Technical Note

JBA Project Code	2024s1619
Contract	Treorchy Rugby Club Flood Modelling
Client	CB3 Consult Limited
Date	March 2025
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Reviewer / Sign off	Paul Redbourne BSc PGCert, MCIWEM, C.WEM
Subject	Treorchy Rugby Club Flood Modelling

1 Introduction

1.1 Terms of reference

JBA Consulting (JBA) were commissioned by Treorchy Rugby Club in May 2024 to assess the flood risk associated with the proposed development of a new clubhouse in Treorchy, Rhondda Cynon Taf. This technical note has been prepared to summarise the flood modelling work that has been completed and to provide an analysis of the model results.

1.2 Study area

The proposed clubhouse is located adjacent to the existing sport pitches at the Oval, Treorchy. The site is also bounded by the Rhondda railway line to the south-west and the Oval access road to the north-east. Fluvial flooding originates from the River Rhondda, a Natural Resources Wales (NRW) designated Main River that is located approximately 100m north of the site. A location plan is provided below in Figure 1-1.

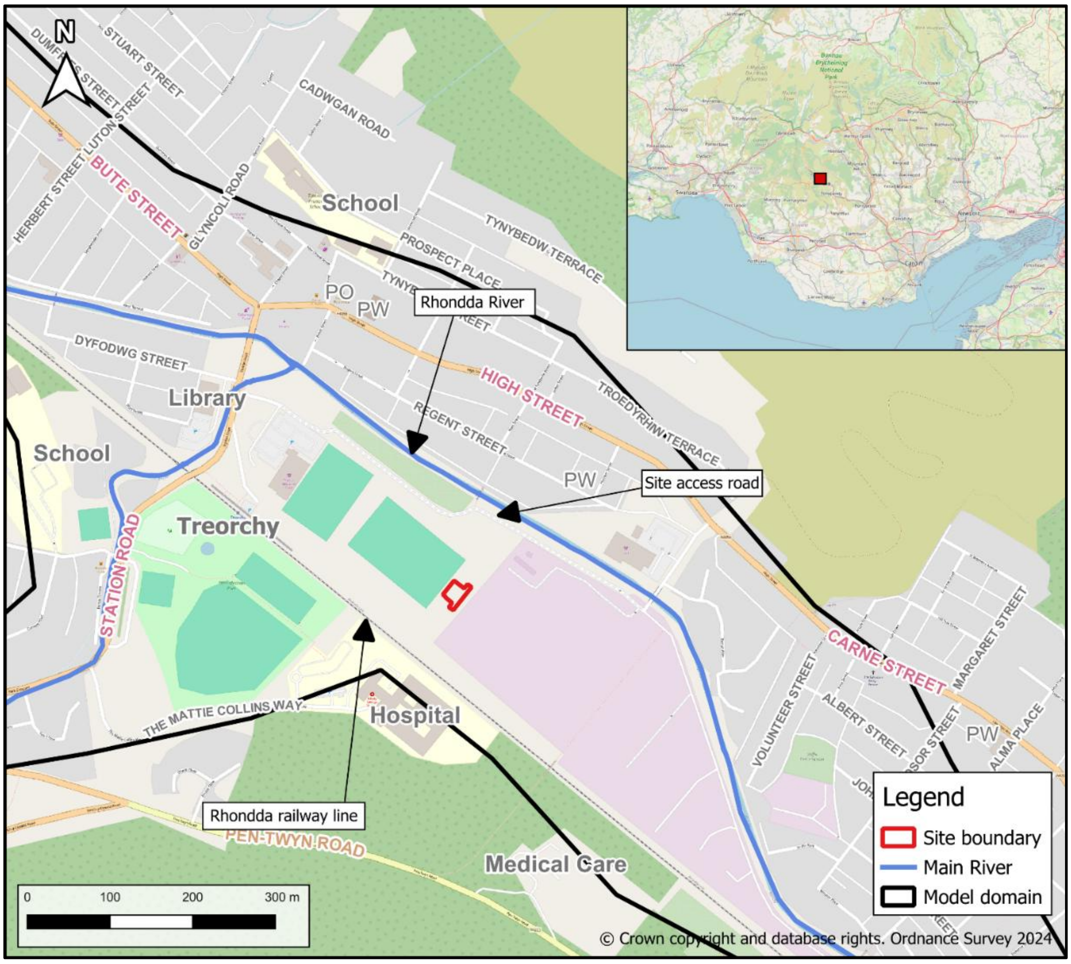

Figure 1-1: Site location plan

1.3 Planning considerations

The site is predominantly located within Flood Zone C2 of the Development Advice Map (DAM). Under the extant TAN-15, the development proposals shall be classed as 'Less Vulnerable', which is permissible in DAM Zone C2 subject to satisfying the Justification Test and Acceptability Criteria. Additionally, the site falls within Flood Zones 2 of the Flood Map for Planning (FMfP). As a result of both the DAM and FMfP mapping, the proposed development must meet the following criteria of TAN-15:

- The clubhouse building is required to be flood free during the 1% AEP (1 in 100) plus climate change event.
- During the 0.1% AEP (1 in 1000) event up to 600mm of internal flooding is tolerable. (Extant TAN-15)
- During the 0.1% AEP (1 in 1000) plus climate change event up to 600mm of internal flooding is tolerable. (Future TAN-15)
- Development must not cause or increase flood risk to third parties.

2 Baseline Modelling

The existing 2024 1D-2D linked ESTRY-TUFLOW Rhondda Middle model was obtained from Natural Resources Wales (NRW) for this project. The model has been updated to use the latest available TUFLOW version at the time this project was commissioned (2023-03-AF) but no further updates were undertaken due to the recent age (2024) of the existing model.

The model was simulated for the 1% AEP plus climate change, 0.1% AEP and 0.1% AEP plus climate change events. An assessment of the impact of climate change has been completed with a fluvial uplift of 25%, in line with the latest Welsh government guidance for climate change allowances[1]. It must be noted that under the extant TAN-15, climate change does not need to be assessed against the 0.1% AEP event. However, the new TAN-15 requires an assessment against the 0.1% AEP plus climate change event. It is uncertain as to when the new TAN-15 shall be implemented but for completeness, the results have been included in this study.

2.1 Baseline model results

The baseline modelling shows that during the 1% AEP plus (25%) climate change event, the north-western edge of the site is flood-free, as shown in Figure 2-1. Most of the site is predicted to flood to depths of less than 300mm; however, the north-east portion reaches a maximum of 350mm. The maximum flood level during this scenario is 158.37m AOD.

1 https://www.gov.wales/sites/default/files/publications/2021-09/climate-change-allowances-and-flood-consequence-assessments_0.pdf

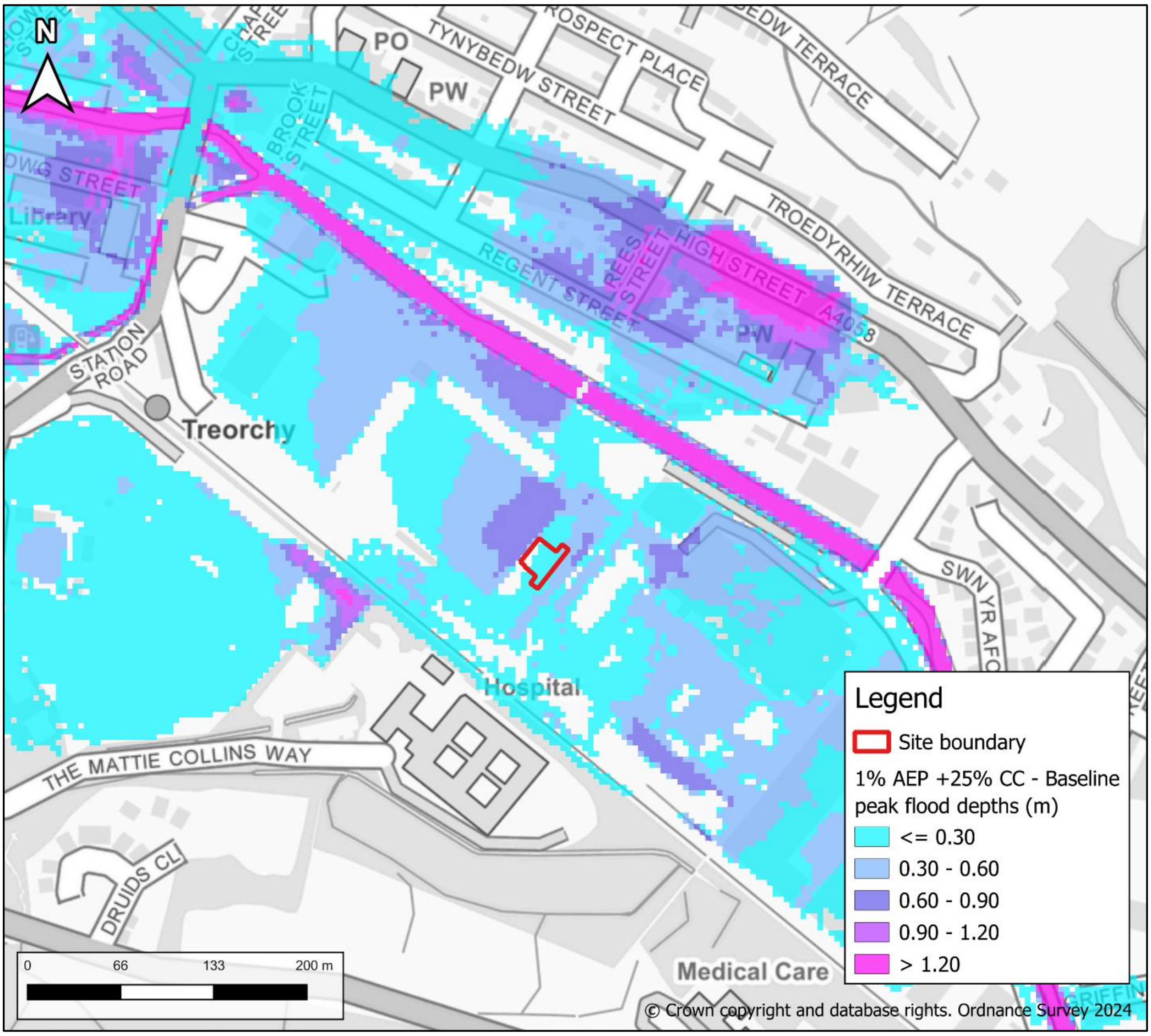

Figure 2-1: 1% AEP plus climate change (25%) event peak flood depths for the baseline scenario.

