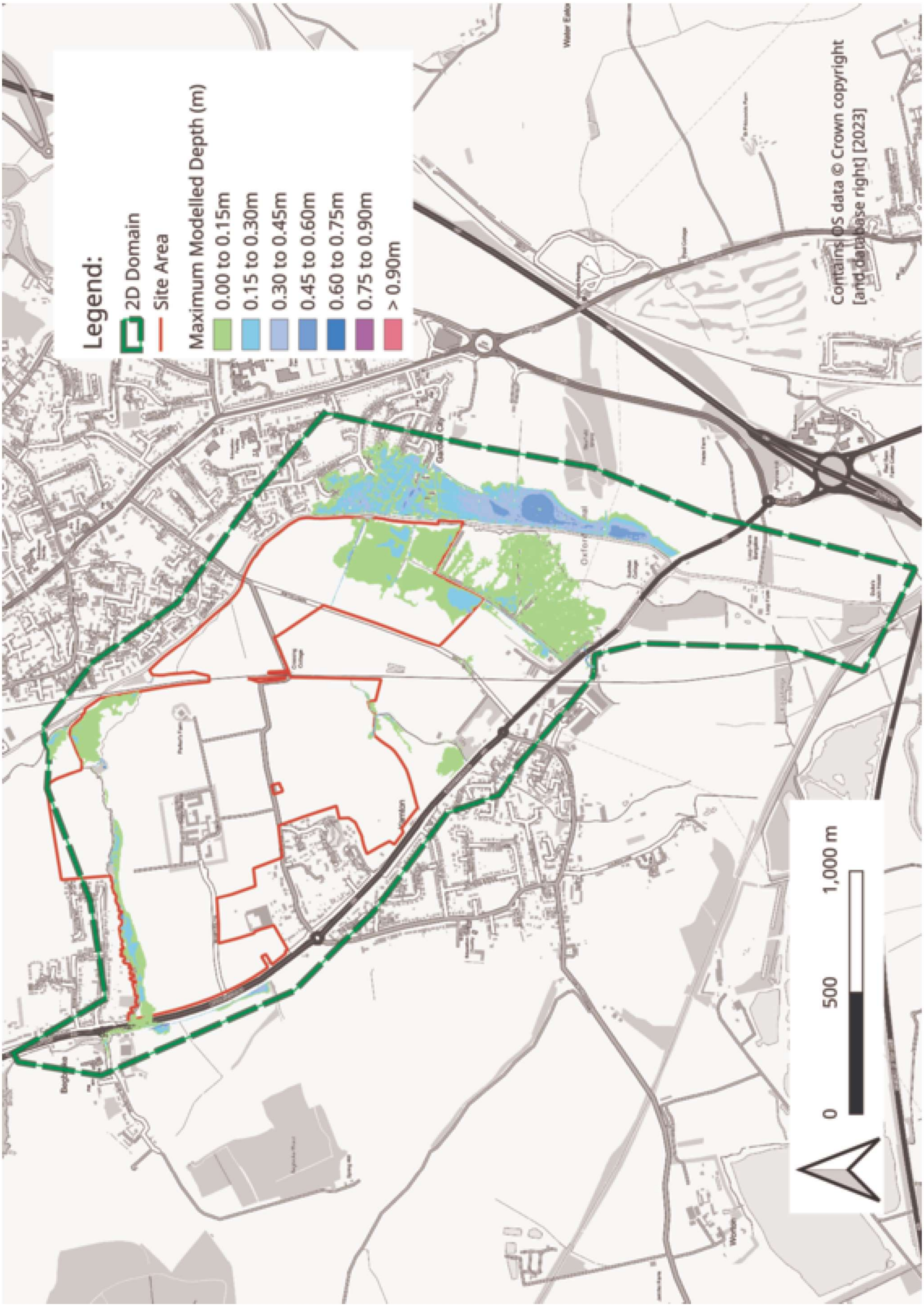

Figure 5.2: *Maximum modelled depth in the 1% AEP event, 11 hour storm duration*

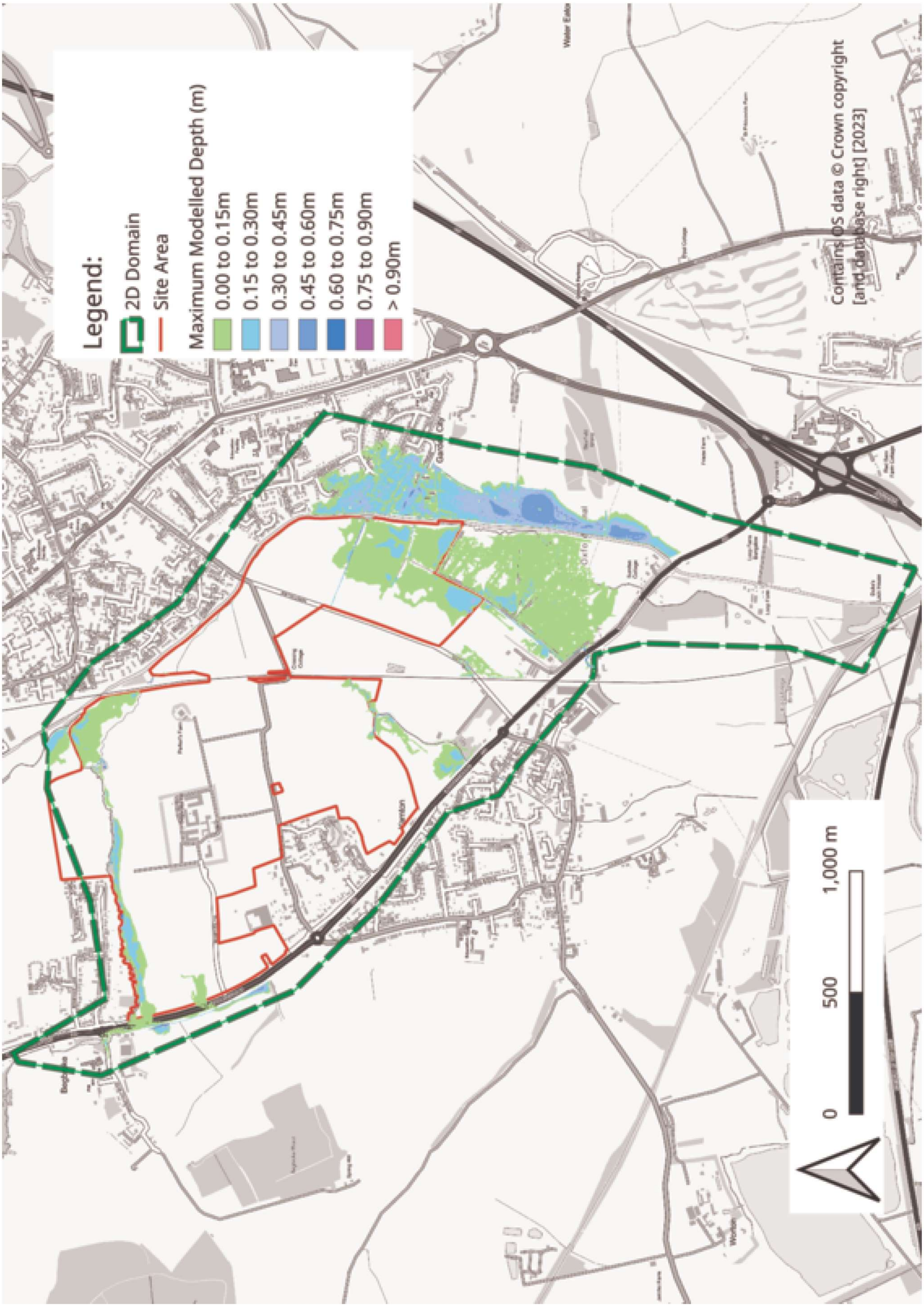

Figure 5.3: *Maximum modelled depth in the 1% AEP event plus 26% allowance for climate change, 11 hour storm duration*

