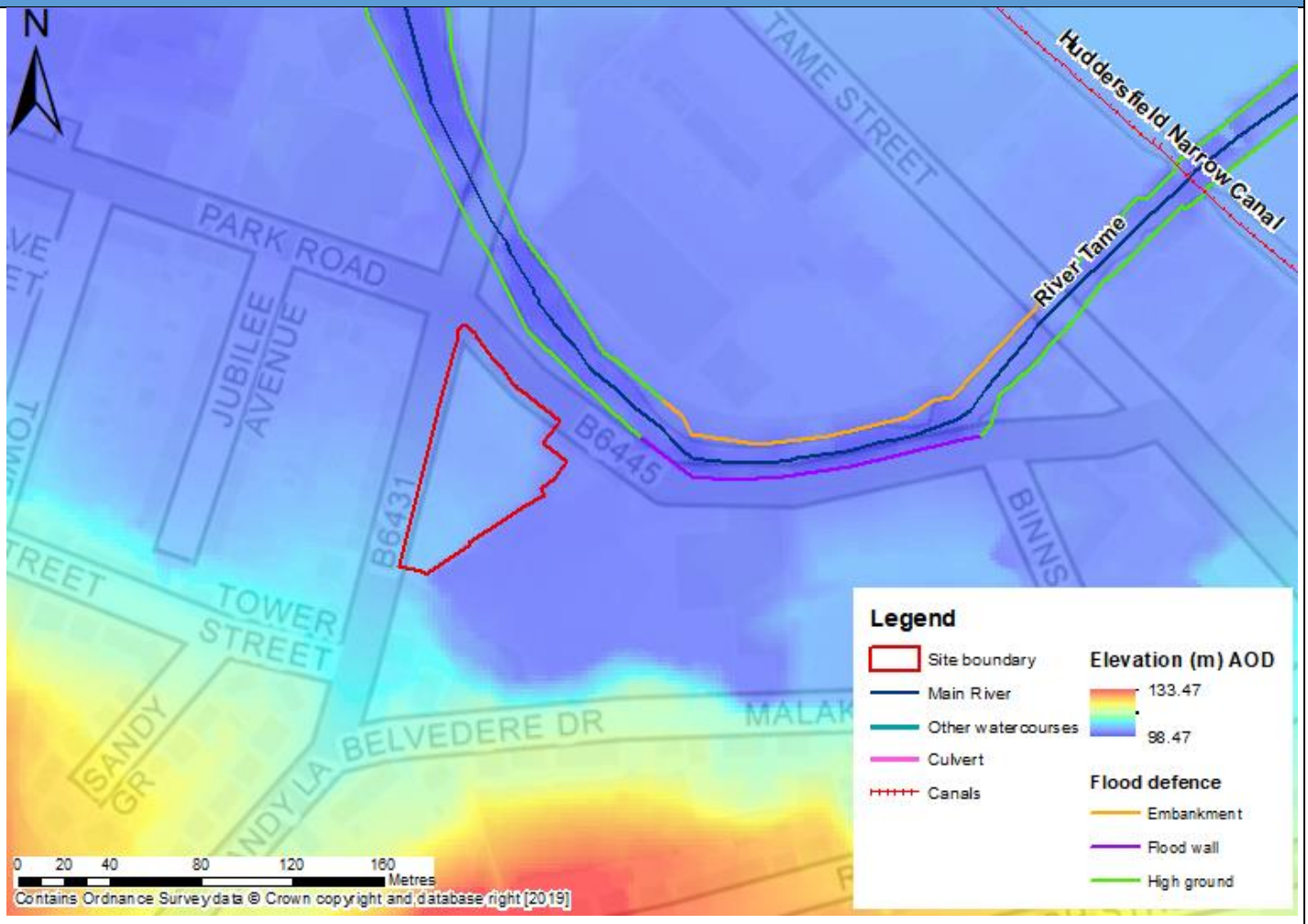


Figure 2: Site with 2m 2017 LIDAR (elevation data)

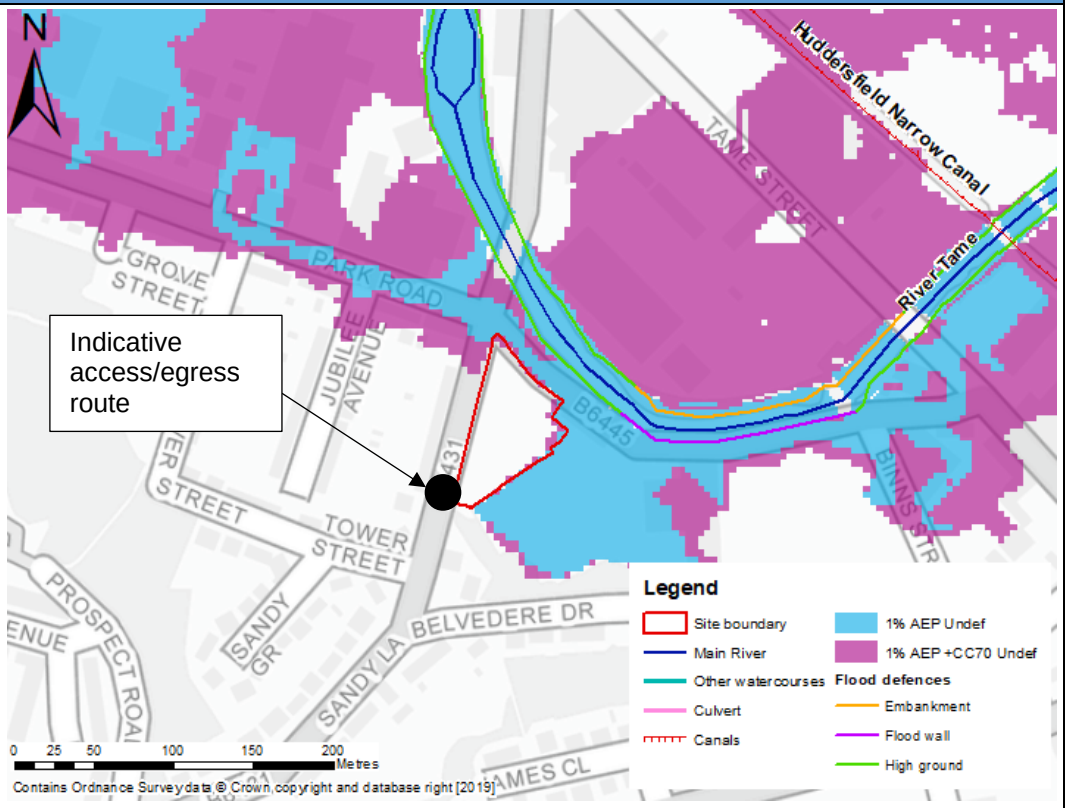
- The site slopes down towards the Tame from 105 m AOD in the south to 104 m AOD in the north.
- The surrounding area to the north and east of the site (where River Tame flows westward past the site) has a lower elevation of approximately 100 m AOD.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	0.00	16.92	0.65	7.91
Fluvial: average depth (m)	Not applicable	0.13	0.60	0.32
Fluvial: maximum depth (m)	Not applicable	0.34	1.46	1.20
Fluvial: average hazard	Not applicable	Low	Low	Low
Fluvial: maximum hazard	Not applicable	Low	Moderate	Moderate

*Note: percentage areas at risk are subject to change once the Flood Map for Planning is updated with the outputs from the River Tame 2018 model which places the site wholly in Flood Zone 1

Site H-DUKSTB-002 – Sandy Lane, Dukinfield	
Modelled fluvial flood risk and climate change (River Tame 2018 model – not yet signed off by EA)	 Figure 3: Undefended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% climate change uplift • The 1% AEP present day outline covers a very small section of the site on the eastern border with the climate change +70% uplift outline inundating a slightly larger area on the eastern boundary of the site. • The 1% AEP present day outline shows the site is at very low risk. • The modelled flood outlines are not consistent with the Flood Map for Planning i.e. Flood Zone 3 is different to the 1% AEP modelled flood outline. It is noted that the Flood Map for Planning will be updated with the modelled flood outlines from the Tame 2018 model, thus placing the majority of the site in Flood Zone 1. • Safe access and egress are achievable to the south of the site via B6431.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, the River Tame is bounded by areas of high ground that act as informal defences which are assessed at condition grade 3 meaning 'Fair' (Table 1.1 Condition Assessment Manual[1]). • East of the site there are two flood walls which are both assessed at condition grade 3. The modelling shows that these defences do not provide any protection to the site. The EA confirms this by stating these walls are not purpose-built defences and there is also a gap in the wall (see Figure 4). Seepage of water through the wall grouting has been observed in high flows.

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site H-DUKSTB-002 – Sandy Lane, Dukinfield	
	 Figure 4: Photograph showing the gap on the wall at approximate NGR SJ9517998124
Flood Warning Area	• The east of the site boundary is located within the Greater Manchester, Mersey and Chester EA FWA. The FWA covers Fern Bank and Millbrook near the River Tame from Spring Bank Lane to Park Road.
Natural Flood Management / Working with Natural Process	• The site is not within any areas recommended for NFM or WwNP.
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the new development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).** • **The site should be able to pass the Exception Test given that the fluvial risk to the site is nominal, based on the Flood Map for Planning and the updated modelling.** • **It is understood that the Flood Map for Planning is to be updated with the outputs from the updated River Tame 2018 model. This places the site in Flood Zone 1 and at nominal risk from climate change.** • **The EA has stated: "once signed off the flood map would be updated possibly around September 2020, but data can be shared externally via our customer and engagement team. We can share the maps with the LPA once they have been signed off which is supposed to be done by the end of December 2020".** • **Safe access and egress routes must be available at times of flood which should be viable via the B6431 to the south of the site. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.**

Site H-DUKSTB-002 – Sandy Lane, Dukinfield	
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to the River Tame, groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and may be an issue in this instance. Groundwater should be assessed as part of an FRA.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	• • • • • • • •
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• The Huddersfield Narrow Canal runs to the north-east of the site on the other side of the River Tame. Risk from canals should be assessed as part of the FRA.

Site H-DUKSTB-002 – Sandy Lane, Dukinfield

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

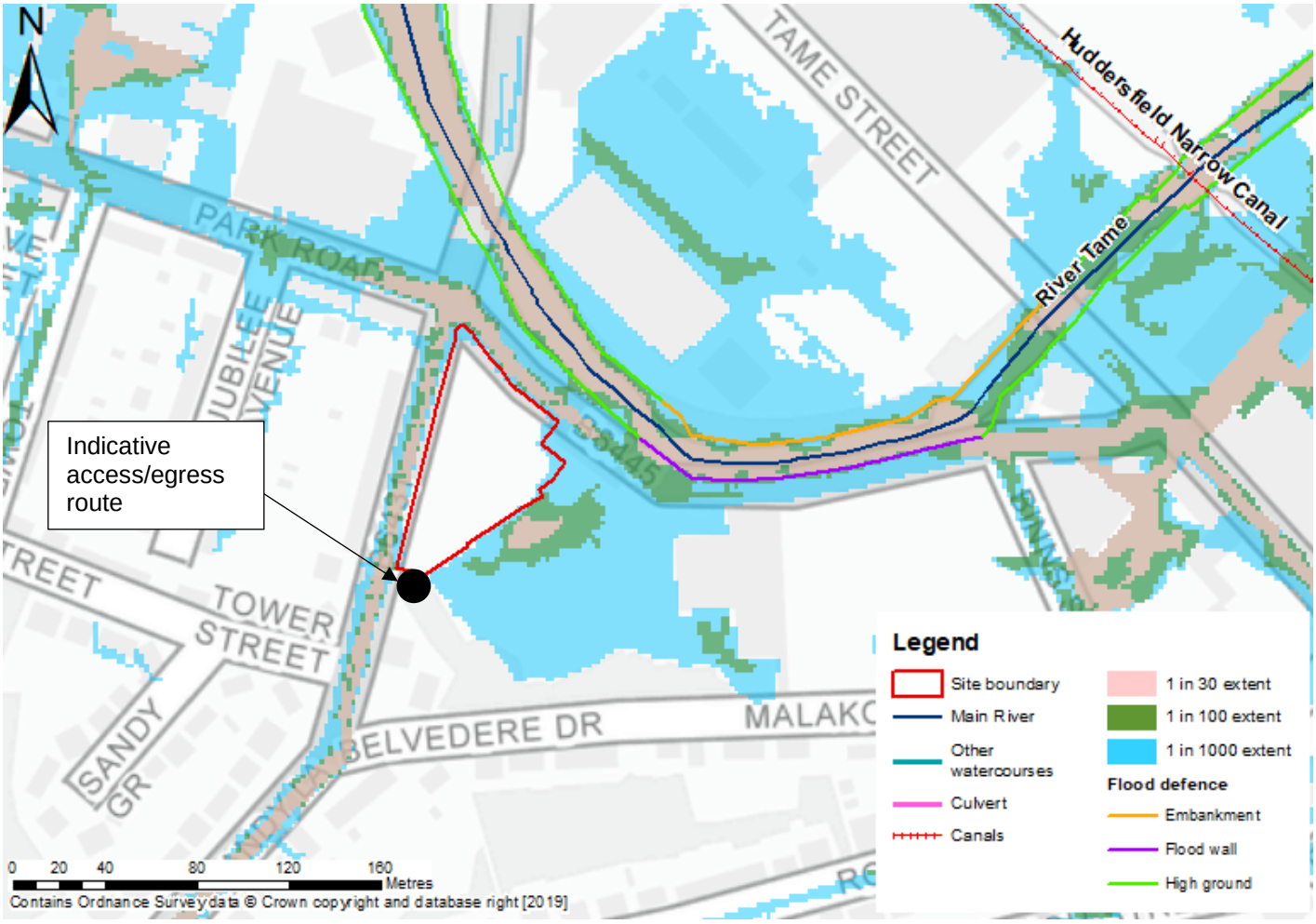


Figure 5: Surface water risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	0.00	0.08	5.62
Surface water flooding depths	Max: N/A	Max: N/A	Max: 0.60 – 0.90m
Surface water hazards	Max: N/A Mean: N/A	Max: N/A Mean: N/A	Max: Significant Mean: Low
Surface water flood risk to development site	• The site is at very low risk of surface water flooding according to the Risk of Flooding from Surface Water map. • However, the main access routes become inundated with floodwaters during the 3.33% and 1% AEP events therefore achieving safe access and egress may be difficult. Alternative routes may be available via the south boundary to Belvedere Drive.		
Climate Change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP outline covers almost 6% of the site covering the boundaries; the		

Site H-DUKSTB-002 – Sandy Lane, Dukinfield

	hazard has been classified as low. • Alternative access and egress point indicated on Figure 5.

Mitigation options & site suitability: surface water	• **Alternative access routes should be investigated for the 3.33% and 0.1% AEP as the B6431 is shown to flood in low and high-risk events and may become inaccessible – see Figure 5. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.**
	• **A drainage strategy will be required to assess offsite risk, to confirm access and to ensure that development cannot increase risk elsewhere.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 100% impermeable area and limiting greenfield runoff rate of Qbar (l/s). It is noted that greenfield runoff rates and volumes may not be achievable for development of brownfield sites, therefore, values as close as reasonably practicable may be agreed with the LLFA.**

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)

For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 100% impermeable area and minimum flow rate of 5 l/s (in accordance with Rainfall runoff management for developments).

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	0.25	0	3	N/A	N/A	N/A
30yr Rainfall+40%	0.25	0	3	N/A	N/A	N/A
100yr Rainfall+20%	0.25	0	3	N/A	N/A	N/A
100yr Rainfall+40%	0.25	0	3	N/A	N/A	N/A

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.

Site H-DUKSTB-002 – Sandy Lane, Dukinfield	
Overall Site Assessment	
Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **It is likely this site will pass the Exception Test, assuming suitable access and egress routes can be identified.**
Recommendation summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed]) or by emailing the local office SPPlanning.RFH@environment-agency.gov.uk Drainage strategy to assess offsite risk to access routes, based on UU requirements. • The FRA should include a drainage strategy for the proposed new development layout, as per UU requirements.
FRA requirements	• The FRA should include emergency planning procedures with particular consideration to achieving safe access and egress routes in times of flood. Any • FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District • Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; • UU; the highways authorities; and emergency services.

Site H-HYDGOD-022 – Brook Street, Hyde	
Location	Brook Street, Hyde, Tameside
Site area (ha)	1.43
Watercourse	Godley Brook
EA Model used	Wilson & Godley Brook 2009
Existing use	Brownfield - cleared
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	1.22

Flood outlines (present day)

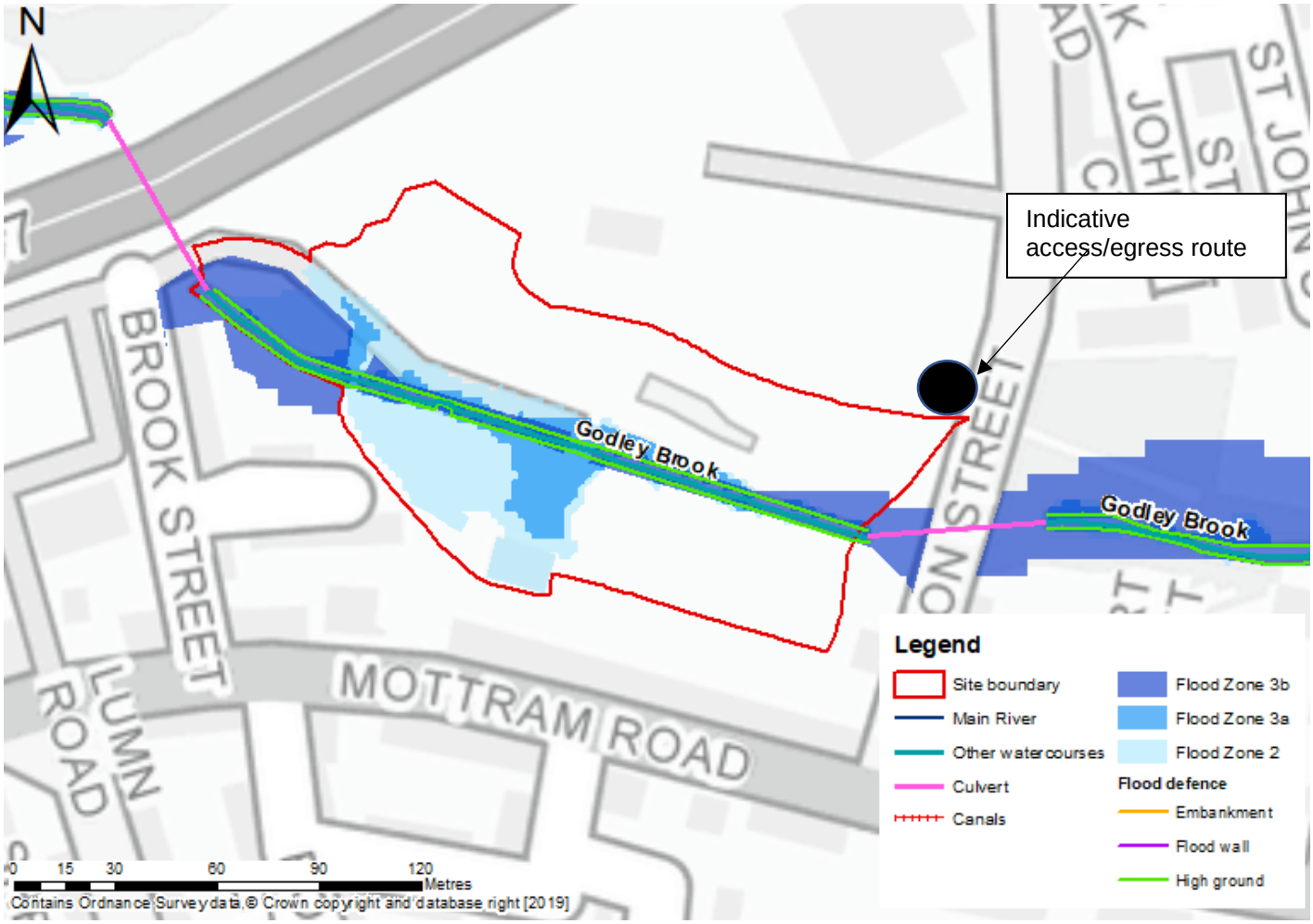


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences

- The Flood Map for Planning does not appear to be based on the existing Godley Brook modelling. Flood Zone 2 appears to have been edited to include buildings that have since been demolished. Flood Zone 3b is based on broadscale modelling therefore is not consistent with Flood Zone 3a.

Site H-HYDGOD-022 – Brook Street, Hyde

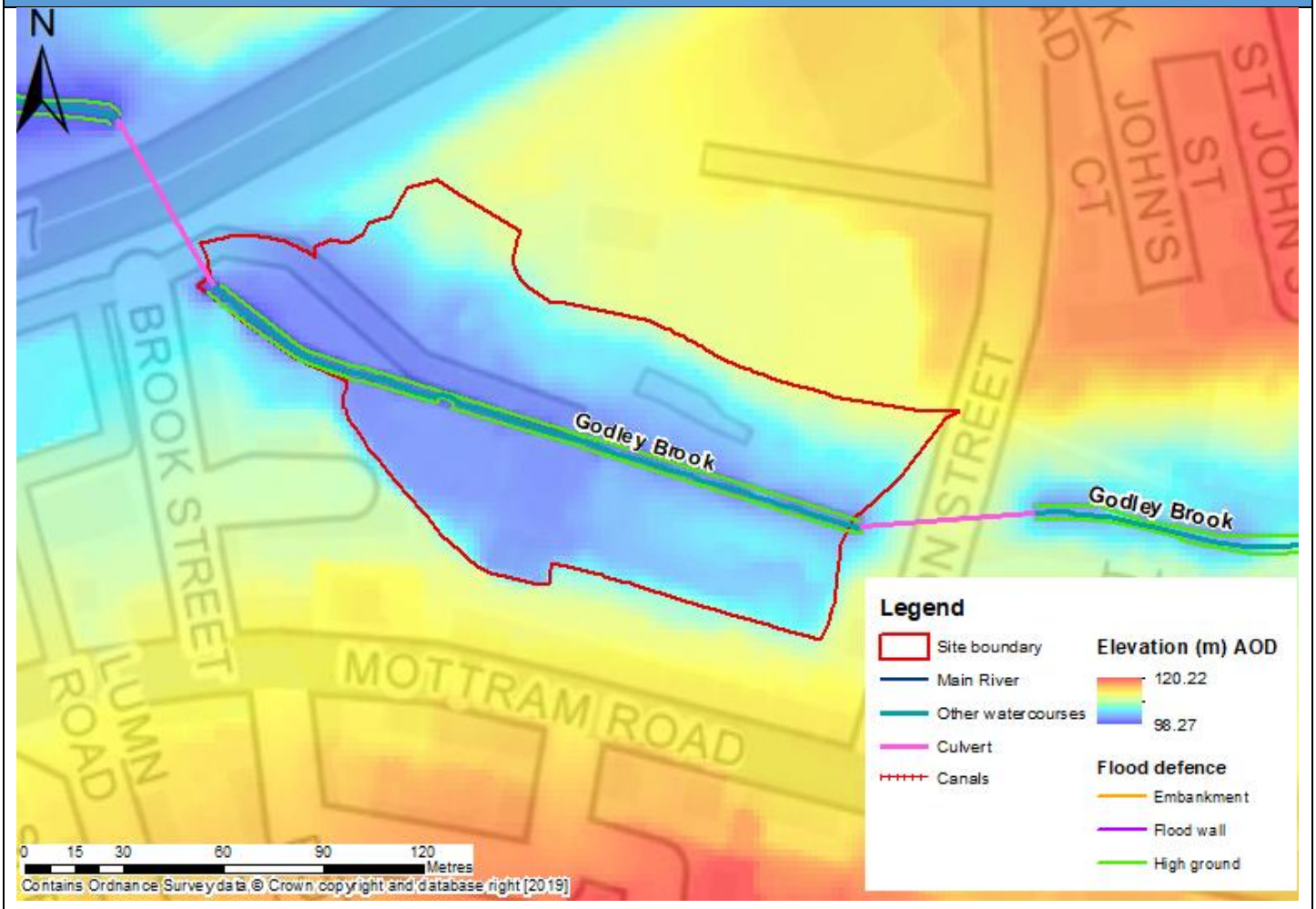


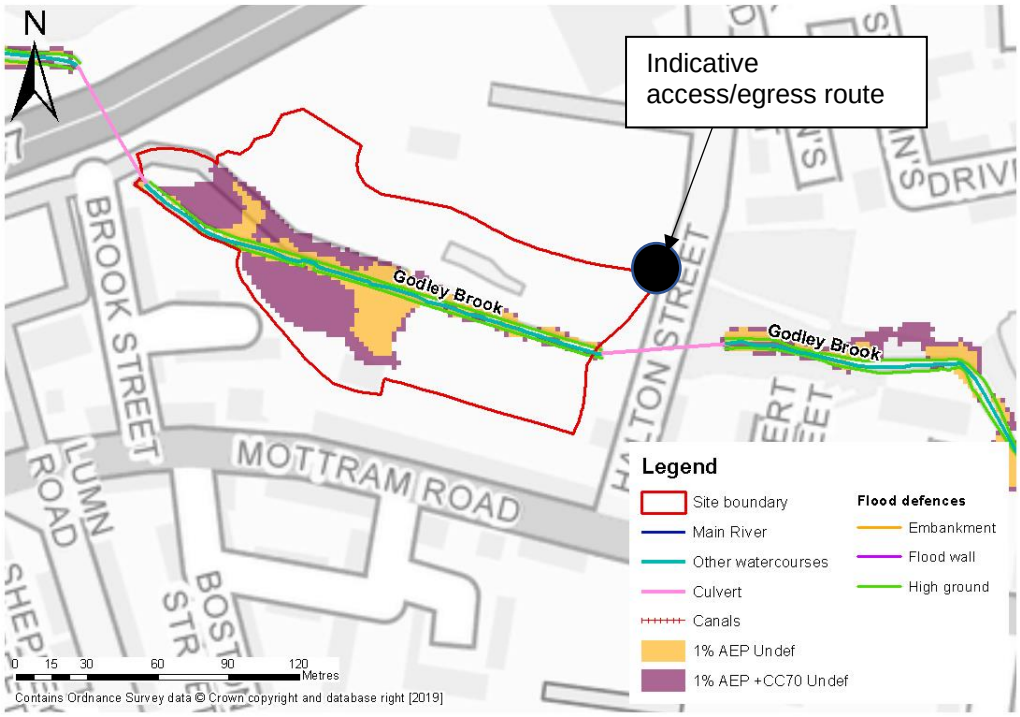
Figure 2: Site with 2m 2017 LIDAR (elevation data)

- Godley Brook flows westward through the centre of the site entering and leaving via culverts.
- The centre of the site where Godley Brook is located, the elevation is an approximate average of 102m AOD. Towards the northern and southern edges of the site the elevation is higher at an approximate average of 108m AOD.
- The residential areas to the south and north-east of the site have higher elevation of approximately 118m AOD.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	14.16	6.80	14.69	12.19
Fluvial: average depth (m)	Not available	0.34	0.36	0.35
Fluvial: maximum depth (m)	Not available	1.56	2.01	1.93
Fluvial: average hazard	Not available	Moderate	Moderate	Moderate
Fluvial: maximum hazard	Not available	Significant	Significant	Significant

Site H-HYDGOD-022 – Brook Street, Hyde	
Modelled fluvial flood risk and climate change (Wilson Godley Brook 2009 model)	 Figure 3: Undefended fluvial outlines for the present day 1% AEP and future risk 1% AEP +70% climate change uplift • The present day 1% AEP outline remains mostly in channel until it comes out of bank in the central and western areas of the site. • The future risk +70% uplift outline covers a larger section of the site towards the centre and west. Climate change depths average around 350 mm. • Safe access and egress appear achievable via Halton Street to the east of the site.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, Godley Brook runs through the centre of the site and is bounded by areas of high ground that act as informal defences which are assessed at condition grades 2 and 3 meaning 'Good' and 'Fair' respectively (Table 1.1 Condition Assessment Manual[1]).
Flood Warning Area	• The site lies outside of any current EA FWAs.
Natural Flood Management / Working with Natural Process	• Part of the site, along the current onsite access round and along the channel, is within a potential WwNP floodplain reconnection area. The aim being to return undeveloped areas to natural floodplain.
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the new development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).** • **The Council states that it has recently resolved to approve a pending**

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site H-HYDGOD-022 – Brook Street, Hyde	
	residential application for this site subject to approval of s106 (18/00818/FUL for 37 houses and 6 apartments). This planning application is accompanied by a site-specific FRA[2]. The FRA concludes that the site is developable based on the following: **○ Finished floor levels to be set 600 mm above the 1% AEP + climate change (+35% upper end allowance for 2050s),** **○ Compensatory storage is made available, based on the above finished floor levels.** **• Additional to the FRA, the following observations and advice are provided for this Level 2 SFRA:** **• Flood Zone 2 of the Flood Map for Planning does not appear to be based on the existing Godley Brook model 0.1% AEP event outline as Flood Zone 2 has been edited to include all existing building footprints that it is in contact with. Flood Zone 3b is based on broadscale modelling and is not consistent with Flood Zone 3a.** **• Based on the current Flood Map for Planning, Flood Zone 3a covers approximately 7% of the site, with a further 14% ruled out for development due to Flood Zone 3b. Maximum flood depths within Flood Zone 3a according to the model are significant at over 1.5 metres and the maximum flood hazard to people rating[3] is classified as 'Significant'. Given the depths, residential development should not take place in Flood Zone 3.** **• The central area of the site, encompassing Flood Zone 3, should be converted to a blue/green corridor and left free of development. The corridor should be designed to mitigate risk and allow free flow of flood water. The corridor can provide multiple benefits including for flood management, ecological and social/amenity purposes.** **• Any development in Flood Zone 3a or the climate change risk area would have to be constructed with finished floor levels above the 1% AEP + climate change flood level plus 600 mm freeboard. Conversely to the FRA, we would suggest the climate change level should be set at the upper end level of +70% on peak flows, based on the fact that the development must remain safe for its lifetime, which is around 100 years for residential.** **• Compensatory storage would however have to be found. There may be space onsite to be able to do this. However, compensatory storage options would have to modelled appropriately. Stilted development is a further option though is likely to be an expensive design solution. A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards.** **• Safe access and egress routes must be available at times of flood, even for above ground floor accommodation. Site design and layout should further investigate the indicative locations shown on Figure's 1, 3 and 4 of this Level 2 SFRA. All such options should be subject to detailed investigation, planning and consultation with the appropriate RMAs. Provision for safe access and egress routes must be demonstrated in any planning application and any associated masterplan.** **• Godley Brook passes through a culvert and resurfaces just before passing into the site heading west. This culvert is approximately 50 metres long and diverts Godley Brook under Halton Street. Godley Brook also exits the site via a culvert on the western boundary to pass under the M67; this**

[2] B.A.K. Building (Contracts) Ltd, Land at Brook Street, Hyde, Flood Risk Assessment 881509-R1(-)-FRA. September 2018

[3] Table 3.2, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR1 The Flood Risks to People Methodology, Defra, Environment Agency, March 2006

Site H-HYDGOD-022 – Brook Street, Hyde	
	culvert is approximately 60 metres long. There will be residual risk associated with these culverts which should be assessed through blockage scenario modelling. Capacity and condition survey would be required to inform the modelling together with ownership and maintenance information. Access to the culvert will be required at all times, therefore development should not obstruct such access. Ideally, development would seek to remove redundant structures/culverted sections to help reduce flood risk and improve WFD status. • **The developer or site owner must find out which permissions and licences are required to maintain, repair, build or remove anything in or around Godley Brook and the culverts. Without appropriate permissions and licences the developer/site owner may be subject to a fine or imprisonment. The EA states This development may require a permit under the Environmental Permitting (England and Wales) Regulations 2016 from the Environment Agency for any proposed works or structures, in, under, over or within eight metres of the top of the bank of Godley Brook, designated a 'main river'.**
Flood Source: Groundwater	
Flood risk: groundwater	• Due to Godley Brook running through the centre of the site, the groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and may be an issue in this instance. The FRA has concluded that risk from groundwater is low.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	•
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• No canals in the vicinity of the site.

Site H-HYDGOD-022 – Brook Street, Hyde

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

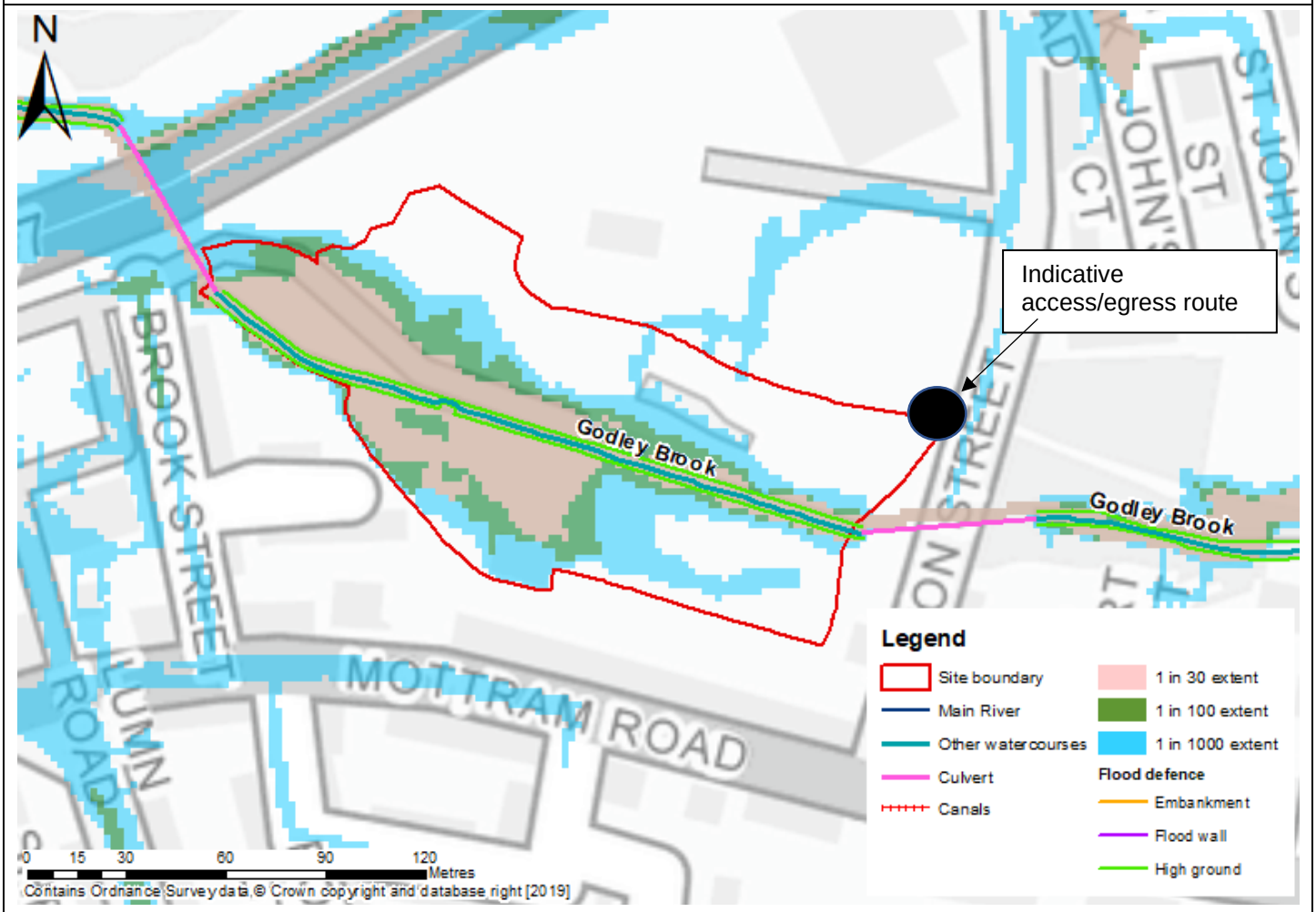


Figure 4: Surface water flood risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	29.91	42.76	61.86
Surface water flooding depths	Max: >1.20m	Max: >1.20m	Max: >1.20m
Surface water hazards	Max: Significant Mean: Moderate	Max: Significant Mean: Significant	Max: Significant Mean: Significant
Surface water flood risk to development site	• Surface water risk to the site is significant. Approximately 43% of the total site area is at risk of surface water flooding in the 1% AEP event to a maximum depth greater than 1.2 m. This appears to be due to the M67 forming a significant flow constraint and as such, causes flows to back up within the steeply graded river corridor. • There is also an offsite flow route in the extreme event flowing from the north and down into Godley Brook via topography. • Based on the 1% AEP outline, safe access and egress are achievable via Halton Street, Mottram Road and Brook Street.		

Site H-HYDGOD-022 – Brook Street, Hyde	
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP outline extends to cover over 60% of the site primarily focused around Godley Brook and the centre of the site. The flow path from the north may also become prominent in the longer term. • Many of the access routes become inundated with floodwaters during the 0.1% AEP event and thus safe access and egress may prove challenging. Provision for safe access and egress routes must be demonstrated in any planning application and any associated masterplan.