During the 0.1% AEP event, flood depths are predicted to be predominantly less than 300mm, with a small area in the north-east of the site shown to reach up to 500mm, as demonstrated in Figure 2-2. The maximum flood level on site is 158.59m AOD in this event.

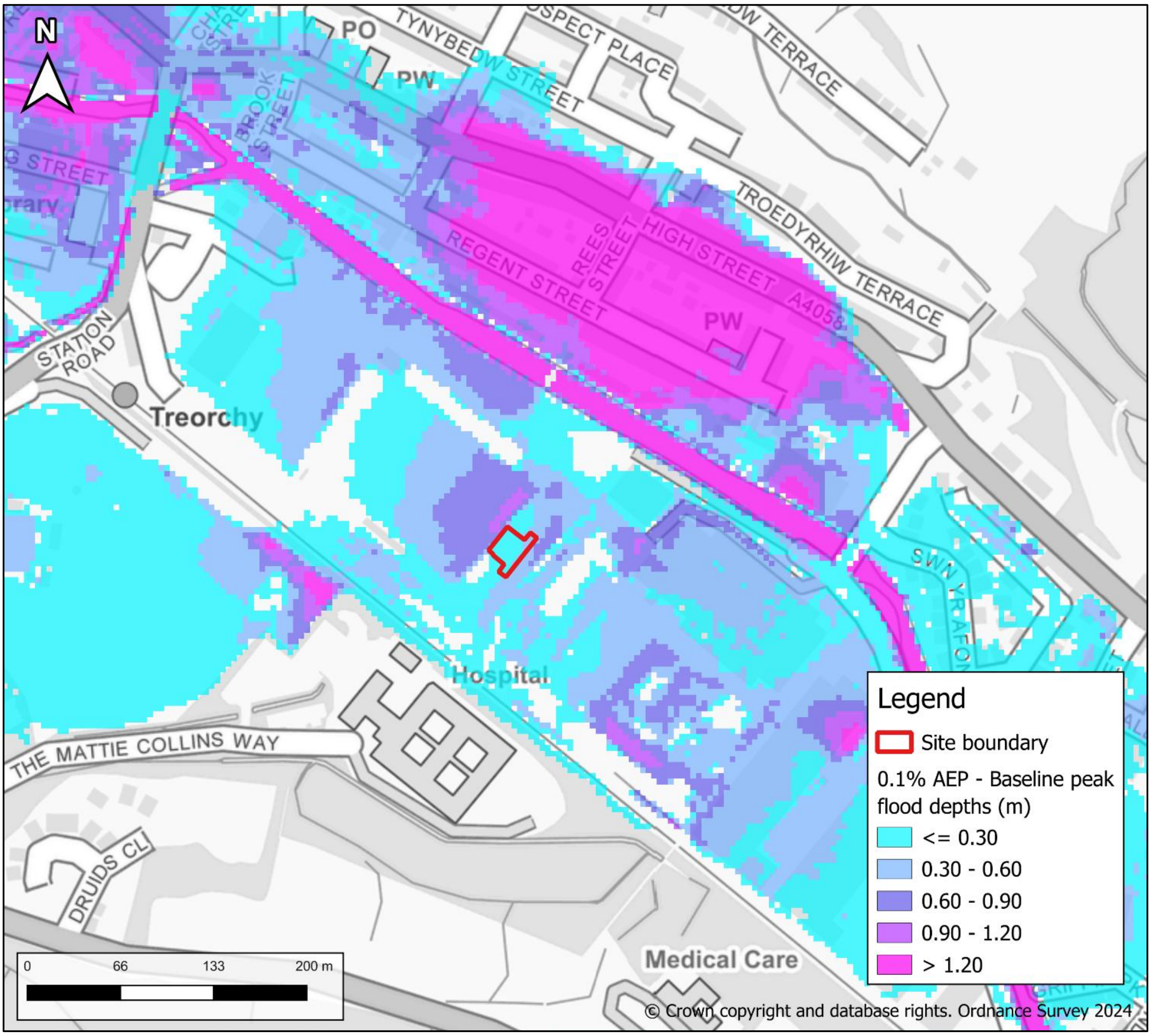

Figure 2-2: 0.1% AEP event peak flood depths for the baseline scenario.

During the 0.1% AEP plus (25%) climate change event, Figure 2-3 shows that the predicted flood depths are predominantly between 300-600mm, with greatest depths in the north-eastern corner reaching 650mm. The maximum flood level during this event is 158.7m AOD.

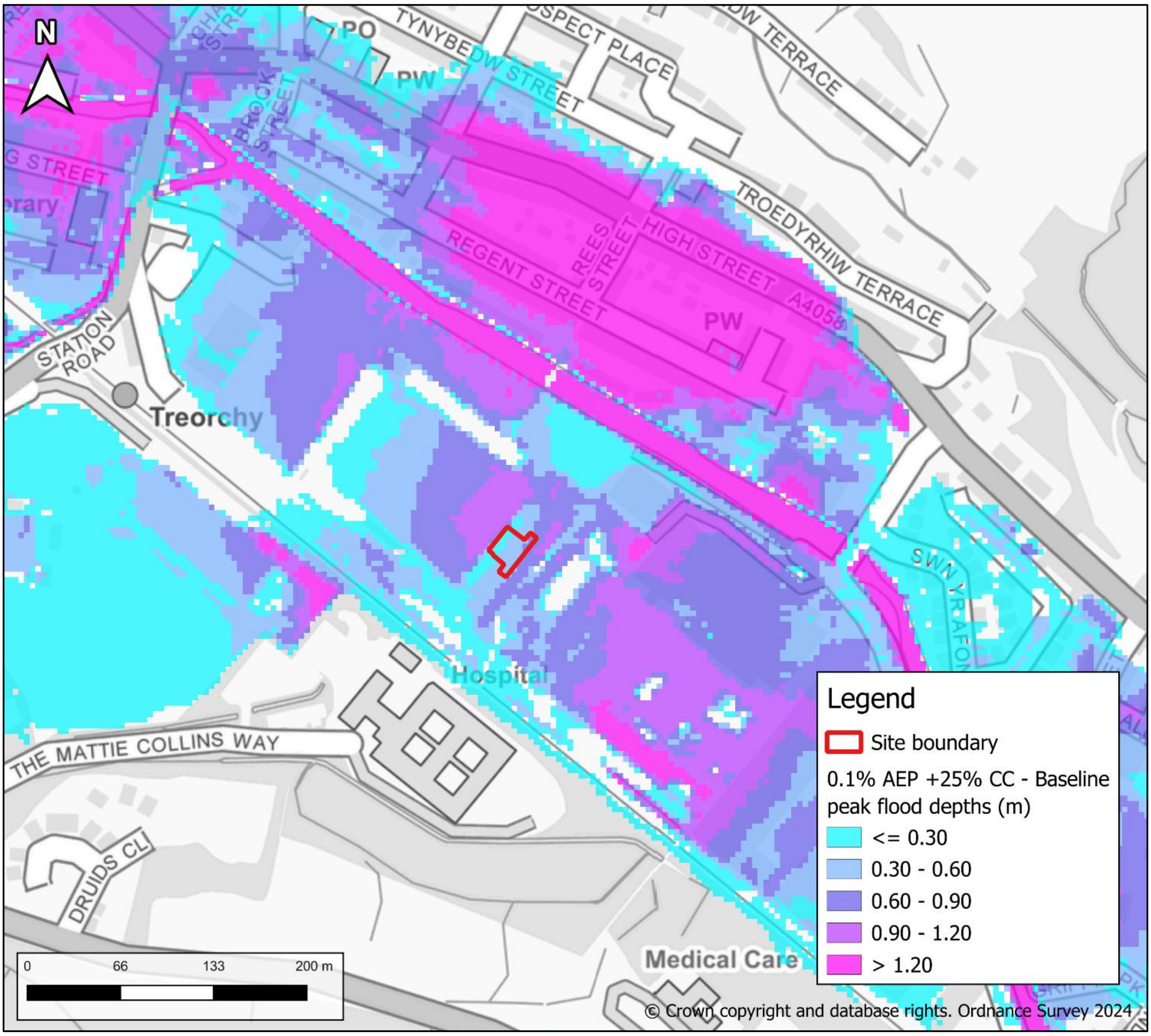

Figure 2-3: 0.1% AEP plus climate change (25%) event peak flood depths for the baseline scenario.