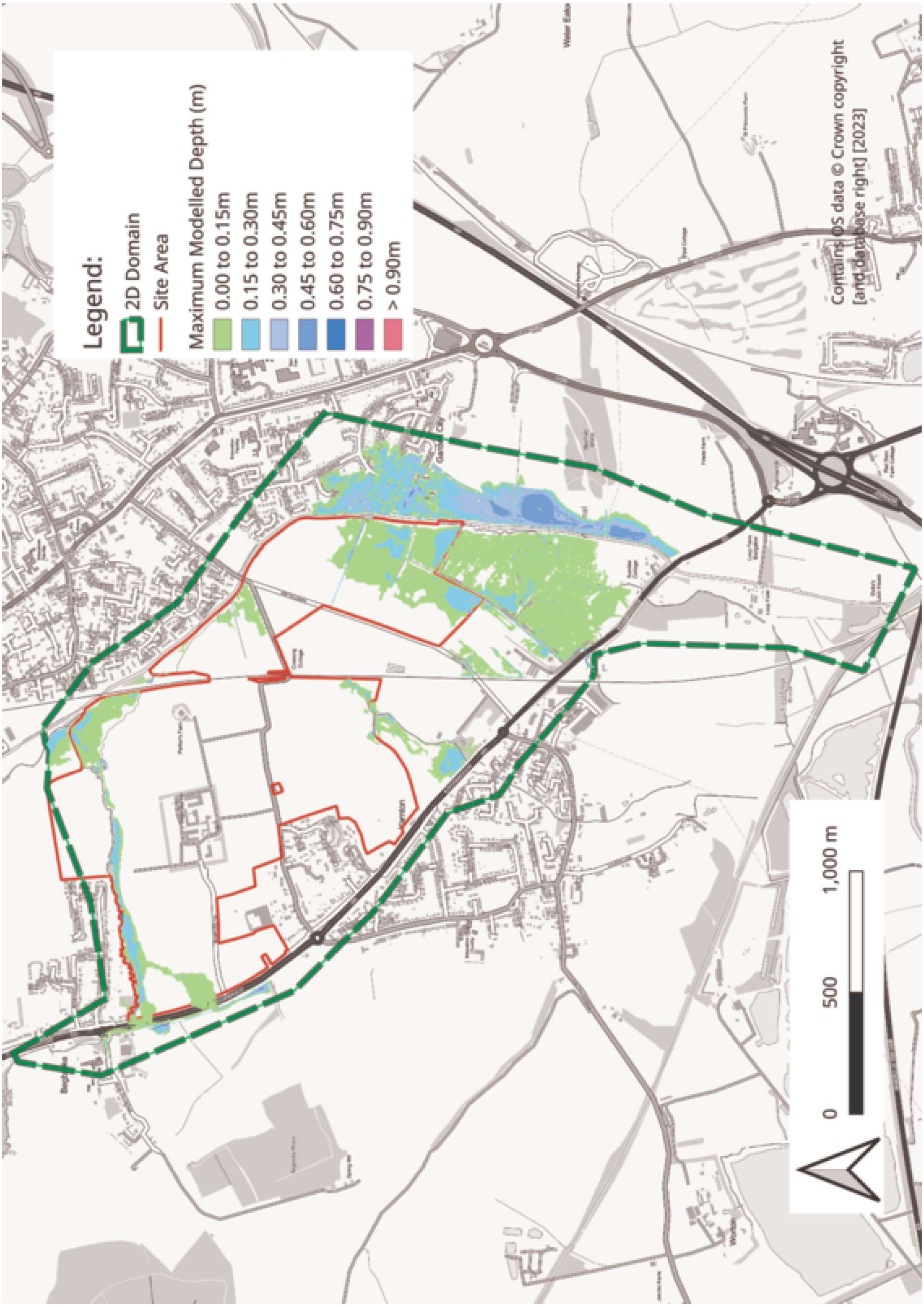

Figure 5.4: *Maximum modelled depth in the 1% AEP event plus 41% allowance for climate change, 11 hour storm duration*

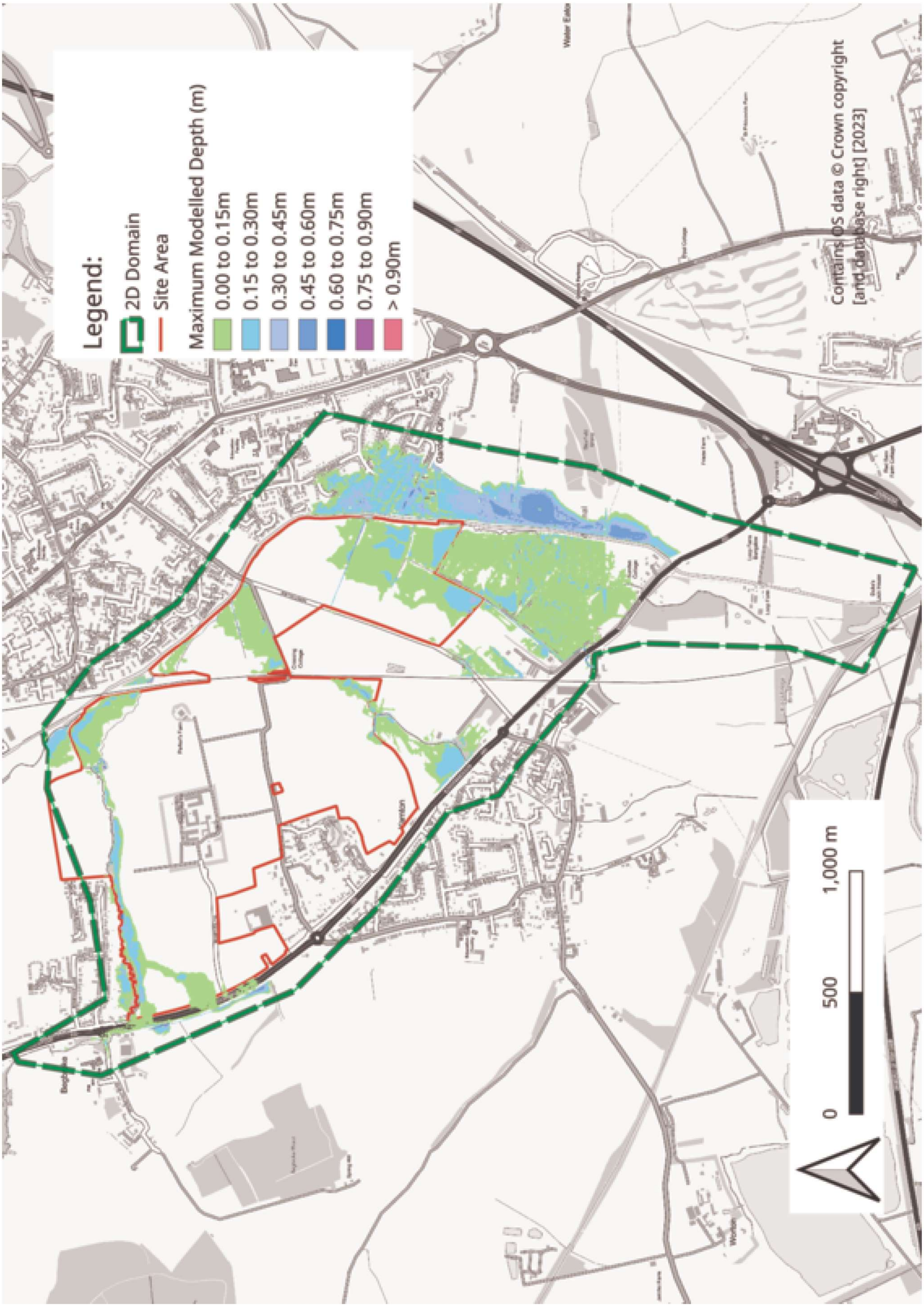

Figure 5.5: *Maximum modelled depth in the 0.1% AEP event, 11 hour storm duration*

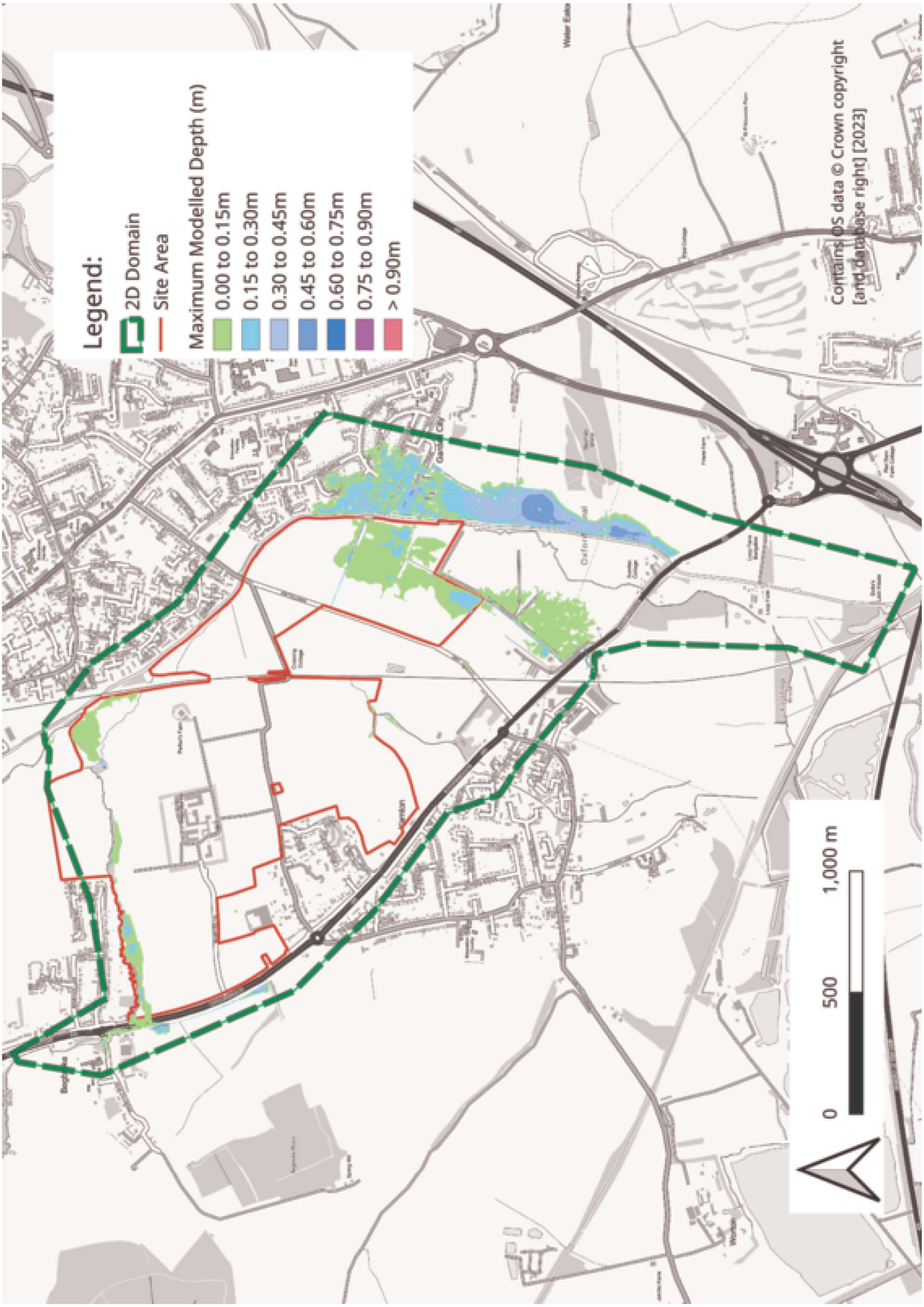

Figure 5.6: *Maximum modelled depth in the 3.33% AEP event, 3.5 hours storm duration*

