TECHNICAL NOTE

JBA Project Code	2024s0643
Contract	Ledgard Mill
Client	Helen Davies
Day, Date and Time	27nd June 2024
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Reviewer / Sign-off	John Panesar BEng (Hons) CEng MICE
Subject	Building on void - Technical parameters

1 Introduction

1.1 Terms of reference

JBA was commissioned by Helen Davies to address concerns raised by the Environment Agency regarding the design of a proposed building on stilts / on a void at Ledgard Mill, Mirfield (planning application ref: 2023/93539).

1.2 Context

Following their letter dated 3rd April 2024 (EA ref: RA/2023/146640) and a follow-up meeting on 14th May 2024, the Environment Agency requested clarifications on the following points:

1 Confirmation of the single design flood level (1%AEP + appropriate climate change allowance), including the source of this data.

2 Clear detailed drawings of the proposed void solution including the dimensions of the openings.

3 Confirmation of the combined solid footprint area of the building supports/columns/perimeter wall. This is the actual area in m2 that will be taken up by the proposed structure.

4 An assessment of the impact of the building on flood flow into and out of the space. This should prove that the proposed solution will not slow down the ingress or egress of flood water on the site. The reason for this is that if it slows inflow, it could deflect flood water onto others. Depending on the specifics, this may need some kind of hydraulic calculations. Details of the flooding mechanisms for the site would be useful here as well, so we can understand how quickly the site floods etc.

5 Confirmation of the soffit level of the void space compared to the design flood level.

6 Clear details of the comparison between baseline and "with scheme" flood extents and depths for the design flood event. This will need to show that there is no increase in flood risk offsite. This should include comparisons of flood levels (in mAOD) and flood extents.

7 Details of the comparison between baseline and 100% void blockage scenario for the design event. This should include comparisons of flood levels (in mAOD) and flood extents. This is needed to understand the worst-case scenario of all maintenance measures failing and the void space becoming blocked. If the impacts of this are significant, then the risk may not be considered acceptable as the proposal will be introducing the potential for an unacceptable impact that wasn't there previously.

8 Full details of the inspection and maintenance regime that is proposed to ensure that the void space is kept available for the lifetime of the development.

1.3 Aim

This Technical Note aims to provide information on the design parameters of the building on void in order to enable the design team to address Points 1, 2, 3, 4, 5 and 7 above.

2 Answers to the Environment Agency's Queries

2.1 Point 1: Design flood level

Whilst the latest government guidance on climate change[1] suggests that a 23% increase in flows should be considered for more vulnerable developments located within the Aire and Calder management catchment, the Environment Agency agreed during the 14th May meeting that the more conservative 30% allowance previously considered as part of the model validation (ref: email dated 24 October 2019 from Kate Wilox, PSO Advisor) could be used.

With regards to the relatively flat site topography and shallow water level gradient, a uniform 'design' (i.e. 100-year with +30% climate change) flood level of 45.38m AOD was selected for the whole site. This value was extracted from *Figure 2-4: Post-development flood levels along proposed buildings* in JBA's Technical Note dated September 2019[2].

2.2 Point 2: Proposed void solution

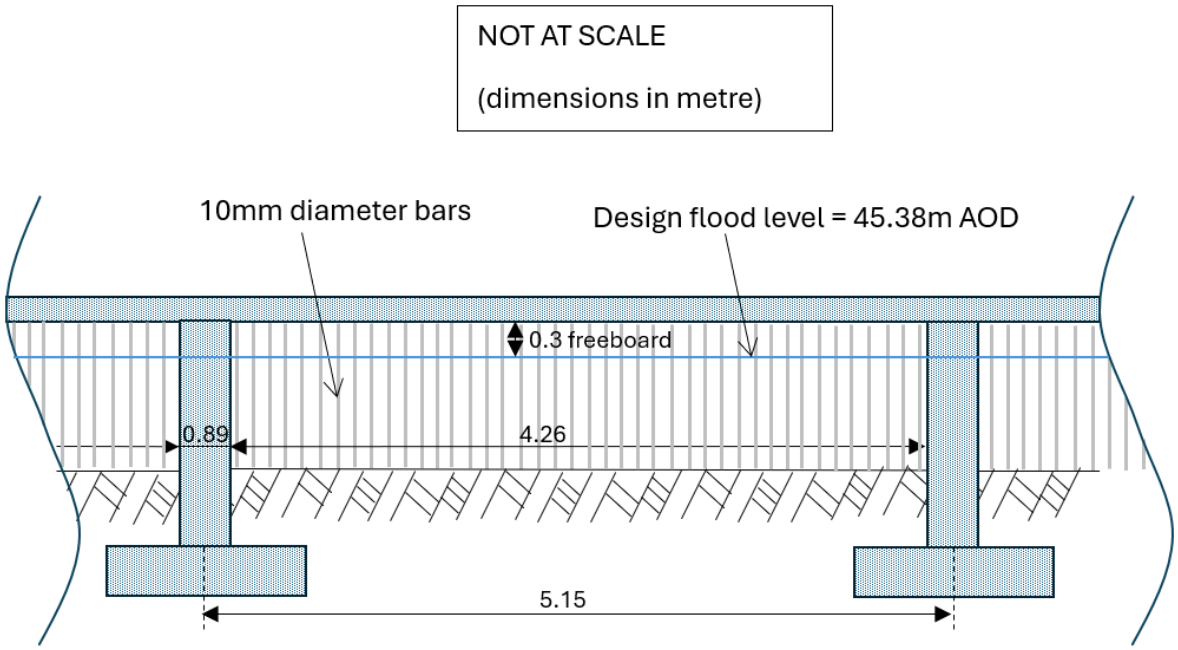
In line with the proposed void solution modelled by JBA Consulting in 2019, it is proposed to use the following design parameters for the building on void.