Mitigation options & site suitability: surface water	• **The site-specific FRA states:**
	  ○ **The majority of the proposed development is located outside of the highest areas of surface water flood risk,**
	  ○ **Finished floor levels will also provide a measure of resilience against pluvial flood risk at the site,**
	  ○ **Surface water runoff from the site will be managed to ensure that flood risk to areas downstream is not increased as a result of the development**
	• **Additional to the FRA, the following observations and advice are provided for this Level 2 SFRA:**
	• **Based on the available surface water mapping, the 3.33% AEP surface water flood outline is greater in extent than that of Flood Zone 3. Detailed surface water modelling should be carried out with particular consideration given to modelling surveyed data for the M67 culvert, this is to ensure that the broadscale EA surface water mapping has not underestimated culvert capacity.**
	• **As discussed for fluvial attenuation, Godley Brook could be enhanced to form a blue/green corridor and be integrated within the site to provide amenity/ecological value. The enhancement of the watercourse could form a series of cascading basins to attenuate surface water runoff.**
	• **As part of a drainage strategy, detailed surface water modelling should be carried out. Surface water modelling should be carried out post site clearance and pre-development to ascertain natural flow paths. Ideally, development would then not obstruct these flow paths. Site design should ensure flow paths are incorporated into site layout, through attenuation basins, or diverted to Godley Brook without increasing existing runoff rates (consultation with the EA would be required).**
	• **It is noted that development proposals may be required to provide additional mitigation measures to reduce flood risk downstream. SuDS measures to attenuate offsite flows may need to be integrated within the site in addition to those managing development runoff. However, infiltration SuDS may not be feasible onsite given the site is currently developed though ground investigations and contamination assessments should be carried out to confirm.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst**

Site H-HYDGOD-022 – Brook Street, Hyde

additionally having due consideration for water use in Greater Manchester.

- **Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (l/s). It is noted that greenfield runoff rates and volumes may not be achievable for development of brownfield sites, therefore, values as close as reasonably practicable may be agreed with the LLFA.**

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Qbar: 14 l/s (FEH Statistical)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall + 20%	6.5	788	229	559	15.8	0.037 ha 2.606 %
30yr Rainfall + 40%	8	976	282	694	19.6	0.046 ha 3.235 %
100yr Rainfall + 20%	8.25	1134	291	843 (284m^3 exceedance storage)	23.8	0.056 ha 3.930 %
100yr Rainfall + 40%	10	1389	353	1037 (343m^3 exceedance storage)	29.3	0.069 ha 4.834 %

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.

Overall Site Assessment

Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **The site-specific FRA concludes development of the site should not be precluded on flood risk grounds as:** ○ **The actual level of flood risk is considered to be low to manageable as mitigation can be incorporated to ensure that the new development remains flood free from a 1 in 100 year plus climate change event.**
Recommendations summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed] or by emailing the local office SPPlanning.RFH@environment-agency.gov.uk • Consideration of climate change for finished floor levels should be set at the upper end allowance 1% AEP +70% (2080s) for residential development, as opposed to

Site H-HYDGOD-022 – Brook Street, Hyde	
	+35% as stated in the FRA. • Ideally, all areas within the existing Flood Zone 3 would be left free of development and be included in a blue/green corridor, along with surface water risk, allowing for climate change. However, the FRA states plans to raise floor levels and find compensatory storage • Additional to the FRA, detailed surface modelling of the site would better inform the drainage strategy including for the culvert which appears to cause much of surface water risk. • The FRA should include emergency planning procedures with particular consideration to safety around the onsite watercourse in a residential area and ensuring safe access and egress routes in times of flood. • The FRA should ensure it is fully in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. • The FRA ensure consultation with the following, where applicable: the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services.

Site H-HYDNEW-003 – Clarendon Road, Hyde, SK14 2LJ	
Location	Clarendon Road, Tameside
Site area (ha)	5.69
Watercourse	Godley Brook
EA Model used	Wilson & Godley Brook 2009
Existing use	Brownfield – industrial and demolished industrial land
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	4.84

Flood outlines (present day)

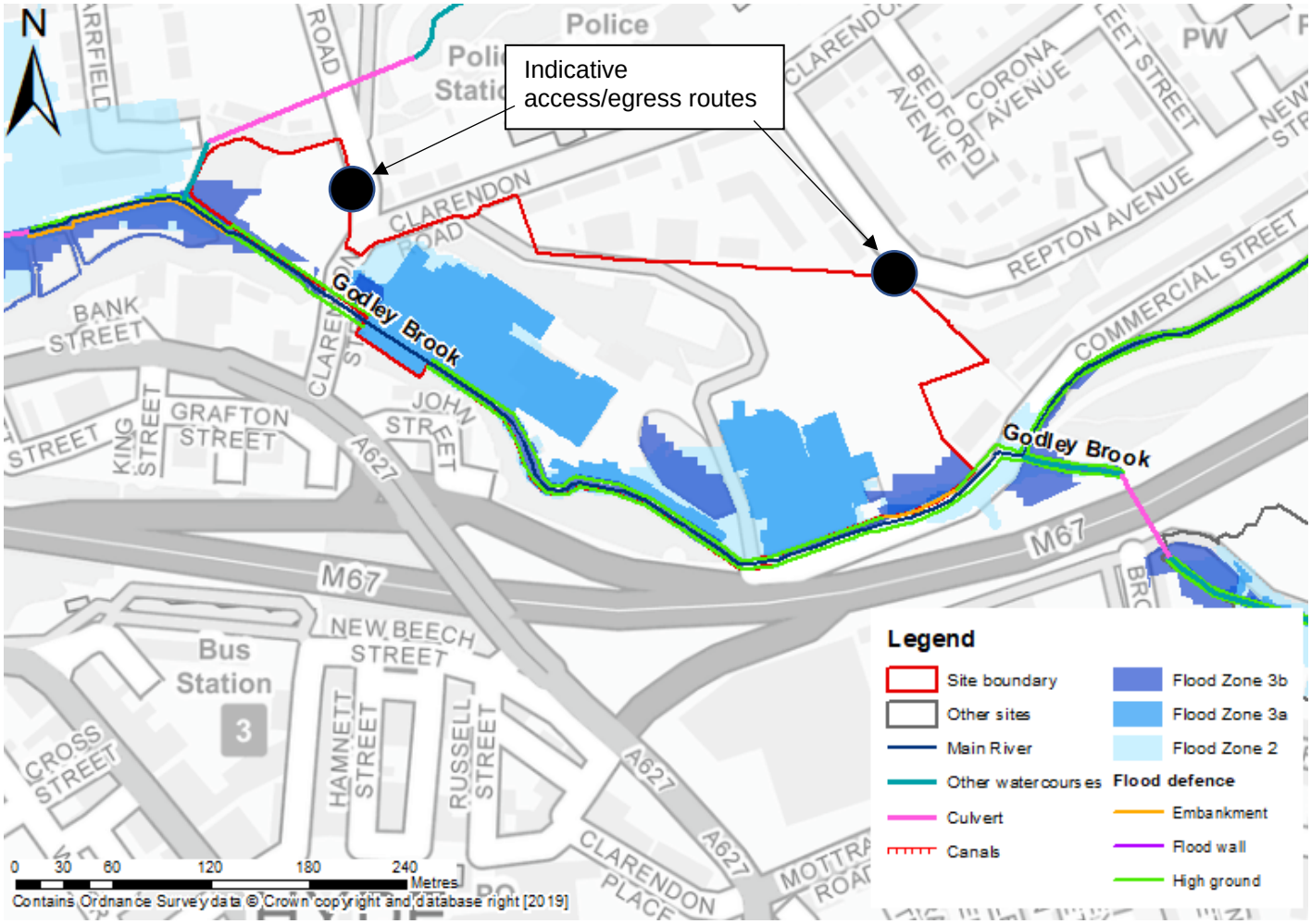


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences.

- The Flood Map for Planning does not appear to be based on the existing Godley Brook modelling. Flood Zone 3 appears to have been edited to include buildings that have since been demolished. Flood Zone 3b is based on broadscale modelling and is not consistent with Flood Zone 3a.

Site H-HYDNEW-003 – Clarendon Road, Hyde, SK14 2LJ

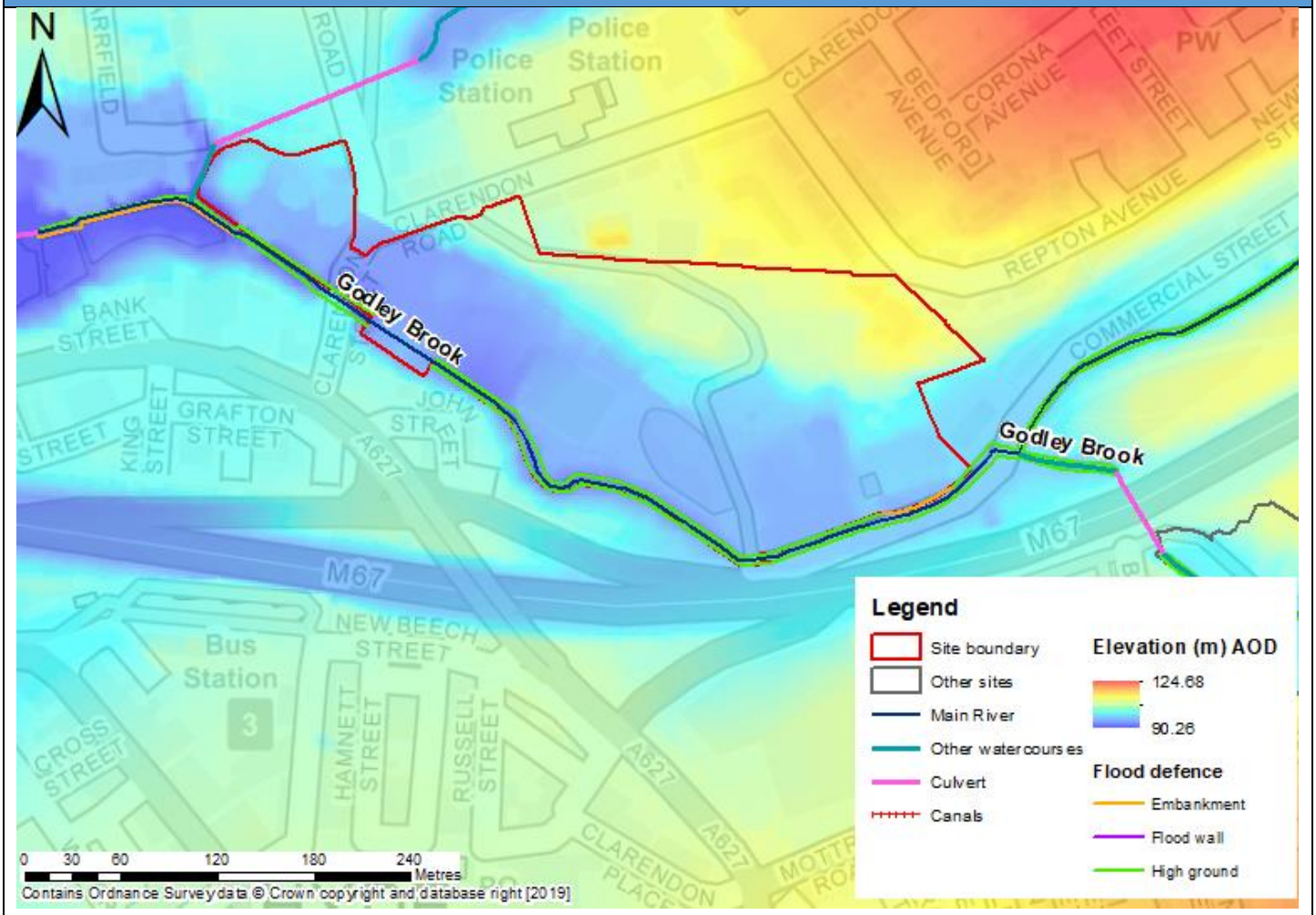


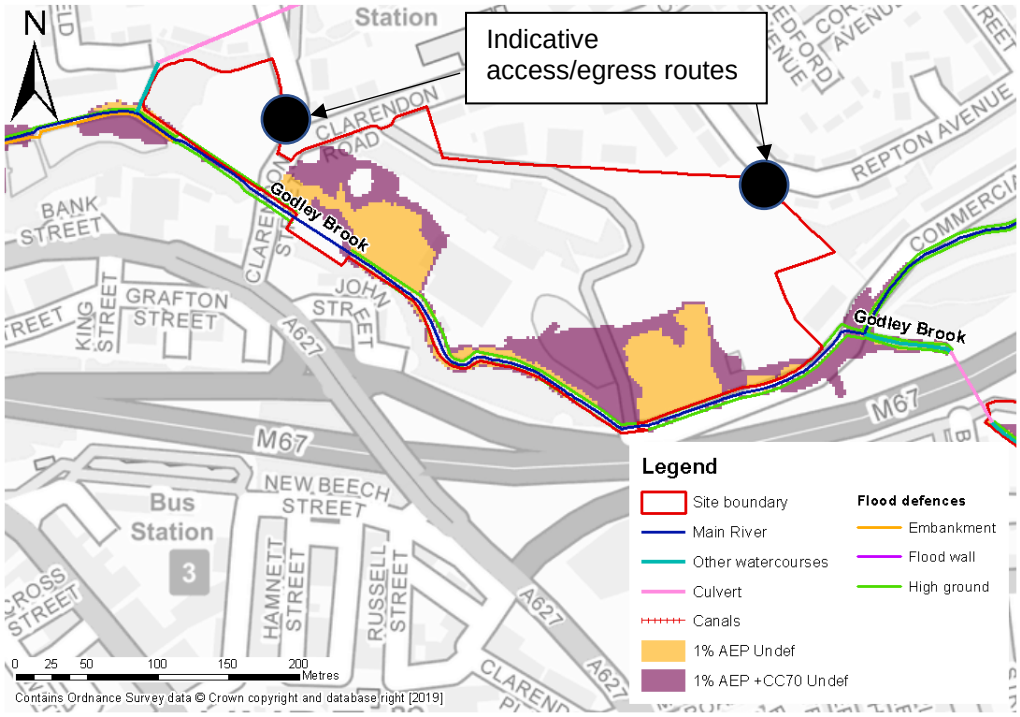
Figure 2: Site with 2m 2017 LIDAR (elevation data)

- The proposed site is located just off Clarendon Road in Hyde; Main River Godley Brook makes up the southern boundary flowing westward.
- The elevation of the site is highest in the north and north east at approximately 105m AOD where it declines in elevation towards the south and south west (where Godley Brook is located) to an elevation of approximately 95m AOD.
- The surrounding elevation also slopes down to Godley Brook.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	9.32	26.60	4.79	27.55
Fluvial: average depth (m)	Not available	0.58	0.81	0.75
Fluvial: maximum depth (m)	Not available	2.78	3.47	3.38
Fluvial: average hazard	Not available	Moderate	Significant	Significant
Fluvial: maximum hazard	Not available	Significant	Significant	Significant

Site H-HYDNEW-003 – Clarendon Road, Hyde, SK14 2LJ	
Modelled fluvial flood risk and climate change (Wilson & Godley Brook 2009 model)	 Figure 3: Undefended fluvial outlines for the present day 1% AEP and future risk 1% + 70% climate change uplift • The 1% AEP extent is localised along Godley Brook which makes up the southern boundary and to two sections of the site which have the lowest elevation. • The 70% climate change uplift extends to cover more of the south of the site while still remaining around the land depressions. • Safe access and egress are achievable via Clarendon Road. • There are discrepancies between the modelling and the Flood Map for Planning.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences database, Godley Brook is bounded by areas of high ground which act as informal defences which are assessed at condition grade 3 meaning 'Fair' (Table 1.1 Condition Assessment Manual[1]).
Flood Warning Area	• The site is not affected by any EA FWAs.
Natural Flood Management / Working with Natural Process	• Several small areas along the channel are within a potential WwNP floodplain reconnection area. The aim being to return undeveloped areas to natural floodplain.
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the new development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).** • **The Flood Map for Planning does not appear to be based on the existing Godley Brook modelling. Flood Zone 3 appears to have been edited to**

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site H-HYDNEW-003 – Clarendon Road, Hyde, SK14 2LJ	
	include buildings that have since been demolished. Flood Zone 3b is based on broadscale modelling and is not consistent with Flood Zone 3a. • **Based on the current Flood Map for Planning Flood Zone 3a covers over 26% of the site isolated primarily to the south of the site around Godley Brook. Maximum flood depths for the modelled 1% AEP event are significant at over 2.8 metres and the maximum flood hazard to people rating[2] is classified as 'Significant'. The current Flood Zone 3 (3a and 3b) covers the majority of the modelled climate change extent. At this stage the recommendation would be to avoid residential development in Flood Zone 3. This may however impact on residential yields.** • **Any new development in Flood Zone 3a or the climate change risk area would have to be constructed with finished floor levels above the 100 year plus climate change flood level plus 600 mm freeboard. Compensatory storage would however have to be found. There may be space onsite to be able to do this. However, compensatory storage options would have to modelled appropriately. Stilted development is a further option though is likely to be an expensive design solution.** • **A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at times of flood, even for above ground floor accommodation. Site design and layout should further investigate the indicative locations shown on Figure's 1, 3 and 4 of this Level 2 SFRA. All such options should be subject to detailed investigation, planning and consultation with the appropriate RMAs. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.** • **There is an unnamed watercourse flowing into Godley Brook at the western edge of the site. This watercourse flows from the north and is partly culverted with the outlet close to the site boundary. Risk from the unnamed watercourse must be quantified before the site can be allocated, as part of an update to this Level 2 SFRA. Modelling should include depth and hazard information and assessment of climate change using the EA's allowances. The outcomes of this modelling may restrict development in the west of the site. There will also be residual risk associated with the culvert outlet which should be assessed at the FRA stage through blockage scenario modelling. Capacity and condition survey would be required to inform the modelling together with ownership and maintenance information. Access to the culvert will be required at all times, therefore development should not obstruct such access. Ideally, development would seek to remove redundant structures/culverted sections to help reduce flood risk and improve WFD status.** • **The southern areas of the site, encompassing Flood Zone 3, should be converted to a blue/green corridor and left free of development. The corridor should be designed to mitigate risk and allow free flow of flood water. The corridor can provide multiple benefits including for flood management, ecological and social/amenity purposes. This corridor could also account for the 8 metre no development buffer of Godley Brook. This is advised by the EA for watercourse access and maintenance purposes. The unnamed watercourse will also be subject to the 8 m no development buffer.** • **The southern site boundary includes parts of the Godley Brook channel. The developer or site owner must find out which permissions and licences are required to maintain, repair, build or remove anything in or around the**

[2] Table 3.2, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR1 The Flood Risks to People Methodology, Defra, Environment Agency, March 2006

Site H-HYDNEW-003 – Clarendon Road, Hyde, SK14 2LJ	
	watercourse. Without appropriate permissions and licences the developer/site owner may be subject to a fine or imprisonment. The EA states This development may require a permit under the Environmental Permitting (England and Wales) Regulations 2016 from the Environment Agency for any proposed works or structures, in, under, over or within eight metres of the top of the bank of Godley Brook, designated a 'main river'.
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to Godley Brook, groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and may be an issue in this instance. Groundwater should be assessed as part of an FRA.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	• • • • • • • • •
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• No canals in the vicinity of the site.

Site H-HYDNEW-003 – Clarendon Road, Hyde, SK14 2LJ

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

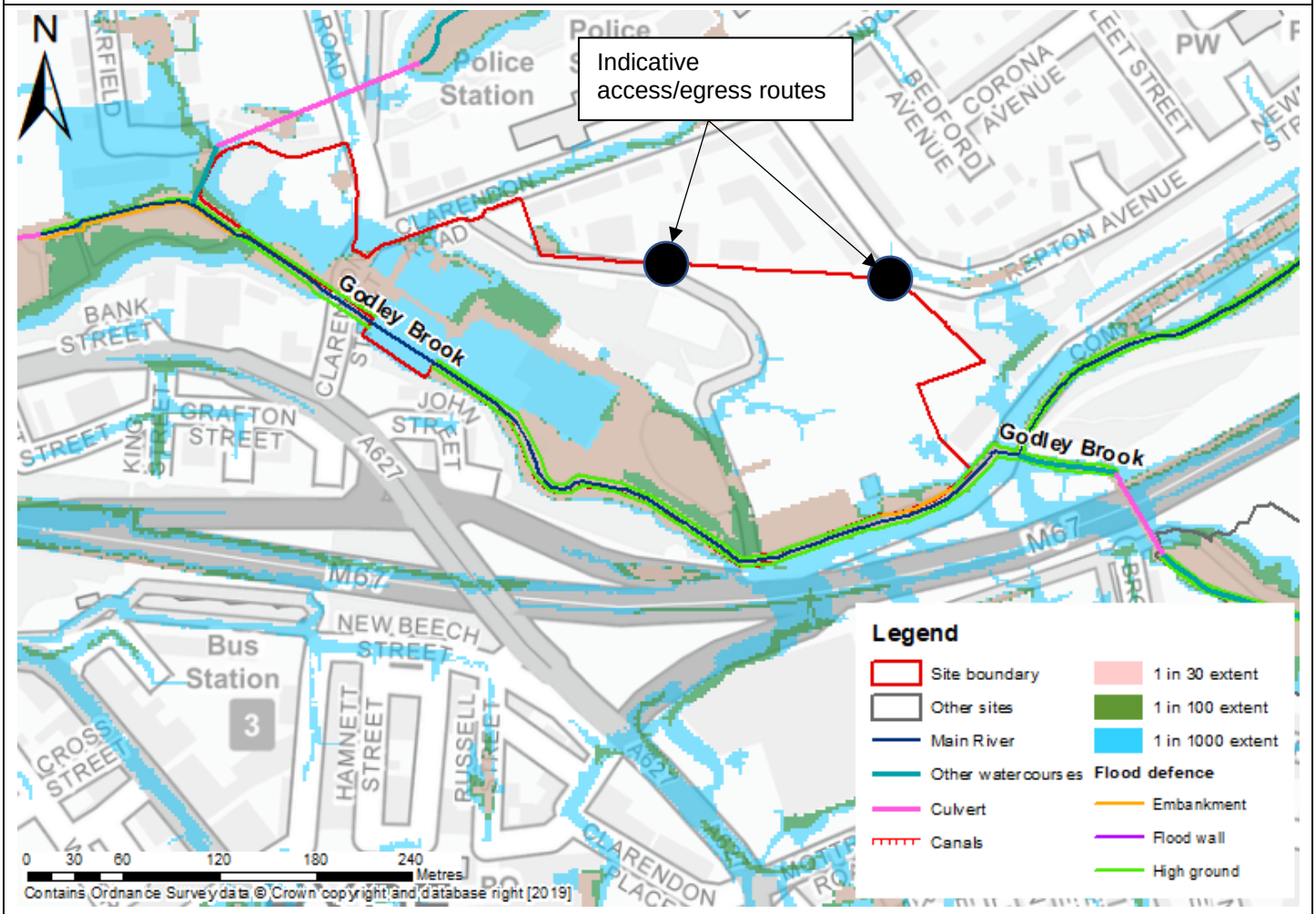


Figure 4: Surface water flood risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	20.47	26.15	46.53
Surface water flooding depths	Max: >1.20m	Max: >1.20m	Max: >1.20m
Surface water hazards	Max: Significant Mean: Moderate	Max: Significant Mean: Moderate	Max: Significant Mean: Significant
Surface water flood risk to development site	• Surface water risk to the site is significant according to the RoFSW map. Approximately 26% of the total site area is at risk of surface water flooding in the 1% AEP event to a maximum depth greater than 1.2 m. This appears to be limited to the southern and western bounds of the site along Godley Brook and constrained by buildings that existed at the time of the national surface water modelling (2013). The north and eastern parts of the site are mainly at very low risk and would be developable. • There is a significant surface water flow route on Clarendon Road flowing east to west and entering the site immediately to the east of where the highway becomes Clarendon Street. This will need to be maintained or managed as part of		

Site H-HYDNEW-003 – Clarendon Road, Hyde, SK14 2LJ	
	development proposals, for example, the flow path may be diverted to the west of the developable area via a conveyance swale alongside Clarendon Street. Commercial Street in the east also acts as a flow route for surface water into the site from offsite sources.
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP outline covers almost 47% of the site covering the south western border; the hazard has been classified as Significant. • Many of the access and egress routes become inundated with floodwaters making provisions for safe access and egress challenging.

Mitigation options & site suitability: surface water	• **Based on the RoFSW, the surface water flood extents are contained by existing development and as such, a site-specific FRA will need to consider the implications of proposed changes in site layout. The topography of the site slopes down towards Godley Brook causing surface water runoff through the site. The extent of surface water flooding in the 1% AEP event indicates that surface water runoff is either contained within the site or flows unattenuated into Godley Brook.**
	• **The RoFSW is caveated with the statement that '*the map does not contain sufficient information for it to be used to determine flood risk to individual properties, but it does give you an indication of whether your area may be affected by surface water flooding and to what extent'.***
	• **However, although broadscale, the RoFSW does indicate that surface water could be a potentially significant issue for the site and that mitigation in the form of major storage facilities could be required on site.**
	• **As part of a drainage strategy, detailed surface water modelling should be carried out onsite and offsite given the number of flow paths originating offsite. However, it is assumed that existing buildings will be removed, and the layout changed significantly. Surface water modelling should be carried out post site clearance and pre-development to ascertain natural flow paths. Ideally, development would then not obstruct these flow paths. Site design should ensure flow paths are incorporated into site layout, through attenuation basins, or diverted to Godley Brook without increasing existing runoff rates (consultation with the EA would be required).**
	• **It is noted that development proposals may be required to provide additional mitigation measures to reduce flood risk downstream. SuDS measures to attenuate offsite flows may need to be integrated within the site in addition to those managing development runoff. However, infiltration SuDS may not be feasible onsite given the site is currently developed though ground investigations and contamination assessments should be carried out to confirm.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **Runoff rates should not exceed current rates and if possible, betterment of**

Site H-HYDNEW-003 – Clarendon Road, Hyde, SK14 2LJ

	existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (l/s). It is noted that greenfield runoff rates and volumes may not be achievable for development of brownfield sites, therefore, values as close as reasonably practicable may be agreed with the LLFA.

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Qbar: 52 l/s (FEH Statistical)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	7	3191	917	2274	17.3	0.152 ha 2.664 %
30yr Rainfall+40%	8.75	3969	1147	2823	21.5	0.188 ha 3.308 %
100yr Rainfall+20%	8.75	4561	1147	3415 (1141m^3 exceedance storage)	26.0	0.228 ha 4.001 %
100yr Rainfall+40%	10.5	5572	1376	4196 (1373m^3 exceedance storage)	31.9	0.280 ha 4.916 %

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.

Overall Site Assessment

Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **Assuming the current area of Flood Zone 3 can be avoided, and therefore the majority of surface water risk, it is likely the Exception Test could be passed. However, uncertainty around the Flood Map for Planning and the Godley Brook modelling remains while the modelling outputs of the unnamed watercourse may impact on the Exception Test.**
Recommendation summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed]) or by emailing the local office SPPlanning.RFH@environment-agency.gov.uk Godley Brook should be remodelled given the uncertainty in the current Flood Map outlines. • Unnamed watercourse should be modelled to quantify risk to the west of the site. Including for residual risk from the culvert. This should be carried out as part of • an update to this Level 2 SFRA to inform the Exception Test. Options for culvert

Site H-HYDNEW-003 – Clarendon Road, Hyde, SK14 2LJ	
	removal should be investigated. Development should seek to remove redundant structures/culverted sections to reduce flood risk and help improve WFD status. • All areas within the existing Flood Zone 3 should be left free of development and be included in a blue/green corridor, along with surface water risk, allowing for climate change. • Drainage strategy, including detailed surface water modelling and investigation into appropriate SuDS options should be carried out, accounting for UU requirements.
FRA requirements	• The discrepancies between the Flood Map for Planning and the modelled data should be investigated and solved at the FRA stage. • Further modelling of various development options may be required. • Requirements for the blue/green corridor should be ascertained to enable safe conveyance or storage of flood water, including for fluvial and surface water sources with consideration of climate change. • The FRA should include emergency planning procedures with particular consideration to safety around the onsite watercourse in a residential area and safe access and egress routes in times of flood. • Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. • Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services.

Site H-MOSSLE-022 – Two Mills Lane, Mossley	
Location	Two Mills Lane, Mossley, Tameside
Site area (ha)	0.23
Watercourse	River Tame
EA Model used	River Tame 2018 (model not yet signed off by the EA)
Existing use	Brownfield – industrial, open carpark, existing building
Existing site flood risk vulnerability classification (NPPF)	Less Vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More Vulnerable
Proposed development impermeable area (ha)	0.23

Flood outlines (present day)

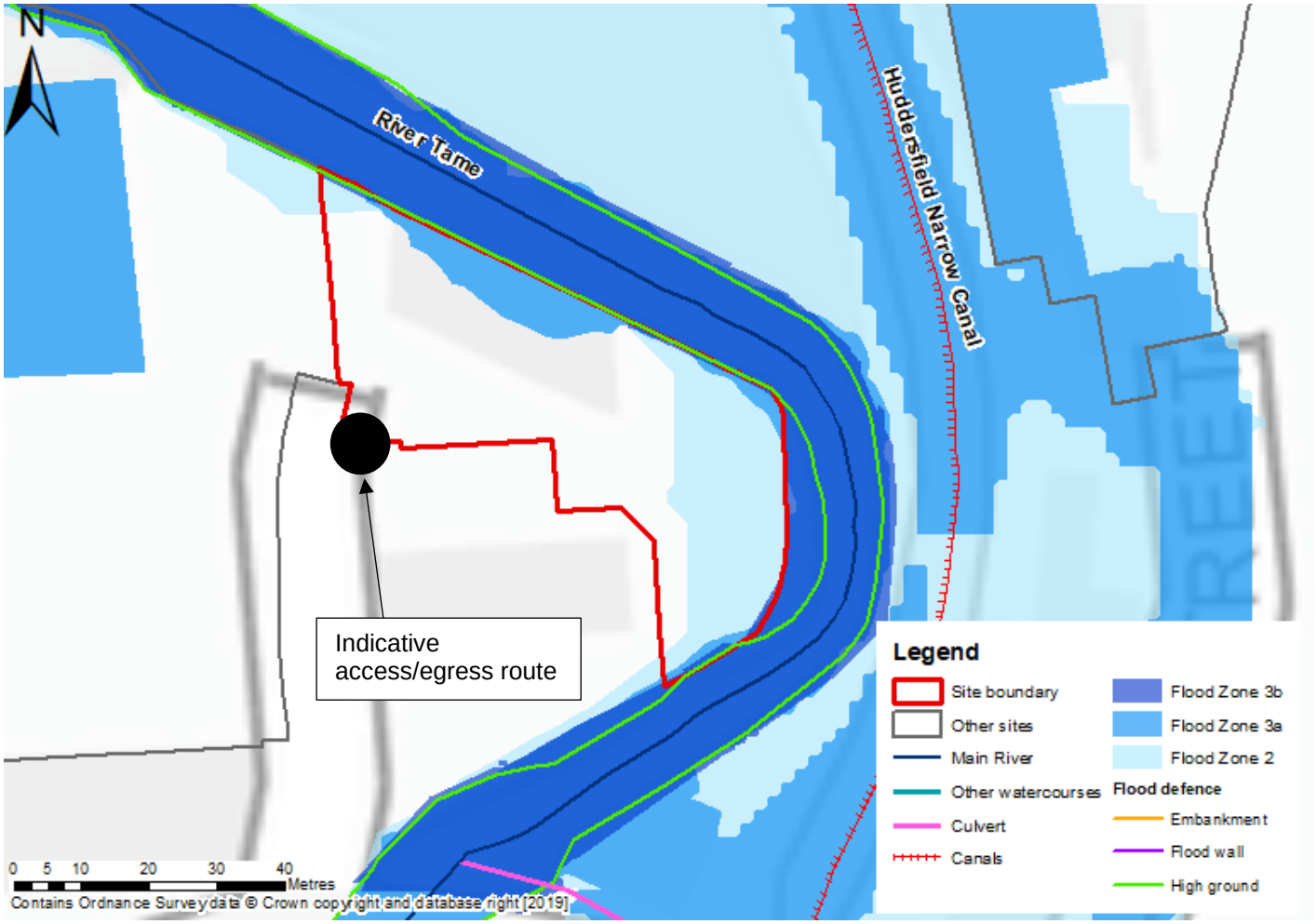


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences (Note: The Flood Map for Planning is subject to change based on the River Tame 2018 modelling)

Site H-MOSSLE-022 – Two Mills Lane, Mossley

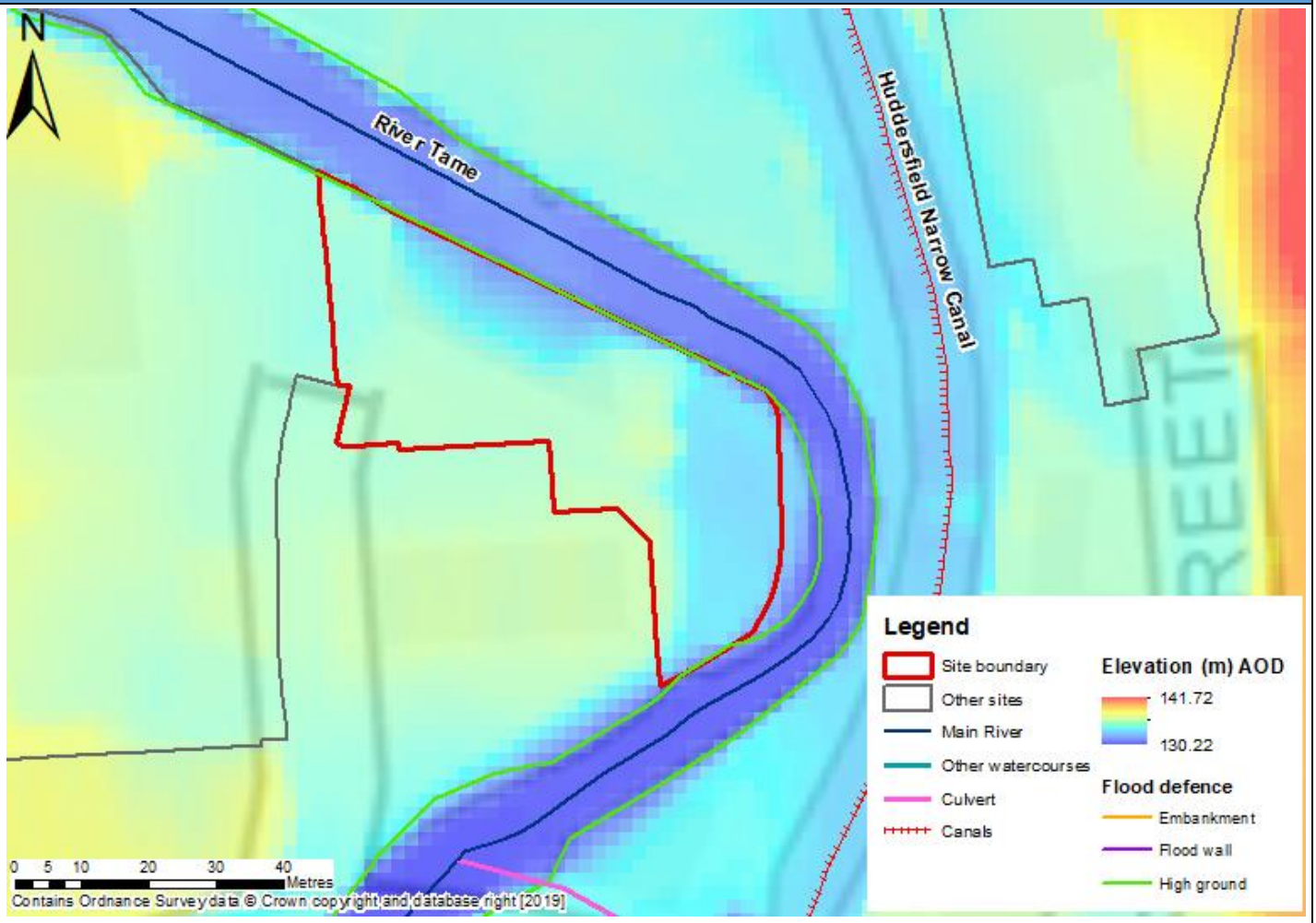


Figure 2: Site with 2m 2017 LIDAR (elevation data)