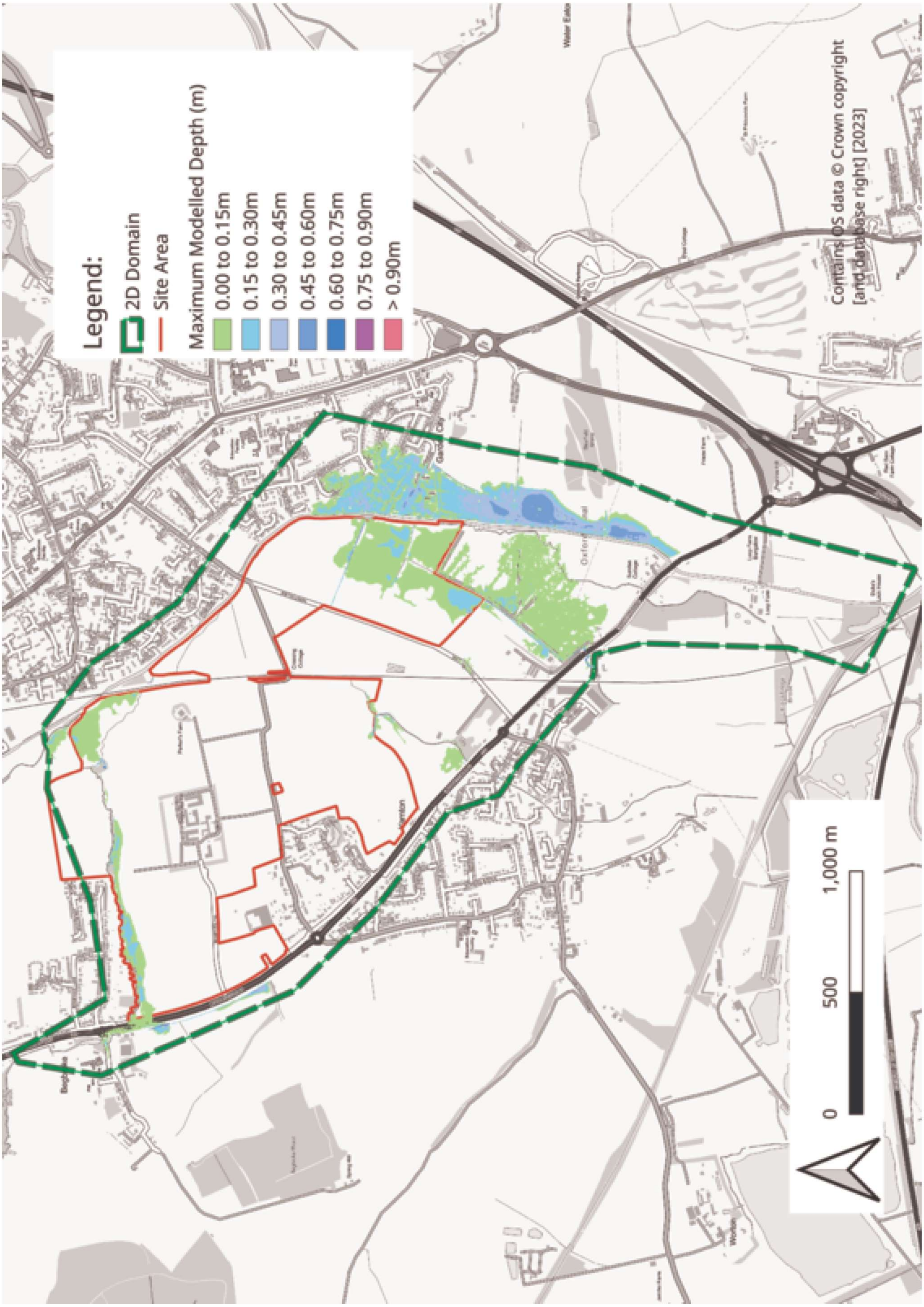

Figure 5.7: Maximum modelled depth in the 1% AEP event, 3.5 hours storm duration

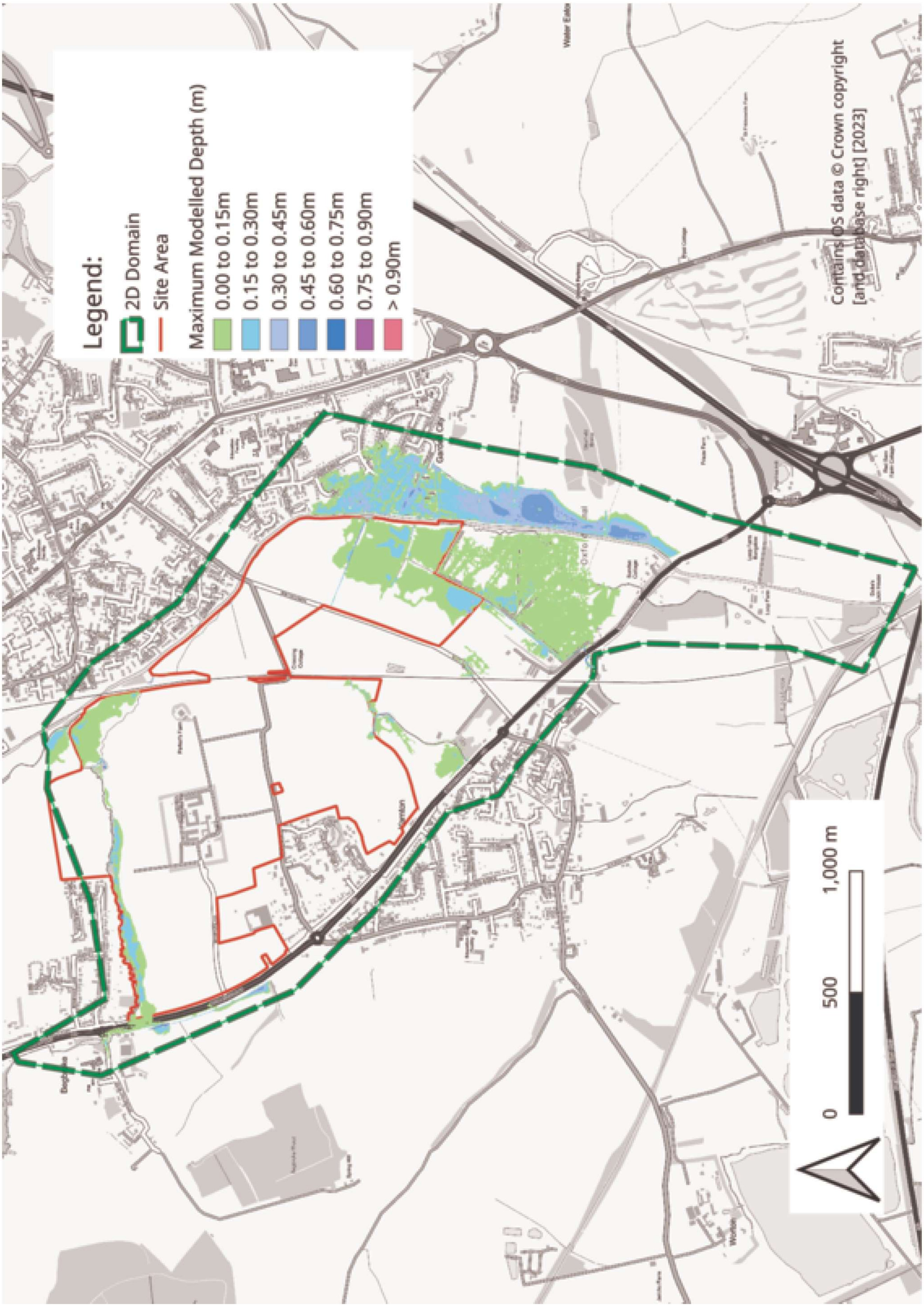

Figure 5.8: *Maximum modelled depth in the 1% AEP event plus 26% allowance for climate change, 3.5 hours storm duration*

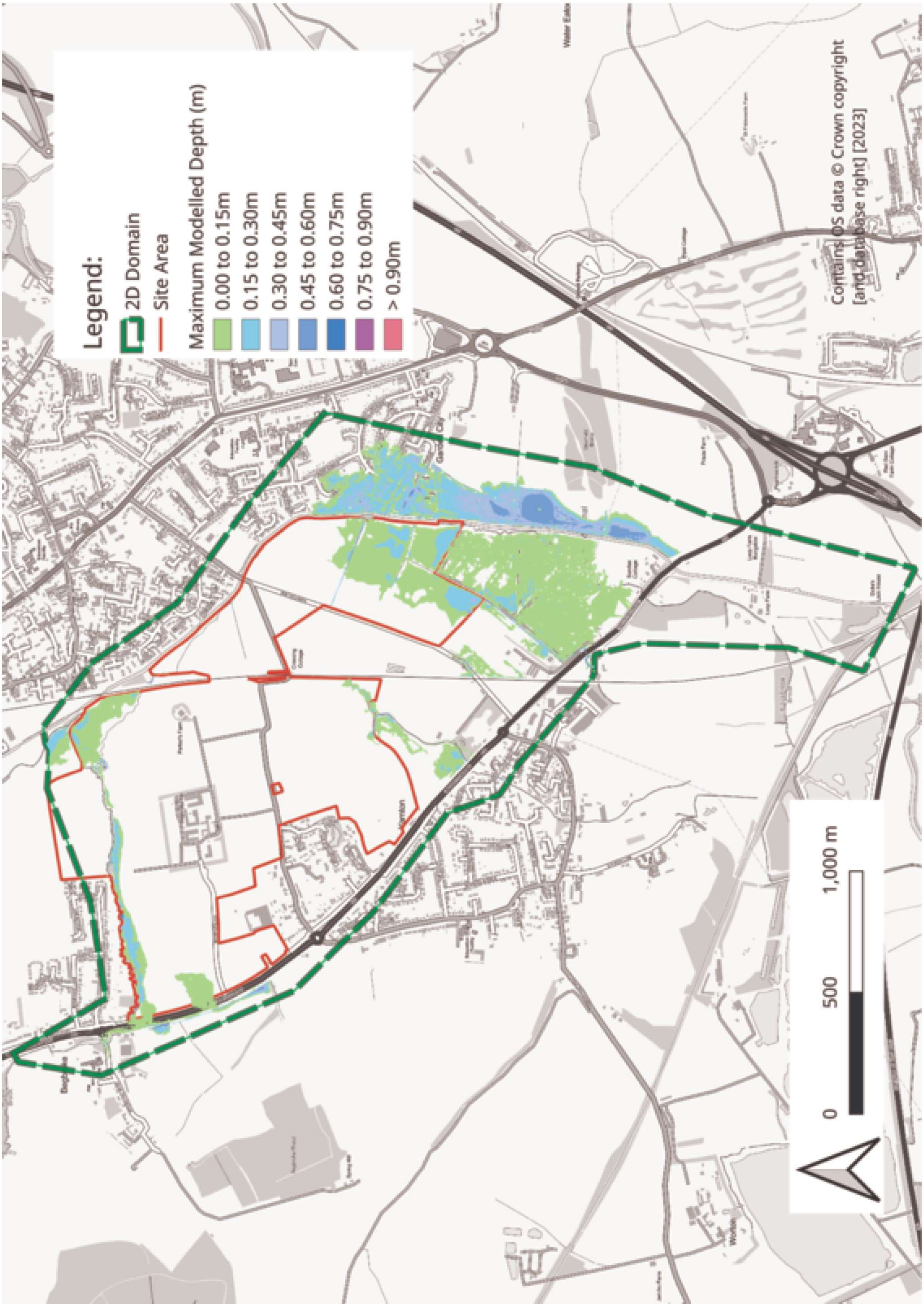

Figure 5.9: *Maximum modelled depth in the 1% AEP event plus 41% allowance for climate change, 3.5 hours storm duration*