- Void base level: at existing ground level (c. 44.55m AOD)
- Void opening width: 4.26m for every 5.15m length of wall
- Pier (between void inlets) width: 0.89m
- Minimum void soffit level: 45.68m AOD
- Open void length per length of wall: 4.26m for every 5.15m length of wall, on the sides of the proposed building facing incoming overland flows (i.e. north-eastern and south-western sides)
- Opening through side walls (parallel to overland flows): No
- Solid to void ratio within void (due to vertical walls, supporting frame, beams, etc): 17%
- Vertical bars: yes, 10mm diameter with 100mm spacing

1 https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#credible-maximum-scenarios

2 2018s0597-A-N001-10_APP.PDF

Figure 1: Building on void parameters - sketch (not at scale)



It is recommended that Architectural drawings submitted on the panning portal are updated to reflect the above design parameters.

2.3 Point 3: Combined solid footprint area of the building supports/columns/perimeter wall

Approximate building dimensions = 108m long (excluding staircases) x 12.4m wide
Average thickness of wall parallel to overland flow (at ground level) = 0.89m Number of walls parallel to incoming overland flows = 23 Total area associated with the lateral walls = 23 x 0.89 x 12.4 ≈ 253.8m^2
Total number of metal bars along building length = (108-(23x0.89)) x 10 ≈ 876 Total number of metal bars along building perimeter = 876 x 2 = 1752 Cross-sectional area of metal bars = PI x 0.01^2/4 = 0.0008m^2 Total area of metal bars = 0.0008 x 1752 = 0.2m^2

Total area occupied by piers, metal bars and walls in the floodplain ≈ 254m^2 approximately.

2.4 Point 4: Impact on flood flows

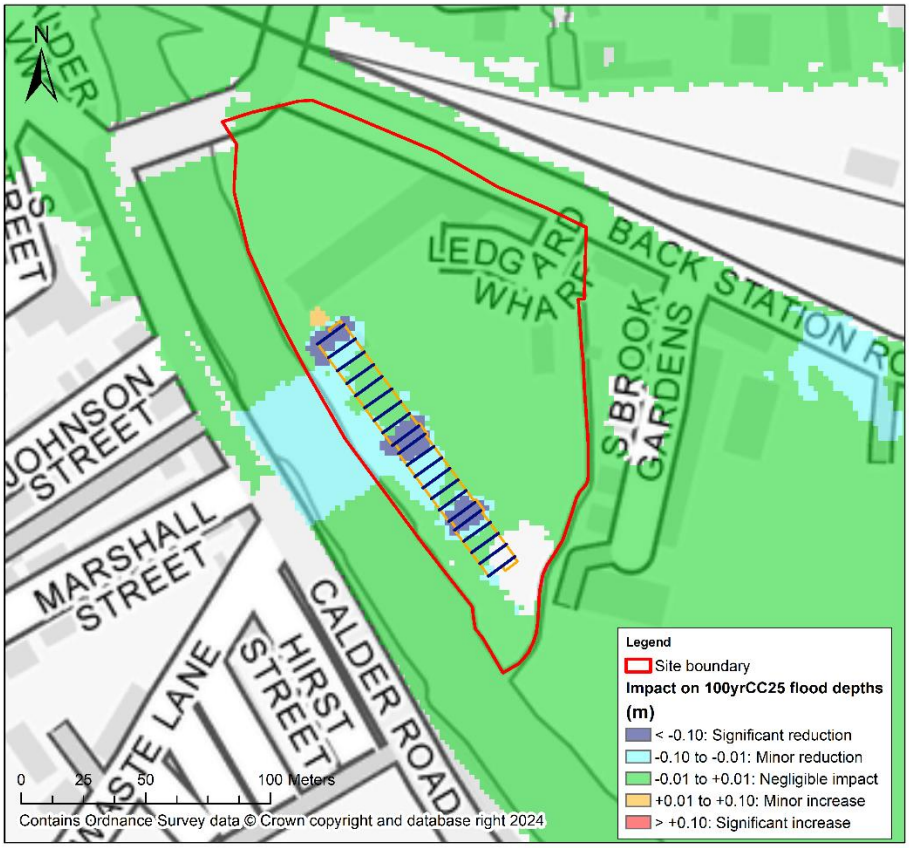
The impact of a 100% blockage of the building's void was initially modelled by JBA in 2019 and is documented in Appendix C4 of their Technical Note[3].