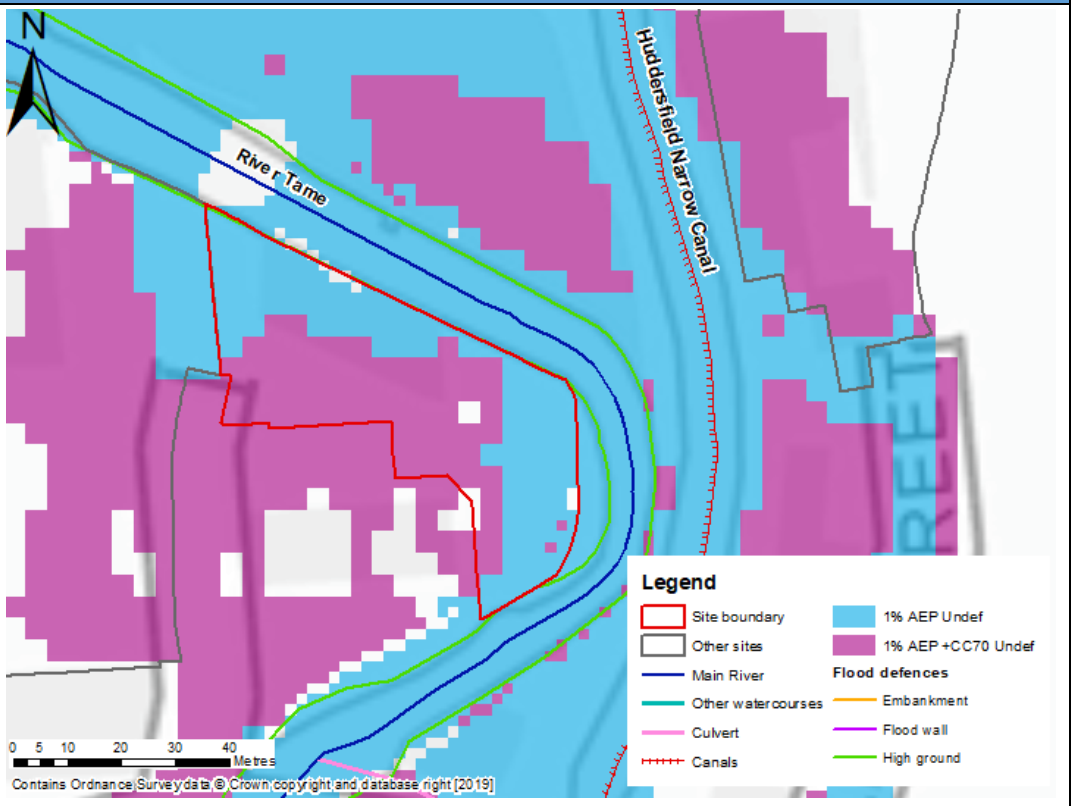
- The elevation of the site is consistent at an average of approximately 134 m AOD with the land sloping to the down to the River Tame where it reaches approximately 132 m AOD.
- The Tame runs along the northern and western boundaries of the site and the Huddersfield Narrow Canal is located east of the development. Both flow from north to south.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	2.36	11.01	23.14	96.50
Fluvial: average depth (m)	Not available	0.75	1.24	1.15
Fluvial: maximum depth (m)	Not available	2.49	3.56	3.30
Fluvial: average hazard	Not available	Moderate	Moderate	Moderate
Fluvial: maximum hazard	Not available	Significant	Significant	Significant

*Note: percentage areas at risk are subject to change once the Flood Map for Planning is updated with the outputs from the River Tame 2018 model

Site H-MOSSLE-022 – Two Mills Lane, Mossley	
Modelled fluvial flood risk and climate change (River Tame 2018 model – not yet signed off by EA)	 Figure 3: Undefended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% climate change uplift • The 1% AEP present day outline covers the majority of the north-west and the east of the site with the climate change +70% uplift extending to cover most of the remaining site area. • The modelled flood outlines are not consistent with the Flood Map for Planning i.e. Flood Zone 3 is different to the 1% AEP modelled flood outline. It is noted that the Flood Map for Planning will be updated with the modelled flood outlines from the Tame 2018 model, thus placing the site at increased risk. • Safe access and egress may be achievable via Two Mills Lane during the 1% AEP event, though alternative arrangements will be required in the longer-term judging by the modelled climate change outline.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, the River Tame is bounded by areas of high ground that act as informal defences which are assessed at condition grade 1 'Very Good' (Table 1.1 Condition Assessment Manual[1]). These informal defences however do not provide formal protection to the site.
Flood Warning Area	• The north and east of the site are included within an EA FWA; the FWA is for the River Tame at Mossley, Britannia and Waggon Road. This may be subject to change once the EA has signed off on the updated Tame model.
Natural Flood Management / Working with Natural Process	• The area of the site along the channel bank is within the WwNP floodplain reconnection area. The intent being to return the area back to the floodplain to lessen risk downstream.
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout**

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site H-MOSSLE-022 – Two Mills Lane, Mossley	
	its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG). • **It is understood that the Flood Map for Planning is to be updated with the outputs from the updated River Tame 2018 model. The EA has stated: "once signed off the flood map would be updated possibly around September 2020, but data can be shared externally via our customer and engagement team. We can share the maps with the LPA once they have been signed off which is supposed to be done by the end of December 2020".** • **Based on the updated modelling, the site is at increased risk from a 1% AEP event and therefore at further risk from Flood Zone 3. Depths are also significant.** • **Based on the Flood Map for Planning as it is currently, the site would be developable (see Figure 1). The Flood Zone 3a area is within the 8 metre no development buffer of the Tame. This is advised by the EA for watercourse access and maintenance purposes.** • **However, based on the updated modelling, it is unlikely the site could pass the Exception Test based on the fact that the 1% AEP event (which will update Flood Zone 3) increases to cover much of the north-western area of the site to significant maximum depths of up to 2.5 metres, with a flood hazard to people rating[2] of 'Significant'. With climate change, virtually the entire site will be at risk in the longer term (see Figure 3).** • **Directing development away from the modelled 1% AEP event outline will leave approximately 0.1 ha developable area. However, this area will be at long term risk from climate change with maximum depths up to 2 metres and average depths of approximately 500 mm. It may be difficult to mitigate these depths and ensure sustainable development for the development lifetime (100 years for residential).** • **Based on the above, it is recommended that the site is not developed for residential use and is converted to open greenspace for flood alleviation. The EA agrees with this statement and requests the site it not developed.** • **Any development in Flood Zone 3a or the climate change risk area would have to be constructed with finished floor levels above the 100 year plus climate change flood level plus 600 mm freeboard. Compensatory storage would however have to be found. Stilted development is a further option though is likely to be an expensive design solution.** • **A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at times of flood, even for above ground floor accommodation. Site design and layout should further investigate the indicative locations shown on Figure's 1 and 4 of this Level 2 SFRA. All such options should be subject to detailed investigation, planning and consultation with the appropriate RMAs. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.** • **Development within the additional area at risk from climate change is also not advisable given the depths and the lack of safe access and**

[2] Table 3.2, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR1 The Flood Risks to People Methodology, Defra, Environment Agency, March 2006

Site H-MOSSLE-022 – Two Mills Lane, Mossley	
	egress routes. Safe access and egress routes must be available at times of flood, even for above ground floor accommodation.
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to the River Tame groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and is unlikely to be an issue in this instance.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	• • • • • • • •
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• The Huddersfield Narrow Canal is in close proximity to the site (23 metres to the eastern boundary of the site). Residual risk from canals must be assessed as part of the FRA.

Site H-MOSSLE-022 – Two Mills Lane, Mossley

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

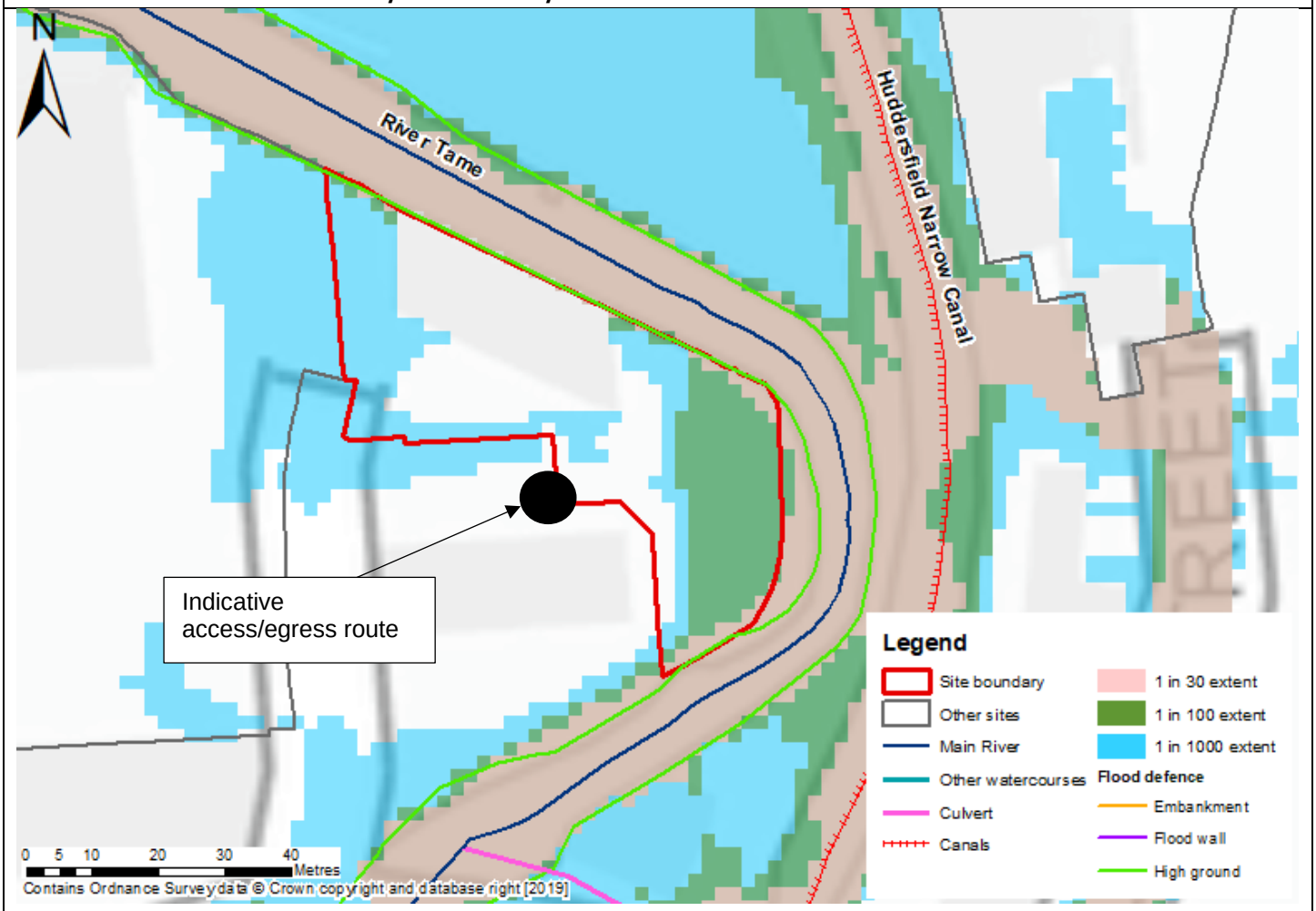


Figure 4: Surface water risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	3.92	27.45	55.05
Surface water flooding depths	Max: 0.30 – 0.60m	Max: >1.20m	Max: >1.20m
Surface water hazards	Max: Low Mean: Low	Max: Significant Mean: Significant	Max: Significant Mean: Significant
Surface water flood risk to development site	• Approximately 28% of the total site area is at risk of surface water flooding in the 1% AEP event to a maximum depth greater than 1.2 m. This is primarily in the east of the site where ground levels drop. • The surface water extent appears to be associated with the River Tame and the existing building constrains surface water from entering the site in the west. • Safe access and egress routes are achievable via the Two Mills Lane to the south west boundary of the site.		

Site H-MOSSLE-022 – Two Mills Lane, Mossley	
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP outline covers over 50% of the site, mostly affecting the east and west boundaries with depths above 1.2 m and the hazard being classified as Significant. • Many of the access and egress routes become inundated during the 0.1% AEP event and safe access may be unachievable.

Mitigation options & site suitability: surface water	• **Development should attempt to avoid the 1% surface water outline in the east.**
	• **The RoFSW is caveated with the statement that '*the map does not contain sufficient information for it to be used to determine flood risk to individual properties, but it does give you an indication of whether your area may be affected by surface water flooding and to what extent*'.**
	• **However, although broadscale, the RoFSW does indicate that surface water could be a potentially significant issue for the site and that mitigation in the form of major storage facilities could be required on site.**
	• **A full drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on proposed layout plans.**
	• **The behaviour of surface water will undoubtably change as a result of site clearance and removal of the existing building. It is likely that risk to the site will increase.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 100% impermeable area and minimum flow rate of 5 l/s (in accordance with Rainfall runoff management for developments). It is noted that greenfield runoff rates and volumes may not be achievable for development of brownfield sites, therefore, values as close as reasonably practicable may be agreed with the LLFA.**

Site H-MOSSLE-022 – Two Mills Lane, Mossley

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Minimum Flow 5 l/s (in accordance with Rainfall runoff management for developments)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	3.25	122	41	81	6.4	0.005 ha 2.348 %
30yr Rainfall+40%	4.25	156	54	103	8.1	0.007 ha 2.986 %
100yr Rainfall+20%	4.75	188	60	128 (47m^3 of exceedance storage)	10.1	0.009 ha 3.710 %
100yr Rainfall+40%	6	236	76	161 (58m^3 of exceedance storage)	12.7	0.011 ha 4.667 %

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.
Overall Site Assessment	
Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **It is unlikely this site could pass the Exception Test based on the updated Tame 2018 modelling.** • **Site to be removed from baseline future housing supply as a result.**
Recommendation summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed] or by emailing the local office SPPlanning.RFH@environment-agency.gov.uk The Flood Map for Planning should be updated with the River Tame 2018 model outputs as soon as possible to avoid any confusion with prospective developers. • The site should not be developed for residential use and ideally should be opened up to allow natural flooding. •

Site H-MOSSLE-022 – Two Mills Lane, Mossley	
FRA requirements	• Any FRA should include emergency planning procedures with particular consideration to safety around the nearby watercourse in a residential area and safe access and egress routes in times of flood. • Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. • Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services.

Site H-MOSSLE-131 – Queen Street, Tameside	
Location	Queen Street, Mossley, Tameside
Site area (ha)	1.08
Watercourse	River Tame
EA Model used	River Tame 2018 (model not yet signed off by the EA)
Existing use	Brownfield – industrial and car park
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	1.08

Flood outlines (present day)

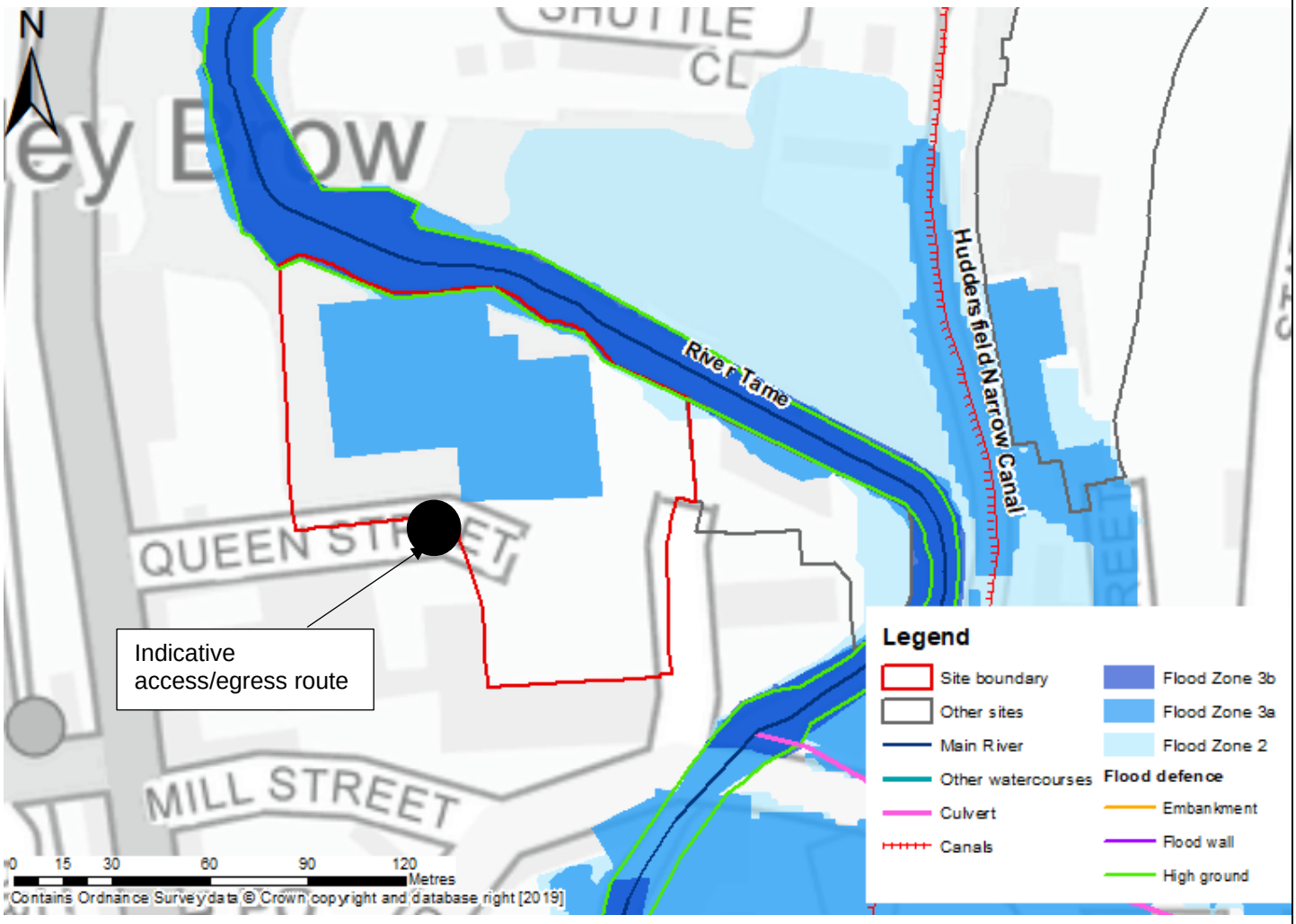


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences (Note: The Flood Map for Planning is subject to change based on the River Tame 2018 modelling).

Site H-MOSSLE-131 – Queen Street, Tameside

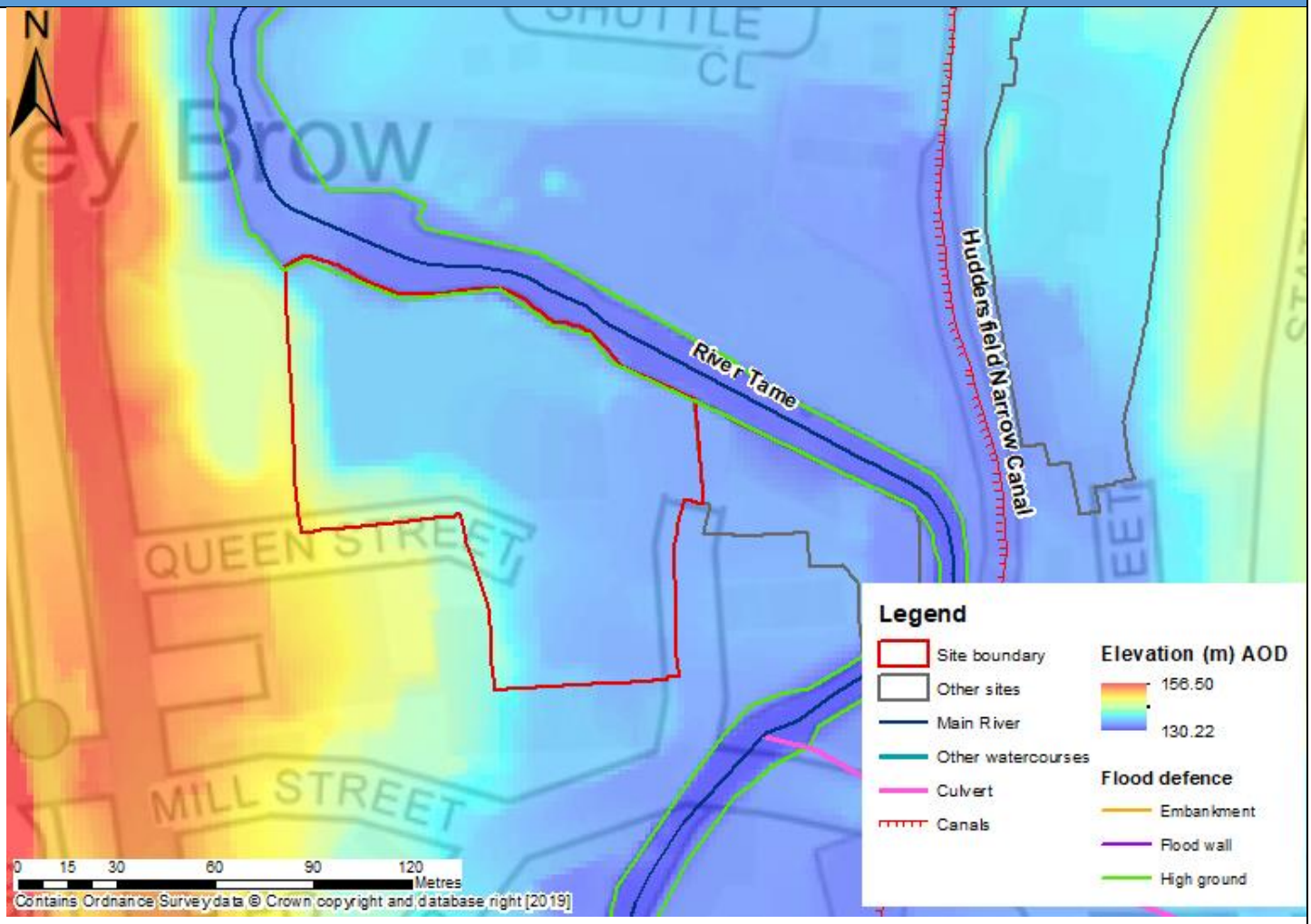


Figure 2: Site with 2m 2017 LIDAR (elevation data)

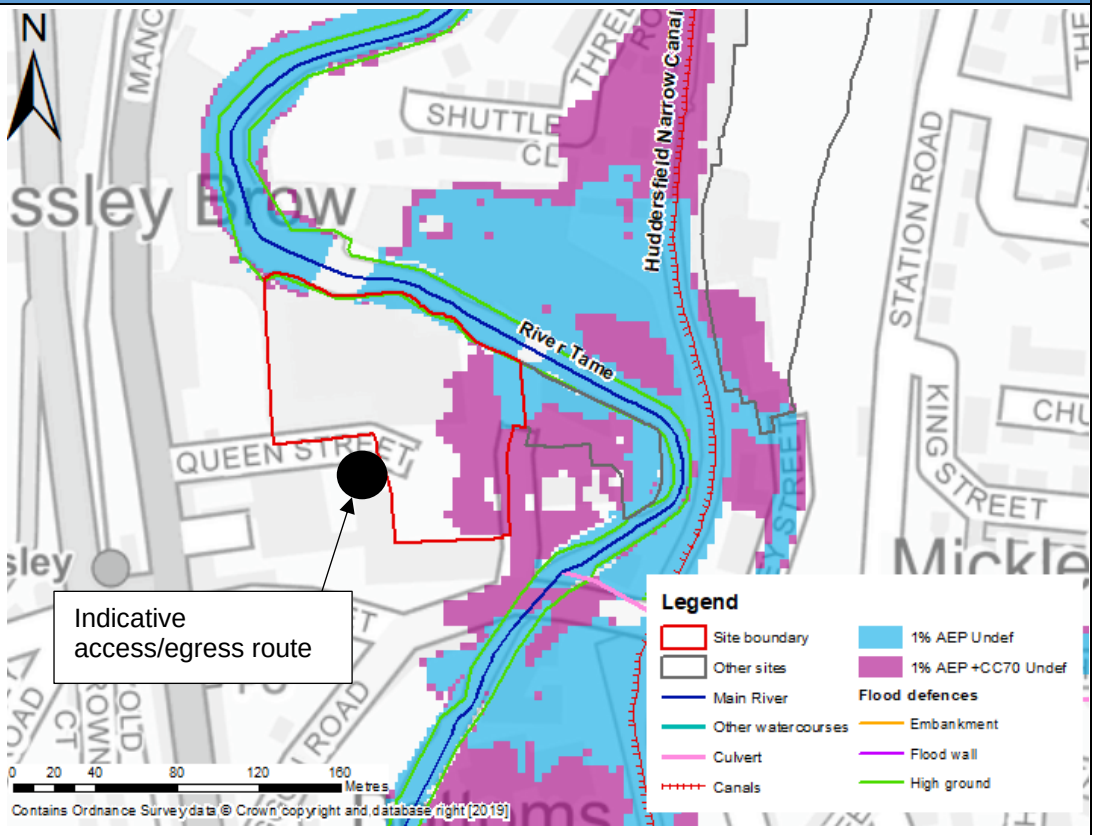
- The elevation of the site is consistent at an average of approximately 135 m AOD with the elevation increasing in the west where it reaches approximately 143 m AOD.
- The surrounding area of Mossley Brow to the west of the site is situated on higher ground of approximately 150 m AOD.
- The River Tame flows southwards along the north and east site boundary.
- The Huddersfield Narrow Canal runs to the east of the site on the other side of the River Tame.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	1.47	37.66	1.54	28.51
Fluvial: average depth (m)	Not applicable	0.64	0.79	0.72
Fluvial: maximum depth (m)	Not applicable	2.91	3.96	3.43
Fluvial: average hazard	Not applicable	Significant	Significant	Significant
Fluvial: maximum hazard	Not applicable	Significant	Significant	Significant

*Note: percentage areas at risk are subject to change once the Flood Map for Planning is updated with the outputs from the River Tame 2018 model

Site H-MOSSLE-131 – Queen Street, Tameside	
Modelled fluvial flood risk and climate change (River Tame 2018 model – not yet signed off by EA)	 Figure 3: Undefended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% climate change uplift • The 1% AEP present day outline covers a small proportion of the site in the north-east with the climate change +70% uplift extends to cover the eastern area of the site. • The modelled flood outlines are not consistent with the Flood Map for Planning i.e. Flood Zone 3 is different to the 1% AEP modelled flood outline. It is noted that the Flood Map for Planning will be updated with the modelled flood outlines from the Tame 2018 model, thus placing the site at lesser risk. • Safe access and egress routes are achievable via Queen street to the west both currently and in the longer term.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, the River Tame is bounded by areas of high ground that act as informal defences which are assessed at condition grades 3 meaning 'Fair' (Table 1.1 Condition Assessment Manual[1]). These informal defences however do not provide formal protection to the site.
Flood Warning Area	• The north of the site is located within the Greater Manchester, Mersey and Chester EA FWA. The FWA is for the River Tame at Mossley, Britannia and Waggon Road. This may be subject to change once the EA has signed off on the updated Tame model.
Natural Flood Management / Working with Natural Process	• There are two small areas within the WwNP floodplain reconnection area. The intent being to return the area back to the floodplain to lessen risk downstream.

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site H-MOSSLE-131 – Queen Street, Tameside	
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG).** • **It is understood that the Flood Map for Planning is to be updated with the outputs from the updated River Tame 2018 model. The EA has stated: "once signed off the flood map would be updated possibly around September 2020, but data can be shared externally via our customer and engagement team. We can share the maps with the LPA once they have been signed off which is supposed to be done by the end of December 2020".** • **Based on the updated modelling, the site is at less risk from a 1% AEP event and therefore at lower risk from Flood Zone 3. Depths within the 1% AEP outline are however significant.** • **Based on the Flood Map for Planning as it is currently, the site has a much smaller developable area (see Figure 1) than shown by the updated modelling (Figure 3). However, Flood Zones 3 and 2 have been artificially edited to include the whole footprint of the existing building. It is assumed this building will be demolished as part of the site redevelopment.** • **Development should be directed away from the modelled 1% AEP event area. Development is further restricted by the 8 metre no development buffer of the Tame. This is advised by the EA for watercourse access and maintenance purposes. The EA advises that any development may require a permit under the Environmental Permitting (England and Wales) Regulations 2016 from the Environment Agency for any proposed works or structures, in, under, over or within eight metres of the top of the bank of the River Tame, designated a 'main river'.** • **It would be advisable to avoid developing in the climate change area where average depths are approximately 700 mm with maximum depths over 3 m. This would leave around 0.7 ha of developable area, based on fluvial risk and accounting for climate change. The site should pass the Exception Test if development can be directed to the 0.7 ha area.** • **Any development in Flood Zone 3a or the climate change risk area would have to be constructed with finished floor levels above the 100 year plus climate change flood level plus 600 mm freeboard. Compensatory storage would however have to be found. Stilted development is a further option though is likely to be an expensive design solution.** • **A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at times of flood, even for above ground floor accommodation. Site design and layout should further investigate the indicative locations shown on Figure's 1, 3 and 4 of this Level 2 SFRA. All such options should be subject to detailed investigation, planning and consultation with the appropriate RMAs.** • **It is recommended that the risk area is converted to open greenspace for flood alleviation using appropriate SuDS, and also used for ecological and social/amenity purposes.**

Site H-MOSSLE-131 – Queen Street, Tameside	
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to the River Tame, groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and should not be an issue in this instance; groundwater should be assessed as part of the FRA.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	• • • • • • • •
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• The Huddersfield Narrow Canal runs to the east of the site on the opposite side of the River Tame. The canal is in close proximity to the site (approximately 95 metres to the eastern boundary of the site). Residual risk from canals must be assessed as part of the FRA.

Site H-MOSSLE-131 – Queen Street, Tameside

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

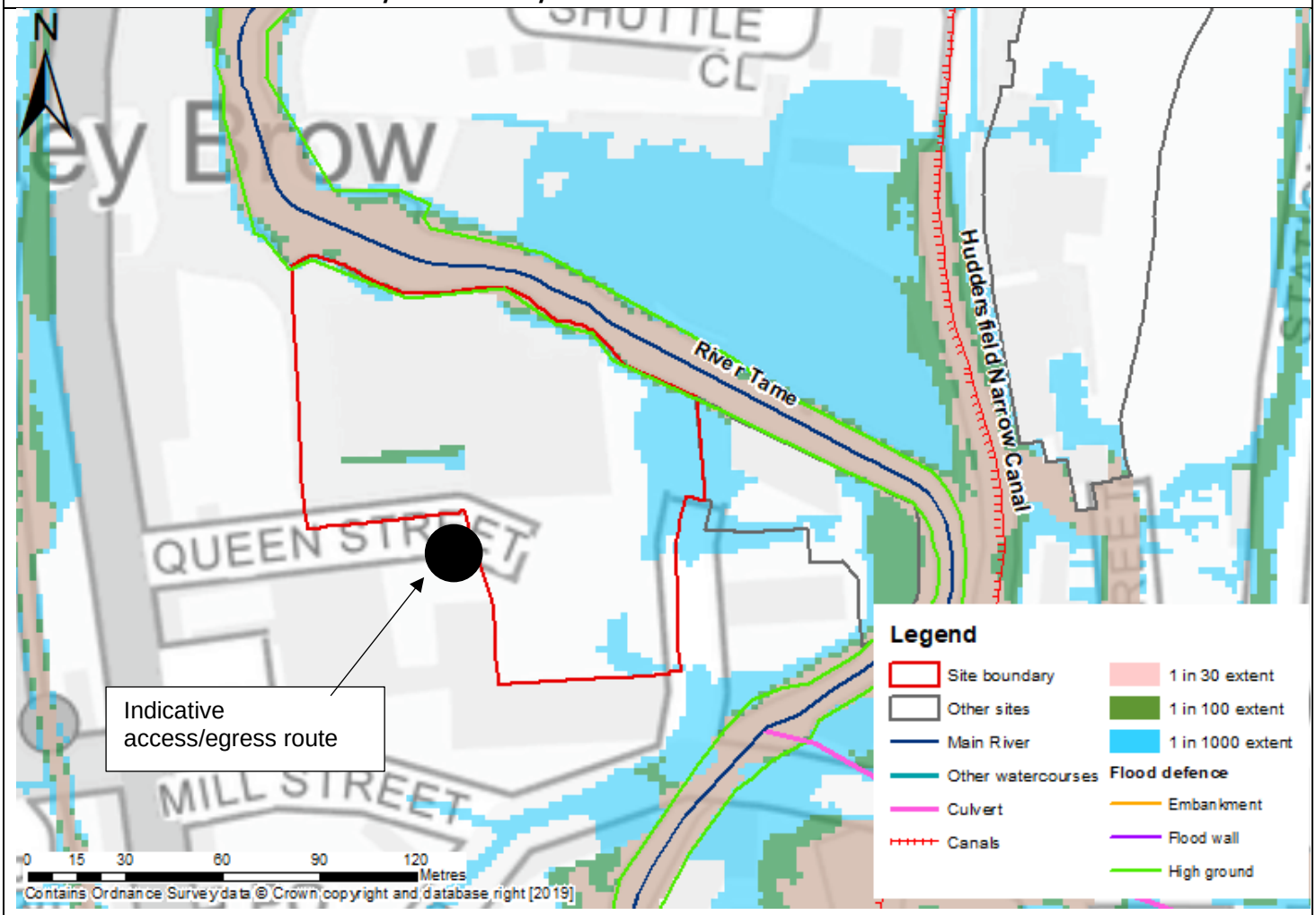


Figure 4: Surface water risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	1.24	3.16	14.08
Surface water flooding depths	Max: 0.90 – 1.20m	Max: >1.20m	Max: >1.20m
Surface water hazards	Max: Moderate Mean: Moderate	Max: Significant Mean: Moderate	Max: Significant Mean: Moderate
Surface water flood risk to development site	• Approximately 3% of the total site area is at risk of surface water flooding in the 1% AEP event to a maximum depth greater than 1.20 m. This is primarily along the River Tame with a small section inundated in the west of the site, constrained by the existing building. • Safe access and egress are achievable via Queen Street to the west as it remains free from inundation.		
Climate Change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.		

Site H-MOSSLE-131 – Queen Street, Tameside

	• The 0.1% AEP outline covers 14% of the site; the hazard has been classified as Significant with maximum depths of over 1.20 m. • The indicative access and egress route via Queen street remains at very low surface water risk.