3 Post-development modelling

3.1 Run 022 – Clubhouse building raising

Ground-raising is required to ensure the clubhouse remains flood-free in the 100-year plus (25%) climate change event. The post-development scenario has been represented by enforcing a 2D Z-Shape layer of the proposed building footprint. It was decided to adopt a single elevation of 168m AOD as this is set well above the flood level to provide proof of concept.

The results show that ground-raising will allow the clubhouse to remain flood-free for all modelled flood events, as presented in Figures 3-1 to 3-3. The depth comparison output presented in Figure 3-4 compares the baseline and post-development flood depth results for the 1% AEP plus climate change event. This shows an increase in flood depths (detriment) on neighbouring land to the north-east, with a maximum increase in flood depth of 10mm. This is above the typically tolerable limit set by NRW of 5mm and therefore is not compliant with the requirements of TAN15.

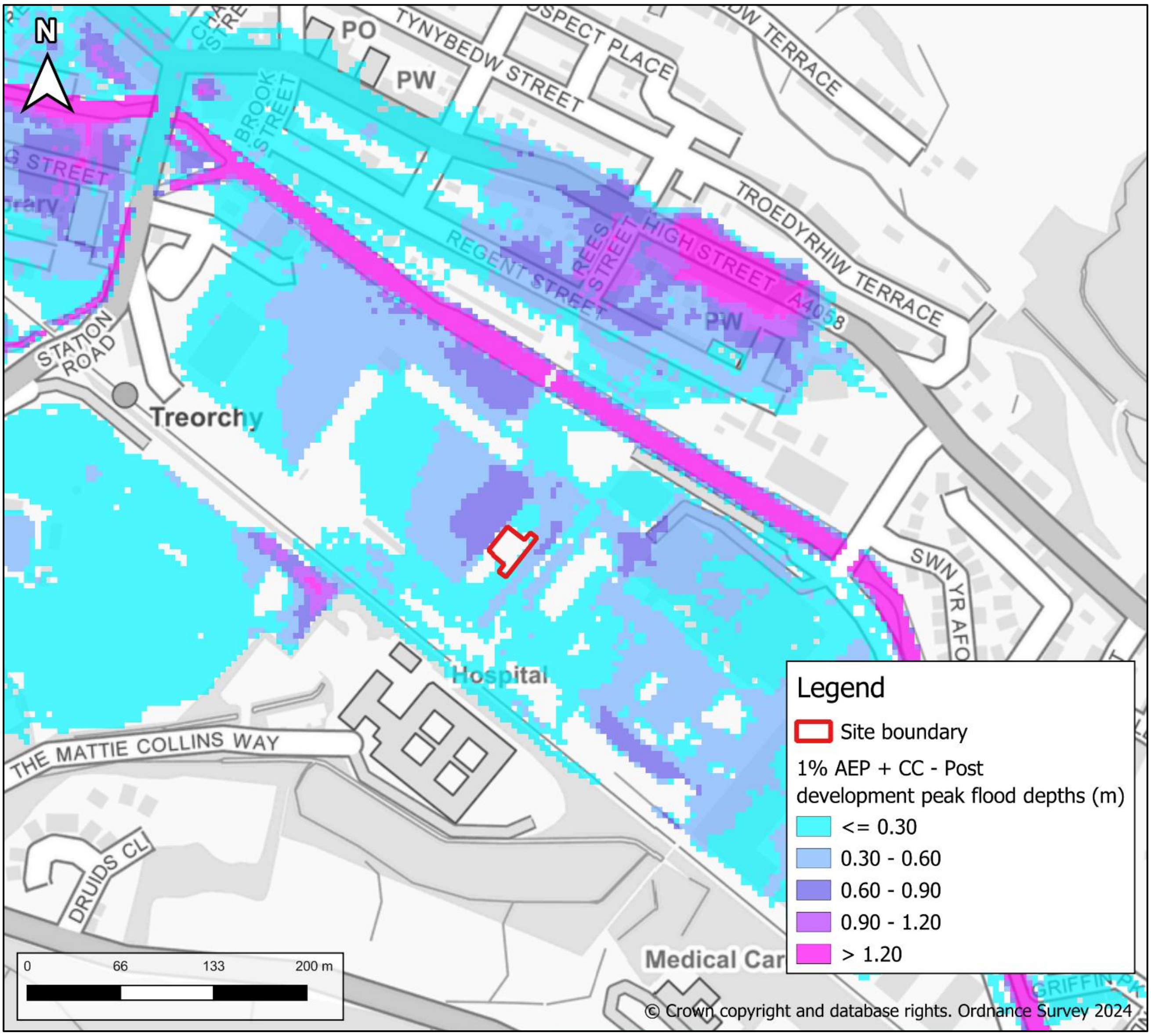

Figure 3-1: 1% AEP plus climate change (25%) event peak flood depths for Run 022.

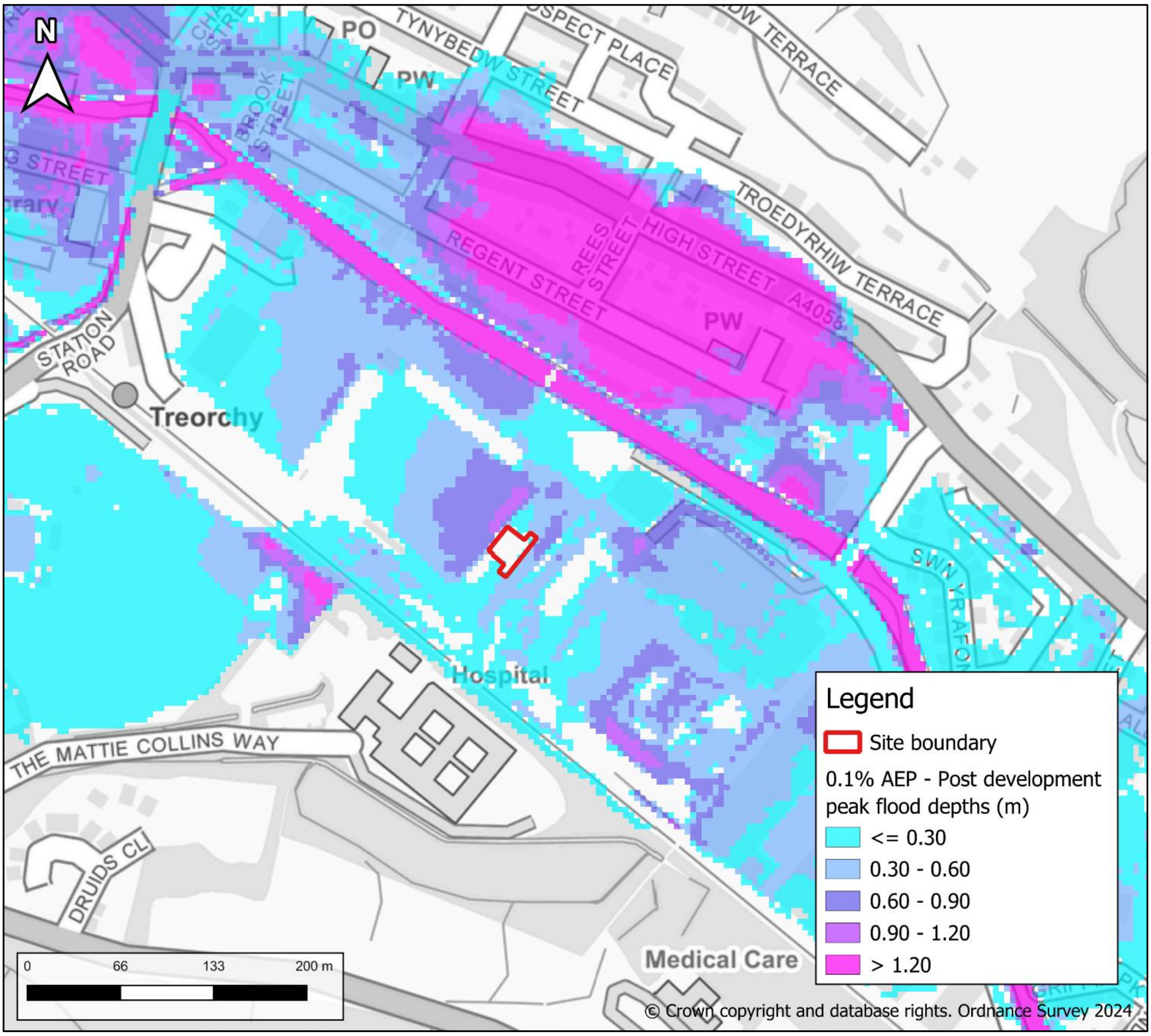

Figure 3-2: 0.1% AEP event peak flood depths for Run 022.