Whilst the modelling approach was validated by the Environment Agency at that time, it is acknowledged that representing a building-on-void by increasing the roughness value over its footprint in the model (i.e. the approach selected in 2018-2019) is no longer considered as standard practice.

As a precautionary measure, the impact of the building on void was re-modelled using current modelling practice, i.e. using flow constriction lines with a 26% blockage value (i.e. =(5.15-(4.26*90%))/5.15). The base of the void was kept to existing ground level (i.e. unchanged) and lateral walls were modelled as 100% impervious.

A comparison of the impact generated by the proposal based on current modelling practice was compared with the flood risk impact map documented in the 2019 Technical Note (see Figure 2).

Figure 2: Flood risk impact analysis

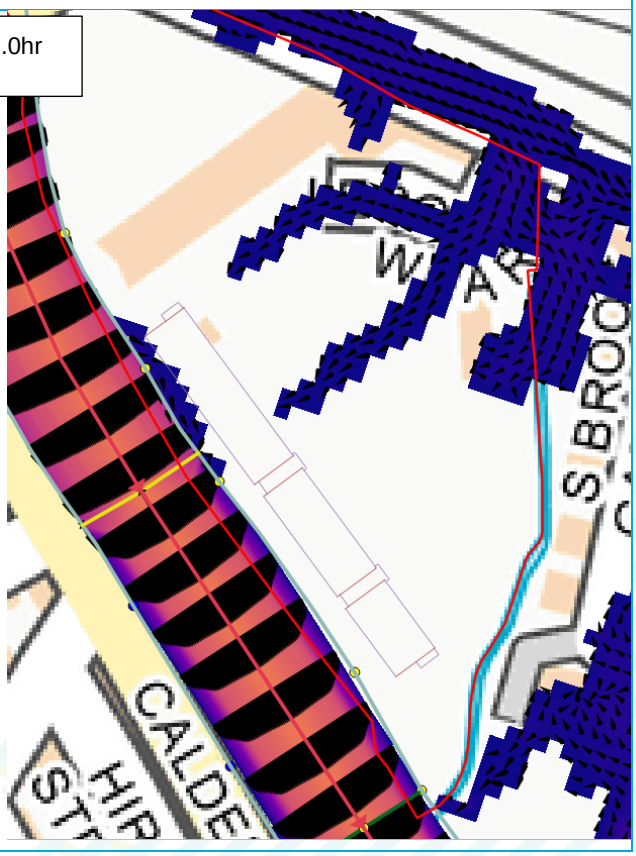


3 2018s0597-A-N001-10_APP 'Hydraulic Modelling at Ledgards Mill, Mirfield' September 2019