Mitigation options & site suitability: surface water	• **Most of the surface water risk is within the fluvial risk areas by the River Tame, by avoiding the fluvial risk areas, as discussed above, the developer will also avoid the majority of the surface water risk, apart from the small area in the west of the site.**
	• **The behaviour of surface water may change as a result of site clearance and removal of the existing building. A drainage strategy would therefore be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This may require surface water modelling based on proposed layout plans.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 100% impermeable area and limiting greenfield runoff rate of Qbar (l/s). It is noted that greenfield runoff rates and volumes may not be achievable for development of brownfield sites, therefore, values as close as reasonably practicable may be agreed with the LLFA.**

Proposed development limiting runoff rate: (l/sec)
Qbar: 8 l/s (FEH Statistical)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall + 20%	12	901	242	659	32.6	0.04 ha 4.1 %
30yr Rainfall + 40%	12	1051	242	809	40.0	0.05 ha 5.0 %
100yr Rainfall + 20%	12*	1181	242	939 (280m^3 of exceedance storage)	46.5	0.06 ha 5.8 %
100yr Rainfall + 40%	12*	1378	242	1136 (327m^3 of exceedance storage)	56.2	0.08 ha 7.0 %
*limited to corresponding 30yr Rainfall critical storm duration						

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated

Site H-MOSSLE-131 – Queen Street, Tameside	
	for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.
Overall Site Assessment	
Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **It is likely this site could pass the Exception Test, based on the updated 2018 Tame model.**
Recommendation summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed] or by emailing the local office SPPlanning.RFH@environment- agency.gov.uk The Flood Map for Planning should be updated with the River Tame 2018 model outputs as soon as possible to avoid any confusion with prospective developers. • Safe access and egress routes must be identified early in the site design process. The risk area, included climate change, should be converted to open greenspace. • The FRA should inform the site design of the open greenspace and investigate • appropriate SuDS techniques.
FRA requirements	• The FRA should include a drainage strategy for the proposed new development layout, accounting for UU requirements. Options modelling will be required were • development to be considered in Flood Zone 3, accounting for climate change. The FRA should include emergency planning procedures with particular • consideration to safety around the nearby watercourse in a residential area and ensuring safe access and egress routes. • Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, • in the absence of any local SuDS policy or guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services. •

Site H-MOSSLE-132 – Audley Street, Mossley, OL5 9WH	
Location	Audley Street, Tameside
Site area (ha)	1.07
Watercourse	River Tame
EA Model used	River Tame 2018 (not yet been signed off by the EA)
Existing use	Industrial / brownfield, existing buildings
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	1.07

Flood outlines (present day)

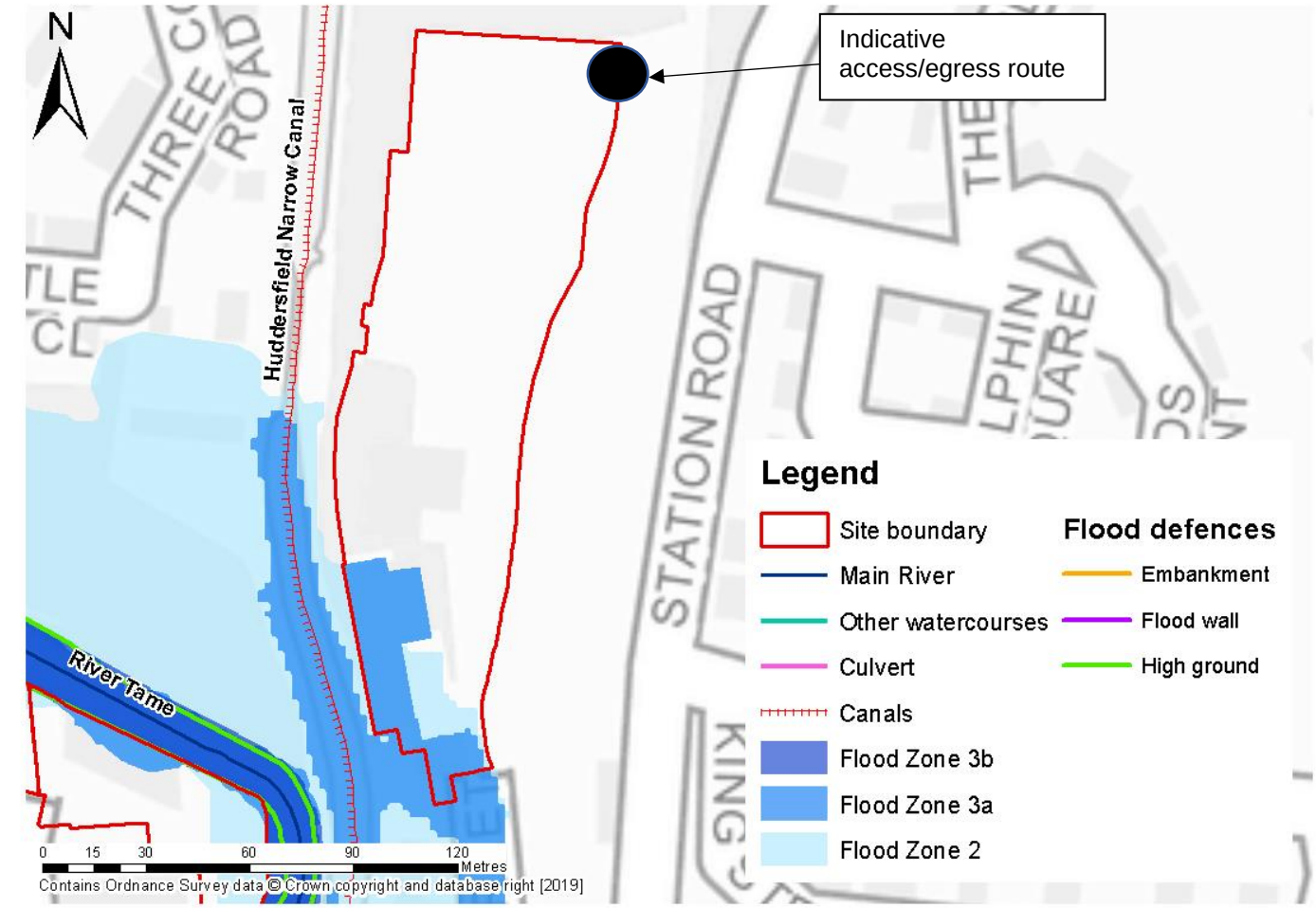


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences

Note: percentage areas at risk are subject to change once the Flood Map for Planning is updated with the outputs from the River Tame 2018 model

Site H-MOSSLE-132 – Audley Street, Mossley, OL5 9WH

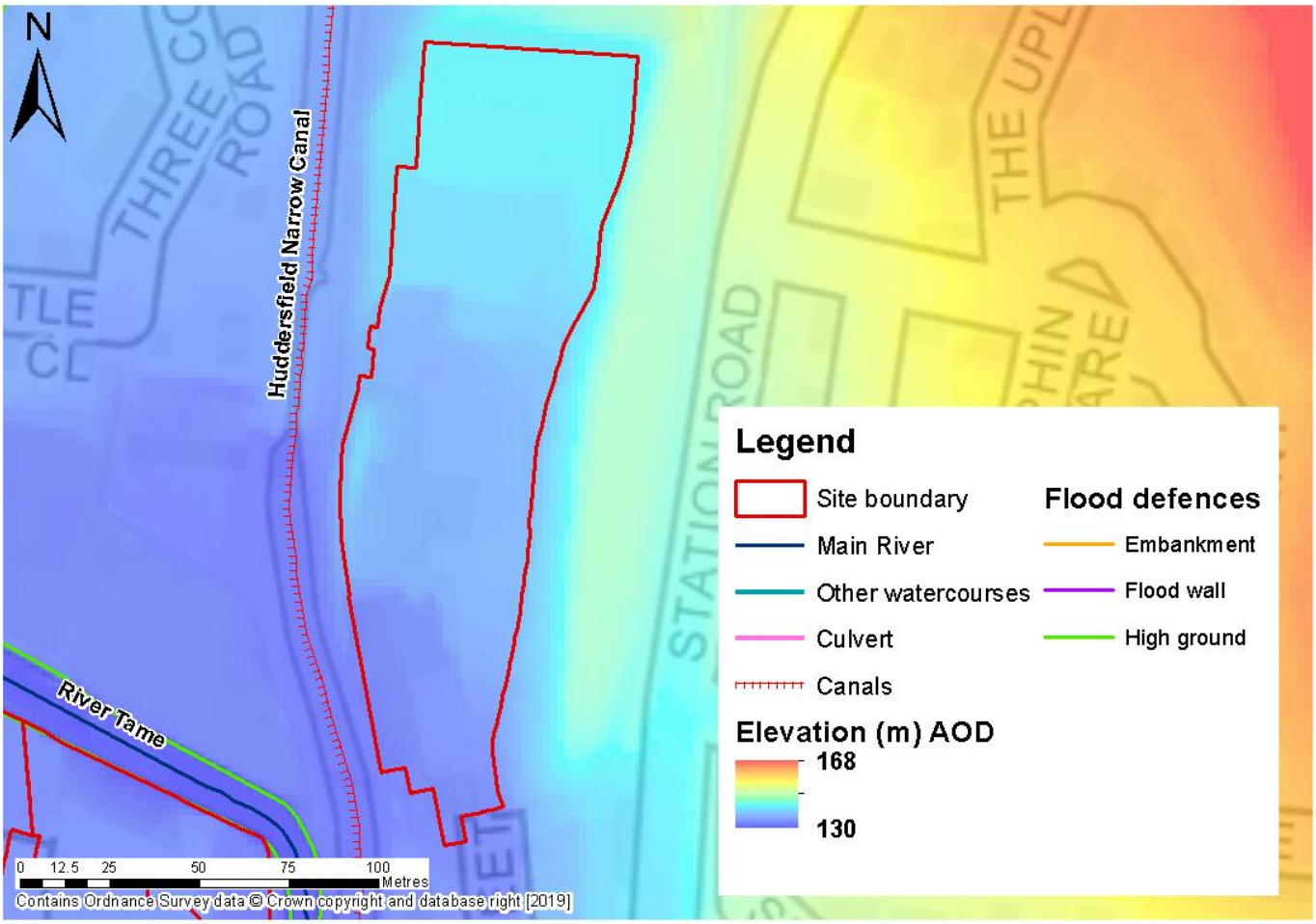


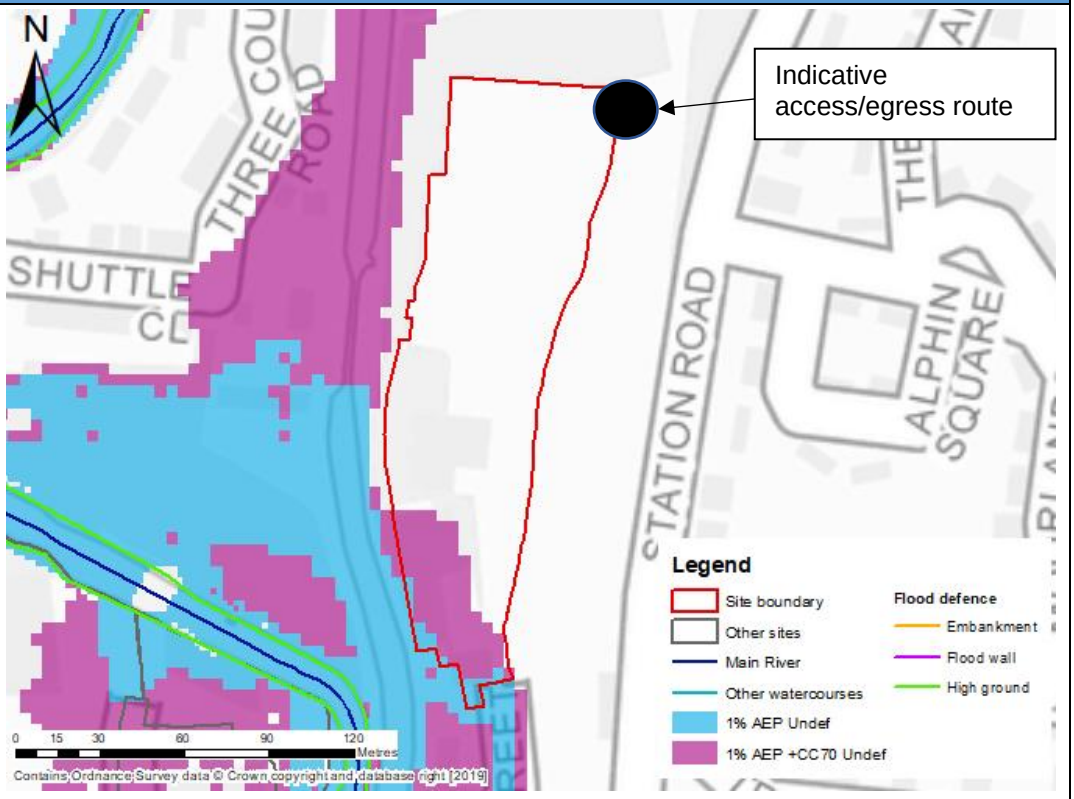
Figure 2: Site with 2m 2017 LIDAR (elevation data)

- The elevation of the site decreases from approximately 141m AOD in the north to approximately 133m AOD in the south.
- The residential area to the north-east has a higher elevation of around 160m AOD.
- The River Tame runs to the west of the side but the site is immediately bound on the west by the Huddersfield Narrow Canal. These watercourses both flow southwards.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	0.00	10.26	3.06	13.81
Fluvial: average depth (m)	Not available	0.09	0.60	0.49
Fluvial: maximum depth (m)	Not available	0.38	1.60	1.53
Fluvial: average hazard	Not available	Low	Significant	Significant
Fluvial: maximum hazard	Not available	Moderate	Significant	Significant

Site H-MOSSLE-132 – Audley Street, Mossley, OL5 9WH	
Modelled fluvial flood risk and climate change (River Tame 2018 model) (model not yet been signed off by the EA)	 Figure 3: Undefended fluvial outlines for the present day 1% AEP and future risk 1% AEP +70% climate change increase • The undefended present day 1% AEP outline only covers a very small section of the south of the site with the climate change +70% uplift extending to cover the south of the site. • The modelled flood outlines are not consistent with the Flood Map for Planning i.e. the site area within the modelled 1% AEP event outline is much smaller than in the current Flood Zone 3. It is noted that the Flood Map for Planning will be updated with the modelled flood outlines from the Tame 2018 model, thus placing the site at less risk. • Safe access and egress should be achievable via Station Road to the east of the site, but there would need to be a purpose-built route created here. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM). • Section 19 Investigation Reports (dated April 2017 and June 2018) refer to historic flooding related to Micklehurst Brook. See documents on https://www.tameside.gov.uk/floodresilience
Defences	• Based on the EA's Spatial Flood Defences database, the River Tame is bound by informal defences of high ground that range in condition grade; the section of the Tame that runs closest to the site has high ground bounding it that has been assessed at condition grade 1 meaning 'Very Good' (Table 1.1 Condition Assessment Manual[1]).
Flood Warning Area	• A section of the south of the site is included within an EA FWA; the FWA is for the River Tame at Mossley, Audley and Egmont areas.

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site H-MOSSLE-132 – Audley Street, Mossley, OL5 9WH	
Natural Flood Management / Working with Natural Processes	• Areas in the south of the site are within areas of potential floodplain reconnection in the WwNP dataset. Typically, these are areas located close to watercourses that do not contain properties. As this area is affected by flooding already, it would be recommended to avoid developing this area to allow for potential future floodplain reconnection.
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG).** • **It is understood that the Flood Map for Planning is to be updated with the outputs from the updated River Tame 2018 model. The EA has stated: "once signed off the flood map would be updated possibly around September 2020, but data can be shared externally via our customer and engagement team. We can share the maps with the LPA once they have been signed off which is supposed to be done by the end of December 2020".** • **The modelled outputs show the level of fluvial risk during the 1% AEP event (which would represent Flood Zone 3 if used to update the Flood Map for Planning) to only cover a very small section to the south of the site, as opposed to the 10% quoted above for Flood Zone 3a.** • **The 1% AEP event + climate change outline from the Tame model covers a similar area to the current Flood Zone 3 of the Flood Map for planning.** • **This site should be able to pass the Exception Test if development is directed north away from the current area of Flood Zone 3a. This would also account for the modelled climate change risk and help ensure sustainable development. The EA has noted agreement with this approach.** • **The risk area is currently open car park and an industrial building. Ideally this area would be cleared of existing development and converted to open greenspace to account for the modelled risk from climate change.** • **Safe access and egress routes must be available at times of flood. However, the Council has stated that the indicative route via Station Road, as shown on Figures 1 and 3, is unlikely to be practical/feasible due to third party landownership and the presence of the existing Tame Valley Trail. Alternative routes must be identified.** • **The Huddersfield Narrow Canal runs along the western site border which may have residual risk associated with it from breach events, for example, overtopping and breach of the canal occurred in 1972 due to vandalism. An FRA should include modelling of overtopping and breach risk scenarios associated with the canal to ascertain residual risk.**
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to the River Tame, groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and is unlikely to be an issue in this instance.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	•

Site H-MOSSLE-132 – Audley Street, Mossley, OL5 9WH	
	• The extent shows the worst credible area that is susceptible to dam breach flooding. The map should be used to prioritise areas for evacuation/early warning. • There are many extents of reservoir inundation that only affect the south-western corner of the site; these come from eight United Utilities owned reservoirs (New Years Bridge, Buckton Vale, Dowry, Rooden, Castleshaw Lower, Castleshaw Upper, Crookgate, and Readycon Dean). • There are some reservoirs where inundation covers the majority of the site; these are four United Utilities owned reservoirs (Dovestone, Greenfield, Yeoman Hey, and Chew). • Much of the reservoir network is owned and managed by United Utilities who monitor and maintain reservoirs as required. United Utilities own 43 reservoirs within Greater Manchester. • The chance of reservoir failure is very rare and there is an extremely good safety record in the UK with no loss of life due to reservoir flooding since 1925. • The extent shows the worst credible area that is susceptible to dam breach flooding. The map should be used to prioritise areas for evacuation/early warning. • United Utilities' ongoing management of reservoirs ensures they do not cause flooding as their presence within the network of surrounding watercourses actually reduces the impact of excess rainfall. • All United Utilities operated reservoirs are managed in accordance with the Reservoirs Act and relevant Health and Safety legislation to ensure they do not fail such requirements. United Utilities also notes that the Environment Agency is responsible for ensuring compliance with the highlighted legislation. • United Utilities also wishes to highlight the drive for continued constructive communication with the relevant local authorities to ensure a coordinated approach to the delivery of site allocations. United Utilities are committed to continuing to work with the relevant Local Authorities and the Greater Manchester Combined Authority as site allocations progress further.
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• The Huddersfield Narrow Canal runs along the west of the site boundary and therefore residual risk must be assessed as part of the FRA.

Site H-MOSSLE-132 – Audley Street, Mossley, OL5 9WH

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

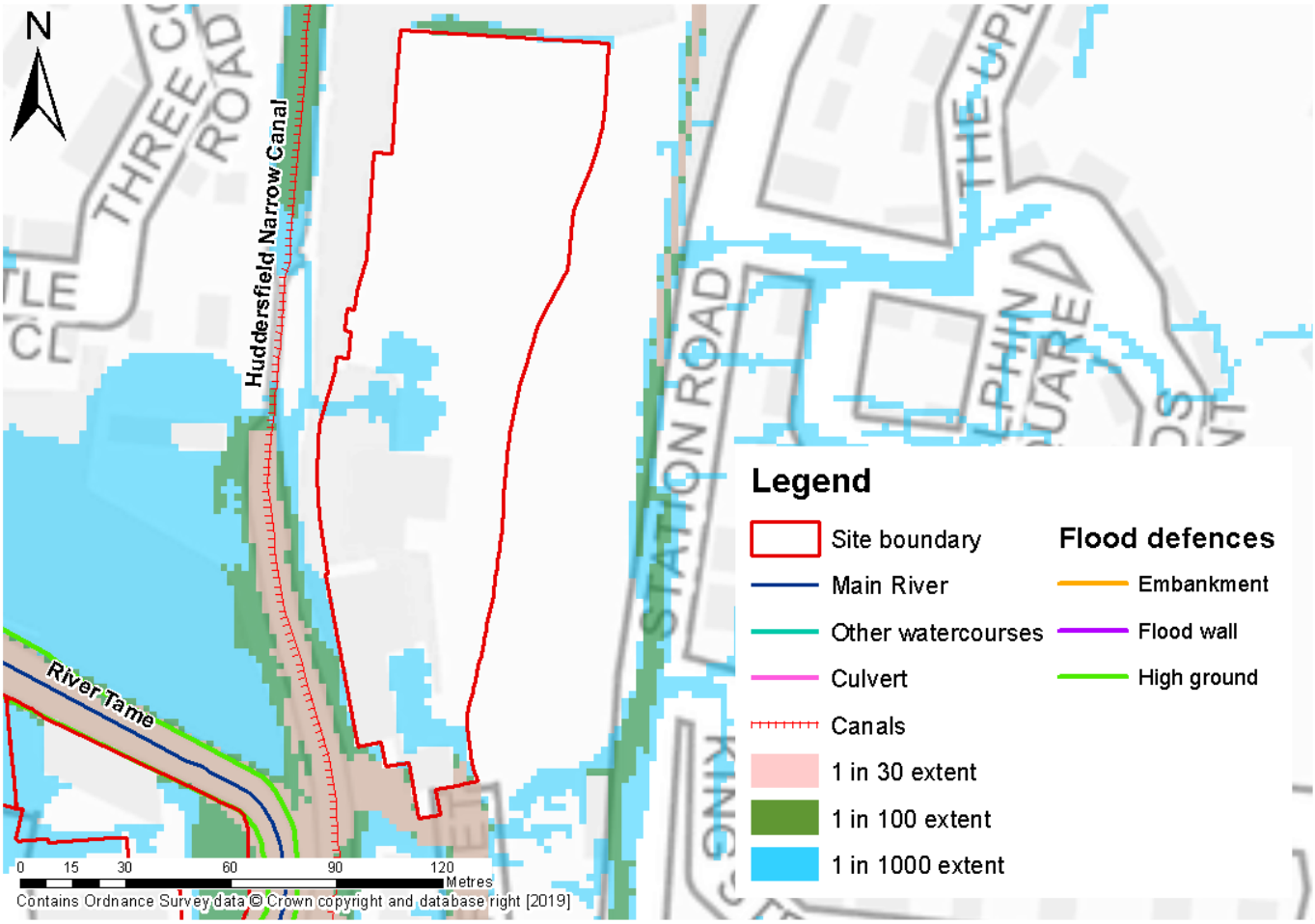


Figure 4: Surface water risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	0.23	0.43	8.91
Surface water flooding depths	Max: 0.15 – 0.30m	Max: 0.30 – 0.60m	Max: 0.30 – 0.60m
Surface water hazards	Max: Low Mean: Low	Max: Moderate Mean: Low	Max: Significant Mean: Low
Surface water flood risk to development site	• The site is at low risk from surface water flooding according to the Risk of Flooding from Surface Water. • Current buildings appear to constrain surface water in the south of the site. • Safe access and egress may however be difficult as the surrounding roads experience surface water inundation during the 1% AEP event. Station Road is shown to be have high to medium surface water risk along its length adjacent to the site. Alternative routes should therefore be considered as part of the FRA and drainage strategy.		
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.		

Site H-MOSSLE-132 – Audley Street, Mossley, OL5 9WH	
	• Approximately 9% of the site experiences inundation from surface water during the 0.1% AEP event. • Safe access and egress to the site may be difficult to achieve in the long term. This should be considered in the FRA.

Mitigation options & site suitability: surface water	• **It is assumed that current development will be demolished to make way for new dwellings. This may well change the behaviour of surface water, particularly in the south of the site, whereby there may be greater risk, once the existing building is removed. This increased risk may be accounted for within the recommended greenspace for this area, which should be designed to control fluvial and surface water risk. Surface water modelling should however by carried out to ascertain surface water flow routes and volumes once the site is cleared. Site layout and design will have to account for this risk through appropriate SuDS. Infiltration SuDS may not be appropriate onsite given it is brownfield, though ground investigation and contamination assessments should be carried out to confirm.**
	• **A full drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on proposed layout plans.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **Given the risk to existing surrounding roads, the drainage strategy and FRA should account for the provision of safe access and egress routes within the site design and layout.**
	• **Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 100% impermeable area and limiting greenfield runoff rate of Qbar (l/s). It is noted that greenfield runoff rates and volumes may not be achievable for development of brownfield sites, therefore, values as close as reasonably practicable may be agreed with the LLFA.**

Site H-MOSSLE-132 – Audley Street, Mossley, OL5 9WH

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Qbar: 8 l/s (FEH Statistical)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall + 20%	12	893	242	651	32.2	0.043 ha 4.056 %
30yr Rainfall + 40%	12	1042	242	800	39.6	0.053 ha 4.984 %
100yr Rainfall + 20%	12*	1171	242	929 (278m^3 of exceedance storage)	46.0	0.062 ha 5.788 %
100yr Rainfall + 40%	12*	1366	242	1124 (324m^3 of exceedance storage)	55.6	0.075 ha 7.003 %

*limited to corresponding 30yr Rainfall critical storm duration

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.

Overall Site Assessment

Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **This site is likely to be able to pass the Exception Test if development is directed north out of the current Flood Zone 3a. This approach should also account for long term fluvial risk as modelled on the River Tame.**
Recommendation summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed]) or by emailing the local office SPPlanning.RFH@environment-agency.gov.uk Convert risk area in the south of the site to multipurpose open greenspace and leave free of development, accounting for climate change. • Detailed FRA and drainage strategy to investigate and ensure availability of routes for safe access and egress at all times during a flood. • The FRA should include a drainage strategy for the proposed new development layout. Surface water modelling should also be carried out to ascertain flow paths
FRA requirements	• and volumes once the site is cleared of existing development. The proposed greenspace should be designed to mitigate long term fluvial risk and surface water through the FRA. • The FRA should include emergency planning procedures with particular •

Site H-MOSSLE-132 – Audley Street, Mossley, OL5 9WH	
	consideration to ensuring safe access and egress routes in times of flood • Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. • Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services.

Site H-WATERL-050 – Park Bridge, Ashton-under-Lyne, OL6 8AW	
Location	Mill Brow, Tameside
Site area (ha)	1.23
Watercourse	River Medlock
EA Model used	River Medlock 2004 (Broadscale model)
Existing use	Mix of greenfield to the north and industrial development to the south
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	1.05

Flood outlines (present day)

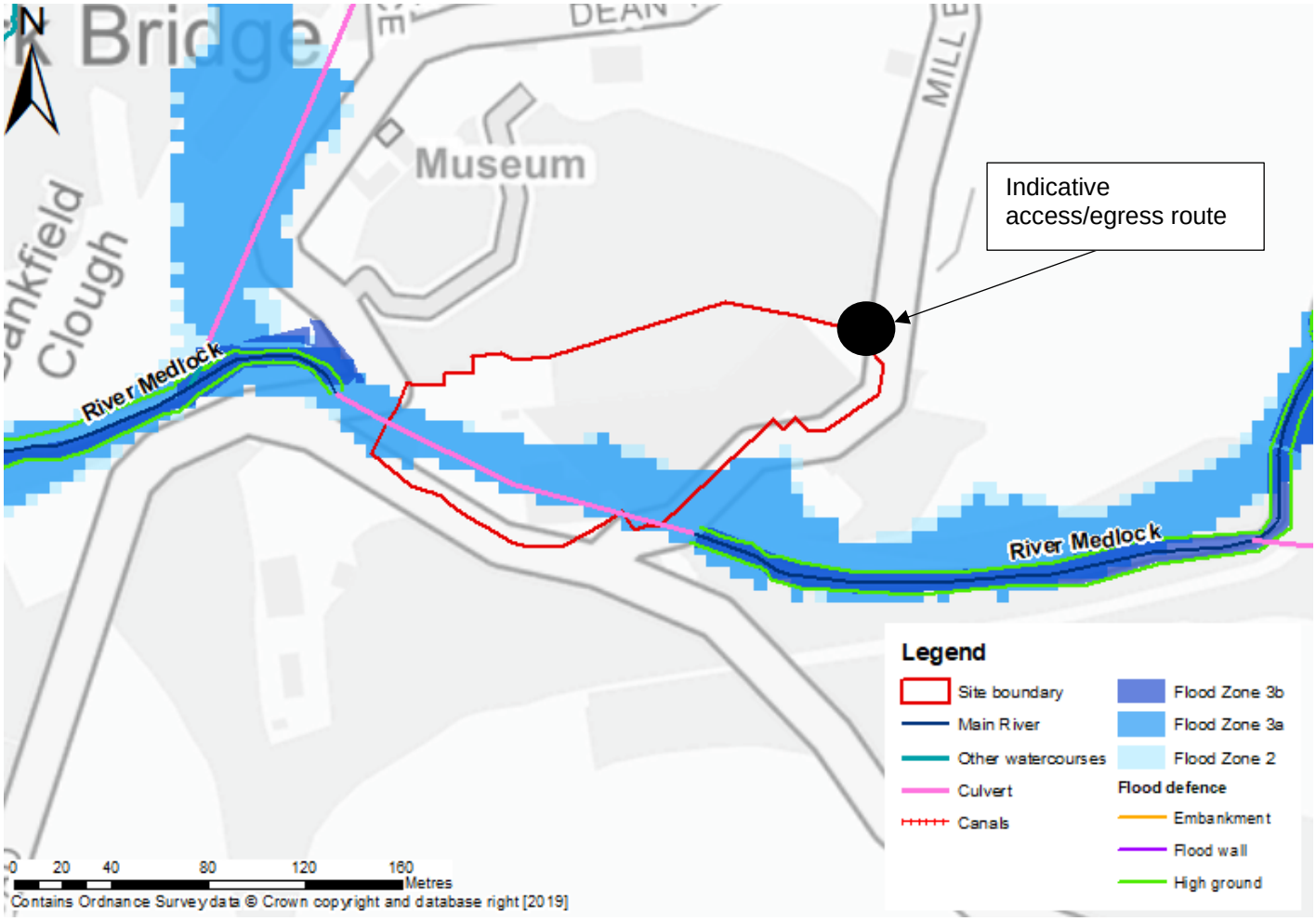


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences

Site H-WATERL-050 – Park Bridge, Ashton-under-Lyne, OL6 8AW

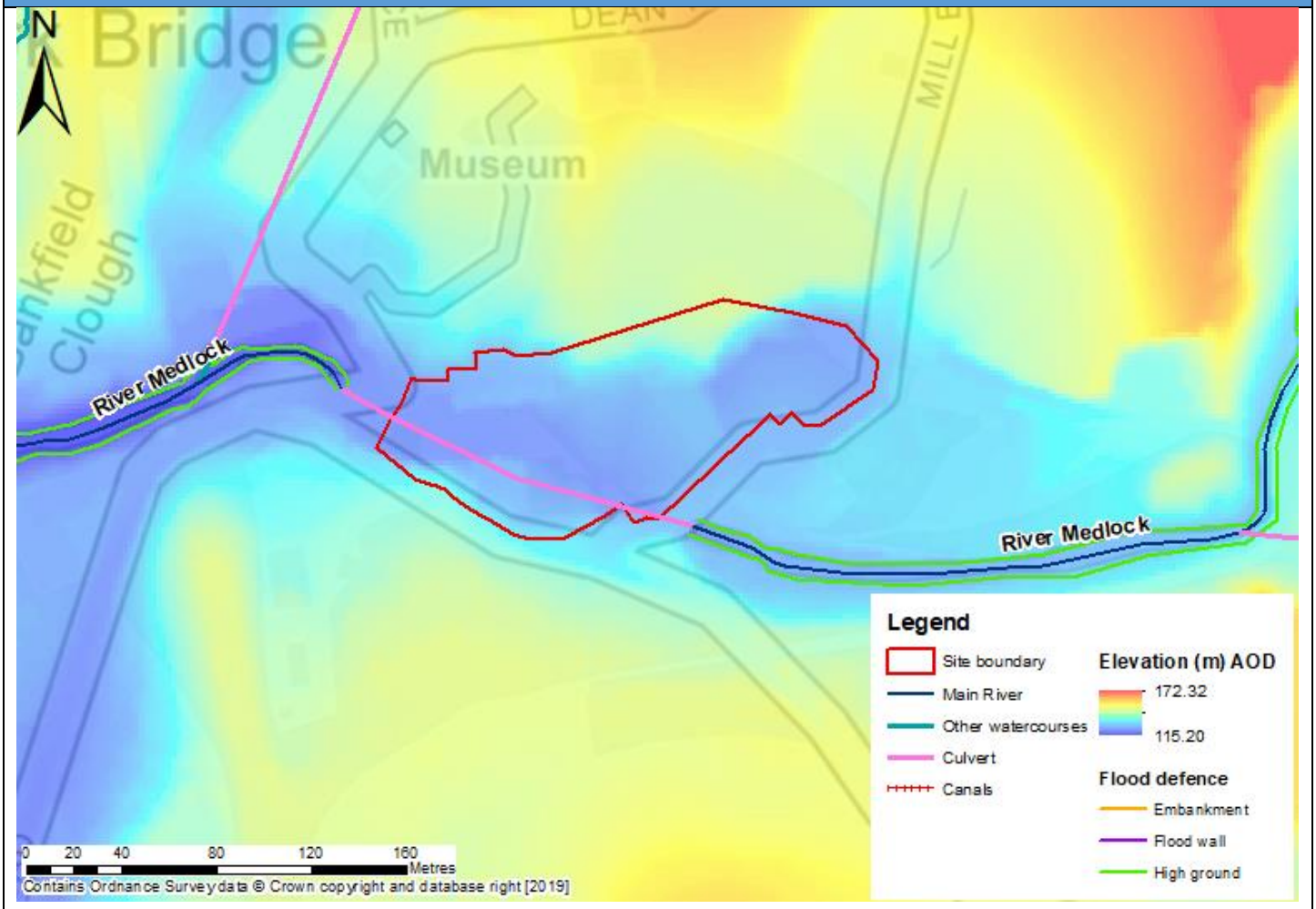


Figure 2: Site with 2m 2017 LIDAR (elevation data)

- The elevation across the site remains between approximately 122 m AOD and 127 m AOD; there is a small pocket of land on the northern boundary where the elevation is higher at an approximate average of 139m AOD.
- The surrounding areas to the north and south of the site have higher elevation of approximately 145 m AOD with the elevation to the north-east increasing as high as 168 m AOD.
- The site sits on top of the culverted River Medlock which runs across the south site boundary flowing westwards.

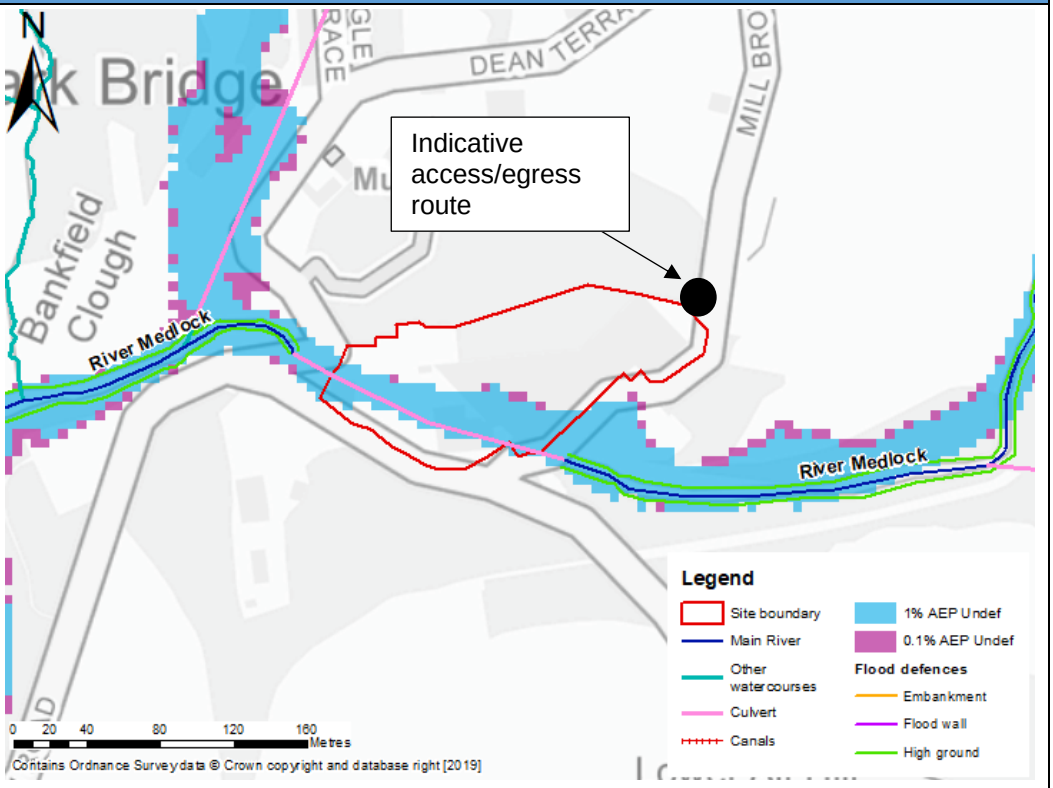
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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change**
	0.00	24.27	1.02	Not available
Fluvial: average depth (m)	Not applicable	1.43	1.59	Not available
Fluvial: maximum depth (m)	Not applicable	2.70	3.15	Not available
Fluvial: average hazard*	Not applicable	Not available	Not available	Not available
Fluvial: maximum hazard*	Not applicable	Not available	Not available	Not available

*Hazard information not modelled

**Climate change not modelled in the broadscale mapping study, 2004

Site H-WATERL-050 – Park Bridge, Ashton-under-Lyne, OL6 8AW	
Modelled fluvial flood risk and climate change (River Medlock 2004)	 Figure 3: Undefended fluvial outlines for the present day 1% AEP and 0.1% AEP. • The 1% AEP present day outline covers the majority of the south of the site following the culverted River Medlock with the 0.1% AEP outline remaining similar to the 1% AEP. • The modelled flood outlines are equivalent to the Flood Map for Planning. Although the outlines and depths were produced using broadscale modelling, the EA has confirmed that there are no plans to update the modelling in this area due to the rural nature of the location. • However, a FRA has been carried out as part of a planning application for the site which shows that all modelled events remain in-channel. • Safe access and egress appear achievable via Mill Brow to the north-east.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, the River Medlock is bounded by areas of high ground which act as informal defences which are assessed at condition grades 2 and 3 meaning 'Good' and 'Fair' (Table 1.1 Condition Assessment Manual[1]). These informal defences are not known to provide any protection to the site.
Flood Warning Area	• The site lies outside of any current EA FWAs.
Natural Flood Management / Working with Natural Processes	• The southern half of the site is within areas of riparian tree planting in the WwNP dataset. • Additionally, the site contains areas within the Irwell NFM dataset. The site being split with the northern half within areas of scrub planting land and the south areas of woodland planting. Both of these can significantly delay the timing of peak runoff in headland catchments.
Observations, mitigation options & site suitability:	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the**

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site H-WATERL-050 – Park Bridge, Ashton-under-Lyne, OL6 8AW	
fluvial	**development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG).** • **The Council has stated that this site has outline consent for residential development 16/00177/OUT (approved 4 Feb 2019). This planning application is accompanied by a site-specific FRA[2]. The FRA has remodelled the River Medlock in 1D, following a channel survey. The modelling shows that the 1% AEP event and the 1% + 70% remain in-channel. This modelling should supersede the modelled flood outlines shown in Figure 3 and should be used to update the Flood Map for Planning.** • **Notwithstanding the FRA conclusions, the following observations and advice is included as part of this Level 2 SFRA:** • **It is recommended that residential development be directed away to Flood Zone 1 in the north of the site. This is also where the indicative safe access point is located.** • **The culverted section of the Medlock is approximately 160 metres long and runs for the entire extent of the southern site boundary. Development should seek to remove redundant structures/culverted sections to reduce flood risk and improve WFD status.** • **There will be residual risk associated with this culvert which should be assessed through blockage scenario modelling. Capacity and condition survey would be required to inform the modelling together with ownership and maintenance information. Access to the culvert will be required at all times, therefore any development should not obstruct such access.** • **The FRA states:** o ***'residual risk within the proposed site will always remain and the development will incorporate features that mitigate any residual risk by providing overland flow paths. The overland flow paths will be designed to convey flows away from the proposed development'*.** • **There must be space made available, i.e. compensatory storage, to enable conveyance of residual floodwaters away from the development. Risk should not be directed offsite and offsite runoff should not exceed existing volumes.** • **Given the culverted section of watercourse on the site, the developer or site owner must find out which permissions and licences are required to maintain, repair, build or remove anything in or around the Medlock and the culvert. Without appropriate permissions and licences the developer/site owner may be subject to a fine or imprisonment. The EA has further noted that as the Medlock is defined as 'Main River', they would be the consenting authority on development. Any applicant may need to apply for a permit under the Environmental Permitting (England and Wales) Regulations 2016 for development in, under, over or within 8 metres of the watercourse.** • **Were development to proceed, options to remove the culvert and open up the Medlock should be sought. This may help reduce residual flood risk though options modelling would be required to confirm.**

[2] Park Bridge, Ashton-Under-Lyne, Flood Risk Assessment, Detail Construction Solutions Limited. December 2016

Site H-WATERL-050 – Park Bridge, Ashton-under-Lyne, OL6 8AW	
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to the River Medlock, groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and may be an issue in this instance. Groundwater should be assessed as part of the FRA.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	•
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• No canals in the vicinity of the site.
Flood Source: Surface Water	
Surface Water Flood Risk to Proposed Development Site	

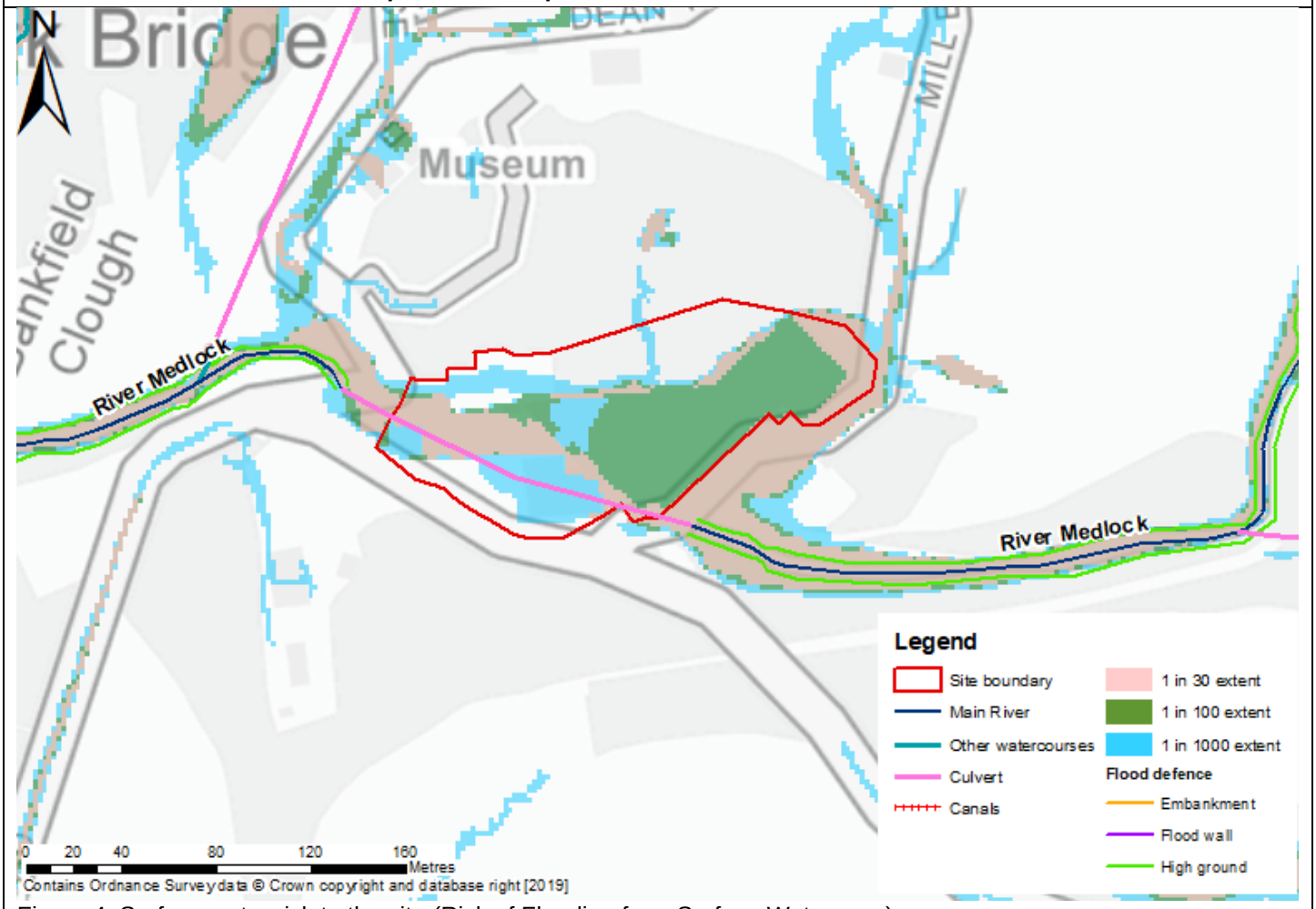


Figure 4: Surface water risk to the site (Risk of Flooding from Surface Water map)

Site H-WATERL-050 – Park Bridge, Ashton-under-Lyne, OL6 8AW			
Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	19.92	54.88	74.53
Surface water flooding depths	Max: >1.20m	Max: >1.20m	Max: >1.20m
Surface water hazards	Max: Significant Mean: Significant	Max: Significant Mean: Significant	Max: Significant Mean: Significant
Surface water flood risk to development site	• According to the RoFSW map, surface water risk to the site is significant. Approximately 55% of the total site area is at risk of surface water flooding in the 1% AEP event to a maximum depth greater than 1.2 m. • Provision for safe access and egress routes do not appear achievable via existing routes. Alternative routes would have to be found. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.		
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP outline extends to cover 75% of the total site area; the hazard has been classified as 'Significant'. • Safe access and egress routes to the site would prove challenging in the 0.1% AEP event.		