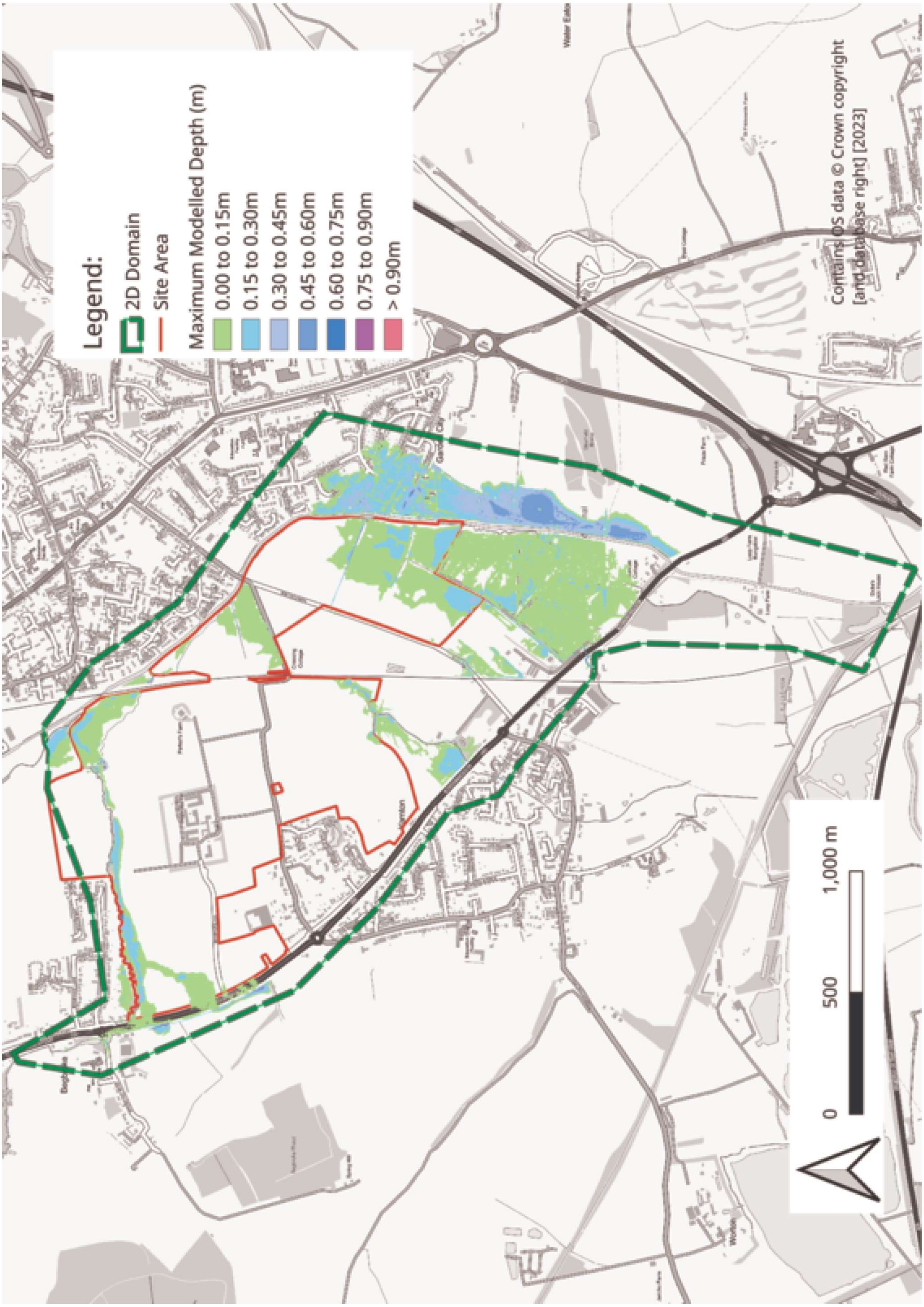

Figure 5.10: *Maximum modelled depth in the 0.1% AEP event, 3.5 hours storm duration*

5.2 Sensitivity Analysis

Three sensitivity tests have been undertaken.

A. Increase and decrease the roughness of the channel and land surfaces by 20%. The sensitivity test helps to quantify the impact of the uncertainty in the selection of roughness values on model results.

B. The downstream boundary conditions on the Eastern Drainage Ditches and the Southern Drainage Ditch have been sensitivity tested by doubling and halving the slope in these boundaries. They are currently modelled using HQ boundaries in the 2D domain on the basis they are located sufficiently downstream of the site to simply remove flow from the model without impacting results within the area of interest. These sensitivity tests quantify whether this assumption is reasonable.

C. The pound level upstream of Duke's Lock has been reduced by 0.1m. In the baseline case, the pound level has been modelled 0.1m higher than the maintained pound level due to a lack of information about the offtake structure at Duke's Lock. This sensitivity test reduces the pound level.

All the sensitivity tests have been undertaken using the 1% AEP design event without an allowance for climate change.

Increase or Decrease in Model Roughness

The results of changing the model's hydraulic roughness coefficients are shown in figures 5.11 and 5.12. The model is relatively insensitive to changes in roughness. Reducing roughness values results in a general reduction in flood extent, whilst increasing roughness values results in a general increase in flood extents. This is to be expected.

The greatest variation in flood extent occurs in area surrounding the Eastern Drainage Ditches and near to the solar farm, some of which falls outside of the site boundary. As ground levels are relatively flat, it is expected that the small changes in water level result in extension or contraction of the extent.

There is limited change to the flood extent around the Rowel Brook North, although it should be noted that increasing the roughness value does result in the ditch to the west of Woodstock Road beginning exceed its capacity.

Downstream Boundary Variation

The results of changing the assumed downstream boundary slopes of the eastern and southern drainage ditches are shown in figures 5.13 and 5.14. Variation in the slope of the HQ boundaries demonstrates that they are sufficiently far downstream to have no impact on-site.

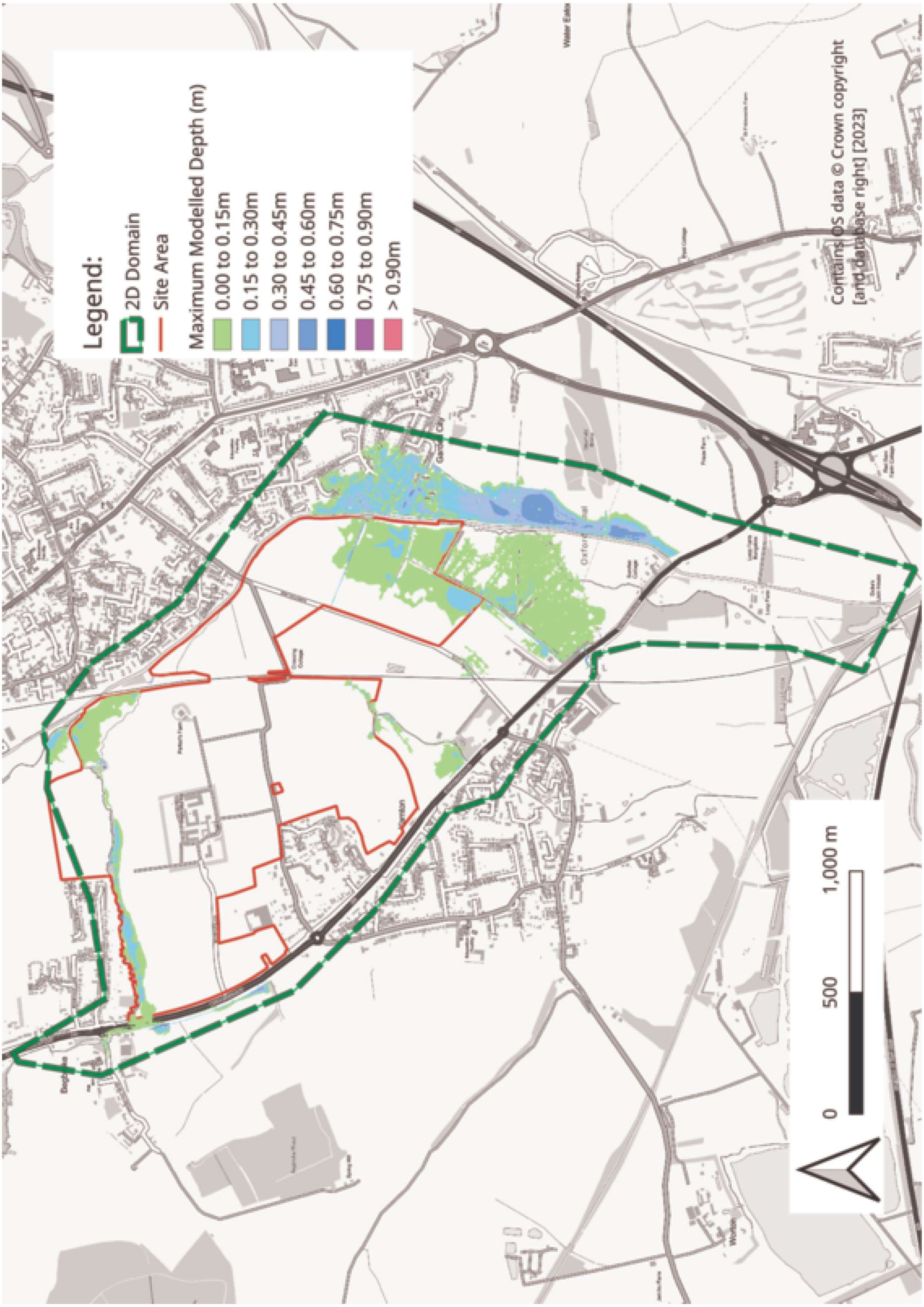

Figure 5.11: *Maximum modelled depth in the 1% AEP event, 11 hour storm duration, 20% increase in roughness*