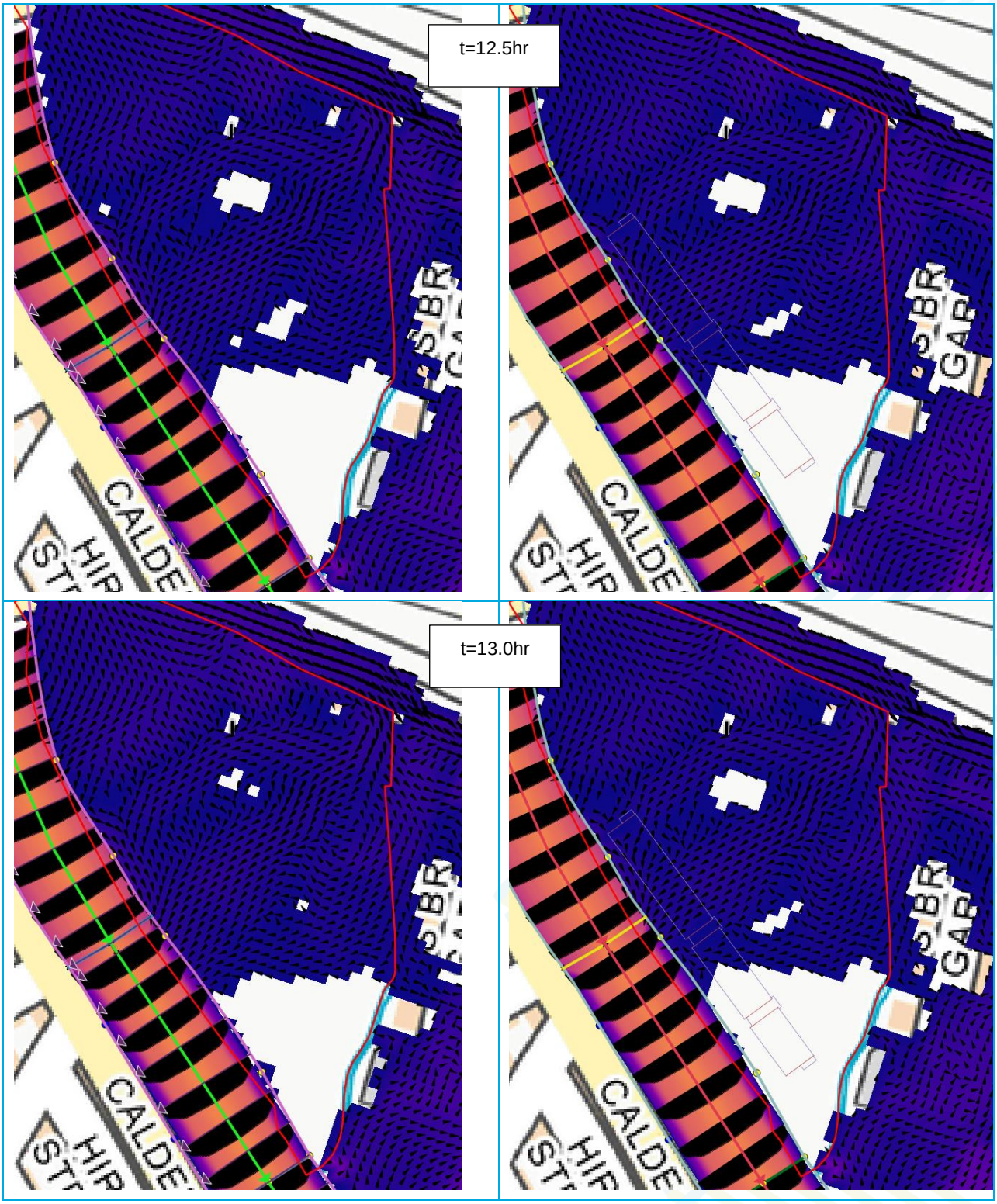
Figure 2 shows a comparable impact on flood depths as the one documented in Figure 2-3 of the 2019 Technical Note and confirms the proposal will not increase flood risk across third-party land.

To complete this assessment, a comparison between the baseline and post-development scenarios of the flood progression and peak velocity vectors at various time intervals in the simulation was carried out in order to confirm the proposed building-on-void will not deflect overland flows across third-party land (see Table 1).