Mitigation options & site suitability: surface water	• **Based on the RoFSW alone, surface water risk would likely rule out residential development of this site, unless major mitigation can be implemented.**
	• **The RoFSW is caveated with the statement that '*the map does not contain sufficient information for it to be used to determine flood risk to individual properties, but it does give you an indication of whether your area may be affected by surface water flooding and to what extent'*.**
	• **However, although broadscale, the RoFSW does indicate that surface water could be a potentially significant issue for the site and that mitigation in the form of major storage facilities could be required on site.**
	• **There are a number of surface water flow paths into the site, due to the steep topography surrounding the site, particularly to the north from Mill Brow.**
	• **Ideally, this site would be fully converted to open greenspace used for storage of surface water and left free of development.**
	• **The site-specific FRA acknowledges the significant risk to the site and states the requirement for:**
	  ○ ***'a strategy to manage the surface water flood risk should be developed. For example, swales could be used to take the excess flow from the road and channel the water around the perimeter of the site. These would need to be designed to carry the 100-year flow plus an allowance for Climate Change'.***
	  ○ ***'management of surface water runoff from the site will also be covered in the drainage strategy.***
	• **Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (l/s).**		

Site H-WATERL-050 – Park Bridge, Ashton-under-Lyne, OL6 8AW

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Qbar: 14 l/s (FEH Statistical)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	6.5	701	229	472	13.3	0.031 ha 2.558 %
30yr Rainfall+40%	8.25	884	291	593	16.8	0.040 ha 3.214 %
100yr Rainfall+20%	8.5	1021	300	721 (249m^3 of exceedance storage)	20.4	0.048 ha 3.908 %
100yr Rainfall+40%	10.25	1257	362	895 (302m^3 of exceedance storage)	25.3	0.060 ha 4.851 %

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.

Overall Site Assessment

Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **It must be proven that surface water can be controlled for the lifetime of the development, without increasing flood risk elsewhere. A drainage strategy is required to inform this, as stated in the site-specific FRA. Assuming the strategy can show this then it is likely the Exception Test can be passed.**
Recommendation summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed]) or by emailing the local office SPPlanning.RFH@environment-agency.gov.uk The Flood Map for Planning should be updated with the new modelling of the Medlock, carried out as part of the FRA. • A drainage strategy is required to show that surface water can be controlled for the lifetime of the development, without increasing flood risk elsewhere. • Residual risk of culvert blockage/failure on the Medlock should be modelled and quantified. • Options for culvert removal should be investigated. Development should seek to remove redundant structures/culverted sections to reduce flood risk and help improve WFD status. •

Site H-WATERL-050 – Park Bridge, Ashton-under-Lyne, OL6 8AW	
FRA requirements	• The FRA should include emergency planning procedures with particular consideration to safety around the onsite watercourse in a residential area and ensuring safe access and egress routes in times of flood. • The FRA should ensure it is fully in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. • The FRA ensure consultation with the following, where applicable: the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services.

Site 1610 – Land adjacent to Manchester Ship Canal	
Location	Lock Lane, Trafford
Site area (ha)	18.95
Watercourse	Manchester Ship Canal
EA Model used	Manchester Ship Canal 1D model, 2010
Existing use	Greenfield
Existing site flood risk vulnerability classification (NPPF)	Water-compatible
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	16.11

Flood outlines (present day)

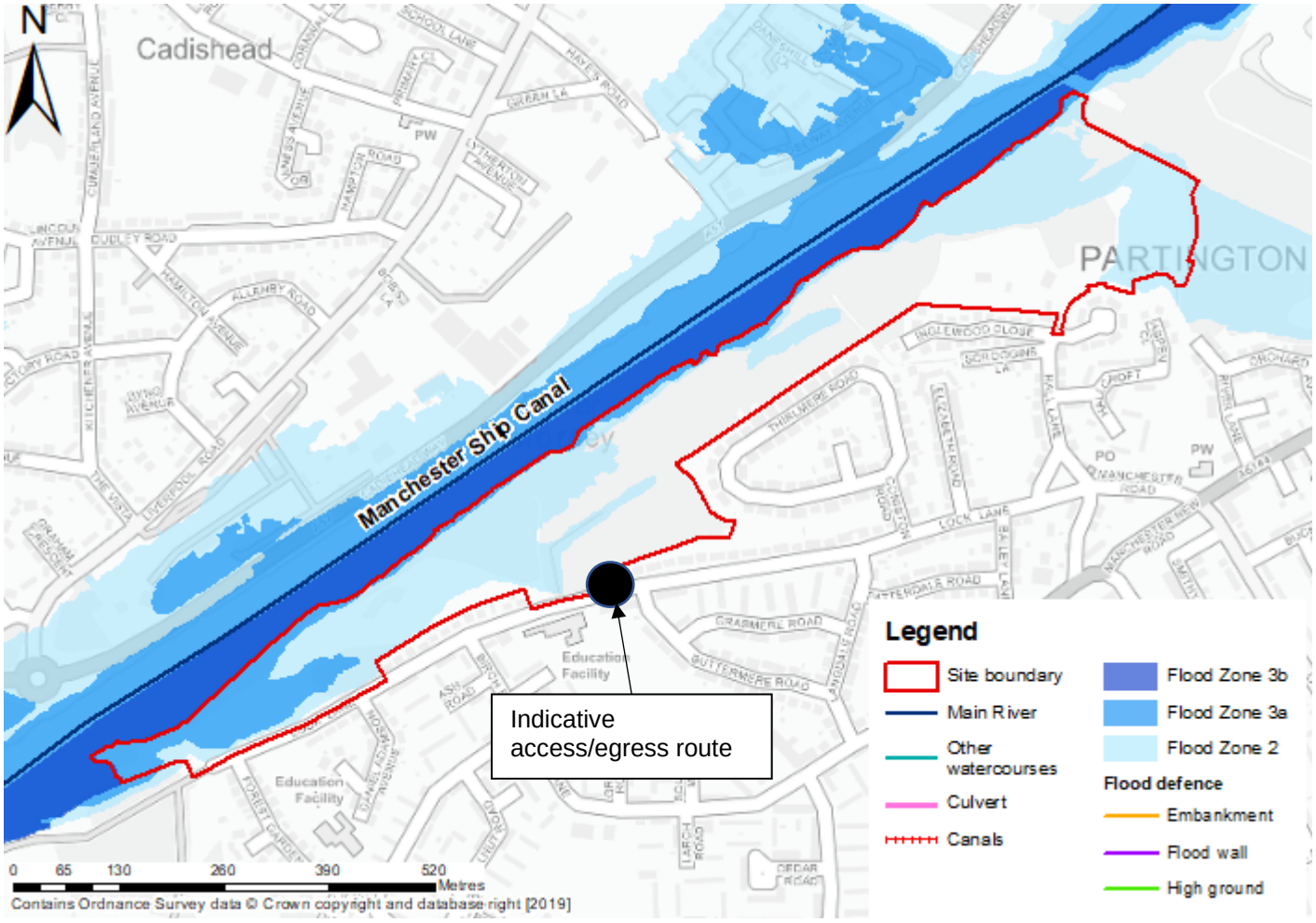


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning). At the time of writing, the Ship Canal is being remodelled and the Flood Map will be subject to change in the near future

Site 1610 – Land adjacent to Manchester Ship Canal

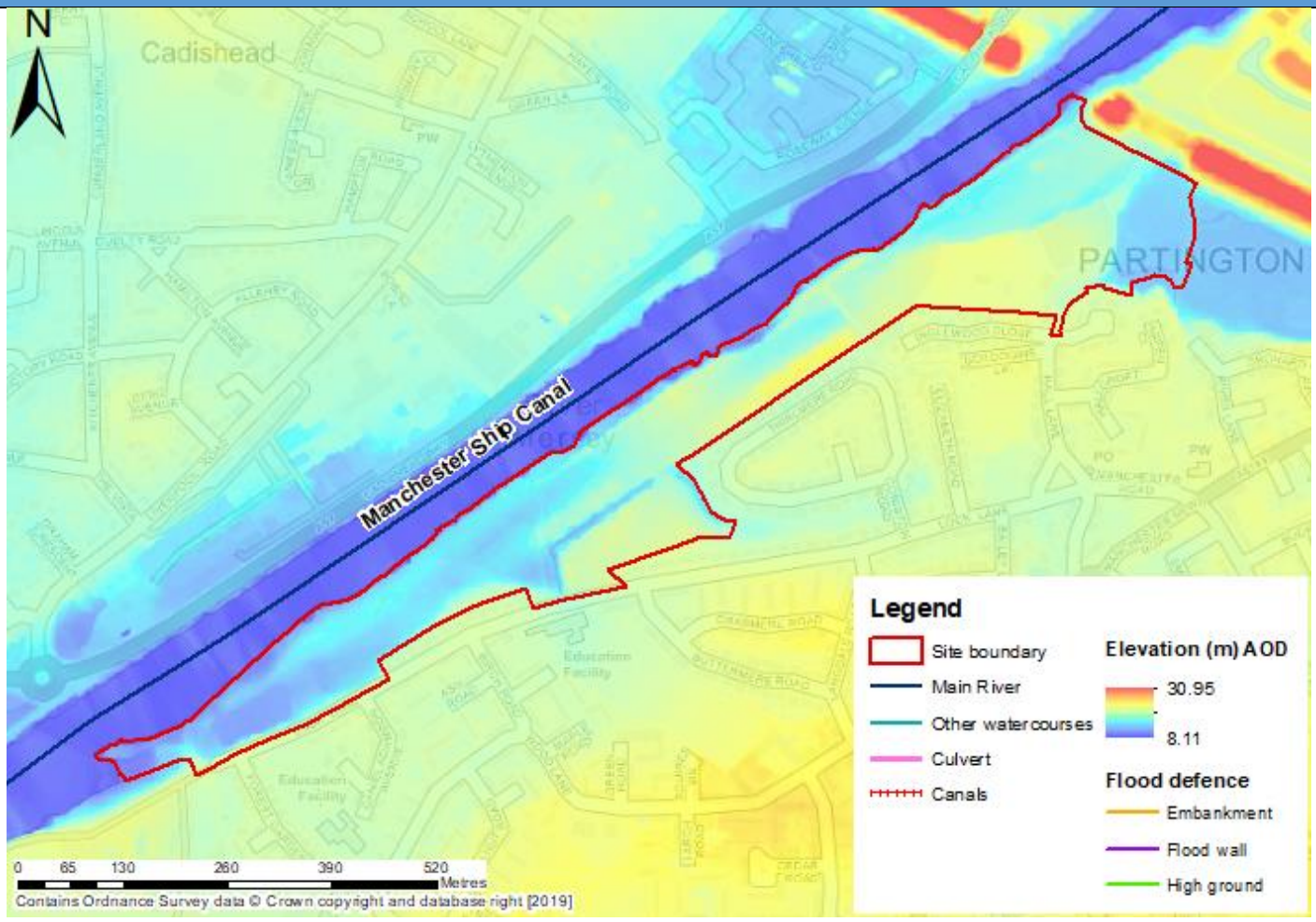


Figure 2: Site with 2m 2017 LIDAR (elevation data)

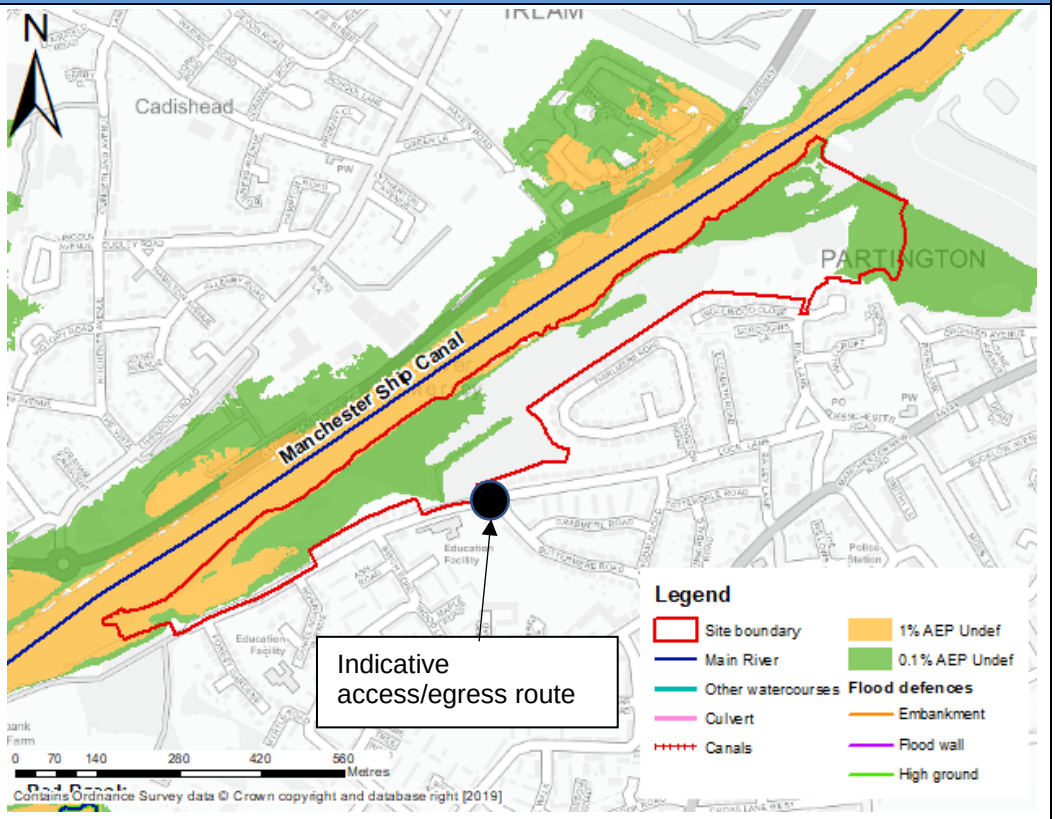
- The elevation across the site varies between 10 m AOD up to 18 m AOD. The lower levels are primarily within the south-west of the site.
- There is a depression in the north eastern corner of the site at Partington, where the elevation is approximately 12 m AOD with the surrounding elevations being approximately 16 m AOD.
- The Manchester Ship Canal flows from the north east towards the south west. The north west facing boundary of the site runs along the left bank of the Ship Canal. Glaze Brook enters the Ship Canal approximately 250 m downslope of the south western site boundary. There also appears to be a ditch running through the centre of the site, reflected by Flood Zone 2 in Figure 1.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	1.12	11.69	41.93	Not available
Fluvial: average depth* (m)	Not applicable	Not available	Not available	Not available
Fluvial: maximum depth* (m)	Not applicable	Not available	Not available	Not available
Fluvial: average hazard*	Not applicable	Not available	Not available	Not available
Fluvial: maximum hazard*	Not applicable	Not available	Not available	Not available

*Depth and hazard data not available in 1D model. 2D domain exists further upstream though stops around the Urmston area and does not cover the site.

Site 1610 – Land adjacent to Manchester Ship Canal	
Modelled fluvial flood risk and climate change (Manchester Ship Canal 1D model, 2010)	 Figure 3: modelled undefended 1% and undefended 0.1% AEP event outlines. • The 1% AEP undefended outline covers the 12% of the site (mainly in the south western corner), with the 0.1% AEP undefended outline increasing coverage to 54% across much of the site. Safe access and egress should still be available via Lock Lane. • At the time of writing, the 2010 model is consistent with the Flood Map for Planning. The updated 2019 MSC model is due to update the Flood Map in late-2020. This Level 2 assessment should be revisited then. • The 2010 model did not model climate change. Due to the requirements of 1D mapping and the channelised form of the canal, it was deemed too assumptive to both remodel and produce outlines from climate change scenarios. As the 1% AEP + 70% climate change is often similar in flows and outlines to the 0.1% AEP extent, a decision was made not to model climate change rather to use the existing 0.1% AEP event as a proxy. The 2019 model will include climate change.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the Environment Agency's Spatial Flood Defences dataset, the Manchester Ship Canal does not have any formal EA flood defences along this part of the watercourse.
Flood Warning Area	• The site lies outside of any current EA FWAs.
Natural Flood Management / Working with Natural Processes	• There are parts of the site in the south-west corner which contain tree planting areas in the WwNP dataset. These areas can significantly delay peak runoff in catchments. Additionally, in the north of the site, there are areas of floodplain reconnection from the same WwNP dataset.

Site 1610 – Land adjacent to Manchester Ship Canal	
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the new development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).** • **It is understood that, at the time of writing, the Ship Canal is being remodelled by the EA. It is expected that this model will be completed and will be used to update the Flood Map for Planning by late-2020. This Level 2 assessment should be revisited and updated once the model becomes available.** • **Currently, at the time of writing, approximately 13% of the site is located within Flood Zone 3, as the current model is 1D only, depths, velocities and hazards cannot be determined as required. It is understood that the updated model is a 2D model, inclusive of depth, velocity and hazard information, also accounting for climate change.** • **Based on the current, limited information, ideally, the areas within Flood Zone 3 should remain as open greenspace and allowed to flood naturally, providing flood storage and continued social/amenity value for the local community.** • **As the MSC is not classified as 'Main River' there is no EA requirement for a no-development buffer zone of 8 metres along the left bank of the Canal. However, this is still considered good practice and further advice should be sought from Peel Ports who are the Navigation Authority for the canal.** • **Consultation should be had between the LPA, the EA, the developer and Peel Ports regarding any development at this site. Peel Ports is the owner and operator of the Ship Canal and also owns land around the Canal.** • **To consider development in Flood Zone 3a, the developer would need to find room for compensatory storage. The developer may consider placing development on stilts to raise the development out of the flood zone. This would however be a costly solution. A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards.** • **Safe access and egress routes must be available at times of flood. Site design and layout should further investigate the indicative locations shown on Figure's 1, 3 and 4 of this Level 2 SFRA. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.**
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to the Manchester Ship Canal, groundwater levels are expected to be similar to the corresponding levels of the MSC. Groundwater will follow topography and is unlikely to be an issue in this instance.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	•

Site 1610 – Land adjacent to Manchester Ship Canal	
	• The extent shows the worst credible area that is susceptible to dam breach flooding. The map should be used to prioritise areas for evacuation/early warning. • The extent of reservoir inundation comes from two reservoirs, one owned by United Utilities (Entwistle) and one owned by the Environment Agency (Sale Ees FSR). • Much of the reservoir network is owned and managed by United Utilities who monitor and maintain reservoirs as required. United Utilities own 43 reservoirs within Greater Manchester. • The chance of reservoir failure is very rare and there is an extremely good safety record in the UK with no loss of life due to reservoir flooding since 1925. • United Utilities' ongoing management of reservoirs ensures they do not cause flooding as their presence within the network of surrounding watercourses actually reduces the impact of excess rainfall. • All United Utilities operated reservoirs are managed in accordance with the Reservoirs Act and relevant Health and Safety legislation to ensure they do not fail such requirements. United Utilities also notes that the Environment Agency is responsible for ensuring compliance with the highlighted legislation. • United Utilities also wishes to highlight the drive for continued constructive communication with the relevant local authorities to ensure a coordinated approach to the delivery of site allocations. United Utilities are committed to continuing to work with the relevant Local Authorities and the Greater Manchester Combined Authority as site allocations progress further.

Site 1610 – Land adjacent to Manchester Ship Canal

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

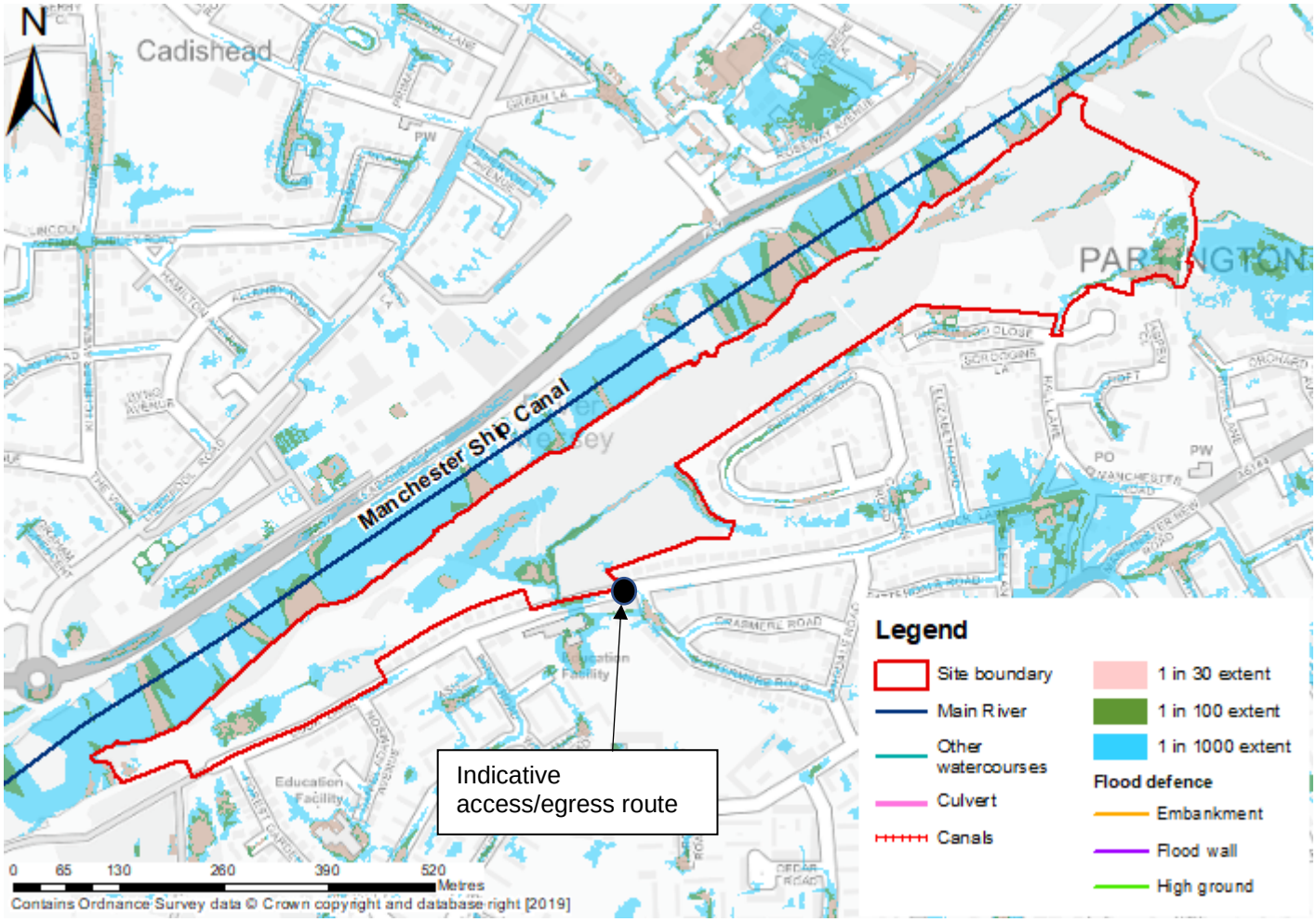


Figure 4: Surface water risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	3.70	6.59	15.67
Surface water flooding depths	Max: 0.90 – 1.20m	Max: >1.20m	Max: >1.20m
Surface water hazards	Max: Significant Mean: Low	Max: Significant Mean: Moderate	Max: Significant Mean: Significant
Surface water flood risk to development site	• The 1% present day AEP outline covers approximately 7% of the site; this extent remains in localised pockets across the site which is consistent with topographic depressions and the ditch running through the centre of the site. • Safe access and egress appear achievable via Lock Lane.		
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP outline extends to cover approximately 16% of the site, largely within the same depressions as the 1% AEP event though to a larger extent. • Safe access and egress may become more challenging in the longer term		

Site 1610 – Land adjacent to Manchester Ship Canal

	though there do appear to be enough safe routes.

Mitigation options & site suitability: surface water	• **Development should attempt to avoid the 1% AEP event surface water outline.**
	• **A drainage strategy is required for the site to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on proposed layout plans. Ideally the risk within the current surface depressions would be kept free of development and utilised as retention ponds to store surface water.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **Given the site is currently greenfield, infiltration SuDS should be feasible onsite. However, ground investigation and contamination assessments would be required.**
	• **For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (l/s).**

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Qbar: 67 l/s (FEH Statistical)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	12	10639	2026	8613	50.9	0.574 ha 3.030 %
30yr Rainfall+40%	12	12412	2026	10386	61.3	0.692 ha 3.654 %
100yr Rainfall+20%	12*	14273	2026	12247 ($3634m^3$ of exceedance storage)	72.3	0.816 ha 4.309 %
100yr Rainfall+40%	12*	16651	2026	14625 ($4239m^3$ of exceedance storage)	86.4	0.975 ha 5.145 %

*limited to corresponding 30yr Rainfall critical storm duration

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.

Site 1610 – Land adjacent to Manchester Ship Canal	
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.
Overall Site Assessment	
Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **Based on existing information it should be possible for development to avoid Flood Zone 3 and incorporate surface water risk into site design and layout, and therefore pass the Exception Test.** • **However, this Level 2 assessment must be revisited once updated modelling of the Ship Canal becomes available from the EA.**
Recommendation summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed]) or by emailing the local office SPPlanning.RFH@environment-agency.gov.uk This site should be reassessed once the updated MSC model becomes available (late-2020). • The FRA should include a drainage strategy for the proposed new development layout, adhering to UU's requirements.
FRA requirements	• The FRA should include emergency planning procedures with particular consideration to safe access and egress routes in times of flood. A fully detailed emergency plan must be included and consulted on with Peel Ports. • Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. • Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services. •

Site SHLAA0023 – Leyland Mill, Wigan	
Location	Leyland Mill Lane, Wigan
Site area (ha)	1.59
Watercourse	River Douglas
EA Model used	River Douglas, 2012
Existing use	Industrial, existing buildings
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	1.59

Flood outlines (present day)

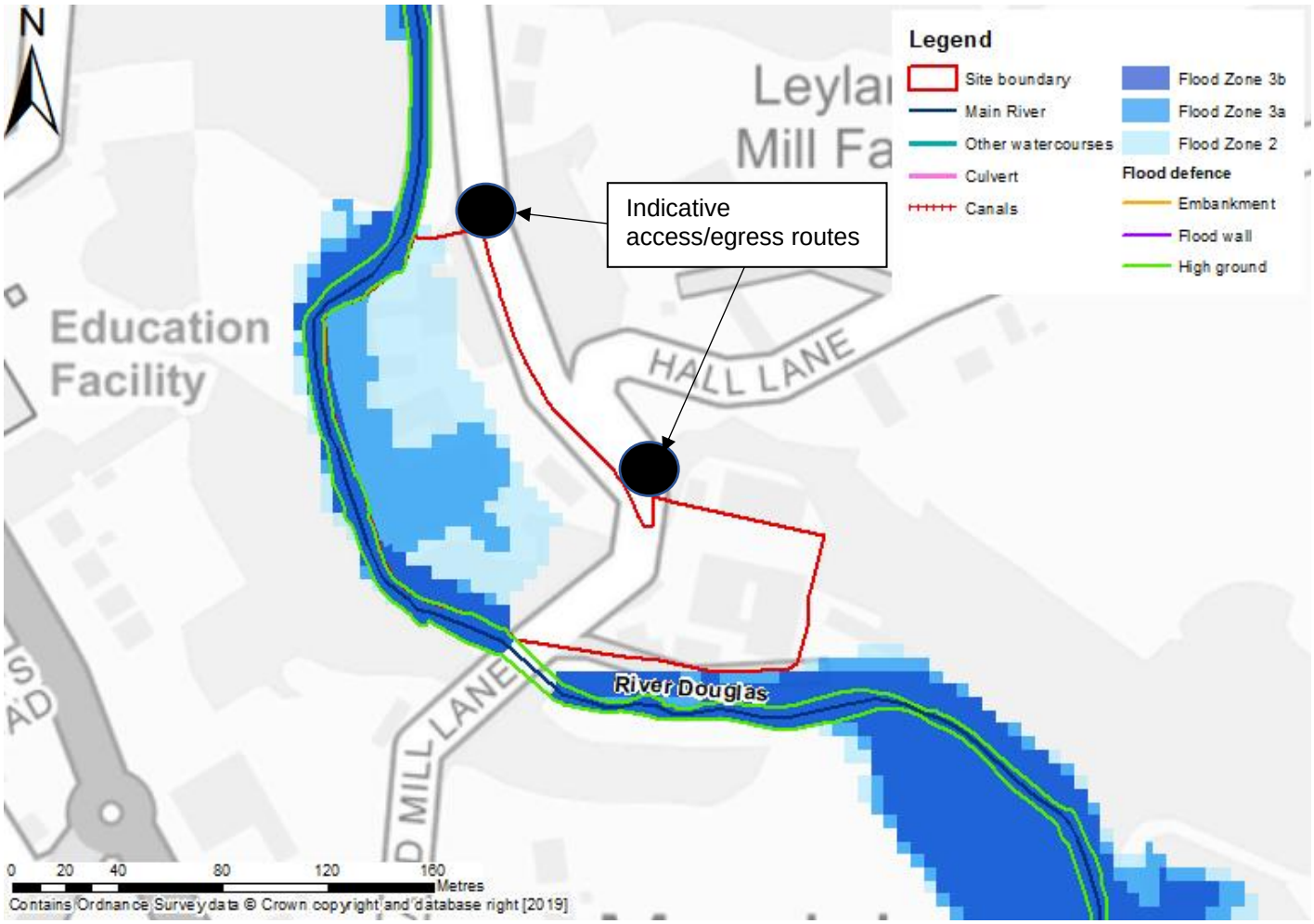


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences

Site SHLAA0023 – Leyland Mill, Wigan

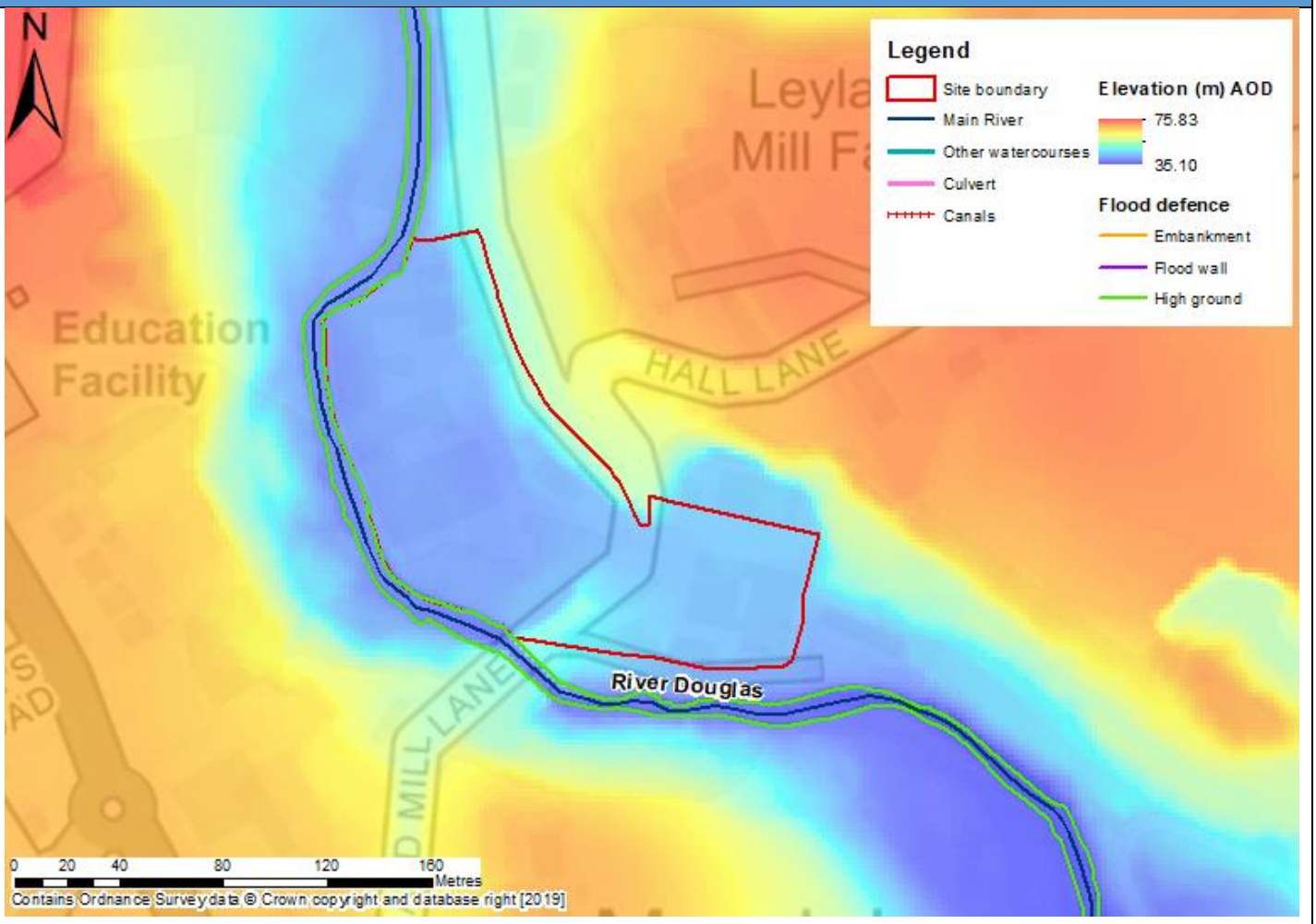


Figure 2: Site with 2 m 2017 LIDAR (elevation data)

- The elevation of the site is consistent at an average of approximately 42 m AOD with it increasing slightly where Land Mill Lane runs through the site to 46 m AOD.
- The surrounding areas to the west and east of the site have a higher elevation of approximately 65 m AOD.
- The River Douglas runs along the site's south western boundary flowing southwards.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change*
	3.94	18.84	23.60	Not available
Fluvial: average depth (m)	Not available	0.08	0.66	Not available
Fluvial: maximum depth (m)	Not available	0.32	1.33	Not available
Fluvial: average hazard	Not available	Low	Significant	Not available
Fluvial: maximum hazard	Not available	Moderate	Significant	Not available

*Climate change not available due to this area being removed from the modelled outlines, see further information below. Flood Zone 2 / 0.1% AEP event outline can be used as a proxy.