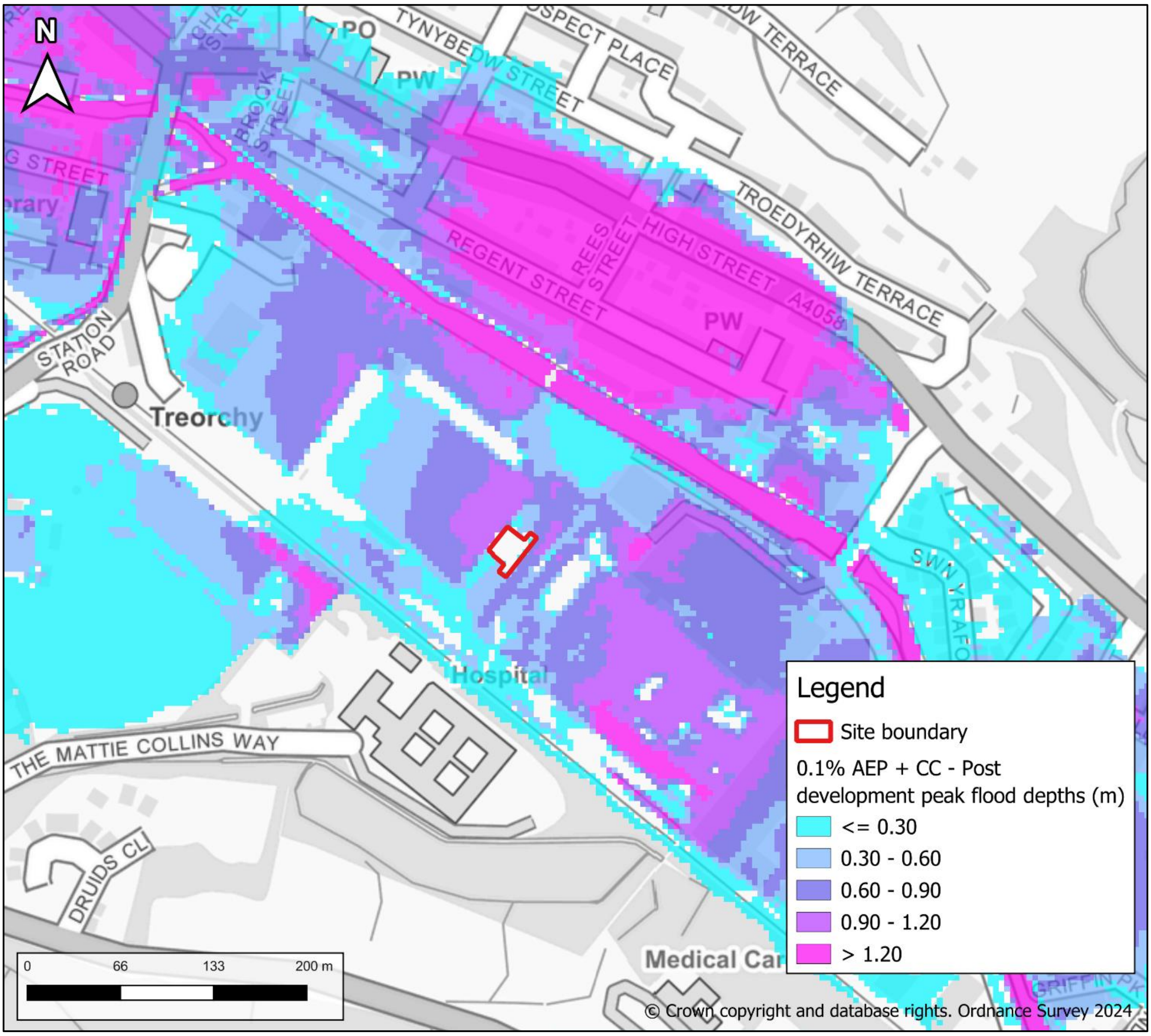

Figure 3-3: 0.1% AEP plus climate change (25%) event peak flood depths for Run 022.

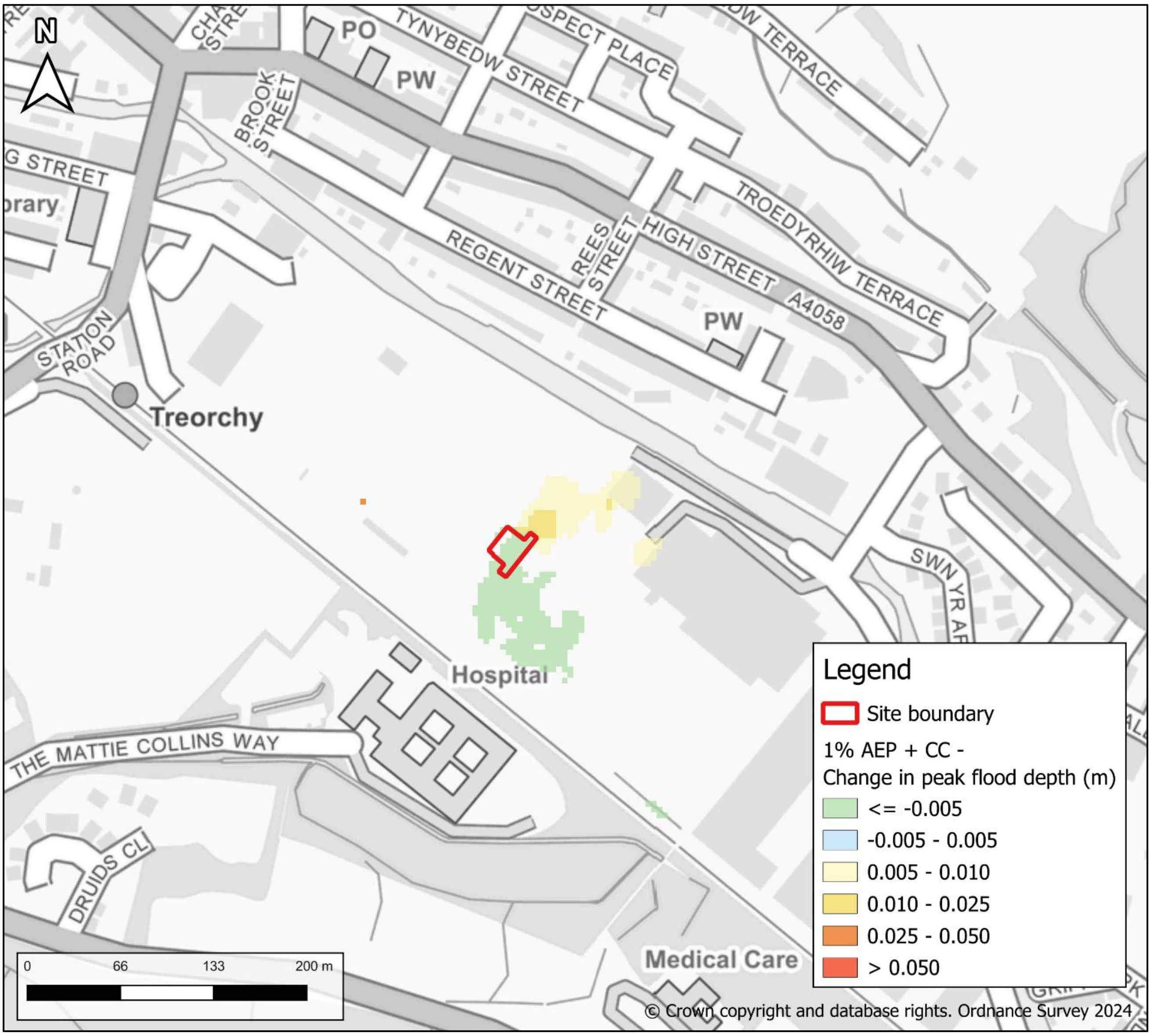

Figure 3-4: Depth comparison of Run 022 relative to the baseline scenario for the 1% AEP plus climate change (25%) event.

3.2 Additional options testing

Due to the third-party detriment associated with the ground raising applied to set the Finished Floor Level for the proposed clubhouse, a series of additional mitigation options have been tested within the hydraulic model. These mitigation scenarios have focused on testing different schematisations of a shallow bund that runs along the eastern boundary of the site, as shown in Figure 3-5. Table 3-1 summarises each of the post-development scenarios that have been tested within this study.