Table 1: Flood extent and velocity vectors versus time

Baseline scenario	Post-development scenario
	


t=11.5hr
t=12.0hr


t=12.5hr
t=13.0hr

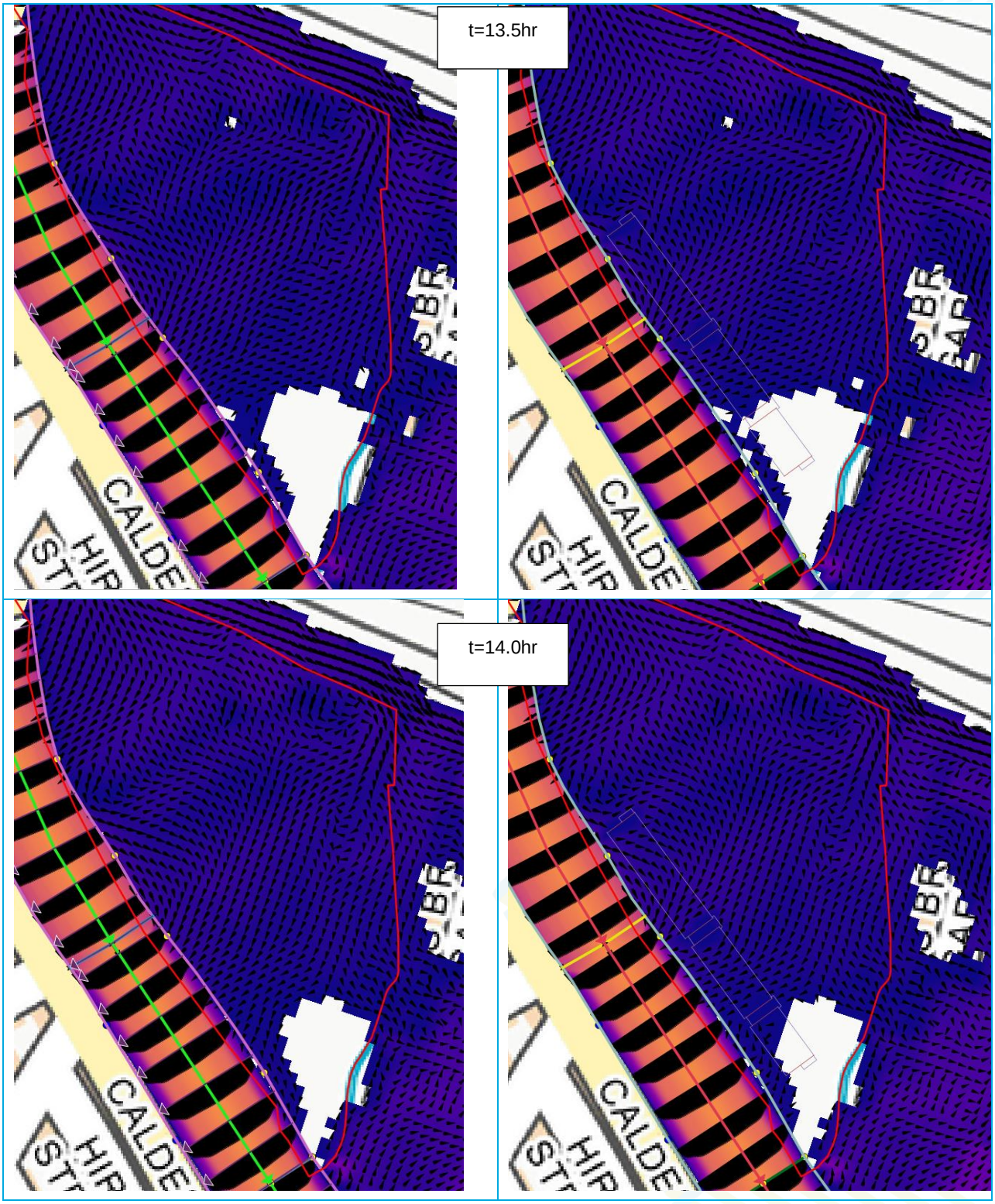

t=13.5hr
t=14.0hr

Table1 shows the proposal generates no noticeable impact on overland flows crossing the site.

The hydraulic modelling files used to benchmark the 2019 model results are available for review, if required, from the following link: 2024s0643-Sent to EA June 2024.zip

2.5 Point 5: Soffit level of the void space

In line with standard practice for the design of buildings on void, a minimum freeboard value of 300mm above the 'design' flood level will be used to set the void's soffit/ceiling level (as illustrated in Figure 1). Following discussion with the Design Team, it is confirmed that the soffit level of the building on void will be set to 46.33m AOD, i.e. approximately 950mm above the design flood level. As a result, the proposal complies with standard practice.

2.6 Point 6: Impact on flood extent

Further to the analysis undertaken under Section 2.4, a comparison between the 100-year with (+30%) climate change baseline and post-development flood extents was carried out (See Figure 3).