Site SHLAA0023 – Leyland Mill, Wigan

Modelled fluvial flood risk and climate change (River Douglas 2012 model)

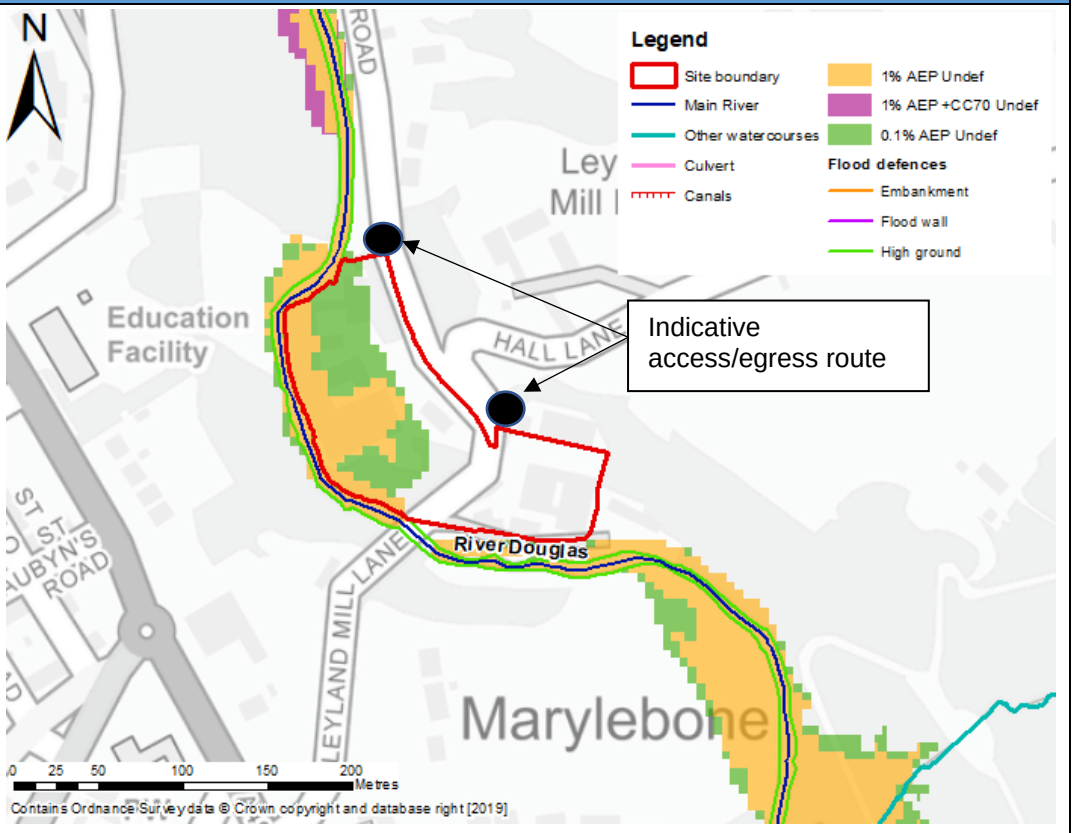


Figure 3: Undefended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% climate change uplift (not modelled in the site)

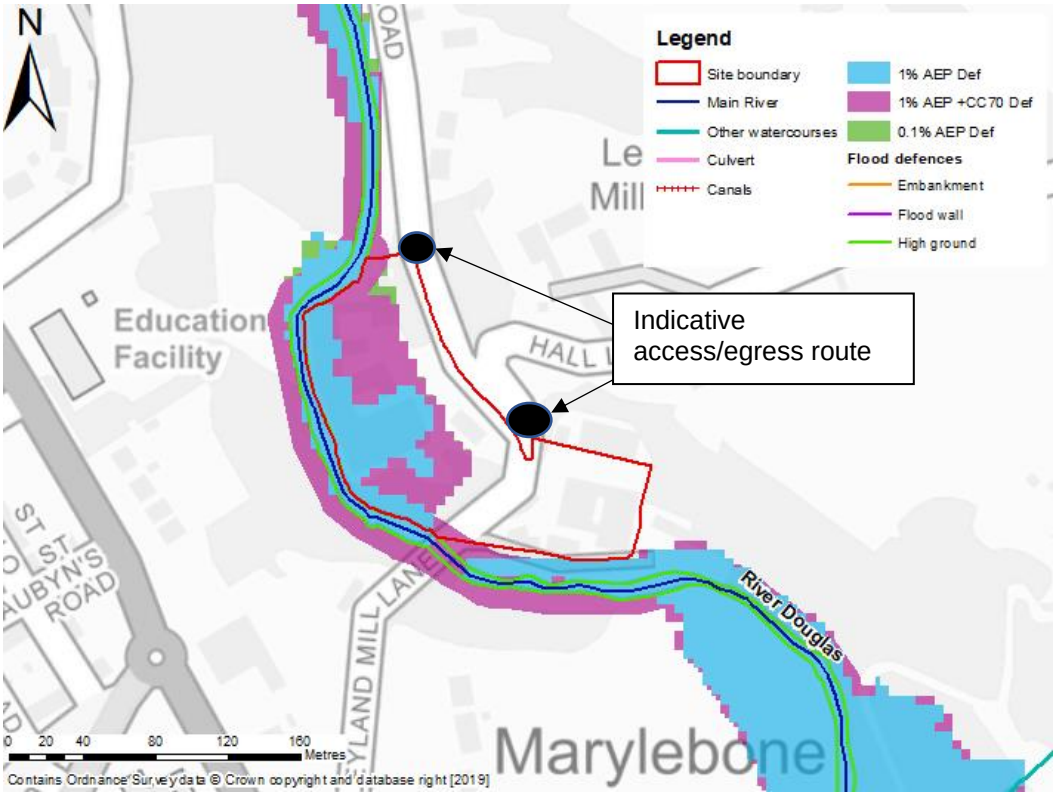


Figure 4: Defended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% climate change uplift

Site SHLAA0023 – Leyland Mill, Wigan	
	• It is understood that there were technical issues with the undefended scenario modelling in the River Douglas 2012 model. Grids were not produced for some areas within the model's 2D domain, namely around the Wigan Flood Alleviation Scheme (FAS) scheme in the Bottling Wood area. For the final modelled outputs, following discussions with the EA area representative, the 0.1% defended outline from the 2012 study was merged with updated climate change outlines in this area. All undefended scenario outlines were removed from this section of the River Douglas due to technical complications. Hence why the climate change outline stops north of the site (Figure 3). The outputs from this modelling have been accepted by the EA as of 11th November 2019. The EA has confirmed there is high confidence in the outlines. • Based on the above, for this Level 2 assessment, risk from climate change will be gauged based on the defended scenario. Figure 4 shows that the majority of the site is at additional risk from climate change. Climate change depths are significant with averages of approximately 830 mm and maximums of 1.57 m; the maximum flood hazard to people rating is 'Significant'. • The Flood Map for Planning is based on the defended model outlines. There is however nominal difference between the undefended and defended outlines.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, the River Douglas is bounded by areas of high ground that act as informal defences which have been assessed at condition grade 3 meaning 'Fair' (Table 1.1 Condition Assessment Manual[1]).
Flood Warning Area	• The site lies outside of any current EA FWAs.
Natural Flood Management / Working with Natural Processes	• Large parts of the site, focused on the southern and western sides, lie within areas of tree planting in the WwNP dataset. These areas can significantly delay the peak runoff in catchments.

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site SHLAA0023 – Leyland Mill, Wigan	
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the new development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).** • **Approximately 19% of the site is within Flood Zone 3a with a further 4% of the site ruled out for development due to Flood Zone 3b. However, Flood Zone 3b is confined to the channel, which should not be built over. Maximum flood depths within Flood Zone 3a are around 320 mm and the maximum flood hazard to people rating[2] is 'Moderate'. With climate change, these maximum depths increase to around 1.57 m.** • **To consider development in Flood Zone 3a, the developer would need to find room for compensatory storage. There is no room onsite and there does not appear to be any areas nearby that could be used. The developer may consider placing development on stilts to raise the development out of the flood zone. This would however be a costly solution. A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. All mitigation must account for climate change and the significant depths and hazards that are predicted on this site in the longer term.** • **Flood Zone 3a and the modelled climate change outline are isolated to the western area of the site along the bank of the River Douglas (Figure 1). The ideal solution from a flood risk management perspective would be that the risk areas are converted to open greenspace that are set aside for flooding. Other benefits can be realised from such an approach including ecological and amenity/social benefits. This open greenspace area should be designed to accommodate fluvial risk, up to the 1% AEP + climate change (+70%) event and the 0.1% AEP surface water event to account for climate change on rainfall intensities.** • **There is an EA requirement to include an 8 m buffer between development and the watercourse. The EA notes that although their permission would be required for development within the 8 m, any access requirements would be subsequently conditioned specific to the development proposal and the site constraints.** • **The area to the east of Leyland Mill Lane is within Flood Zone 1 and is at very low risk from climate change. Residential development should be directed to this area, reducing the developable area to around 0.4 hectares.** • **The River Douglas flows under Leyland Mill Lane via a road bridge just outside the site boundary. Any works on this bridge that may affect the flow regime of the watercourse could increase risk to the site. This bridge should be assessed for condition and capacity and also for residual risk through blockage scenario modelling. Any modelling to assess this should be undertaken as part of an update to this Level 2 SFRA. Ownership and maintenance information should also be confirmed.** • **Safe access and egress routes must be available at times of flood, even for above ground floor accommodation. Site design and layout should further investigate the indicative locations shown on Figure's 1, 3 and 4 of this Level 2 SFRA. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.**

[2] Table 3.2, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR1 The Flood Risks to People Methodology, Defra, Environment Agency, March 2006

Site SHLAA0023 – Leyland Mill, Wigan	
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to the River Douglas, groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and is unlikely to be an issue in this instance.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	• Just over 98% of the site is located within the maximum extent of flooding risk from reservoirs according to the EA's Reservoir Flood Map (RFM) with the average depth being over 2m. Follow the link to view the RFM online: [Link Removed] • The extent shows the worst credible area that is susceptible to dam breach flooding. The map should be used to prioritise areas for evacuation/early • warning. The extent of the reservoir inundation comes from five United Utilities owned • reservoirs (Yarrow, Rivington Lower, Worthington, Anglezarke, and Arley). Much of the reservoir network is owned and managed by United Utilities who monitor and maintain reservoirs as required. United Utilities own 43 reservoirs • within Greater Manchester. The chance of reservoir failure is very rare and there is an extremely good safety • record in the UK with no loss of life due to reservoir flooding since 1925. United Utilities' ongoing management of reservoirs ensures they do not cause flooding as their presence within the network of surrounding watercourses • actually reduces the impact of excess rainfall. All United Utilities operated reservoirs are managed in accordance with the Reservoirs Act and relevant Health and Safety legislation to ensure they do not fail such requirements. United Utilities also notes that the Environment Agency • is responsible for ensuring compliance with the highlighted legislation. United Utilities also wishes to highlight the drive for continued constructive communication with the relevant local authorities to ensure a coordinated approach to the delivery of site allocations. United Utilities are committed to continuing to work with the relevant Local Authorities and the Greater Manchester Combined Authority as site allocations progress further.
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• No canals in the vicinity of the site.

Site SHLAA0023 – Leyland Mill, Wigan

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

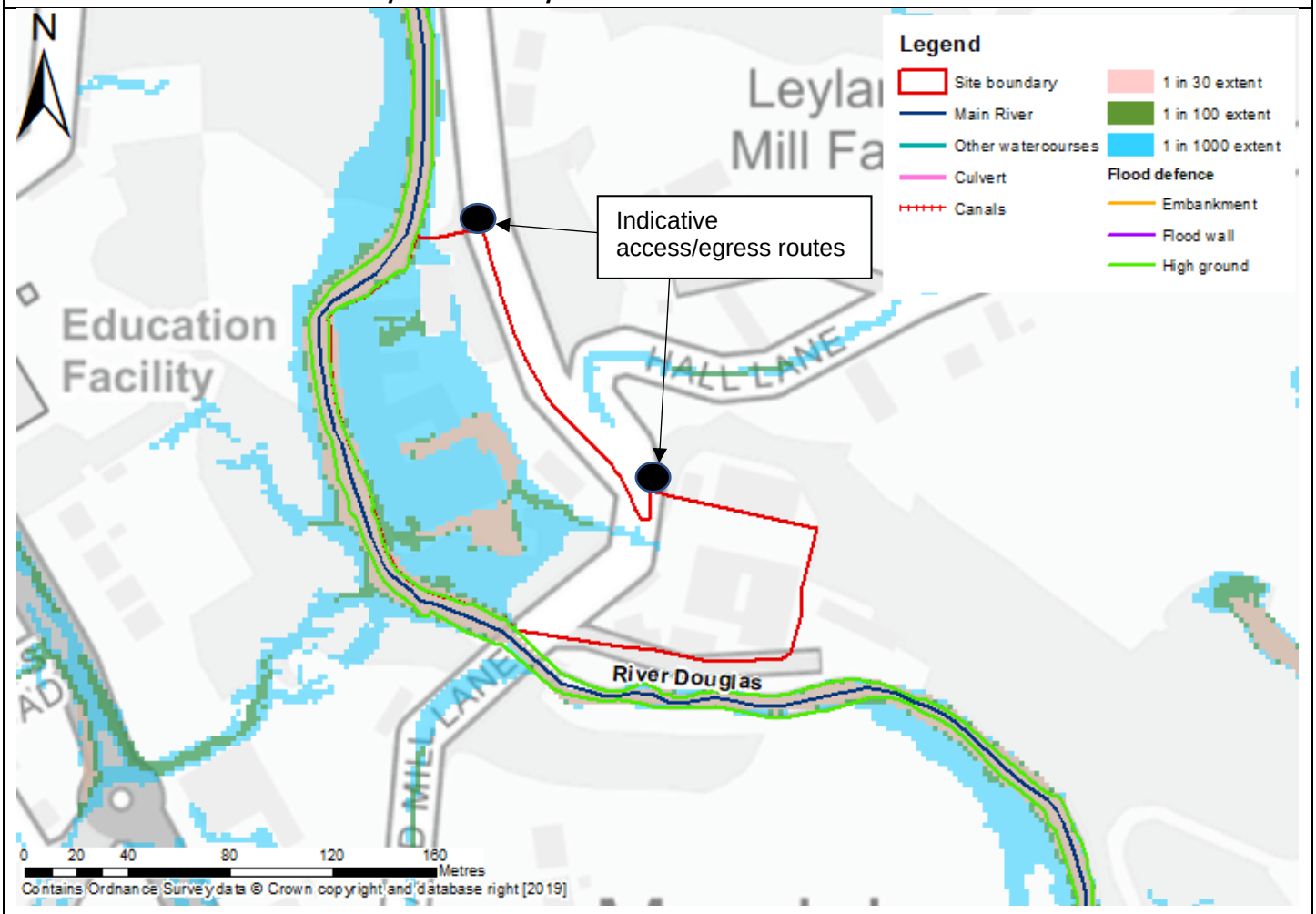


Figure 4: Surface water risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	6.96	11.24	47.19
Surface water flooding depths	Max: 0.30 – 0.60m	Max: 0.60 – 0.90m	Max: >1.20m
Surface water hazards	Max: Significant Mean: Moderate	Max: Significant Mean: Moderate	Max: Significant Mean: Significant
Surface water flood risk to development site	• Approximately 11% of the total site area is at risk of surface water flooding in the 1% AEP event to a maximum depth of 900 mm. This is within the area of the site west of Leyland Mill Lane; the same areas where fluvial risk is present. Surface water appears to pond, constrained by existing buildings, before flowing down to the River Douglas. • Safe access and egress should still be possible via Hall Lane or Wingates Road to the north of the site.		

Site SHLAA0023 – Leyland Mill, Wigan	
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP outline covers almost 50% of the site covering the western area; the hazard has been classified as Significant. The same area is shown to be at risk from fluvial climate change. • Safe access and egress may still be possible via Hall Lane or Wingates Road to the north.

Mitigation options & site suitability: surface water	• **The assumption is that existing industrial buildings will be demolished to make way for new residential development. Given the 1% AEP surface water event outline is constrained by current development, it is likely that the behaviour of surface water will change significantly once the site is cleared. Surface water modelling should be carried out post site clearance and pre-development to ascertain natural flow paths. If possible, natural flow paths should be designed into the site layout, using appropriate SuDS, or diverted to suit development layout, without increasing risk offsite.**
	• **However, most of the surface water risk is within the fluvial risk area. By avoiding the fluvial risk areas and utilising this area for flood storage as open greenspace, as discussed above, the developer will also avoid the surface water risk both present day and in the longer term.**
	• **Were development to proceed, the FRA should assess the current drainage system in place, given the site is partially developed and partially brownfield, to ascertain whether the current system can accommodate residential development or whether further capacity is required. A full drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on proposed layout plans.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 100% impermeable area and limiting greenfield runoff rate of Qbar (l/s). It is noted that greenfield runoff rates and volumes may not be achievable for development of brownfield sites, therefore, values as close as reasonably practicable may be agreed with the LLFA.**

Site SHLAA0023 – Leyland Mill, Wigan

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Qbar: 17 l/s (FEH Statistical)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	4.5	894	193	701	16.3	0.05 ha 2.9 %
30yr Rainfall+40%	5.5	1089	236	854	19.9	0.06 ha 3.6 %
100yr Rainfall+20%	5.5	1225	236	989 (288m^3 of exceedance storage)	23.0	0.07 ha 4.1 %
100yr Rainfall+40%	6.5	1475	278	1197 (343m^3 of exceedance storage)	27.9	0.08 ha 5.0 %

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.
Overall Site Assessment	
Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **It is unlikely this site can pass the Exception Test, unless development can be directed to the area east of Leyland Mill Lane and/or developable area reduced, as advised in this Level 2 SFRA.**
Recommendation summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed]) or by emailing the local office SPPlanning.RFH@environment-agency.gov.uk Two thirds of the site west of Leyland Mill Lane, should be left free of development and converted to multipurpose amenity open greenspace. • Development should be focused to the east of Leyland Mill Lane, leaving approximately 0.4 hectares developable area. • Any updates to modelling blockage scenarios should be carried out as an update to the Level 2 SFRA to better inform the Exception Test. • Detailed modelling will be required were options to pursue development west of Leyland Mill Lane to be explored. This options modelling should be carried out as part of an FRA.
FRA requirements	• The FRA should include a drainage strategy for the proposed new development layout, accounting for UU requirements. •

Site SHLAA0023 – Leyland Mill, Wigan	
	• The FRA should include emergency planning procedures with particular consideration to safety around the adjacent River Douglas and safe access and egress routes in times of flood. • Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. • Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services.

Site SHLAA0240 – Land off Barn Lane	
Location	Barn Lane, Wigan
Site area (ha)	3.17
Watercourse	Millingford Brook
EA Model used	2004 Broadscale JFlow model
Existing use	Greenfield – farmland
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	2.69

Flood outlines (present day)

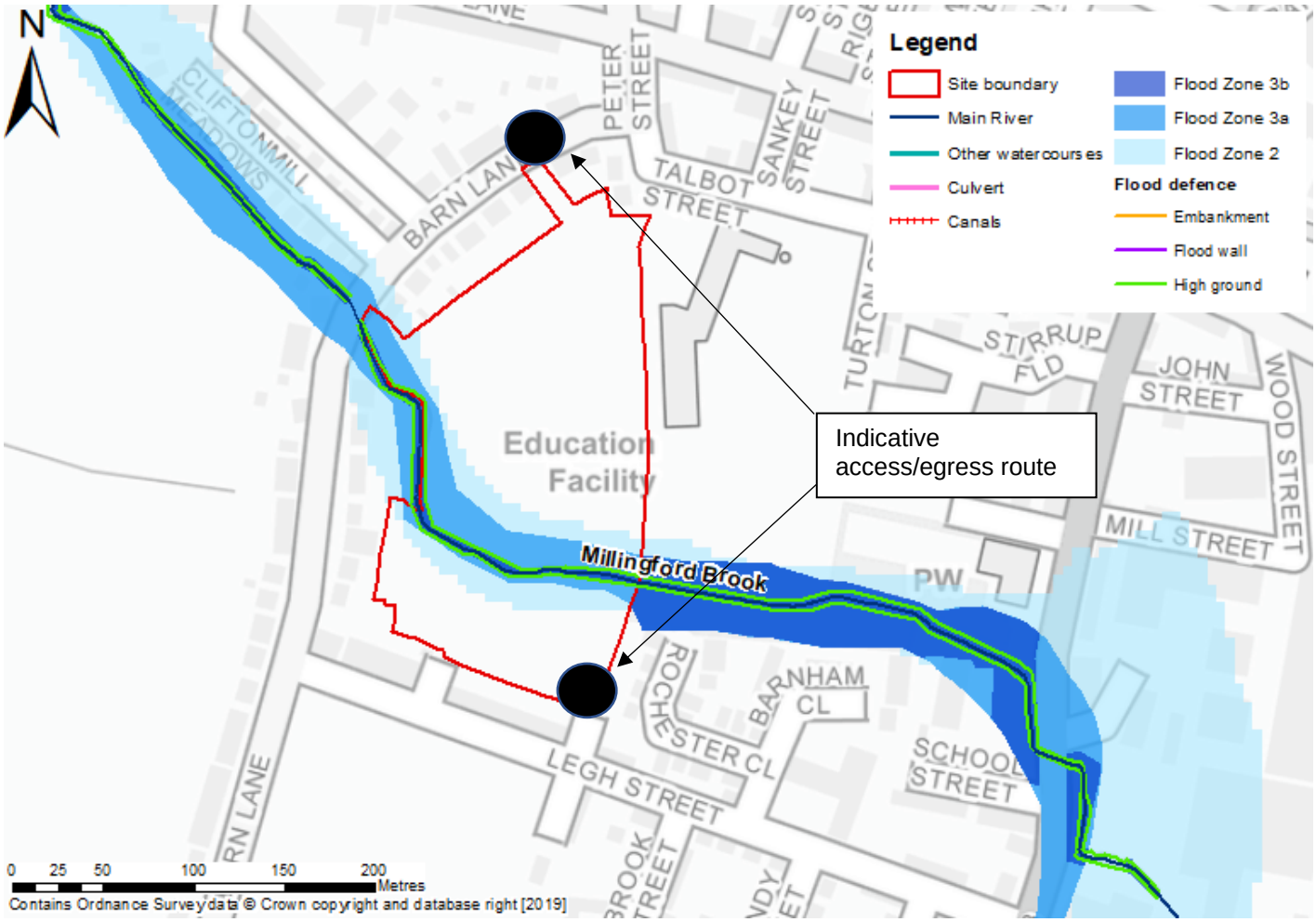


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences.

Site SHLAA0240 – Land off Barn Lane

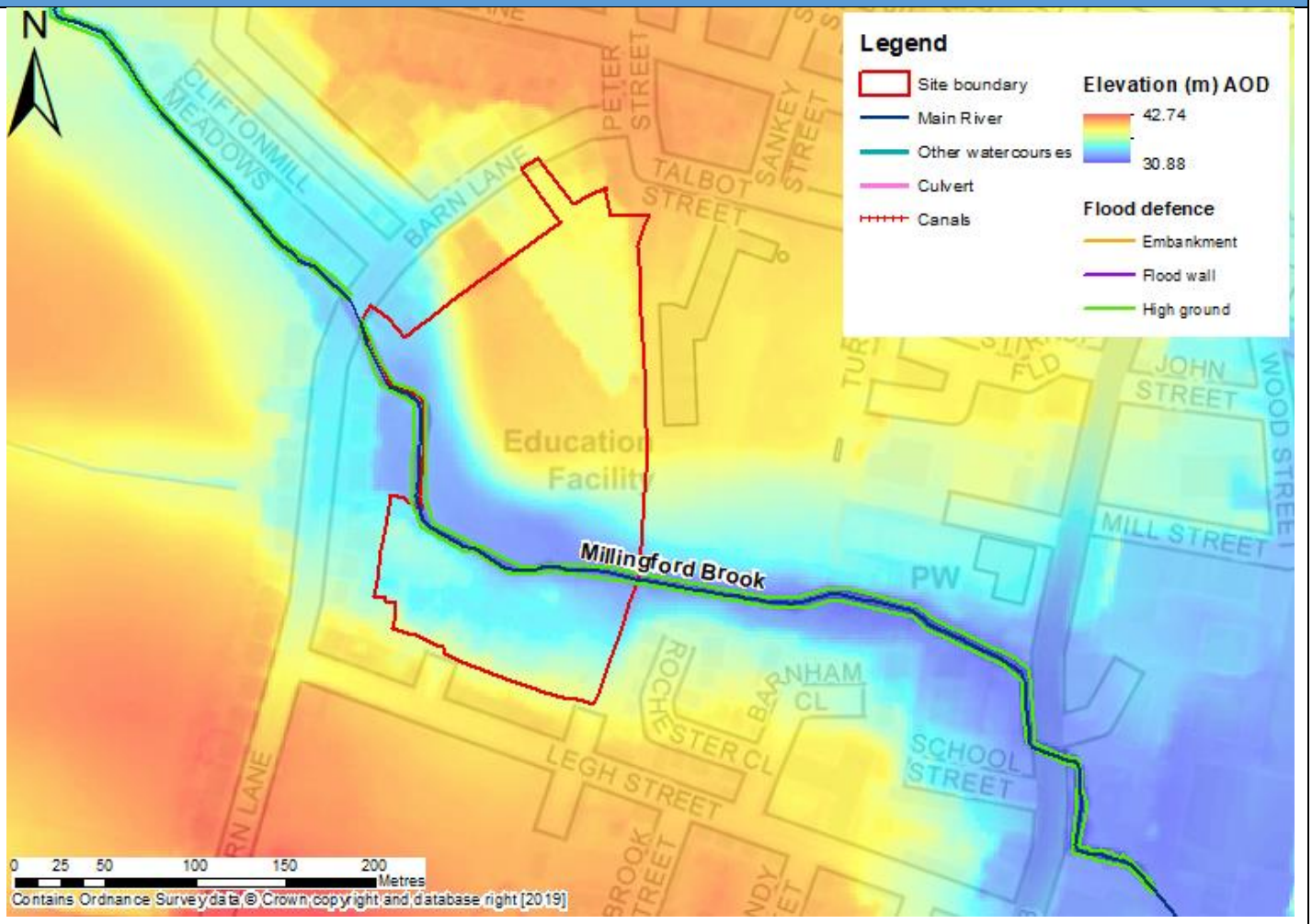


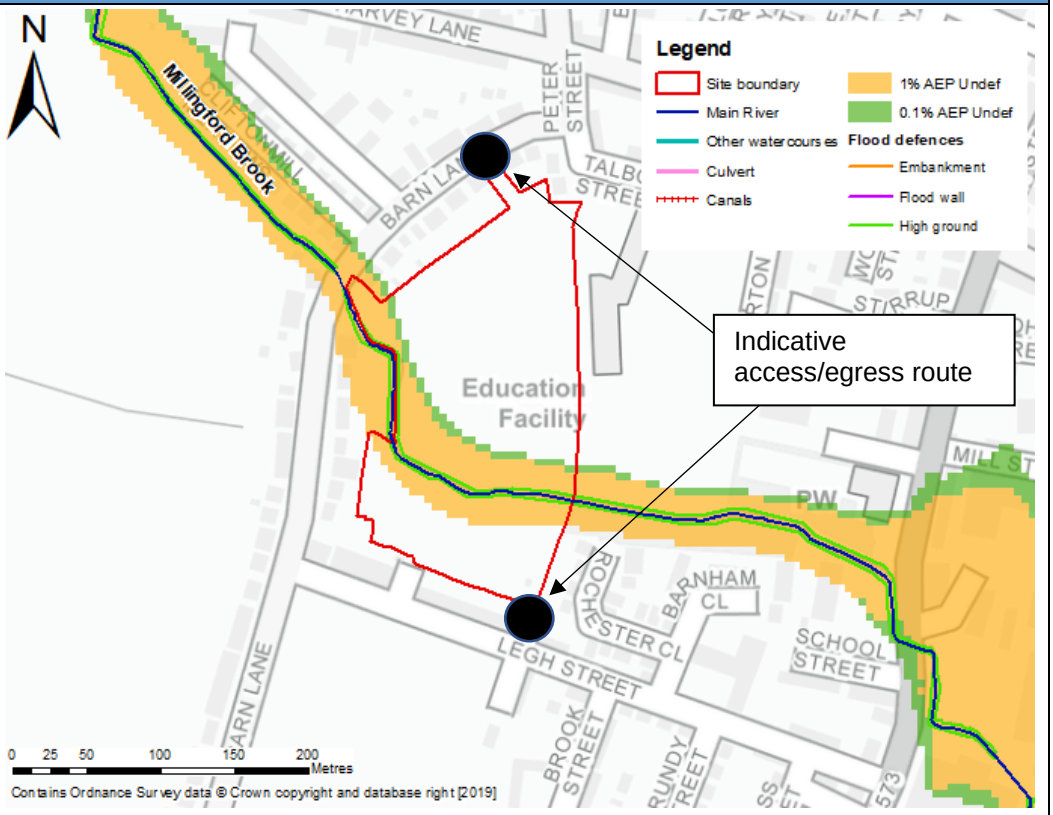
Figure 2: Site with 2m 2017 LIDAR (elevation data)

- Millingford Brook flows southwards through the centre of the site at around 34m AOD.
- The topography slopes down to Millingford Brook from the north at approximately 39m AOD; and the south at approximately 36m AOD.
- The surrounding residential area to the north has a higher elevation of approximately 40m AOD and the area to the south reaches a high of 42m AOD.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	3.21	12.44	11.11	Not available
Fluvial: average depth (m)	Not applicable	0.93	1.04	Not available
Fluvial: maximum depth (m)	Not applicable	1.78	2.17	Not available
Fluvial: average hazard*	Not applicable	Not available	Not available	Not available
Fluvial: maximum depth	Not applicable	Not available	Not available	Not available
*Hazard information not modelled				

Site SHLAA0240 – Land off Barn Lane	
Modelled fluvial flood risk and climate change (2004 Broadscale JFlow model)	 Figure 3: Undefended fluvial outlines for the present day 1% AEP and 0.1% AEP. • The 1% AEP present day outline covers the majority of the centre of the site following Millingford Brook; there were no climate change outlines produced as this model is broadscale JFlow modelling at a national scale. Although the outlines and depths were produced using broadscale modelling, the EA has confirmed that there are no plans to update the modelling in this area. • Modelled flood depths are significant and could cause significant hazard to life and property. • The 1% AEP is not consistent with the Flood Map for Planning Flood Zone 3. Flood Zone 3 appears to have been manually edited though the EA is unclear on why. • Safe access and egress are achievable via Barn Lane for the north of the development and Legh Street in the south of the development.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, Millingford Brook is bounded by areas of high ground that act as informal defences which are assessed at condition grade 3 and 4 meaning 'Fair' and 'Poor' (Table 1.1 Condition Assessment Manual[1]).
Flood Warning Area	• The site lies outside of any current EA FWAs.
Natural Flood Management / Working with Natural Processes	• This site lies outside any areas included in the WwNP or Irwell NFM datasets.
Observations, mitigation options & site suitability:	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the new development will not be placed in danger from flood hazards throughout**

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site SHLAA0240 – Land off Barn Lane	
fluvial	**its lifetime. It is for the applicant to show that the change of use meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).** • **Millingford Brook flows directly through the site. The developer or site owner must find out which permissions and licences are required to maintain, repair, build or remove anything in or around Millingford Brook. Without appropriate permissions and licences the developer/site owner may be subject to a fine or imprisonment.** • **The fluvial flood risk information is based on broadscale modelling. The EA however has confirmed that there are no current plans to update the modelling in this area.** • **Flood Zone 3 is different in extent to the modelled 1% AEP event outline; however, this does not make a significant difference to development viability.** • **12% of the site is within Flood Zone 3a with significant modelled average depths of 930 mm. Residential development should not be permitted in Flood Zone 3a; this is mainly isolated to Millingford Brook.** • **It is noted that the fluvial information for Millingford Brook at this location is based on broadscale modelling and may therefore be underestimating or overestimating risk. However, the surface water flood zones (Figure 4) are spatially similar along the watercourse to the fluvial flood zones therefore the broadscale model outlines may be adequately representative of fluvial risk.** • **The broadscale model does not included climate change information. However, by using Flood Zone 2 as a proxy, climate change may not cause significant additional fluvial risk to the site. This is most likely as a result of the topography which slopes from the north and south of the site towards the centre.** • **Consultation will be required with the EA as to whether Millingford Brook requires remodelling as a more detailed 2-dimensional model. It is recommended that climate change is modelled as an update to the Level 2 SFRA, using the EA's allowances for peak river levels that are available at the time.** • **This site may pass the Exception Test if development is directed to Flood Zone 1 to the north and south of Millingford Brook. This should be possible though development yields may be impacted.** • **The risk area is currently open greenfield land and allotments and should be left open to flood naturally. It is recommended that this area is converted to a blue/green corridor to provide multiple benefits including flood storage, ecological value and social/amenity value for the community.** • **Development is restricted by the 8 metre no development buffer of Millingford Brook. This is advised by the EA for watercourse access and maintenance purposes. This buffer should fit in with the proposed blue/green river corridor.** • **At the north-western site boundary, Millingford Brook flows through a bridge under Barn Lane; this bridge should be subject to a condition survey and also blockage scenario modelling to assess residual risk.** • **Safe access and egress routes must be available at times of flood, as indicated in Figures 1, 3 and 4. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.**

Site SHLAA0240 – Land off Barn Lane	
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to Millingford Brook, groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and may be an issue in this instance. Groundwater should be assessed as part of the FRA.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	•
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• There are no canals in the vicinity of this site.
Flood Source: Surface Water	

Surface Water Flood Risk to Proposed Development Site

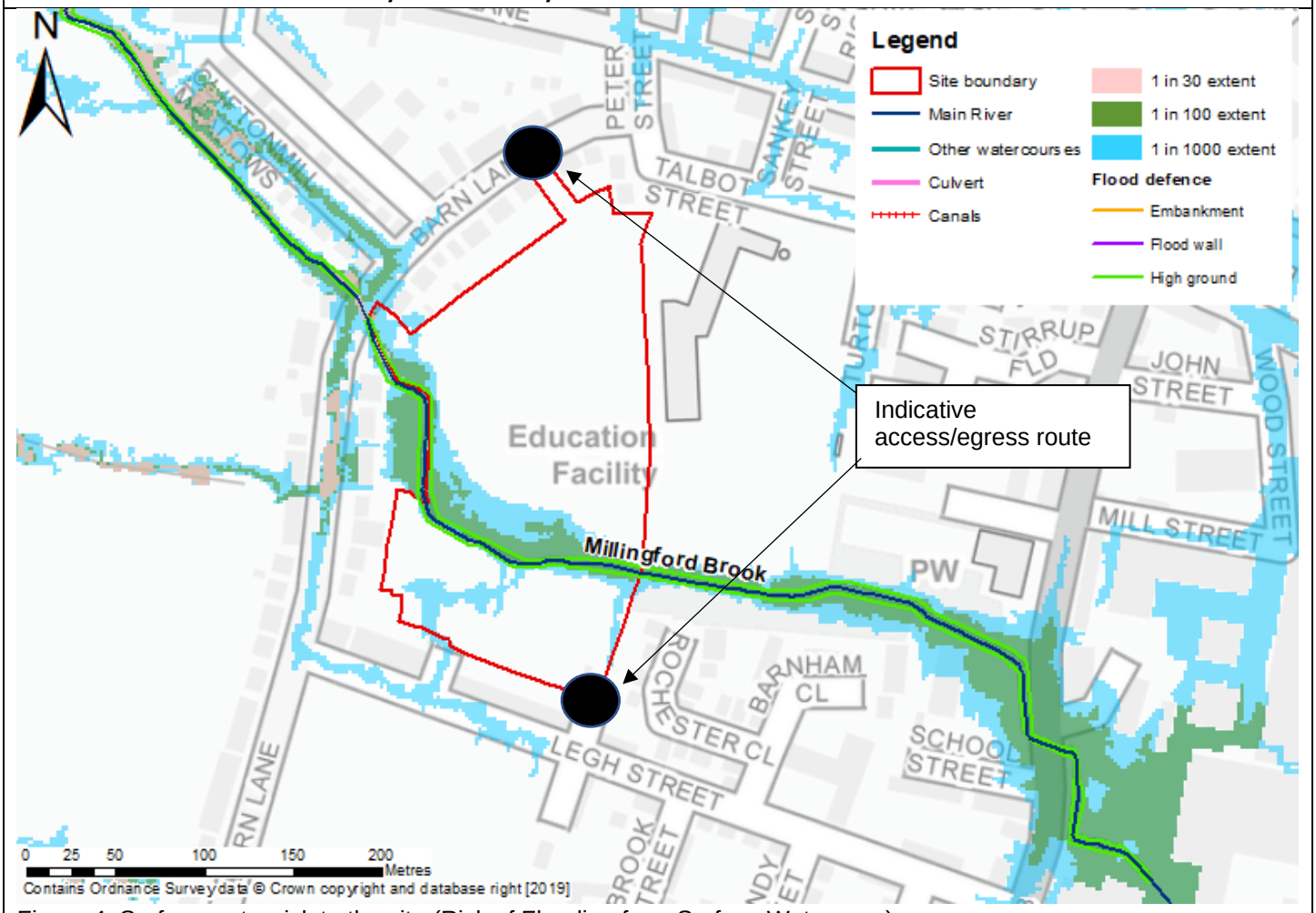


Figure 4: Surface water risk to the site (Risk of Flooding from Surface Water map)

Site SHLAA0240 – Land off Barn Lane			
Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	3.21	10.40	26.47
Surface water flooding depths	Max: 0.60 – 0.90m	Max: 0.60 – 0.90m	Max: >1.20m
Surface water hazards	Max: Significant Mean: Moderate	Max: Significant Mean: Significant	Max: Significant Mean: Significant
Surface water flood risk to development site	• Approximately 10% of the total site area is at risk of surface water flooding in the 1% AEP event to a maximum depth of 900 mm. This follows the course of Millingford Brook and is similar in extent to fluvial risk. • Safe access and egress are achievable via Barn Lane to the north and Legh Street to the south.		
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP outline covers 26% of the site, again following the course Millingford Brook. However, the extreme event causes a flow path from Legh down to Millingford Brook. • Safe access and egress to the southern area of the site should still be achievable via Legh Street to the east, though access and egress from the northern area may be challenging but still achievable via Barn Lane.		