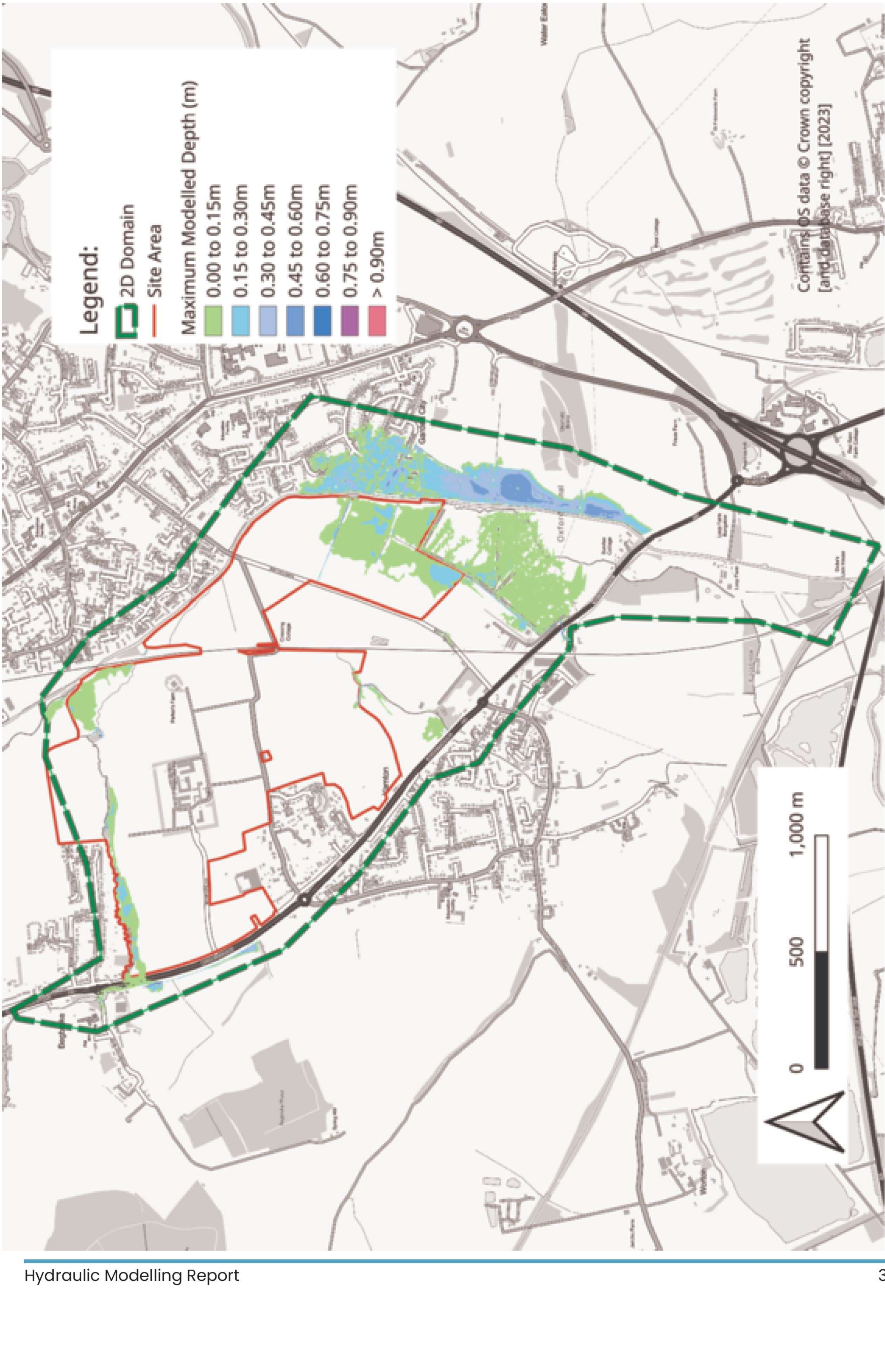

Figure 5.12: *Maximum modelled depth in the 1% AEP event, 11 hour storm duration, 20% reduction in roughness*

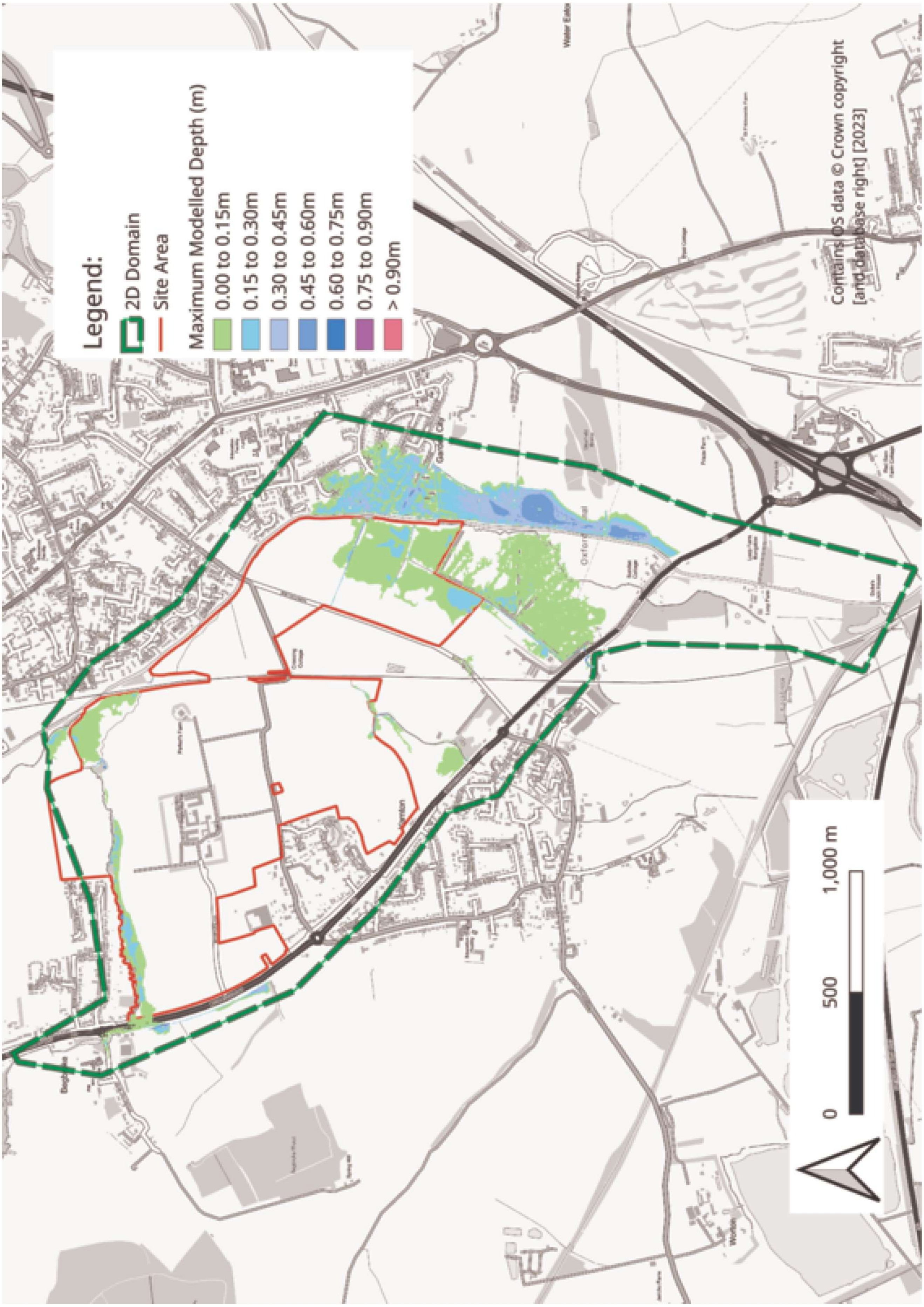

Figure 5.13: Maximum modelled depth in the 1% AEP event, 11 hour storm duration, HQ boundary gradient doubled to 0.02