Figure 3: Impact on flood extent

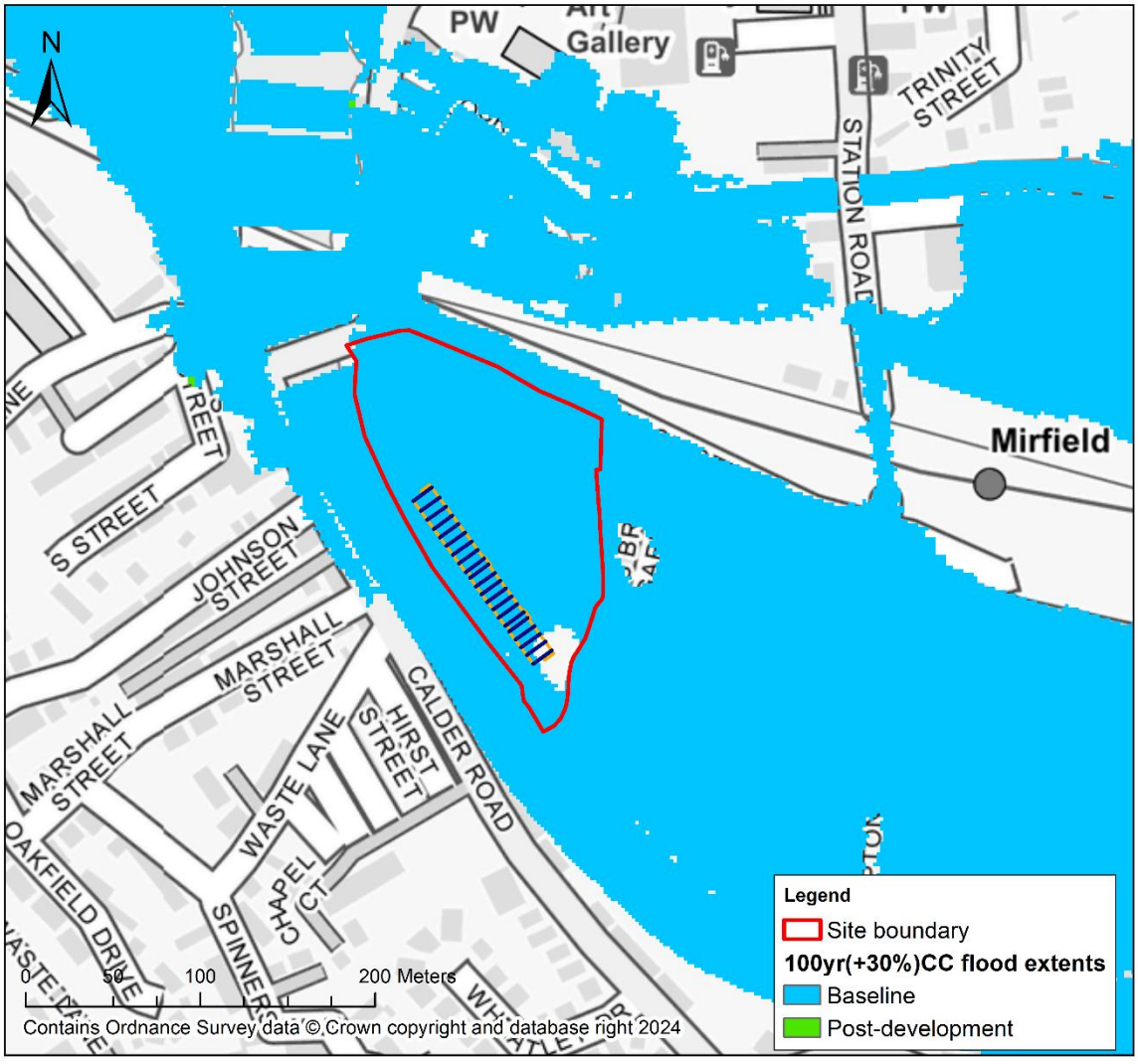