Mitigation options & site suitability: surface water	• **Development should attempt to avoid the 1% AEP event surface water outline. This should be possible given most of the surface water risk is within the fluvial risk areas along the course of Millingford Brook. By avoiding the fluvial risk areas, as discussed above, the developer will also avoid the surface water risk. The proposed blue/green corridor should also account for surface water risk.**
	• **As the site is currently greenfield, a full drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on proposed layout plans. Infiltration SuDS should be possible onsite given the majority of the site is greenfield. Ground investigation and contamination assessments would be required to confirm.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (l/s).**		

Site SHLAA0240 – Land off Barn Lane

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Qbar: 24 l/s (FEH Statistical)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	5.75	1509	348	1161	19.1	0.077 ha 2.442 %
30yr Rainfall+40%	6.75	1825	408	1417	23.4	0.094 ha 2.980 %
100yr Rainfall+20%	7.25	2102	438	1663 ($502m^3$ of exceedance storage)	27.4	0.111 ha 3.497 %
100yr Rainfall+40%	8.25	2518	499	2019 ($602m^3$ of exceedance storage)	33.3	0.135 ha 4.246 %

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.

Overall Site Assessment

Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **This site is likely to pass the Exception Test if the recommendations in this Level 2 SFRA are followed and development is directed to Flood Zone 1.**
Recommendation summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed] or by emailing the local office SPPlanning.RFH@environment-agency.gov.uk Incorporation of blue/green corridor, within which no development can take place, to attenuate fluvial and surface water risk. • Updated modelling to more detailed 2D model on Millingford Brook to update the broadscale 2004 national mapping plus climate change modelling. This • should be undertaken as an update to this Level 2 SFRA. Ensure safe access and egress routes are identified early in the site design process. • Quantification of residual risk from the Barn Lane bridge. •
FRA requirements	• The Barn Lane road bridge should be assessed for capacity and condition and

Site SHLAA0240 – Land off Barn Lane	
	possibly residual risk through blockage scenario modelling. • The FRA should include emergency planning procedures with particular consideration to safety around the onsite watercourse in a residential area and safe access and egress routes in times of flood. • Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. • Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services.

Site SHLAA0325 – York Road, Wigan	
Location	York Road, Ashton-in-Makerfield, Wigan
Site area (ha)	0.62
Watercourse	Millingford Brook
EA Model used	Millingford Brook 2014
Existing use	Brownfield – cleared land and car park
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	0.62

Flood outlines (present day)

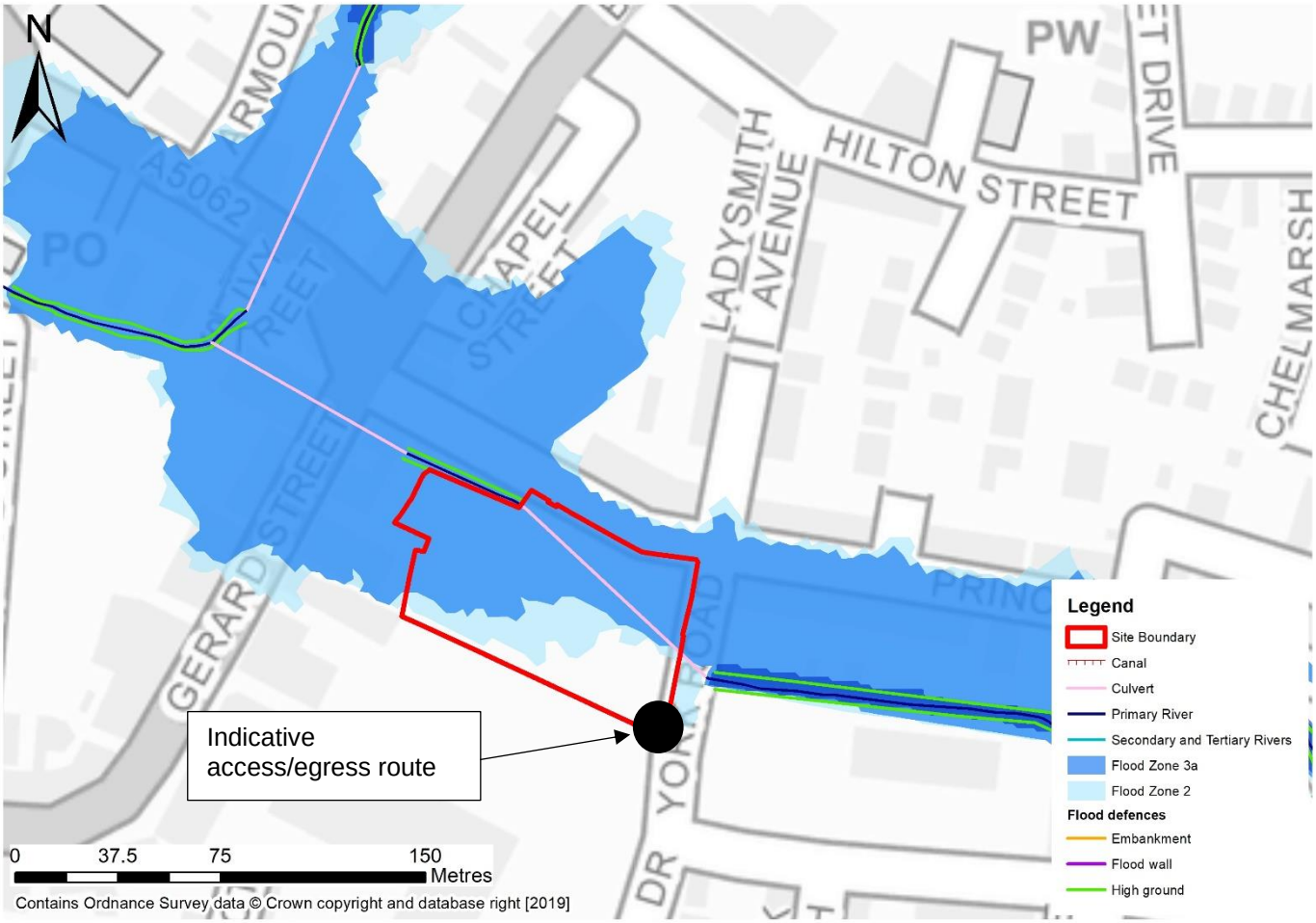


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences

Site SHLAA0325 – York Road, Wigan

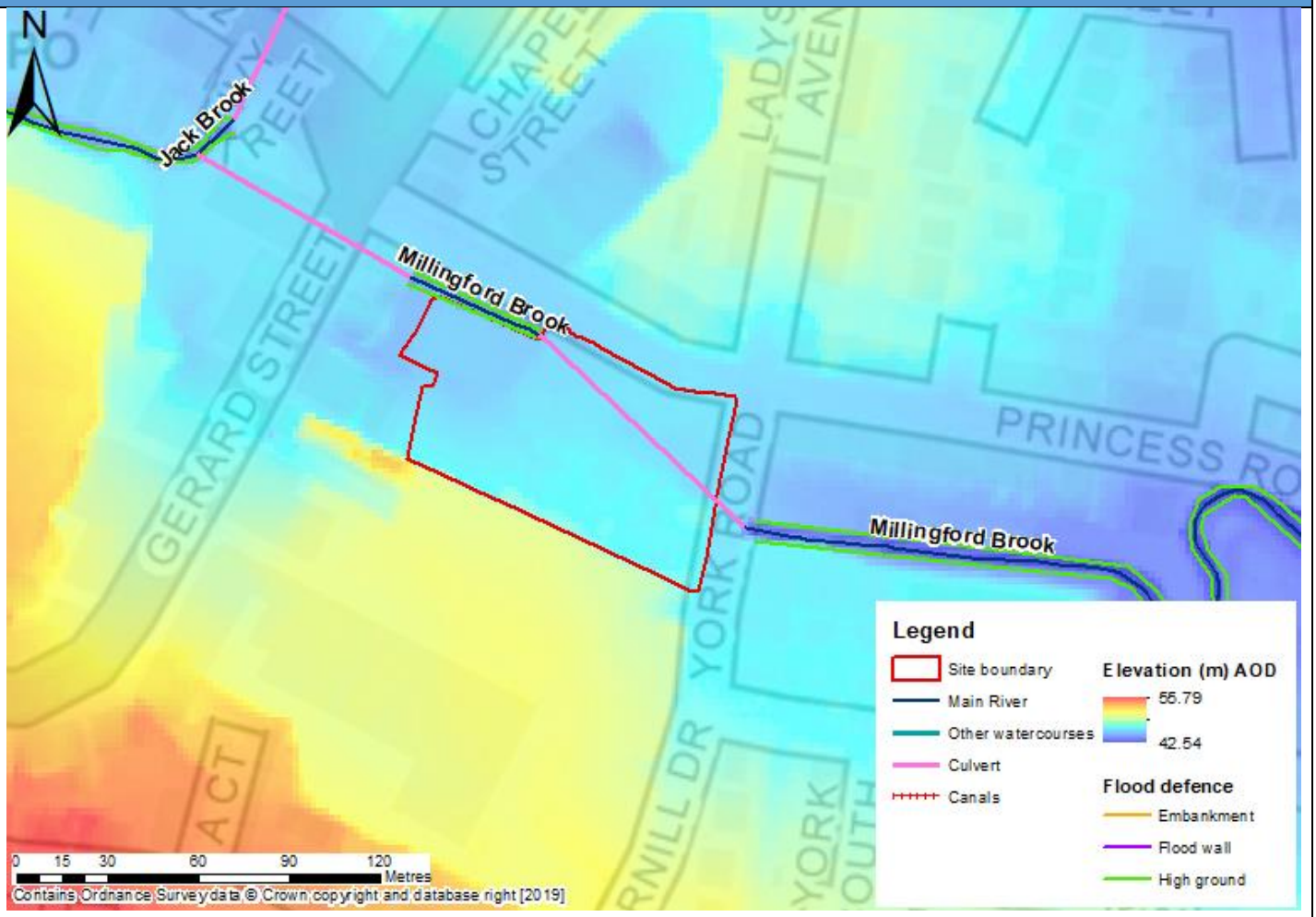


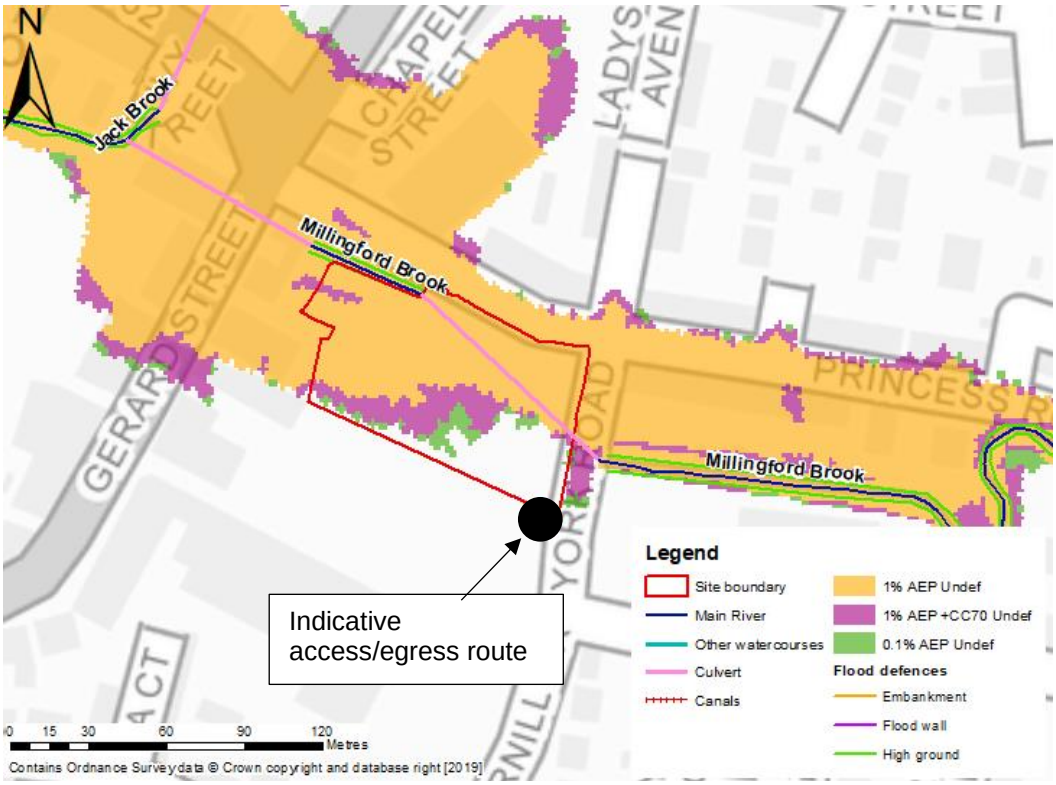
Figure 2: Site with 2 m 2017 LIDAR (elevation data)

- The elevation of the site is consistent at an average of approximately 47 m AOD.
- Immediately to the south of the site, the elevation increases to an average of 51 m AOD.
- The site sits on top of the culverted Millingford Brook which flows in an easterly direction.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	0.00	61.39	16.48	74.59
Fluvial: average depth (m)	Not applicable	0.36	0.51	0.5
Fluvial: maximum depth (m)	Not applicable	2.57	2.88	2.83
Fluvial: average hazard	Not applicable	Moderate	Significant	Significant
Fluvial: maximum hazard	Not applicable	Significant	Significant	Significant

Site SHLAA0325 – York Road, Wigan	
Modelled fluvial flood risk and climate change (Millingford Brook 2014 model)	 Figure 3: Undefended fluvial outlines for the present day 1% AEP and future risk of 1% +70% climate change uplift • The 1% AEP present day outline covers 61% of the site stretching across the northern half of the site. The 1% and 0.1% AEP modelled flood outlines have been used to update Flood Zone 3 and 2 respectively, however, Flood Zones 2 and 3 have had their outlines smoothed. • With the 1% AEP plus climate change (+70%) scenario, the outline extends to cover 75% of the site with more of the centre of the centre being inundated. The average depth of the climate change scenario across the site is approximately 510 mm with the maximum being 2.9 m. • Safe access and egress routes area achievable via York Road in the south east corner.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, there are areas of high ground which act as informal defences on Millingford Brook which are assessed at condition grade 4 and 5 meaning 'Poor' and 'Very Poor' (Table 1.1 Condition Assessment Manual[1]). These informal defences provide zero protection to the site.
Flood Warning Area	• The majority of the site is located within the Greater Manchester, Mersey and Chester EA FWA. The FWA is for Millingford Brook at Ashton in Makerfield.
Natural Flood Management	• The site lies outside any areas included in the WwNP and Irwell NFM datasets.

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Site SHLAA0325 – York Road, Wigan	
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG).** • **At the time of writing, the Council confirms there is a pending planning application on this site for residential development. The EA has objected to the site on flood risk grounds.** • **The fluvial risk to this site is significant both present day and in the long term with climate change. This site should not be developed for residential use as the risk is too great.** • **Additionally, a 90-metre culvert runs through a large section of the site where development should be avoided. The EA note that the culverted watercourse through the centre of the site will further limit any development potential at this location. If development is still pursued then consideration should be given to the removal of the structure to both reduce flood risk and to provide WFD benefits.** • **The risk area is currently open car park and brownfield land and should be left open to flood naturally. It is recommended that this area is converted to open greenspace to provide multiple benefits including flood storage, ecological value and social/amenity value for the community.**
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to Millingford Brook, groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and is unlikely to be an issue in this instance.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	•
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• There are no canals within the vicinity of the site.

Site SHLAA0325 – York Road, Wigan

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

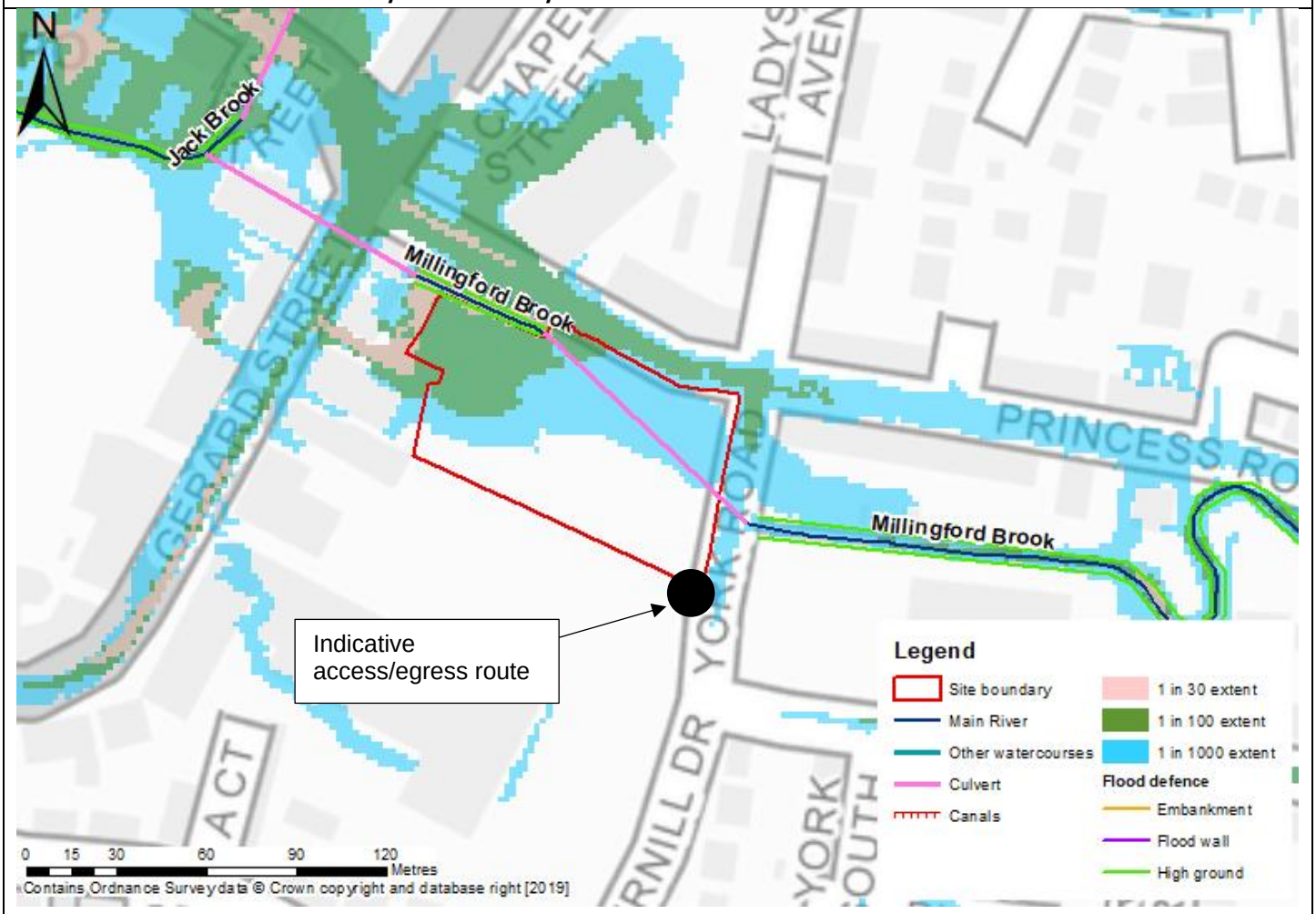


Figure 4: Surface water risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	1.09	22.53	58.02
Surface water flooding depths	Max: 0.30 – 0.60m	Max: 0.60 – 0.90m	Max: 0.90 – 1.20m
Surface water hazards	Max: Moderate Mean: Low	Max: Significant Mean: Moderate	Max: Significant Mean: Significant
Surface water flood risk to development site	• Approximately 23% of the total site area is at risk of surface water flooding in the 1% AEP event with maximum depths of between 600 and 900 mm. • The extent is localised around the north-western corner of the site where Millingford Brook enters the culvert system. • Safe access and egress are achievable via York Road to the south east.		

Site SHLAA0325 – York Road, Wigan						
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP outline extends to cover 58% of the site, primarily the northern half of the site boundary. This extent follows topography and is localised around the culverted section of Millingford Brook. • Safe access and egress may be viable via York Road to the south, although this road still experiences inundation during the 0.1% AEP event.					
Mitigation options & site suitability: surface water	• **Development should attempt to avoid the 1% AEP event surface water outline. However, most of the surface water risk is within the fluvial risk areas and appears to be related to Millingford Brook.** • **Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 100% impermeable area and minimum flow rate of 5 l/s (in accordance with Rainfall runoff management for developments). It is noted that greenfield runoff rates and volumes may not be achievable for development of brownfield sites, therefore, values as close as reasonably practicable may be agreed with the LLFA.**					
Surface Water Flood Risk from Proposed Development						
Proposed development limiting runoff rate: (l/sec) Minimum Flow 5 l/s (in accordance with Rainfall runoff management for developments)						
Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	6.5	361	82	279	22.1	0.019 ha 3.000 %
30yr Rainfall+40%	7.75	438	98	341	27.0	0.023 ha 3.667 %
100yr Rainfall+20%	8	498	101	397 (118m^3 of exceedance storage)	31.4	0.026 ha 4.269 %
100yr Rainfall+40%	9.5	602	120	482 (141m^3 of exceedance storage)	38.2	0.032 ha 5.183 %
Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.					
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.					

Site SHLAA0325 – York Road, Wigan	
Overall Site Assessment	
Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **It is unlikely this site can pass the Exception Test given the significant present day and long-term fluvial risk. The EA would also discourage any development over a culvert.**
Recommendations summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed] or by emailing the local office SPPlanning.RFH@environment-agency.gov.uk This site should not be developed for residential use and should be converted to open greenspace with amenity value. • Options for culvert removal should be investigated. Development should seek to remove redundant structures/culverted sections to reduce flood risk and help • improve WFD status. FRA should have been supplied as part of the application, which is pending at the time of writing (July 2020).
FRA requirements	• Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF • and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; • the highways authorities; and emergency services. **Site to remain in 2020 baseline land supply until a decision is made on the pending development application.**
Council decision	•

Site SHLAA0405 – Land off Barn Lane	
Location	River Way, Wigan
Site area (ha)	0.44
Watercourse	River Douglas
EA Model used	River Douglas 2012
Existing use	Commercial / car park
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	0.44

Flood outlines (present day)

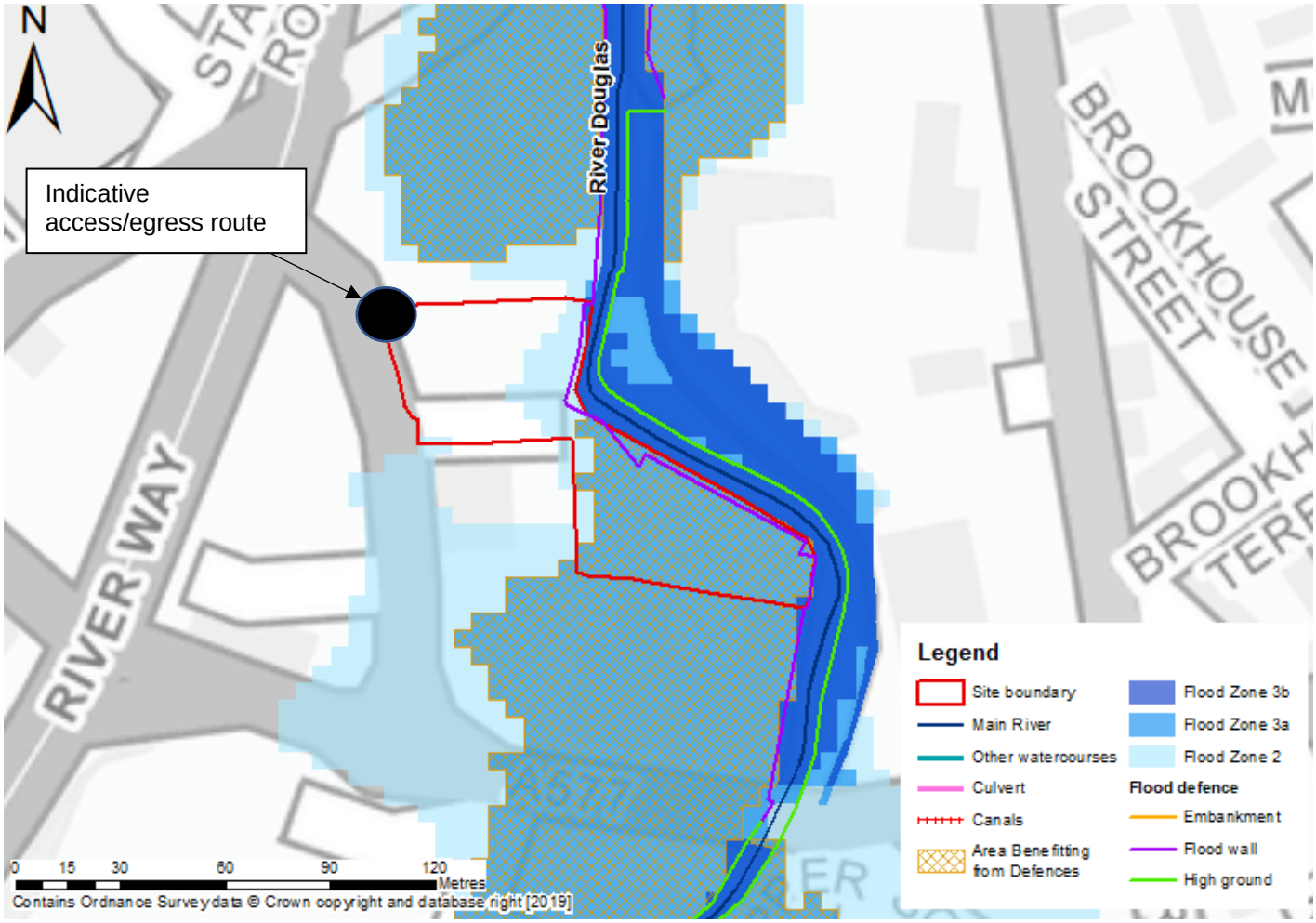


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences

- The southern half of the site is located within an Area Benefitting from Defences (ABD) which covers all of Flood Zone 3.

Site SHLAA0405 – Land off Barn Lane

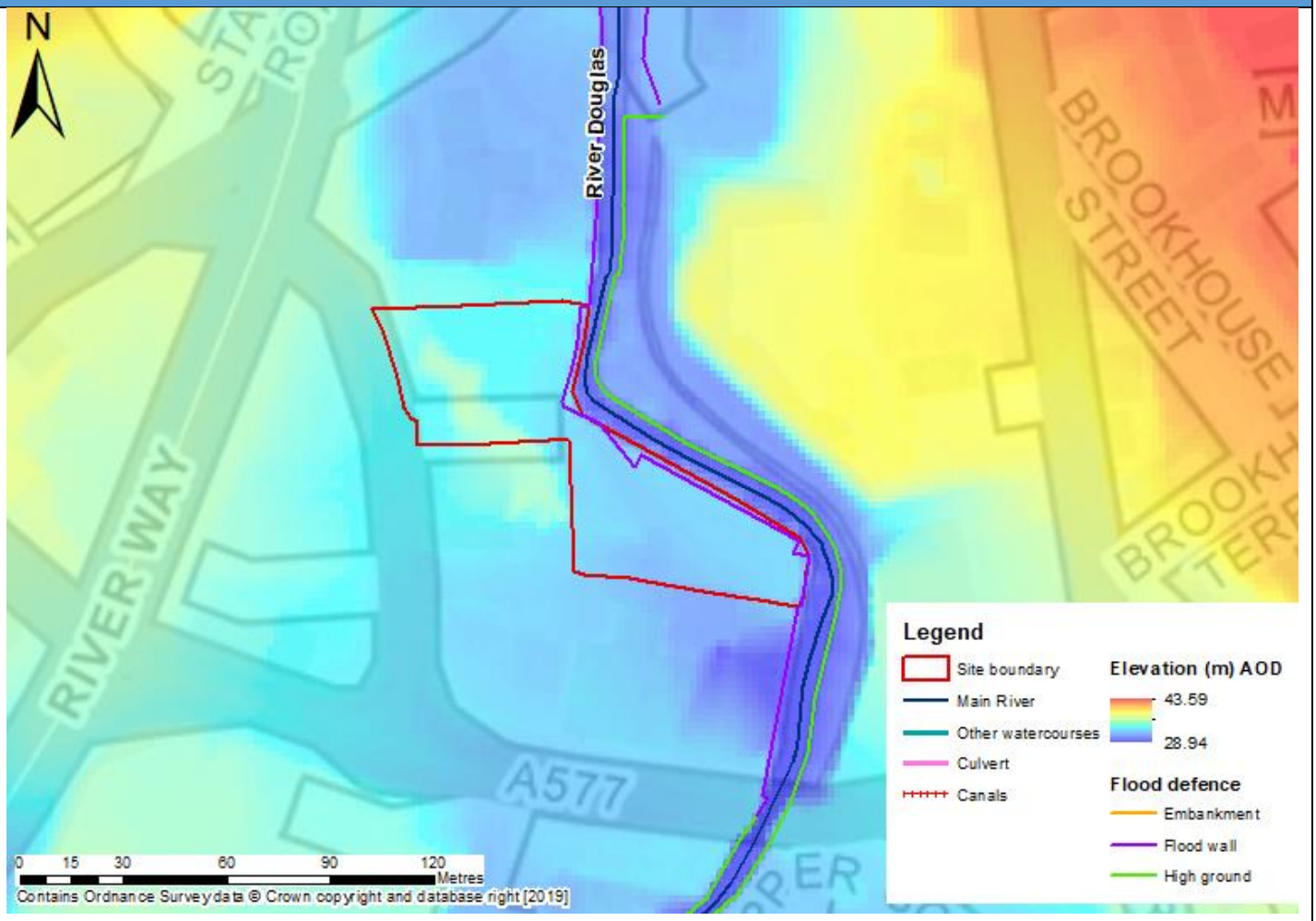


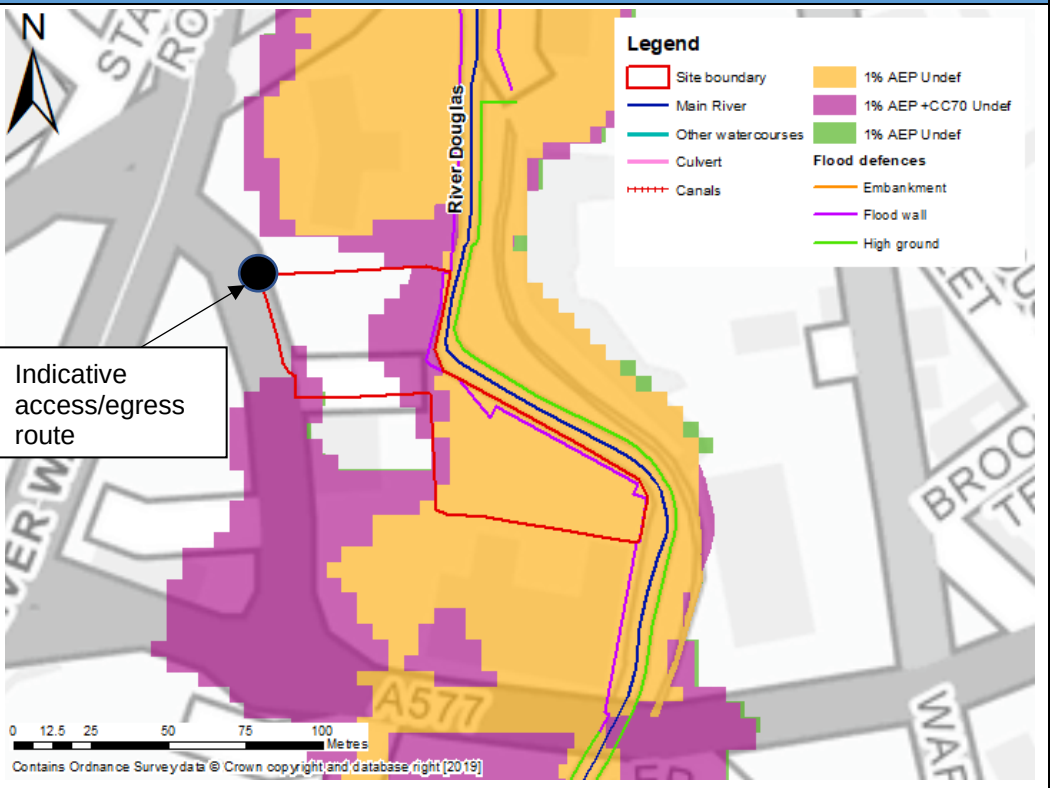
Figure 2: Site with 2 m 2017 LIDAR (elevation data)

- The elevation of the site is consistent at an average of approximately 33 m AOD; this is the same as the surrounding area to the west.
- There is a section of higher ground within the northern part of the site where the elevation is approximately 35 m AOD.
- The River Douglas to the east of the site has a lower elevation in-bank of approximately 30 m AOD and flows north to south.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	0.76	47.70	15.49	70.16
Fluvial: average depth (m)	Not applicable	0.34	1.00	0.97
Fluvial: maximum depth (m)	Not applicable	1.72	2.53	2.16
Fluvial: average hazard	Not applicable	Moderate	Significant	Significant
Fluvial: maximum hazard	Not applicable	Significant	Significant	Significant

Site SHLAA0405 – Land off Barn Lane	
Modelled fluvial flood risk and climate change (River Douglas 2012 model)	 Figure 3: Undefended fluvial outlines for the present day 1% AEP and future risk 1% AEP with +70% climate change uplift • The 1% AEP present day undefended event outline covers the whole of the southern area of the site and is the same in extent as Flood Zone 3 of the Flood Map for Planning. • The 1% AEP undefended + climate change event outline extends further and into the north of the site. Maximum flood depths increase from 1.7 metres up to 2 metres with climate change. The maximum depths within the areas at additional risk from climate change i.e. outside of Flood Zone 3 in the northern part of the site are approximately 700 mm with an average in this area of around 300 mm. • Safe access and egress should be possible via River Way in the north-western corner.
Historic flooding	• The site lies outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, the River Douglas is bound by a flood wall with a design Standard of Protection (SoP) of 100 which is assessed at condition grade 3 meaning 'Fair' (Table 1.1 Condition Assessment Manual[1]). • This flood wall provides protection to the site up to a 1% AEP flood event, reflected by the ABD shown in Figure 1.
Flood Warning Area	• The majority of the site is within an EA FWA; the FWA is for the River Douglas at Wigan, between Scholes and Poolstock.
Natural Flood Management / Working with Natural Processes	• The site lies outside any areas included in the WwNP and Irwell NFM dataset.