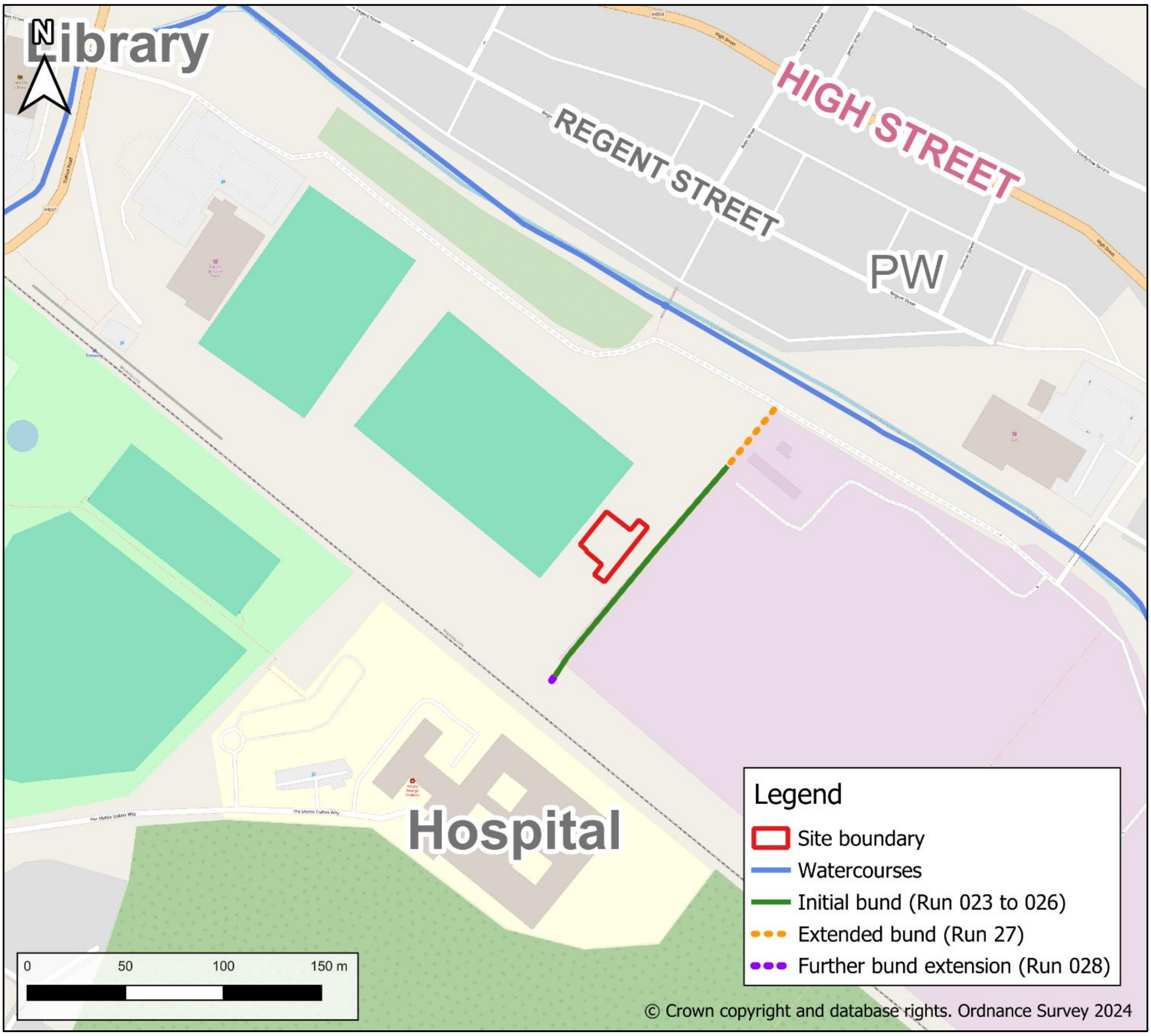

Figure 3-5: Modelled bund locations.

Table 3-1: Description of post-development modelled scenarios.

Run reference:	Description
Run 022	Building raised to be flood-free during all modelled events (no embankment included).
Run 023	A 0.3m bund applied along the eastern boundary of the site. This was modelled by enforcing a Z-line which was read into the model using the ‘ADD’ command. This approach adds 0.3m to existing ground levels.

Run reference:	Description
Run 024	The bund is maintained in the existing location as modelled for run 023 but raised to 0.5m.
Run 025	This scenario explored the option of setting the bund to a uniform level of 159m AOD. This was modelled by enforcing a Z-line which was read into the model using the 'MAX' command.
Run 026	The same bund schematisation as applied in Run 025 but lowered the crest elevation to 158.8m AOD.
Run 027	The embankment was lowered further to a level of 158.5m AOD and extended to the northeast, as shown in Figure 3-5.
Run 028	Embankment level was maintained at 158.5m AOD but was also extended to the south-west, presented in Figure 3-5. This scenario demonstrates the maximum possible length of the embankment due to restriction of the Rhondda railway line to the south and the site access road to the north.

3.3 Run 023: 0.3m bund along the eastern boundary of the site.

With the application of a 0.3m high bund applied along the eastern boundary of the site, the water levels on the sports pitches increase as expected but there is also an increase in flood depths immediately downstream to the south-east of the site. Figure 3-6 shows the depth comparison output for the 1% AEP plus (25%) climate change event, which highlights that downstream of the site, neighbouring land would experience an increase in flood depth of up to 50mm.

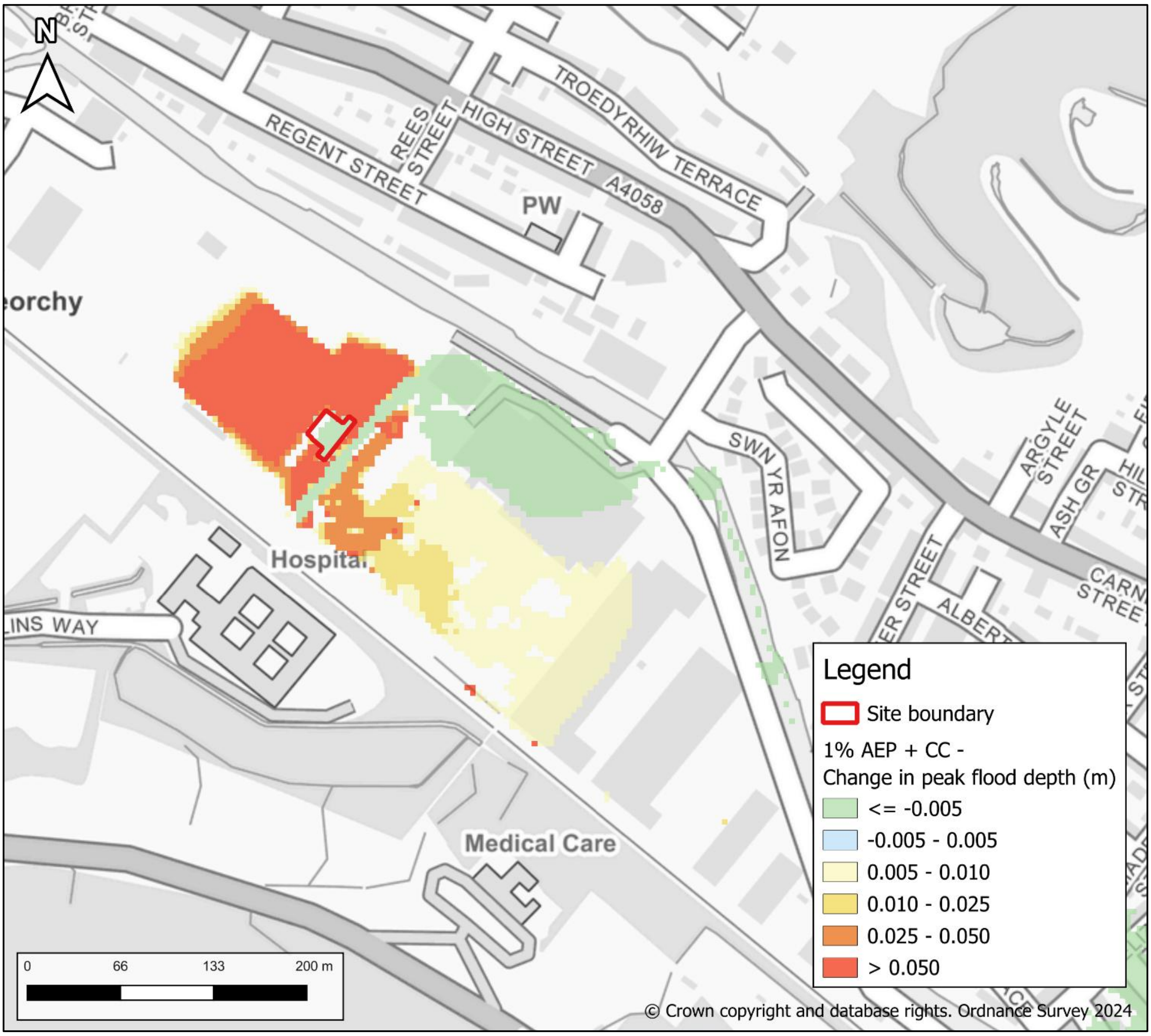

Figure 3-6: Depth comparison of Run 023 relative to the baseline scenario for the 1% AEP plus climate change (25%) event.

3.4 Run 024: 0.5m bund along the eastern boundary of the site.

Similarly to the 0.3m bund, the 0.5m bund continues to cause detriment to the land south-east of the site but to a slightly lesser extent. However, as shown in Figure 3-7, flows now begin to bypass the embankment at its northern end, increasing flood depths by up to 50mm to neighbouring property located to the north-east of the site for the 1% AEP plus (25%) climate change event.