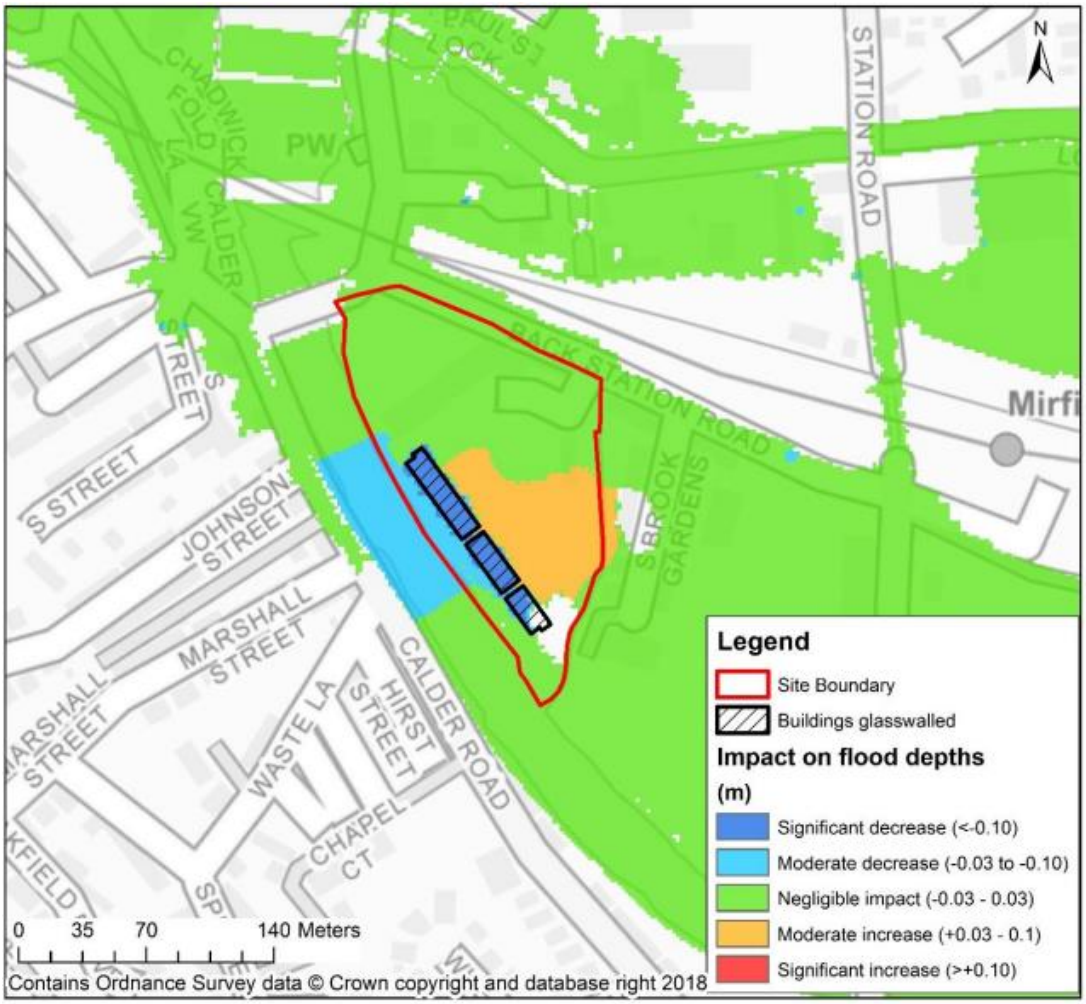