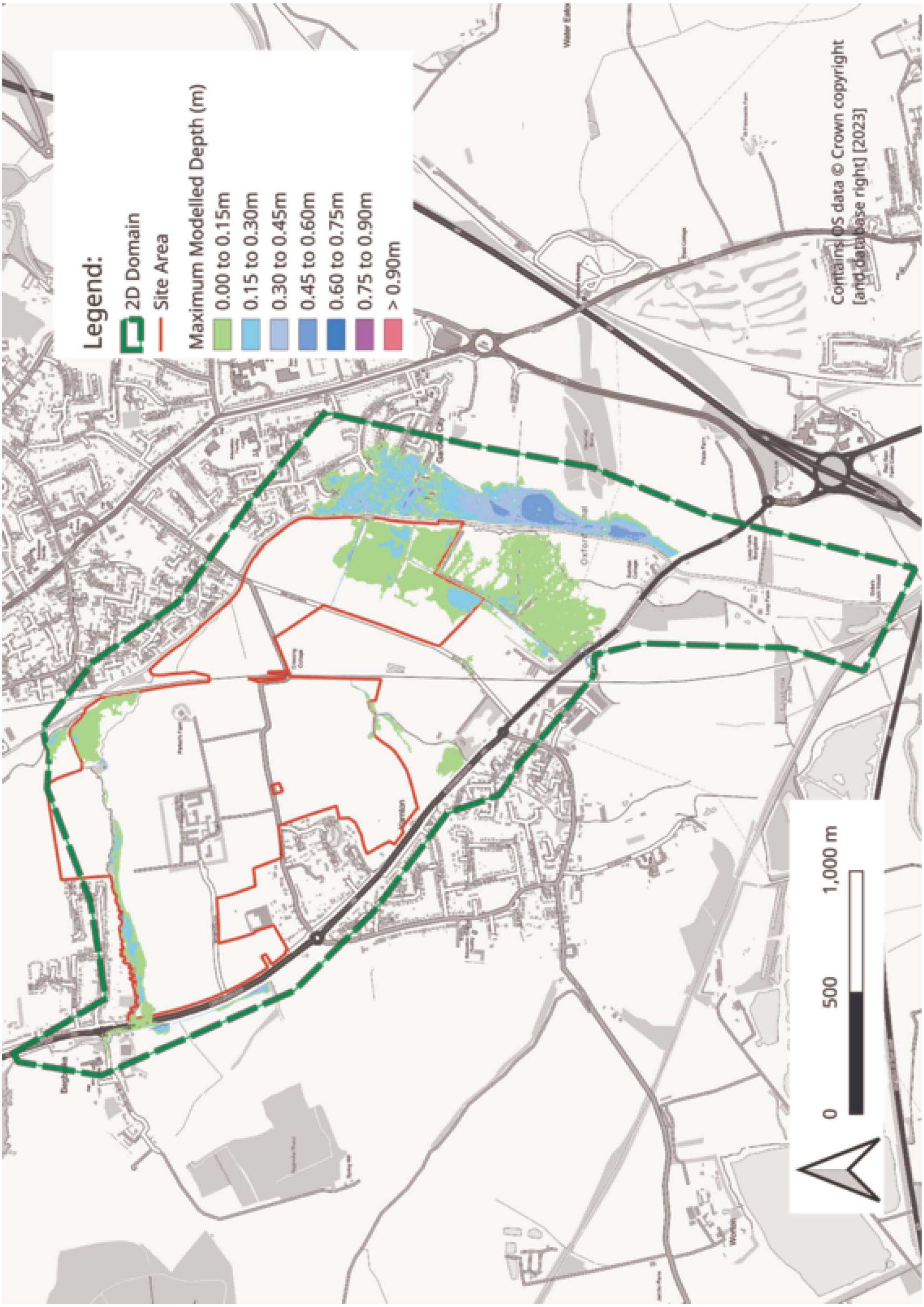

Figure 5.14: Maximum modelled depth in the 1% AEP event, 11 hour storm duration, HQ boundary gradient halved to 0.005

Canal Pound Level Variation

The result of changing the assumption made about the downstream pound level at Dukes Lock on the Oxford canal is shown in figure 5.15. Variation in the canal pound level is shown to have negligible impact on-site. There is some change in water level within the bypass channel at Kidlington Green Lock, but this is extremely localised and has no impact on flood extent.

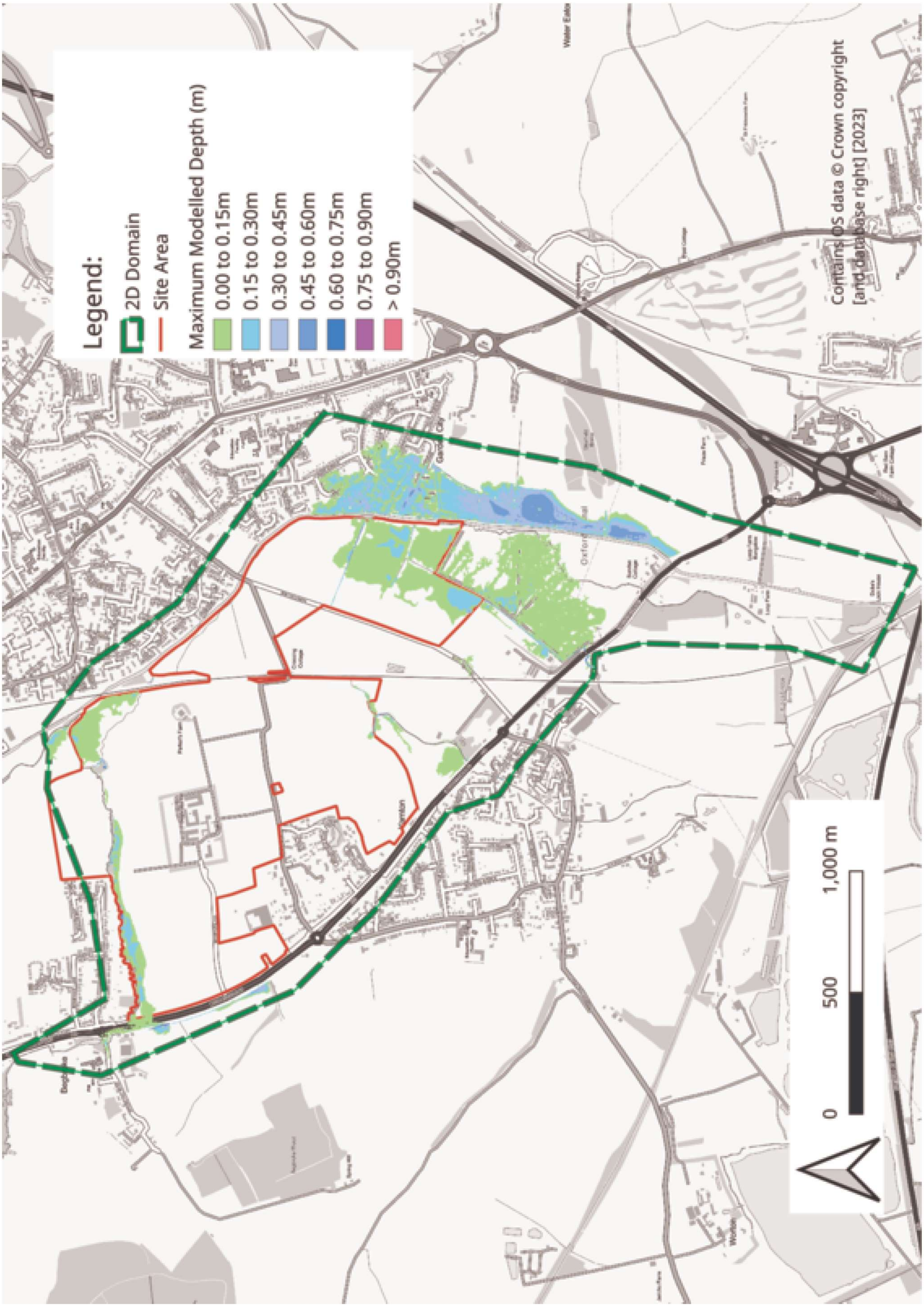

Figure 5.15: *Maximum modelled depth in the 1% AEP event, 11 hour storm duration*

6. Proposed Swale

6.1 Overview

The model shows flooding to the northwest of the site in the 0.1% AEP event and 1% AEP event with 41% climate change allowance. The water comes from the Begbroke Hill area, west of Woodstock Road, flowing across the road into the site area where buildings are proposed (figures 5.4 and 5.5). This flooding then drains into Rowel Brook North floodplain.

Mitigation will be required to ensure that the new development does not flood during these events. The mitigation strategy recommended in this report is to construct a swale to the west of the site area at risk, running parallel to the road.

6.2 Model

The swale has been modelled in the 1D, utilising the same techniques as described in section 4.3. It's location is illustrated in figure 6.1.

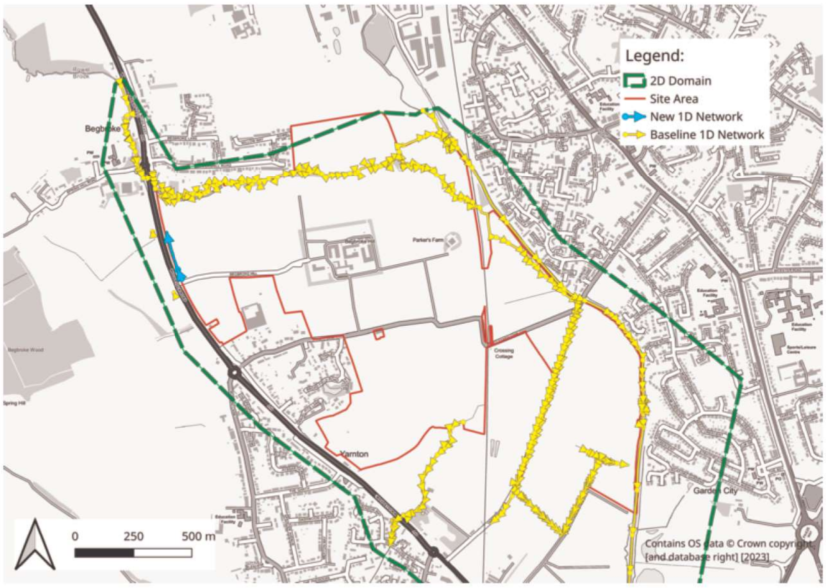

Figure 6.1: *Location of Swale in the North-west of the site*

The geometry of the swale has a base width of 5 m, a top width of 7 m, and is 0.5 m deep. This forms a shallow channel with 1:2 sides, extending for 207.7 m. The channel geometry is deliberately large so that the swale acts in part as flood storage as well as conveying the flow around the site.

The topography around the swale's east and north banks has been altered to form a 'wall', shown in figure 6.2. This ensures that all of the flow across the Woodstock Road is captured by the swale in all of the design flood events where the swale operates. In practice, this structure does not need to be implemented as a wall and could be a low embankment or any other structure impervious to flood water east of the swale to an average height of approximately 0.3 m.

The swale has been designed to attenuate the flood water as well as convey it to the north. This ensures that the travel time for water moving through the swale is similar to that of water that does not cross the Woodstock Road and that flood risk is therefore not increased in the Rowel Brook due to providing a more direct flow path.