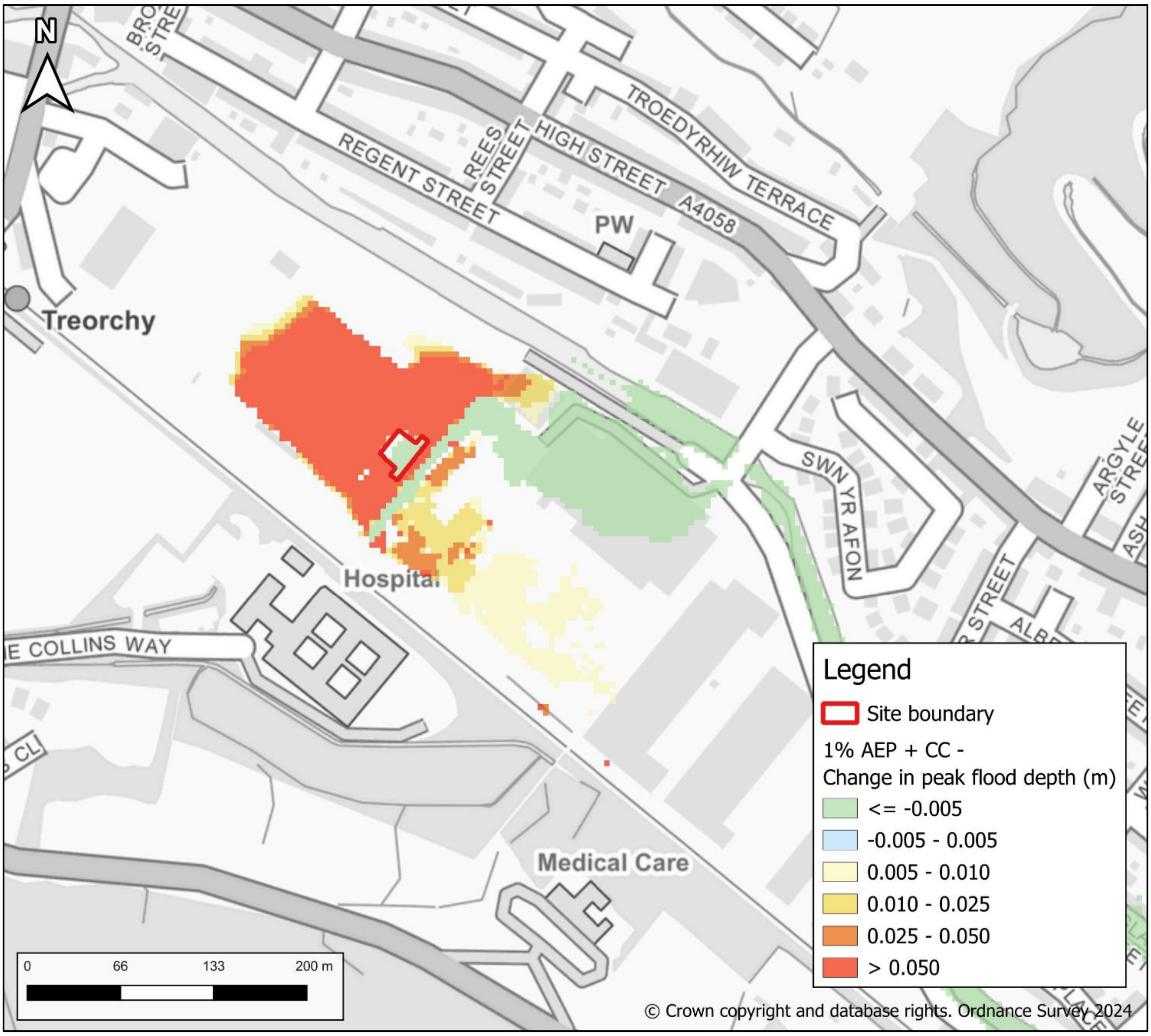

Figure 3-7: Depth comparison of Run 024 relative to the baseline scenario for the 1% AEP plus climate change (25%) event.

3.5 Run 025: Embankment applied at a constant level of 159m AOD.

During this scenario, the modelled results show that overtopping of the eastern boundary bund does not occur, removing the third-party detriment to the land located south-east of the site. However, this is increasing water levels to the rugby ground and forcing more water to the north where it bypasses the bund. As shown in Figure 3-8, this increases the flood depths by up to 220mm to the neighbouring property located to the north-east of the site during the 1% plus (25%) climate change event.

During the 0.1% AEP event, the presence of the bund set to 159m AOD, water levels within the rugby club increase to such an extent that it also increases flood depths at the supermarket located at the north-western edge of the Oval sports grounds, as shown in Figure 3-9.

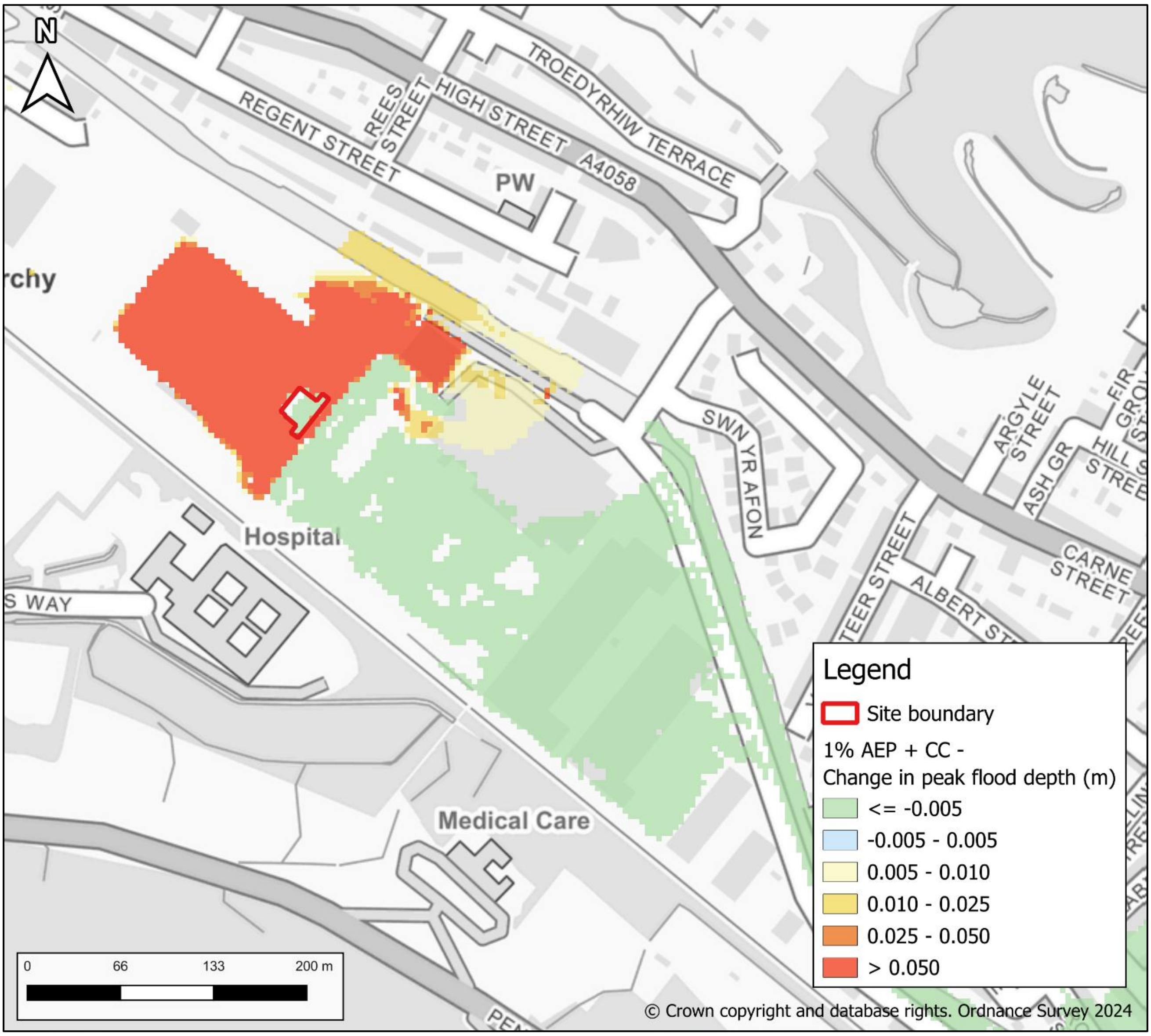

Figure 3-8: Depth comparison of Run 025 relative to the baseline scenario for the 1% AEP plus climate change (25%) event.