Figure 3 shows that the post-development flood extent is completely overlapped by / does not extend beyond the baseline flood extent. As a result, this confirms that the proposal does not increase flood extents elsewhere.

2.7 Point 7: Blockage risk analysist

The impact of a 100% blockage of the building's void was initially modelled by JBA in 2019 as part of a sensitivity analysis and is documented in Appendix C4 of their Technical Note (see extract below).

Figure 4: Impact of 100% blocked building on void (extract from 2019 Technical Note)



As mentioned under Section 2.4, modelling practices have changed since the model was validated by the Environment Agency. To ensure this blockage risk analysis complies with latest modelling practices, the impact of a blockage to the proposed building's void inlets was re-modelled using the 2024 model version. Given the width of the openings (i.e. 4.26m), a 50% blockage ratio was deemed a more realistic (yet very conservative) value than the 100% value used in 2019. The impact of the 50% blockage to the 100-year with (+30%) climate change flood depths was quantified and is represented in Figure 5.

Figure 5: Impact of 50% blocked building on void (2024 model version)

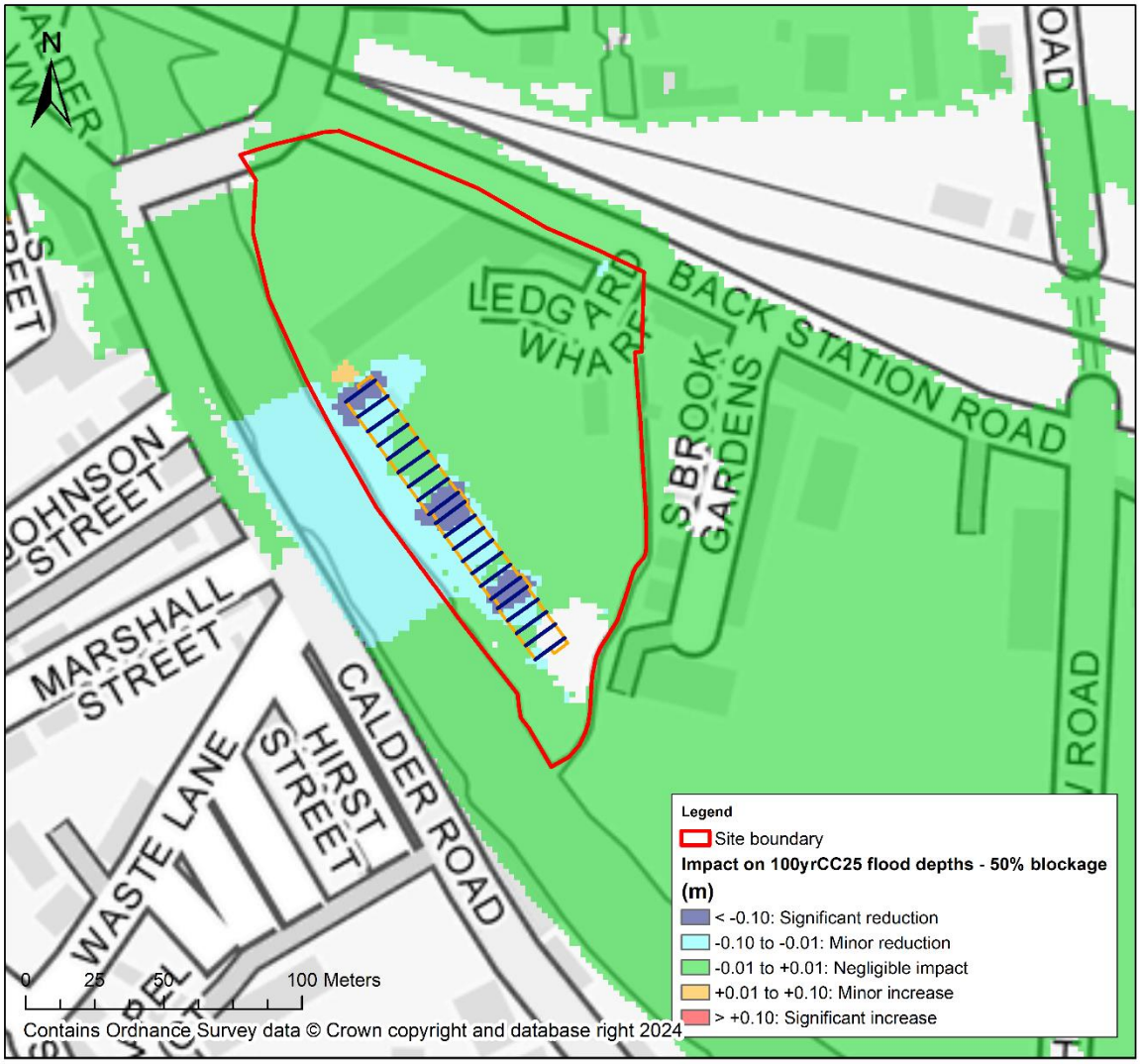


Figure 5 shows that a 50% blockage to the proposed void inlets will not increase the risk of flooding to third-party land.

2.8 Point 8: Inspection and maintenance regime

The void will be privately maintained.

The following table sets out the void maintenance plan which remains in place for the lifetime of the building. It is the responsibility of the site owners to incorporate and implement the appropriate operational arrangements which are discussed in this table.

Table 2 - Operation and Maintenance requirements for the void

Activity	Task list	Frequency
Regular inspections	Inspect void ceiling / underside of floor slab for damages	Annually or after a flood
	Inspect for debris and vegetation (particularly near the void inlets)	Monthly or after a flood
	Inspect void bed and piles for erosion	Annually or after a flood
	Inspect damages to bars at void inlet	Annually or after a flood
Maintenance	Remove debris and vegetation growing 100mm above the void bed	Bi-annually
	Remove debris and vegetation near or at the void inlets	Bi-annually
	Ensure the void is not used for storage and/or that its design storage capacity is not reduced.	Always
	Prevent uncontrolled access to the void	Always
	Ensure the void inlets remain operational / unobstructed over the lifespan of the proposed development.	Always
Remedial actions	Repair damages from erosion	As required
	Repair damages to bars	As required

3 Conclusion

Despite the degree of conservatism embedded into this analysis (e.g. climate change allowance, blockage ratio used in the modelling) results documented in this Technical Note confirm that the proposed building on void:

- can be designed with a Finished Floor Level set more than 600mm above the 'design' flood level;
- will minimise the impact of a hypothetical blockage at the void inlets;
- will generate a negligible impact on flood risk elsewhere;
- can be designed to remain operational over the life-span of the scheme.

Based on the above, it is considered that the principle of a building on void at the Ledgard Mill site remains viable from a flood risk point of view.