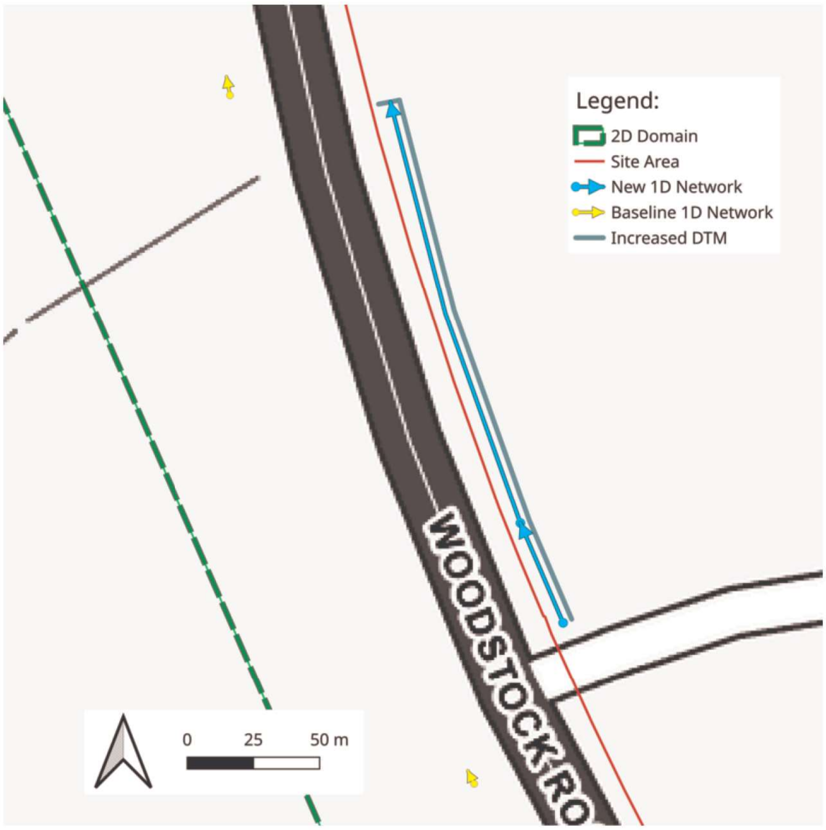

Figure 6.2: *Location of where the DTM has been increased to form a natural wall*

6.3 Results

Maximum Depth

Figures 6.3 and 6.4 show the maximum depth results when the swale is included for the 1% AEP event with 41% allowance for climate change and the 0.1% AEP event, 11-hour storm duration.

The maximum flood depth results illustrate that flooding is situated around the northern edge of the field, in the Rowel Brook North's floodplain. The maps show there is still build-up on Woodstock Road, yet it is not spilling over into the development area, demonstrating that the swale is a functional flood mitigation option.

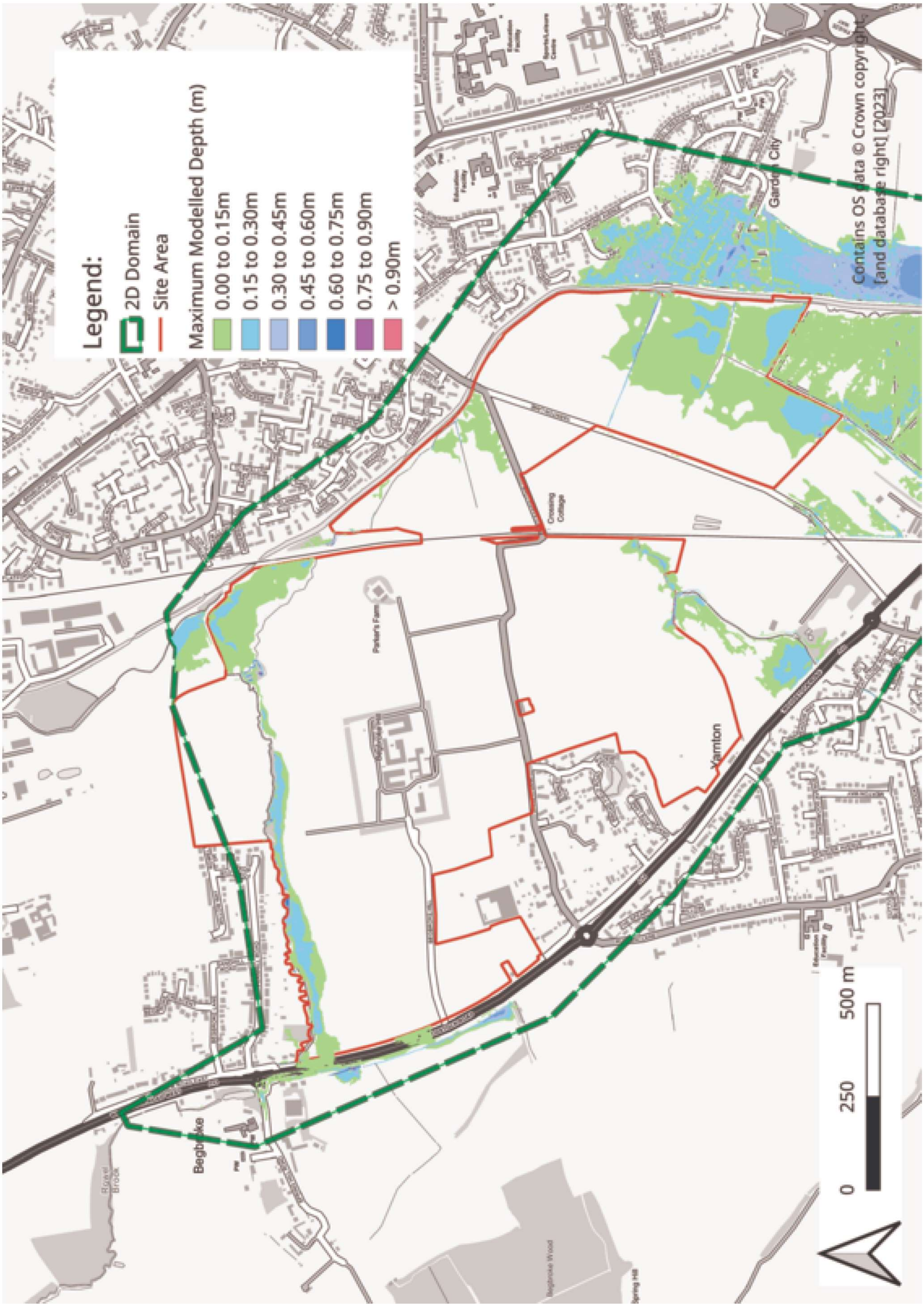

Figure 6.3: *Maximum modelled depth with mitigation in the North-west of the site in the 1% AEP event plus 41% allowance for climate change, 11 hour storm duration*

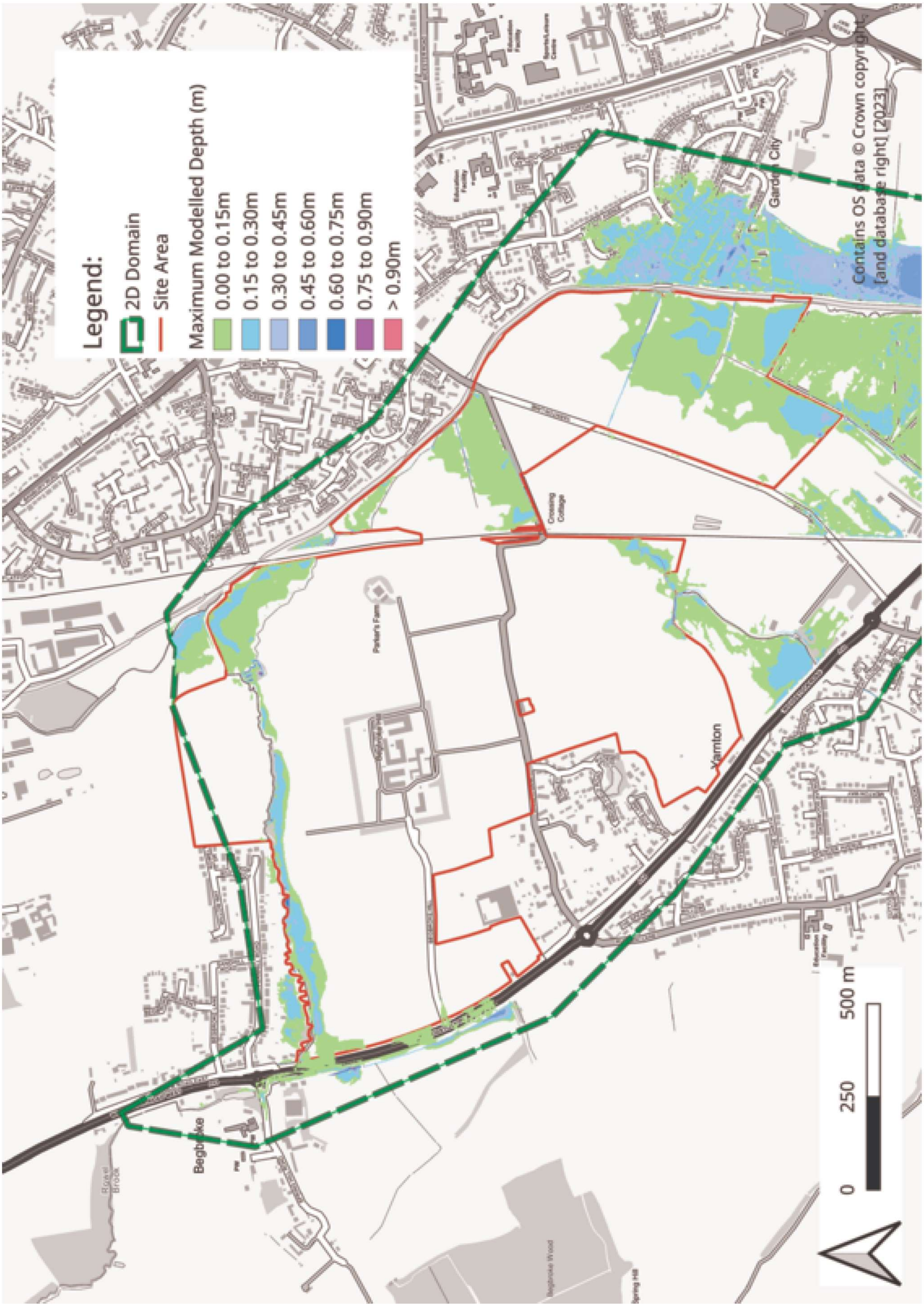

Figure 6.4: *Maximum modelled depth with mitigation in the North-west of the site in the 0.1% AEP event, 11 hour storm duration*

Flood Level Differences

Figures 6.5 and 6.6 show the difference in maximum flood level between the mitigated swale scenario and the baseline model, for the 1% AEP event plus 41% allowance for climate change and the 0.1% AEP event, 11 hour storm duration. Where there is zero or negligible (<5 mm) change in the maximum flood level, the results have been blanked out. For an increase in maximum flood level the results are shades of orange/red and where there has been a decrease the results are green/blue.