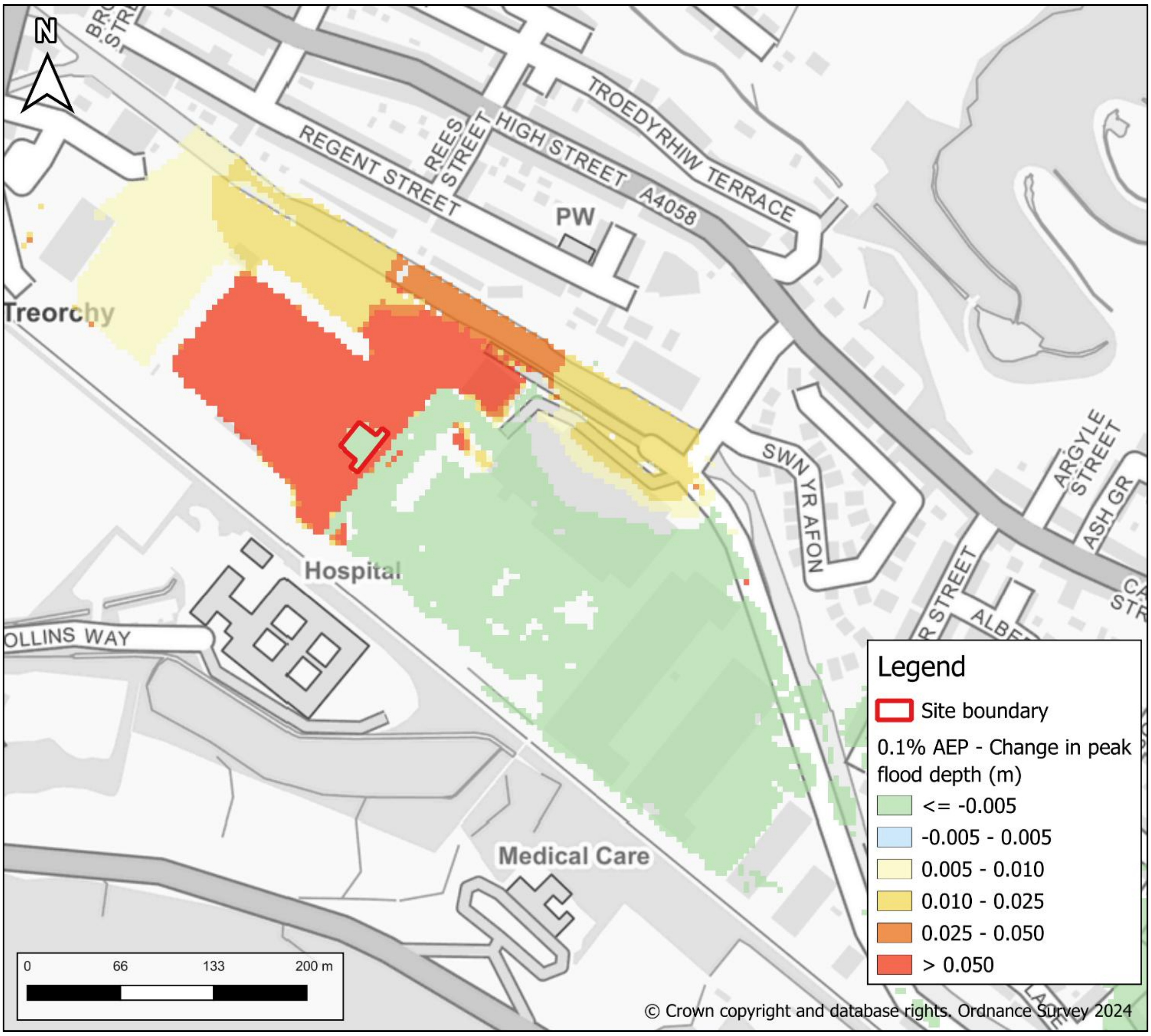

Figure 3-9: Depth comparison of Run 025 relative to the baseline scenario for the 0.1% AEP event.

3.6 Run 026: Embankment applied at a constant level of 158.8m AOD.

For model run iteration 026, the eastern boundary bund was lowered by 200mm to 158.8m AOD. The depth comparison shown in Figure 3-10 highlights that third-party detriment is similar to model run iteration 025, but there is less of an increase in water levels upstream of the bund and therefore, the increase in flood depths to the River Rhondda and the neighbouring properties in the north-east is reduced.

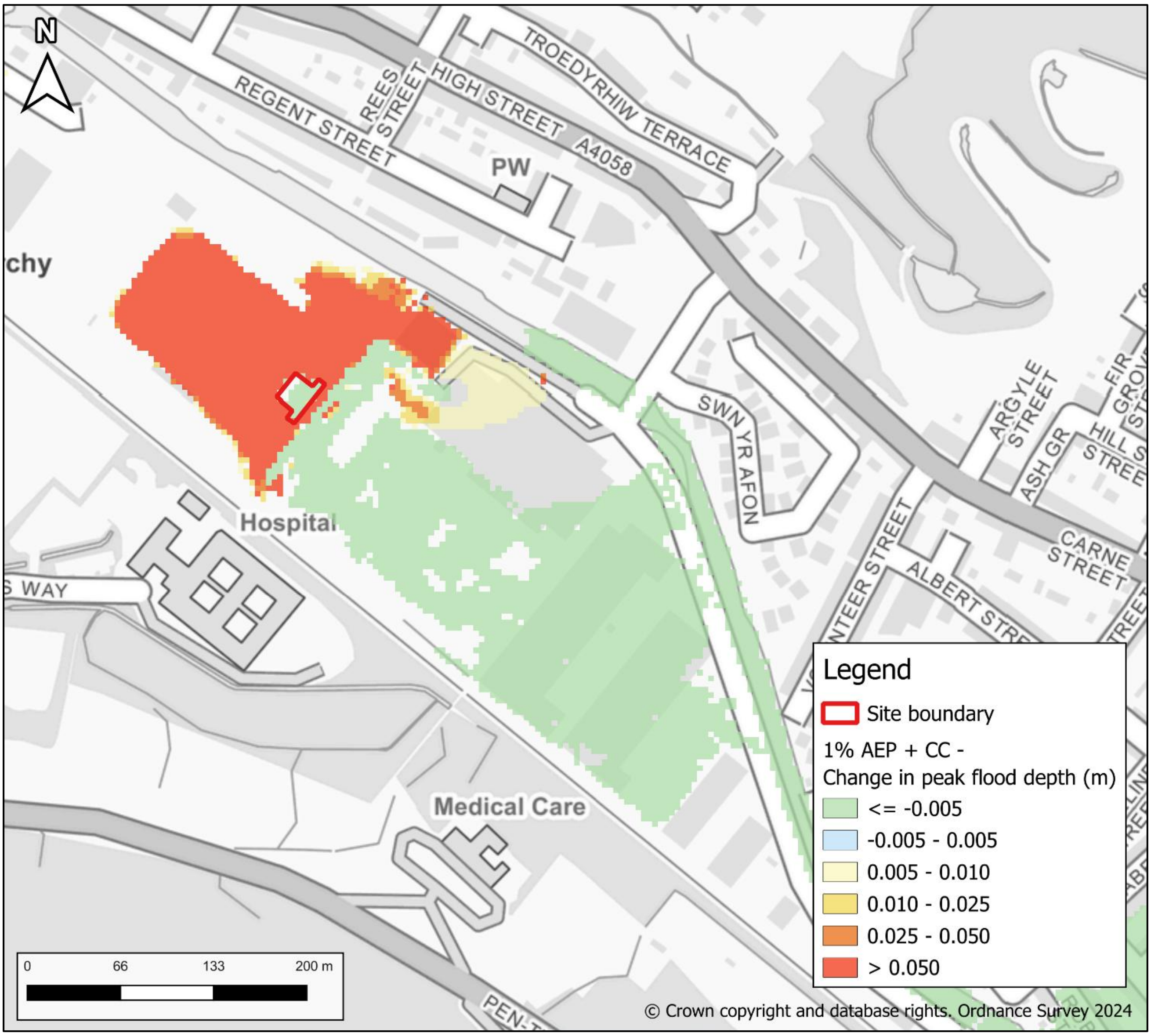

Figure 3-10: Depth comparison of Run 026 relative to the baseline scenario for the 1% AEP plus climate change (25%) event.

3.7 Run 027: Embankment applied at a constant level of 158.5m AOD and extended further to the north-east.

For model run iteration 027, the bund was further lowered to 158.5m AOD and extended further to the north. Figure 3-11 highlights that this approach is much more beneficial in terms of third-party detriment to the neighbouring properties located to the north-east of the site. However, this mitigation option results in an increase in flood risk to the neighbouring land located to the south-east of the site, with flood depths increasing by up to 60mm in the 1% AEP plus climate change (25%) event.