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG).** • **Approximately 48% of the site is located within Flood Zone 3 according to the Flood Map for Planning, however the whole of this Flood Zone 3a area of the site is within an ABD, making the risk residual (Figure 1). The modelled 1%AEP undefended event + climate change (Figure 3) covers the majority of the site with average depths of around 1 metre across the site.** • **It is clear from the modelling that the site is currently protected by flood defence infrastructure and can therefore be described as being at residual risk of defence failure or overtopping without being at direct risk of fluvial flooding. However, the main issue with this site is the effects of climate change and the fact that the long-term sustainability of the site depends on the future maintenance of the flood defences.** • **Regarding the location of the site within an EA ABD, the EA states that EA defences are there to protect existing communities and are not normally built or maintained to facilitate new development in high flood risk areas, such as this. The EA cannot guarantee how long they will maintain the defences for as this depends on changes to Government funding and priorities.** • **However, it is reasonable to assume that in the middle of a town, the EA will not allow the current defences to fall into disrepair and will maintain them at their current bank height. This is a case of new development benefiting from the defences that are already there to protect existing communities. Further interventions will however be required to address the impacts of climate change if standards of protection are to be maintained.** • **Were development to be permitted, defence breach and overtopping scenarios should be modelled to ascertain residual risk and to help formulate robust emergency plans for all site users to be aware of in times of flood. Pre-application discussion would be required, location and specification of the breach to be modelled should be discussed with the EA.** • **Ideally, the southern area of this site would not be developed for residential use. It should be the case that any future development at this site should be considered sustainable without continued reliance on EA flood defence investment and maintenance. Were development to be permitted, condition inspection of the flood defences should be carried out pre-development planning.** • **There is an EA requirement to include an 8 m buffer between development and the watercourse. The EA notes that although their permission would be required for development within the 8 m, any access requirements would be subsequently conditioned specific to the development proposal and the site constraints.** • **It may be possible to develop the northern area of the site which is mostly Flood Zone 1 though with parts at risk from climate change. Maximum climate change depths on this area are approximately 700 mm with an average of around 300 mm. Again, ideally this area would not be developed for residential use. However, it may be possible to mitigate these depths in the long term by possibly raising floor levels above the 1% AEP event + climate change level whilst also accounting for 600 mm freeboard. The developer may also consider placing development on stilts to raise the development out of the flood zone. This would however be a**

Site SHLAA0405 – Land off Barn Lane	
	costly solution. A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. • **Safe access and egress routes must be available at all times of flood, even for above ground flood accommodation. Site design and layout should further investigate the indicative locations shown on Figure's 1, 3 and 4 of this Level 2 SFRA. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.**
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to the River Douglas, groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and is unlikely to be an issue in this instance.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	• • • • • • • •
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• No canals in the vicinity of the site.

Site SHLAA0405 – Land off Barn Lane

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

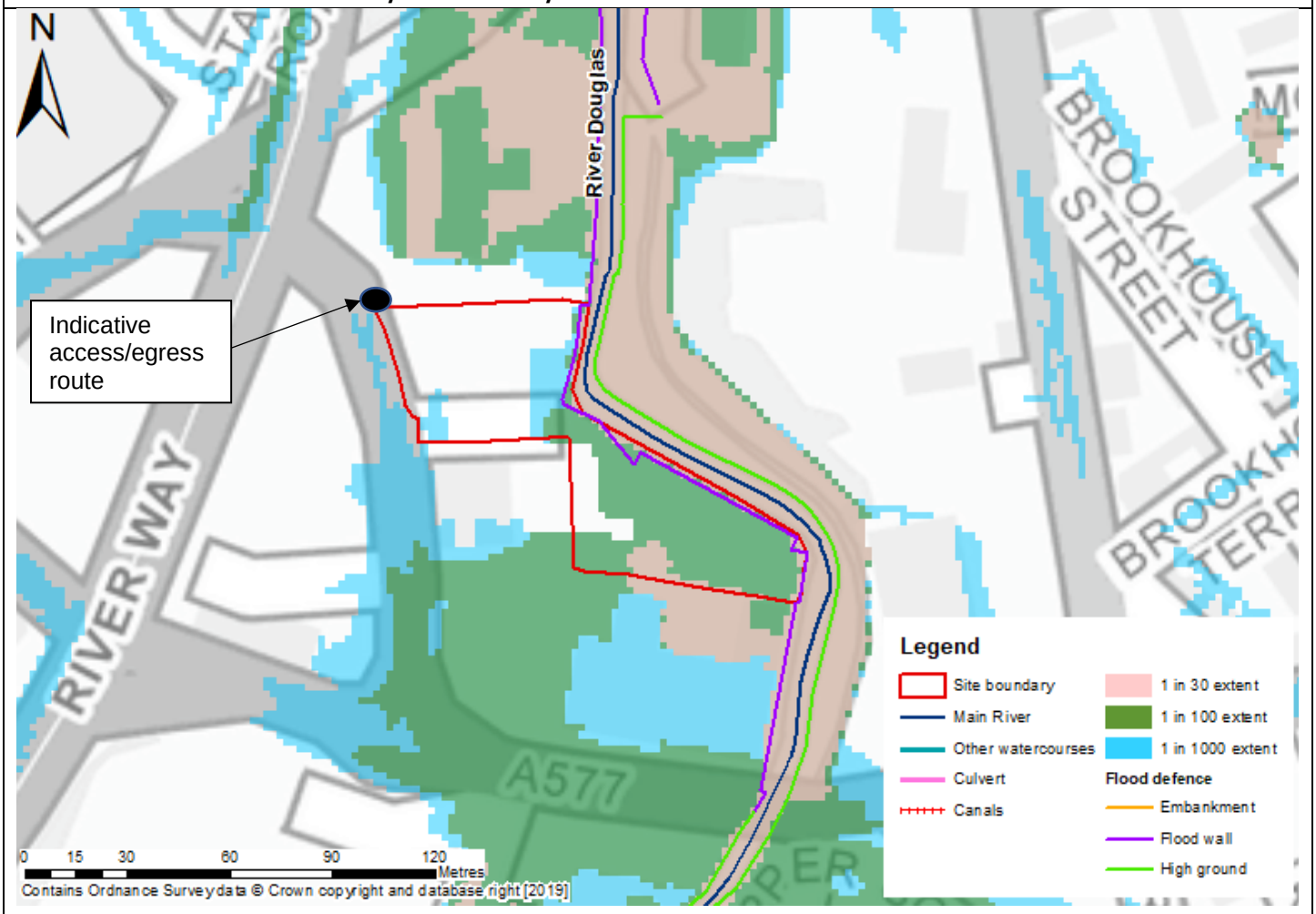


Figure 4: Surface water risk to the site (Risk of Flooding from Surface Water map)

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	7.56	48.87	56.43
Surface water flooding depths	Max: 0.30 – 0.60m	Max: >1.20m	Max: >1.20m
Surface water hazards	Max: Moderate Mean: Moderate	Max: Significant Mean: Significant	Max: Significant Mean: Significant
Surface water flood risk to development site	• Approximately 49% of the total site area is at risk of surface water flooding in the 1% AEP event to a maximum depth greater than 1.2 m and a Significant hazard rating. This is primarily in the southern section of the site where Flood Zone 3 covers. • The risk appears to be associated with the River Douglas. • Safe access and egress are achievable via River Way to the north of the site.		

Site SHLAA0405 – Land off Barn Lane	
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP outline does not extend much further into the site with an additional 7% more of the site being inundated. • Safe access and egress should still be possible from River Way to the north.

Mitigation options & site suitability: surface water	• **Development should attempt to avoid the 1% AEP event surface water outline in the south of the site. However, most of the surface water risk is within the fluvial risk areas and appears to be related to the River Douglas. By avoiding the fluvial risk areas, as discussed above, the developer will also avoid the majority of the surface water risk.**
	• **It is recommended the southern area of the site is not developed and is used for open greenspace for containment of surface water. Appropriate SuDS techniques should be assessed though infiltration SuDS may not be feasible given this area of the site is currently hardstanding and developed. Ground investigation and contamination testing would be required.**
	• **It is unknown whether surface water is able to drain into the River Douglas, due to the flood wall that is in place. There should be a number of non-return valves in place on the flood wall to allow surface water to drain from the site into the watercourse. A full drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on proposed layout plans.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 100% impermeable area and minimum flow rate of 5 l/s (in accordance with Rainfall runoff management for developments). It is noted that greenfield runoff rates and volumes may not be achievable for development of brownfield sites, therefore, values as close as reasonably practicable may be agreed with the LLFA.**

Site SHLAA0405 – Land off Barn Lane

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Minimum Flow 5 l/s (in accordance with Rainfall runoff management for developments)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	4.25	242	54	189	14.9	0.013 ha 2.864 %
30yr Rainfall+40%	5	293	63	230	18.2	0.015 ha 3.485 %
100yr Rainfall+20%	5.25	334	66	268 ($79m^3$ of exceedance storage)	21.2	0.018 ha 4.061 %
100yr Rainfall+40%	6.25	403	79	324 ($94m^3$ of exceedance storage)	25.7	0.022 ha 4.909 %

Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.
Overall Site Assessment	
Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **To pass the Exception Test, it must be proven that the development will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.** • **Due to the location of this site being within an existing community that already benefits from built defences, it is not seen as the same level of risk as if the site was on a newly allocated development area. Residual risk to the site remains due to it being within an area benefiting from** • **defences.** **Options discussed in this Level 2 SFRA should be explored through appropriate options modelling to assess the likelihood of the site passing**
Recommendation summary	• **the Exception Test.** Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed]) or by emailing the local office SPPlanning.RFH@environment-agency.gov.uk It is recommended that the southern area of the site is not developed for • residential use, given the residual risk, long term risk from climate change and risk from surface water. The northern part of the site should be further assessed in terms of climate change modelling and whether mitigation can ensure development can remain •

Site SHLAA0405 – Land off Barn Lane	
	safe for its lifetime, including for safe access and egress routes.
FRA requirements	• Any FRA should include a drainage strategy for the proposed new development layout, assuming development planning is to proceed, adhering to UU's requirements. • A detailed Emergency Plan should accompany the FRA detailing safe access and egress routes and evacuation procedures in times of flood. • Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. • Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services.

Site GM Allocation 31 – Land East of Boothstown	
Location	Land East of Boothstown, Salford
Site area (ha)	29.03
Watercourse	Shaw Brook
EA Model used	Shaw Brook 2009, JBA JFlow 2020
Existing use	Greenfield
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	24.68

Flood outlines (present day)

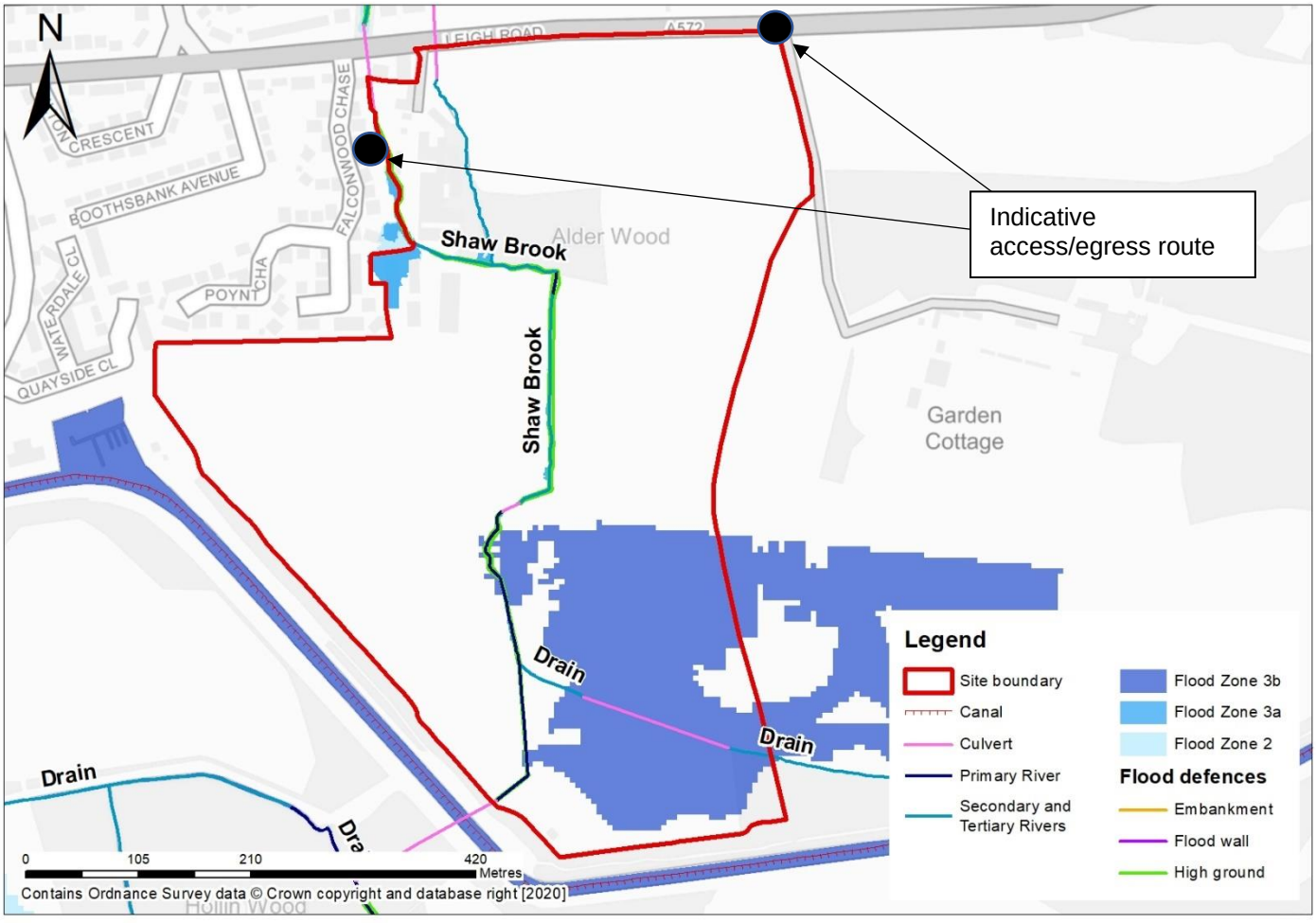


Figure 1: Site boundary with flood zone mapping (Flood Map for Planning) and flood defences

- The south of the site allocation contains outlines from Flood Zone 3b, which when queried, dates from 2009. The origin of the extent is unclear however i.e. whether it is from older broadscale modelling or additional unknown modelling

Site GM Allocation 31 – Land East of Boothstown

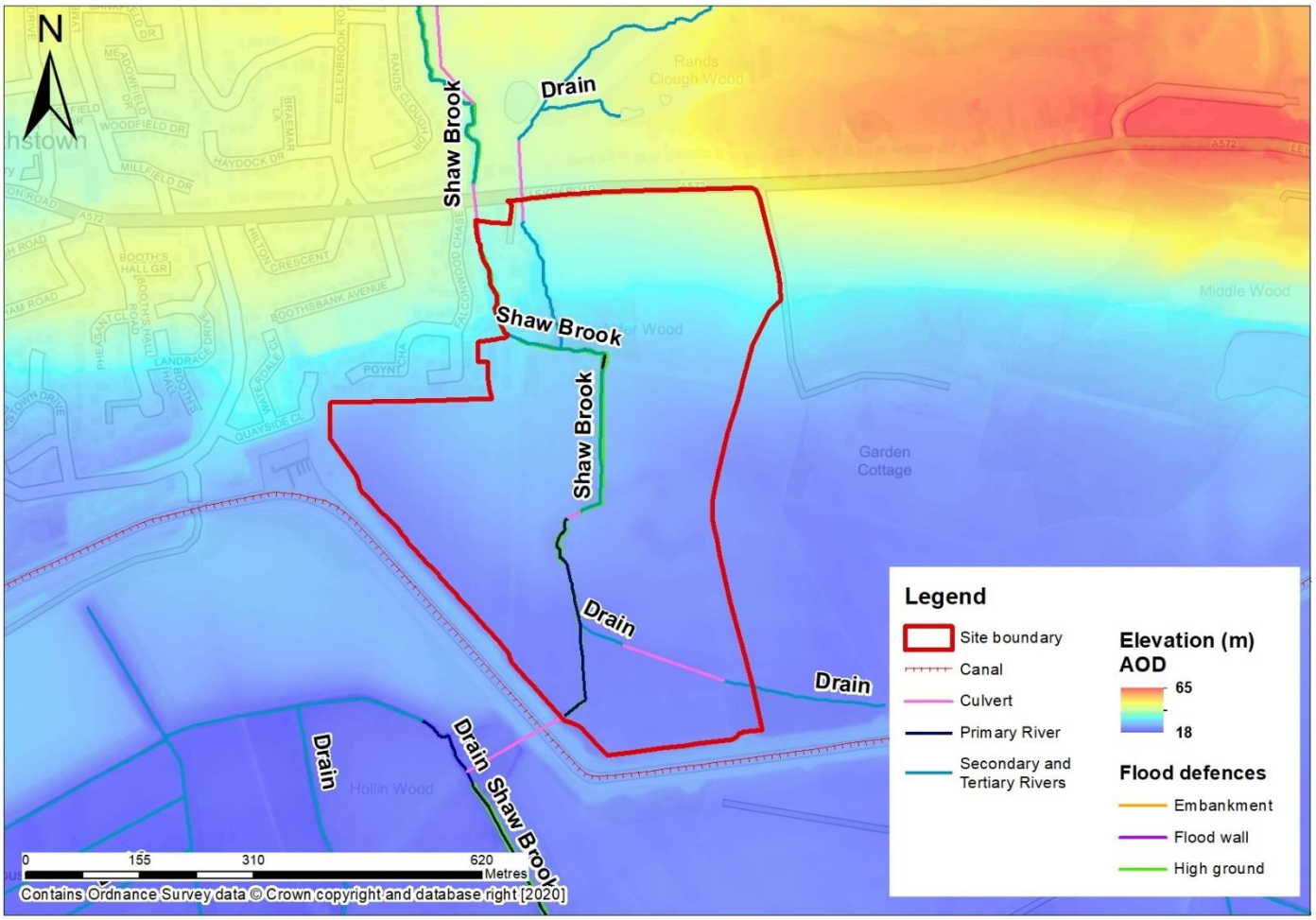


Figure 2: Site with 2m 2017 LIDAR (elevation data)

- The proposed site is located east of Falconwood Chase and is bounded to the north by the A572 and to the south by Bridgewater Canal.
- Shaw Brook flows southwards passing underneath the A572, through the centre of the site and passes underneath Bridgewater Canal at the southern extent. There is also an ordinary watercourse, classified as a drain, that splits away from Shaw Brook and flows easterly out of the site.
- The sites elevation is highest in the north (approximately 41m AOD) sloping down to its lowest elevation at the southern boundary, at approximately 21m AOD.

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Flood Source: Fluvial

Flood Zones (%)	Flood Zone 3b	Flood Zone 3a	Flood Zone 2	Climate Change
	16.72	1.15	1.19	53.14
Fluvial: average depth (m)*	Not applicable	0.14	0.25	0.23
Fluvial: maximum depth (m)*	Not applicable	2.58	3.07	2.97
Fluvial: average hazard*	Not applicable	Moderate	Moderate	Moderate
Fluvial: maximum hazard*	Not applicable	Moderate	Moderate	Significant
*Depth and hazard data taken from JFlow modelling due to Shaw Brook being 1-Dimensional only, see Figure 4				

Site GM Allocation 31 – Land East of Boothstown

Modelled fluvial risk and climate change (Shaw Brook 2009 – 1-Dimensional only and latest JBA JFlow 2020 modelling)

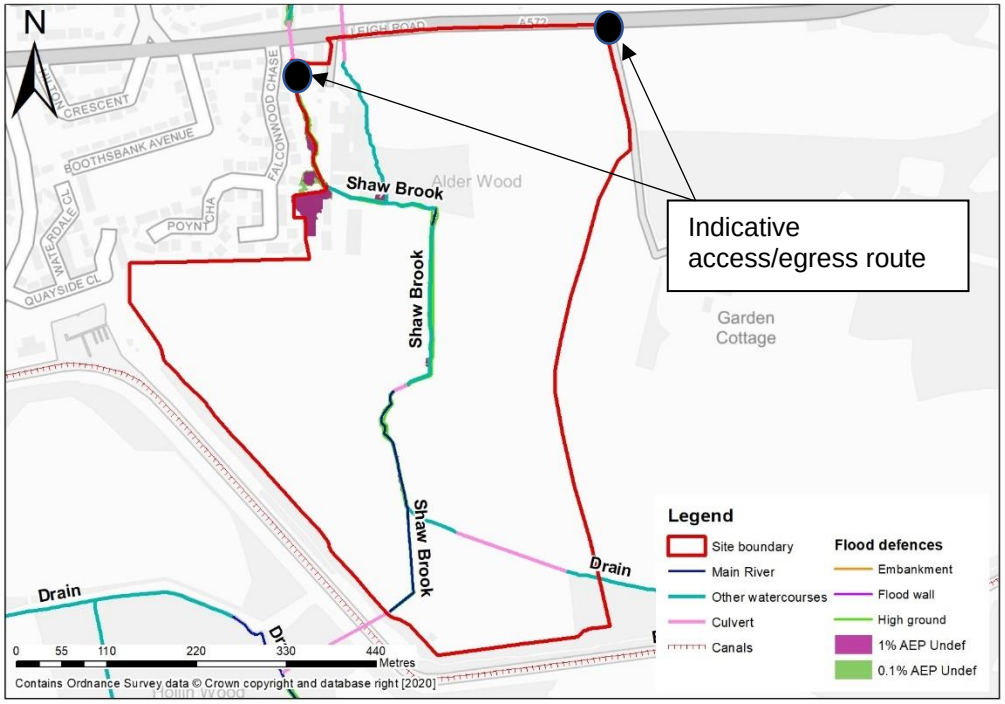


Figure 3: Undefended fluvial outlines for the present day 1% AEP and 0.1% AEP (Shaw Brook 2009 model)

- Both the 1% AEP and 0.1% AEP present day outlines remain in channel for the majority of the site. There is a small area of flooding at the east of the site boundary though this is localised only to this area.
- The modelled flood outlines are equivalent to the Flood Map for Planning.
- Depth and hazard information are not available from the Shaw Brook model as it is 1D only.
- Safe access and egress are achievable west via Falconwood Chase and to north onto the A572.

Site GM Allocation 31 – Land East of Boothstown

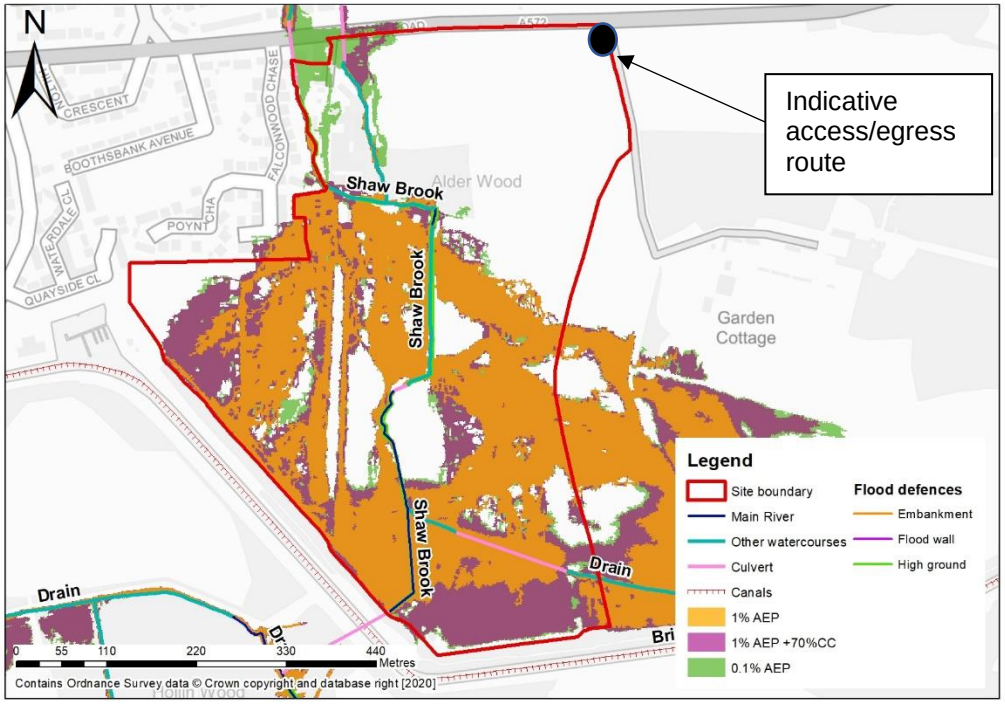


Figure 4: Fluvial outlines for the present day 1% AEP, 0.1% AEP and future risk 1% AEP+70%CC (JBA JFlow model 2020)

- These flood outlines are taken from the latest JFlow modelling of Shaw Brook and all field drains within the site boundary.
- The JFlow modelled flood outlines show the site to be at considerably greater risk than the 2009 modelling shows.
- The modelled outputs from this study resemble the existing Flood Zone 3b suggesting that the existing mapping may be based on earlier broadscale modelling.
- Water comes out of bank from Shaw Brook and flows south before exiting through the eastern boundary of the site. The majority of the southern half of the site is inundated with flood water during the present day 1% AEP event.
- Average flood depths within the site are approximately 140mm in the 1% AEP event, increasing to 230mm in the 1% AEP +70%CC event. The deepest flooding is primarily focused in the south of the site as water pools against the Bridgewater Canal. A second distinct area of flooding is shown to be in the same location as a high-risk (3.33% AEP) surface water flow path, see Figure 5. This is likely to be as a result of local topography.
- Bridgewater Canal acts as a barrier for further flood water spreading south, though there is a culvert through which Shaw Brook flows and passes underneath the canal. This may explain the increase in flood risk south of the canal, as this structure was not originally represented in the Shaw Brook 2009 model. This structure is likely to be highly restrictive on flow volumes passing through it, thus increasing flood risk to the site.

Historic flooding	• The site is located outside of the Environment Agency's Historic Flood Map (HFM).
Defences	• Based on the EA's Spatial Flood Defences dataset, Shaw Brook are bound by areas of high ground which act as informal defences which are assessed at condition grade 3 meaning 'Fair' (Table 1.1 Conditions Assessment Manual[1]).

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

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Flood Warning Area	• The site is located outside of any current EA FWAs.
Natural Flood Management / Working with Natural Process	• The site is almost entirely within areas of tree planting within the WwNP dataset. Additionally, there are areas of riparian planting alongside both banks of Shaw Brook, running through the centre of the site. Both these areas can significantly delay the peak runoff in catchments as well enhancing floodplain roughness to obstruct significant flow paths. • There are also smaller areas around the site within the dataset as runoff attenuation features. These are areas of high flow within the RoFSW maps based on the premise that runoff time may be influenced by temporary storage if designed correctly.
Observations, mitigation options & site suitability: fluvial	• **Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG).** • **According to the Flood Map for Planning, 1% of the site is within Flood Zone 3. 17% is shown to be within Flood Zone 3b, however, this Flood Zone 3b outline should be reassessed as its origin is unknown.** • **The broadscale JFlow modelling (Figure 4) shows considerably greater risk to the site. Given these significant differences between the current Flood Map for Planning and the latest JFlow modelling, further detailed modelling will be required to fully quantify flood risk to the site from Shaw Brook.** • **Based on the outputs from this Level 2 SFRA, a further, more detailed flood risk review[2] has been carried out for the site which illustrates an indicative SuDS plan to mitigate fluvial risk, including zoning of development around several onsite and offsite attenuation basins, linked by a network of open and piped swales. There is also an option to install a further culvert under the Bridgewater Canal to direct floodwater to a purpose-built offsite wetland, if required. The capacities and volumes of these indicative basins and swales are based on the flood extents and depths produced from the JFlow modelling. It is strongly advised that, the site-specific FRA for the site includes detailed 2D hydraulic modelling of Shaw Brook, based on detailed channel survey.** • **The more detailed flood risk review also indicates that fluvial flows to the RHS site that lies adjacent to the east can be attenuated through the network of swales and attenuation and basins and the opening up the culvert at the southern end of the site.** • **Shaw Brook currently flows through multiple culverts located onsite. Any development should seek to investigate options looking into culvert removal, where feasible. Scenario modelling, using the recommended 2D hydraulic model, would be required to ascertain the effects on flood risk and possible WFD benefits. Any structures that cannot feasibly be removed should be subject to culvert blockage modelling to ascertain residual risk.** • **As Shaw Brook is designated 'Main River', the EA requires an 8 metre no development buffer of the watercourse, for access and maintenance purposes.** • **Given that Shaw Brook runs directly through the site, the developer or site**

[2] Peel Investments (North) Limited, GM ALLOCATION 31 - LAND EAST OF BOOTHSTOWN, SALFORD. Site Appraisal - Drainage and Flood Risk, May 2020

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	owner must find out which permissions and licences are required to maintain, repair, build or remove anything in or around both watercourses and the structures present on the watercourse. Without appropriate permissions and licences the developer/site owner may be subject to a fine or imprisonment. • **Safe access and egress routes must be available at times of flood. This should be achievable via the east of the site onto Falconwood Chase and the north to the A572. Site design and layout should further investigate the indicative locations shown on Figure's 1, 3 and 5 of this Level 2 SFRA. Provision for safe access and egress routes would need to be demonstrated in any planning application and any associated masterplan.**
Flood Source: Groundwater	
Flood risk: groundwater	• Due to the site's proximity to Shaw Brook, groundwater levels are likely to be similar to the corresponding levels in the river. Groundwater will follow topography and may be an issue in this instance. Groundwater should be assessed as part of the FRA.
Flood Source: Infrastructure Failure – Reservoirs (Residual)	
Flood risk: reservoir	•
Flood Source: Infrastructure Failure – Canals (Residual)	
Flood risk: canal	• The Bridgwater Canal runs alongside the south of the site boundary and therefore residual risk must be assessed as part of the FRA.

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Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

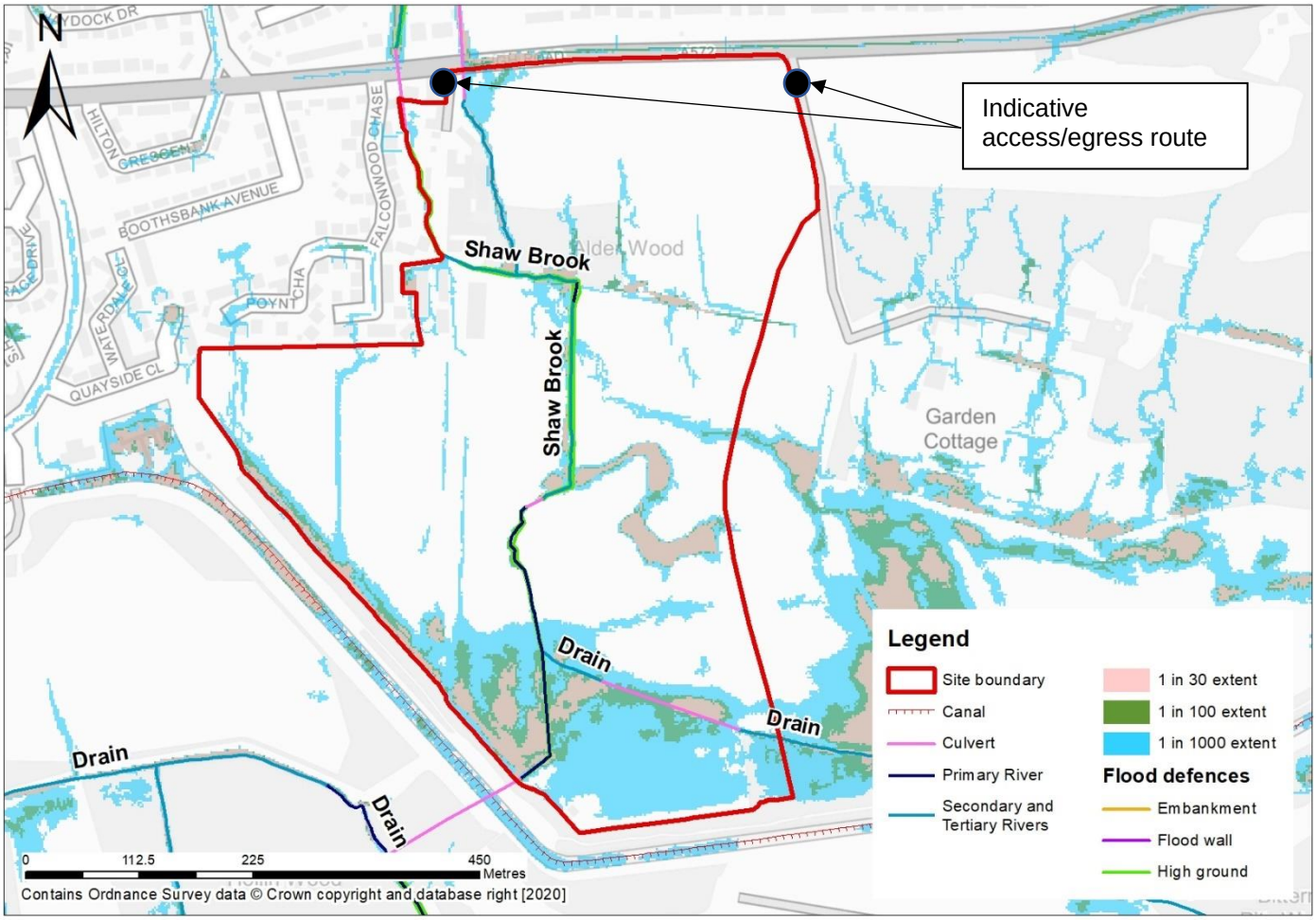


Figure 5: Surface water risk to the site

Existing development: Risk of Flooding from Surface Water map (%)	High Risk (1 in 30 AEP outline)	Medium Risk (1 in 100 AEP outline)	Low Risk (1 in 1000 AEP outline)
	5.26	9.28	25.58
Surface water flooding depths	Max: 0.90 – 1.20m	Max: 0.90 – 1.20m	Max: 0.90 – 1.20m
Surface water hazards	Max: Significant Mean: Significant	Max: Significant Mean: Significant	Max: Significant Mean: Significant
Surface water flood risk to development site	• Around 5% of the site is at risk of surface water flooding from the 1% AEP event, over 25% is at risk from a 0.1% AEP event. • Much of the site which is at risk from surface water is focused in the south of the site, pooling at the boundary of Bridgewater Canal. This area is also at risk from fluvial sources so any measures undertaken to mitigate risk would also be combatting risk from surface water. • There are two flow routes from Shaw Brook, flowing east. One of these is mainly low risk whilst the other larger path is the largest area of high risk (1% AEP) surface water to the site. • Safe access and egress would be possible from the west of the site, for example		

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	onto Falconwood Chase or the A572.
Climate change	• The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events. • The 0.1% AEP outline covers just over 25% of the total site area; the hazard has been classified as Significant. This extreme event outline is primarily pooled in the southern corner of the site boundary at the edge of Bridgewater Canal. • Access and egress should still be achievable onto Falconwood Chase or the A572 including incorporating for future risk.

Mitigation options & site suitability: surface water	• **Development should avoid the surface water flow routes if possible and incorporate them into the site layout, allowing natural flows. It may be possible to regrade the site topography and to divert flow paths to suit the development plans, without increasing risk offsite.**
	• **A full drainage strategy would be required, to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on the proposed layout and investigation into appropriate SuDS techniques. As the site is currently greenfield, infiltration SuDS should be possible, subject to ground investigation and contamination testing.**
	• **UU states the following requirements:**
	  ○ **Applicants will be expected to manage surface water through sustainable drainage features that provide multi-functional benefits as opposed to a reliance on underground conventional piped and tanked storage systems.**
	  ○ **The design of new development should consider the inclusion of water efficiency measures in the development of new buildings as way to further reduce flood risk. New development can become more resilient to climate change by encouraging water efficiency measures including green roofs, water saving and recycling measures to further minimise flood risk. Such a proactive approach is designed to adapt new development to climate change, whilst additionally having due consideration for water use in Greater Manchester.**
	• **Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (l/s).**

Surface Water Flood Risk from Proposed Development

Proposed development limiting runoff rate: (l/sec)
Qbar: 194 l/s (FEH Statistical)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	6.75	15024	3300	11724	23.9	0.782 ha 2.692 %
30yr Rainfall+40%	8.25	18327	4033	14294	29.2	0.953 ha 3.283 %
100yr Rainfall+20%	8.5	20970	4155	16815 ($5091m^3$ of exceedance storage)	34.3	1.121 ha 3.862 %
100yr Rainfall+40%	10	25264	4899	20375	41.6	1.358 ha

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				(6081m^3 of exceedance storage)		4.679 %
Climate change	• Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.					
Surface water: flood risk impacts from development site, mitigation & SuDS	• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. • Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.					
Overall Site Assessment						
Can the second part of the Exception Test be satisfied as part of a site-specific FRA?	• **Based on the further, more detailed review of flood risk3, it is likely this site can pass the Exception Test at the site-specific FRA stage. However, more detailed modelling of Shaw Brook should be carried out along with options modelling for SuDS.**					
Recommendation summary	• Early discussions should take place with the Environment Agency with regards to flood risk issues on this site. The Environment Agency offers early engagement through an advisory service via their website ([Link Removed]) or by emailing the local office SPPlanning.RFH@environment-agency.gov.uk • Further detailed modelling of Shaw Brook is required to fully quantify fluvial risk to the site. The outputs from this should then inform site design and layout, including the provision for safe access and egress routes during times of flood. • A full drainage strategy should be formulated to inform the FRA, to account for surface water flow routes and how to mitigate within a proposed layout. This should adhere to the requirements stated by UU in this Level 2 SFRA. • The FRA should account for the recommended updated modelling outputs and the drainage strategy.					
FRA requirements	• The FRA should include a suitable emergency plan identifying safe access and egress routes during a flood. • Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; • GMSF and District Council Local Plan policies; and national SuDS policy and guidelines, in the absence of any local SuDS policy or guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and emergency services. •					

[3] Peel Investments (North) Limited, GM ALLOCATION 31 - LAND EAST OF BOOTHSTOWN, SALFORD. Site Appraisal - Drainage and Flood Risk, May 2020