Figure 6.5 demonstrates that the construction of the Swale prevents the proposed development from flooding and causes no increased flood risk anywhere else, for the 1% AEP plus 41% climate change allowance event. The 0.1% AEP event (figure 6.6) has a increase in maximum flood level just north of the swale where the water moving through the swale is redirected north toward the Rowel Brook floodplain. The dark red conveys there is new flood water and the orange conveys that the new flood water has caused an increase in maximum flood level of 0.005–0.100 m at the edge of the floodplain. This increased flood risk is entirely contained within the site boundaries and does not impact on any part of the proposed development. The model shows no increased flood risk to any third party.

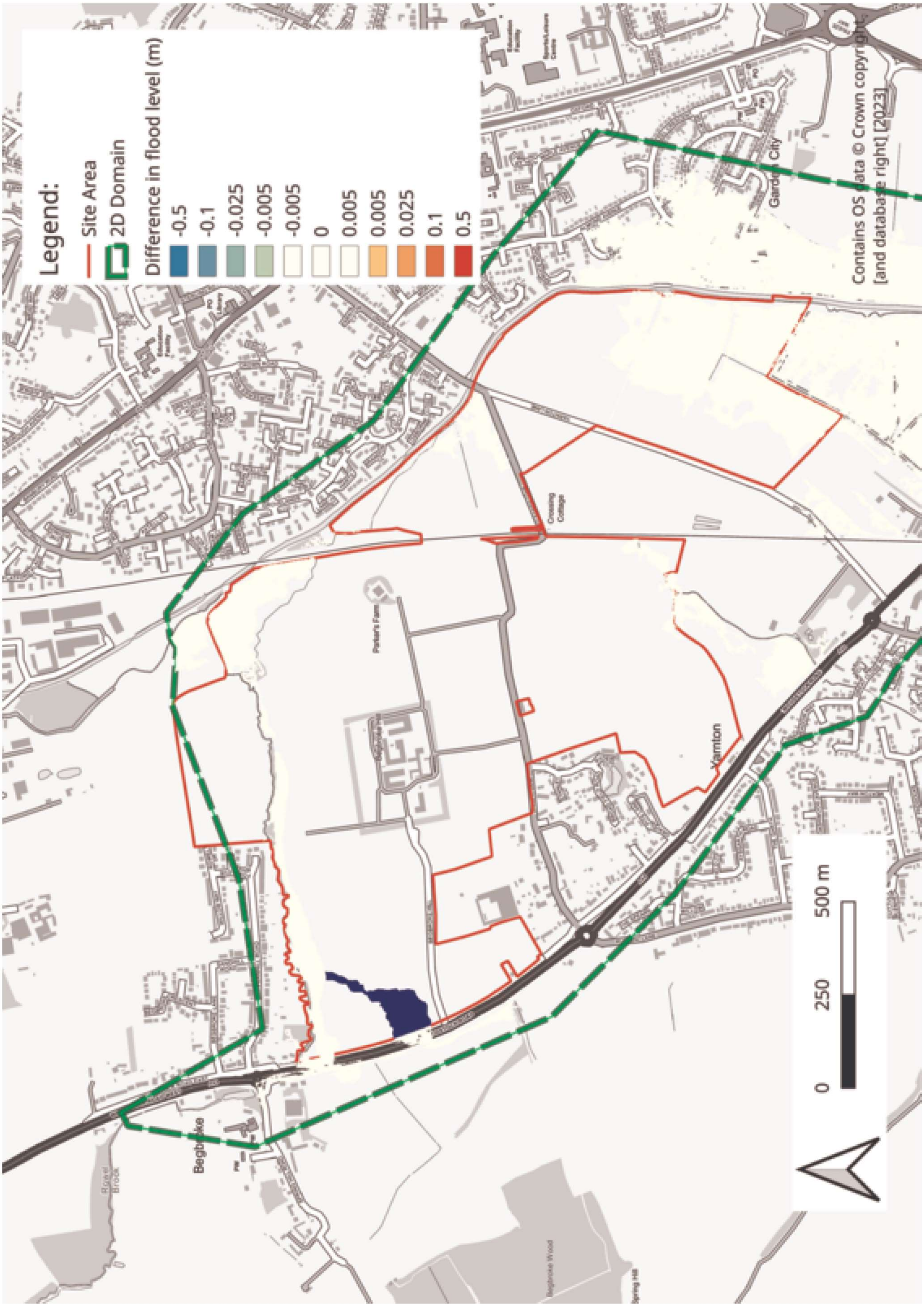

Figure 6.5: *Difference in flood level between the baseline model and the North-west mitigation scenario in the 1% AEP event plus 41% allowance for climate change, 11 hour storm duration*

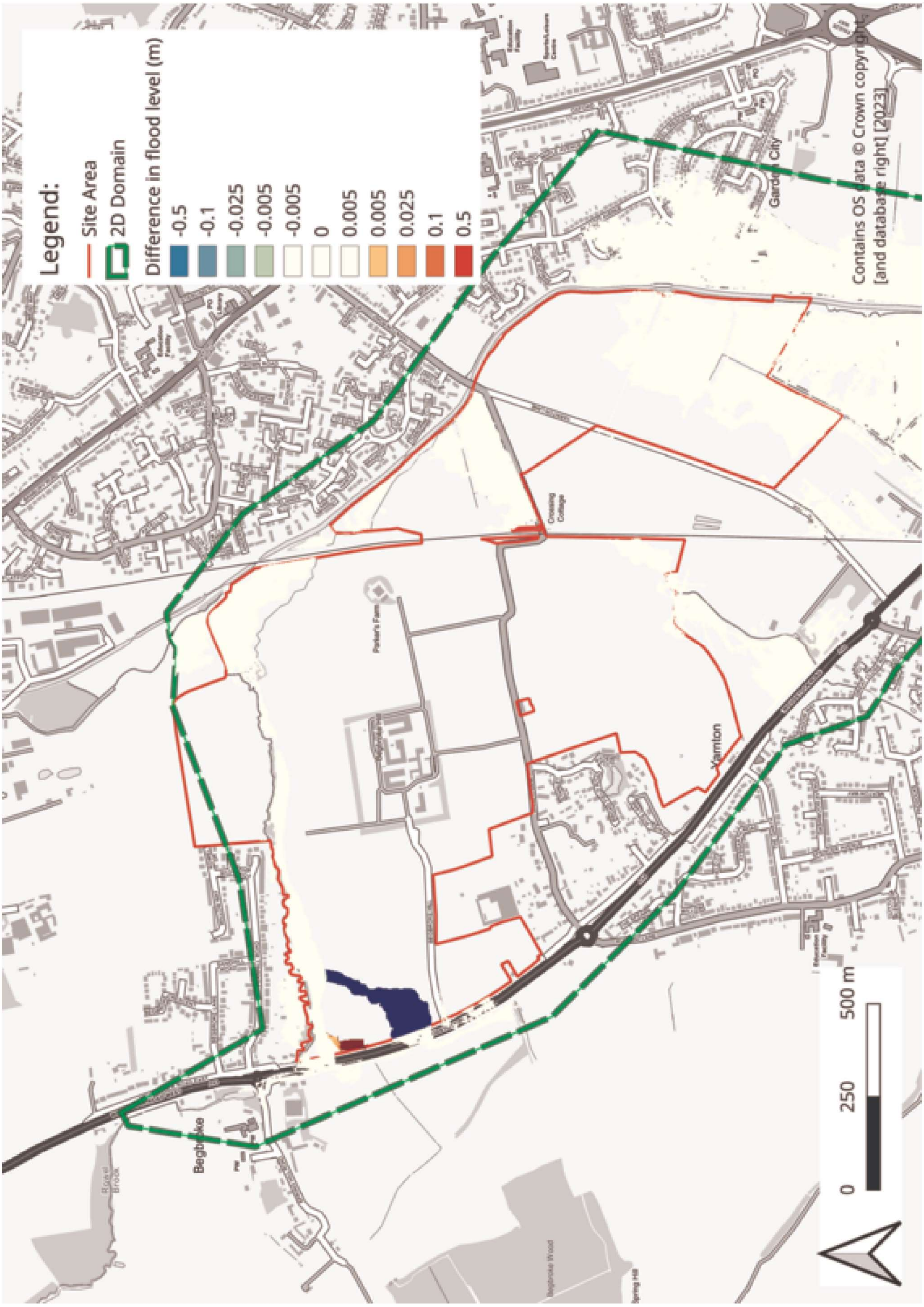

Figure 6.6: Difference in flood level between the baseline model and the North-west mitigation scenario in the 0.1% AEP event, 11 hour storm duration

RECOMMENDATIONS

7. Conclusions

Edenvale Young Associates were commissioned to undertake hydraulic modelling adjacent to the existing Begbroke Science Park, Oxfordshire. The following tasks have been undertaken:

- A baseline ESTRY-TUFLOW model has been constructed using detailed topographic survey and a bespoke hydrological analysis has been undertaken.
- The model has been run for a range of design events
- Sensitivity testing has been undertaken to assess the impact of key assumptions on the results

The results show flooding to the site of interest, with the majority of out of bank flooding occurring on the eastern side of the site close to the Oxford Canal and Eastern Drainage Ditches. Where proposed development would intersect with the flood extents of the 1% AEP events with climate change allowance it is recommended that such development is relocated, or mitigation work is undertaken to ensure that the development is not at risk and no third-party impacts are caused.

A small area of flood risk to the proposed development in the 1% AEP with 41% climate change allowance and 0.1% AEP flood events has been identified in the northwest corner of the site. The modelling has been used to inform the outline design of a swale which has been shown to be an effective flood mitigation measure for these events that does not cause any third-party impact.

APPENDIX

A. Flood Estimation Report