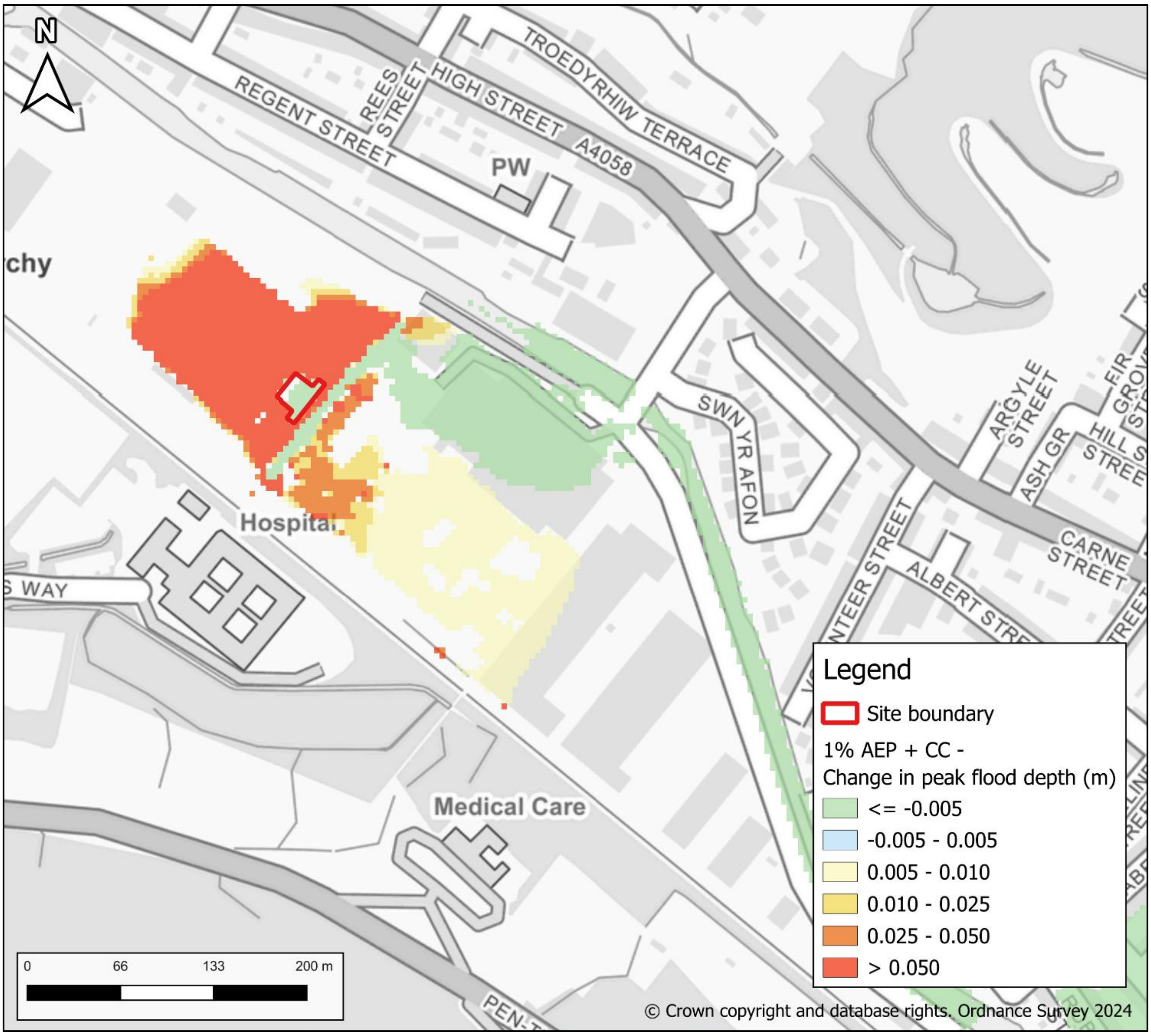

Figure 3-11: Depth comparison of Run 027 relative to the baseline scenario for the 1% AEP plus climate change (25%) event.

3.8 Run 028: Embankment applied at a constant level of 158.5m AOD and extended the north-east and south-west.

Post-development model run iteration 028 involved the extension of the bund further to the south to help minimise any bypassing at this location adjacent to the railway line. This has been extended as far as deemed possible due to the presence of the railway line boundary. Figure 3-12 shows that the southern bund extension is successful in reducing the amount of third-party detriment in this area but is not sufficient to remove it entirely. Additionally, this option also leads to an increase in flood risk to the north-east in comparison to model run iteration 027.

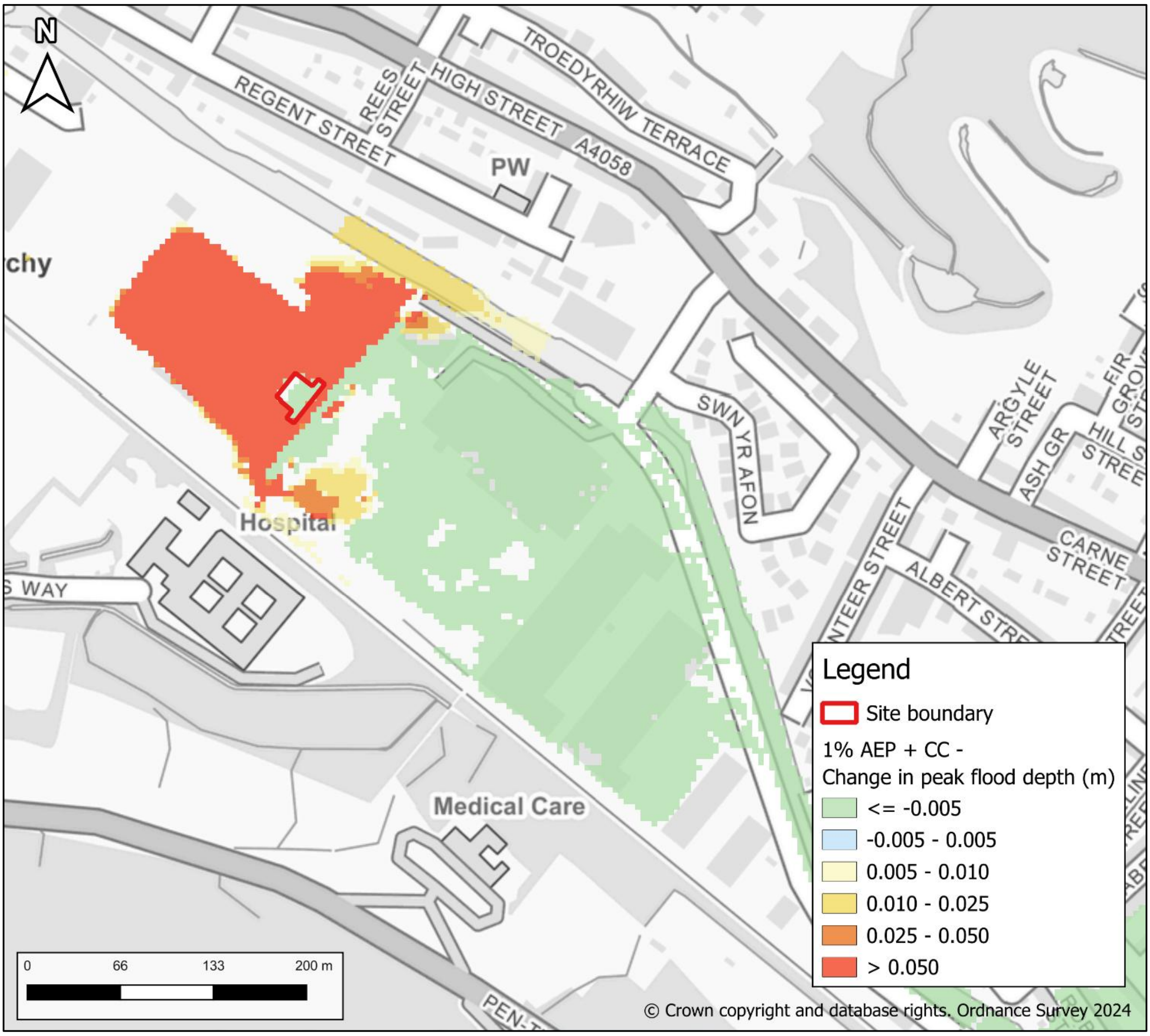

Figure 3-12: Depth comparison of Run 028 relative to the baseline scenario for the 1% AEP pus climate change event.

3.9 Options summary

The hydraulic modelling exercise has demonstrated that if the proposed clubhouse building was to be raised to be flood free in the 1% AEP plus climate change event, then there are unavoidable third-party impacts on neighbouring properties. The inclusion of additional site-specific mitigation on site is unlikely to be able to manage these risks and therefore an alternative approach for the site is recommended.

To be compliant with the requirements of TAN15, the building will need to be raised to a Finished Floor Level above the 1% AEP plus climate change event maximum water level

(158.37m AOD) but with void space underneath the building to maintain overland conveyance and floodplain storage.

For the development proposals to comply with TAN-15, the Finished Floor Level (FFL) of the building should be raised to a minimum of 158.38m AOD. This would mean that during the 0.1% AEP event, internal flood depths of up to 220mm may occur. Whilst 600mm of flooding is tolerable during the 0.1% AEP event, you may wish to consider further raising the FFL of the clubhouse so that it is flood-free under all conditions. In accordance with the predicted flood level during the 0.1% AEP event, this would be to a minimum level of 158.59m AOD.

Climate change does not need to be assessed against the 0.1% AEP event under the extant TAN-15. However, if the new TAN-15 is implemented and the planning application for this development falls under the new TAN-15, an assessment of the 0.1% AEP plus climate change event is required. Under these circumstances, the predicted flood level increases to 158.70m AOD.

4 Conclusion

- JBA Consulting (JBA) were commissioned by Treorchy Rugby Club to undertake a flood modelling exercise to better understand the flood risk associated with the proposed development of a clubhouse at the Oval, Treorchy.
- The 2024 1D-2D linked ESTRY-TUFLOW Rhondda Middle model was obtained from Natural Resources Wales and updated to the latest version of TUFLOW (2023-03-AF).
- A new baseline model was developed and simulated for the 1% AEP plus climate change, 0.1% AEP, and 0.1% AEP plus climate change events.
- To be compliant with the requirements of TAN15, the proposed clubhouse will need to be raised so that the FFL is above the 1% AEP plus climate change event.
- The new model was used to test a series of post-development scenarios to identify whether site specific mitigation could be adopted to manage an increase in flood risk to neighbouring third parties, but this was unsuccessful.
- It is proposed that the FFL of the building is raised to be flood free at minimum during the 1% AEP plus climate change event, and the void space is used underneath the building so that existing flow paths are not significantly impacted
- Should the building be raised as outlined in this study, a Flood Consequences Assessment (FCA) will be produced to support a planning application and any other approvals required.