Westwood Mill

Updated Masterplan

Modelling addendum

REVISION E

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EdenvaleYoung

New Civil Engineer 100 COMPANIES OF THE YEAR 2018

WINNER Design Innovator

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1 Introduction

This report serves as an addendum to the Westwood Mill Modelling Report Prepared by Edenvale Young in June 2016 (Revision F). In December 2019, Edenvale Young Associates Ltd. were supplied with a revised masterplan for the development as shown in .

Hydraulic modelling has been undertaken to understand the flood risk to the latest proposed property layout with peak inflows applied using the 2017 JBA hydrology[1] as shown in Table 1. Hydraulic modelling has been undertaken to understand the flood risk to the latest proposed property layout. The main changes to the latest masterplan include;

- An increase in size of the mill pond
- As a result of the mill pond size increase, residential blocks south of the pond have moved closer towards the river.
- All residential development is now contained towards the eastern end of the site. There is no longer development along the Mill leat.

Table 1| Peak inflows applied in modelling (m^3/s) cc = climate change

Return Periods (years)	EVY 2016 peak inflows applied in previous modelling	JBA 2017 peak inflows applied in latest modelling
1 in 25	46.25	52.47
1 in 100	64.22	70.05
1 in 100 + 30% cc	83.48	91.07
1 in 100 + 50% cc	105.08	105.08
1 in 1000	120.98	112.14

[1] Flood estimation report: Rivers Colne and Holme JBA Consulting: 2016s5068 - Colne and Holme hydrology report v2.2.docx October 2017

2 Modelling

2.1 Software

The modelling has now been simulated using the latest version of the software which includes; Flood modeller pro version: 4.5.1.6163 and TUFLOW version: 2018-03-AC-iDP-w64.

2.2 Model Baseline (Pre-Development Scenario)

There have been no updates to the baseline model other than using the latest version of the software described above. Inflows have been updated to match JBA peak inflows. This was to ensure consistency when comparing the results to the updated masterplan modelling.

2.3 Updated masterplan

The latest masterplan has been simulated as scenario 'L'. The changes have reflected the updated masterplan arrangement which includes;

- Updated model roughness (2d materials files) to reflect the new property layouts, areas of hardstanding and green spaces.
- Increased area for the mill pond and modelling of the proposed off-take structure from the mill pond into the Colne.
- Removal of the "southern wall" which is no longer present in the latest masterplan as the latest arrangement of property prevents flow through the site.
- Relocating the previously proposed house platforms to fit the updated masterplan (Figure 4).
- Representation of the road at 100mm above the 1 in 25 flood level
- Representation of a flood compensation volume to compensate for raising the access road to the site for a 1 in 25 year event.

The development platform used for the properties to the south of the lake in the previous master plan has been removed because it now falls within the lake. Accordingly, the properties in this area are positioned at the existing ground level.

3 Model results

3.1 Baseline – Pre-development Scenario

The maximum flood depths for the baseline scenario are given in Figure 5 to Figure 9 for:

- 1 in 25-year return period
- 1 in 100-year return period
- 1 in 100-year return period plus an allowance of 30% for climate change
- 1 in 100-year return period plus an allowance of 50% for climate change
- 1 in 1000-year return period

It is important to note that a small proportion of the site is in flood zone 3b (1 in 25-year event).

3.2 Post Development Scenario – Revised Master Plan

The maximum flood depths, maximum level and flood hazard for the proposed development are given in Table 1. Peak inflows have been updated for the above return periods listed above and are given in Table 2.

Table 2| Post Development Figure References

Figures
Figure 10: Post -development Scenario: Maximum Modelled Flood Depths for the 1 in 25 year Event
Figure 11: Post -development Scenario: Maximum modelled flood depths for the 1 in 100 year event
Figure 12: Post -development Scenario: Maximum Modelled Flood Depths for the 1 in 100 year return period plus 30% allowance for climate change

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Figure 13: Post -development Scenario: Maximum Modelled Flood Depths for the 1 in 100 year return period plus 50% allowance for climate change
Figure 14 : Post -development Scenario: Maximum Modelled Flood Depths for the 1 in 1000 year return period
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In the post development scenario all residential property (labelled A through to I Figure 4) are outside the functional flood plain (see Figure 10). In the 100 year event plus 30% climate change, all 20 properties flood in the "I.1 and I.2 blocks" would be at risk of flooding on the assumption that the ground floor levels of the buildings are set at the existing ground level.

Based on discussion with Clive Onions Ltd it has been assumed that properties adjacent to the Mill Pond in Block I (see Figure 4) will have living accommodation on the first floor with non-residential (i.e. garages) on the ground floor. Ground floor levels would be set at 0.3m above existing ground level.

If ground floor levels within Block I are placed 0.3m above exiting ground level, then then only the most easterly of the seven properties would be at risk of internal flooding. The hydraulic modelling indicates that the maximum depth of internal flooding would be in the order of 0.88m (see Figure 17 and Table 3).

Block G, F, E and H are adjacent to the extents but do not flood because they are on a raised platform. Nevertheless. it is recommended that finished floor levels should be set as the maximum of the following criteria. The proposed FFLs are show in Table 4.

1. 1 in 100 year return period maximum water level with a climate change allowance of 30% plus a freeboard of 0.3m

Or

2. 1 in 100 year return period maximum water level with a climate change allowance of 50%

Table 3| Proposed Ground Floor Levels to Block I (Non Residential Accommodation) 1 in 100 year return period with a 30 % climate change allowance (Figure 15 shows the reference points used)

Block	Maximum Water Level (m AOD)	Existing Ground Level (m AOD)	Proposed Ground Floor Level (m AOD)
I1	117.09	116.20 to 116.67	117.33 to 117.39
I2	117.37	117.03 to 117.14	117.57 to 117.67

Table 4| Proposed Finished Floor Levels to Block E to K (Residential Accommodation) 1 in 100 year return period with a 30 % and 50% climate change allowance

Block	1 in 100 + 30% CC (m AOD)	Minimum FFL Criteria 1 (m AOD)	1 in 100 + 50% CC (m AOD)	Minimum FFL Criteria 2 (m AOD)
E to H	116.84	117.14	117.11	117.11
K	113.20	113.50	114.53	114.53

Flood Hazard mapping indicates that for properties in Blocks A to E, Block H and J to K, there is safe access and egress onto Low Westwood Lane and there are no restrictions associated with evacuation.

Evacuation of properties in Blocks G, I1 and I2 must be along the Mill Pond Embankment and through the main mill building. Provision must therefore be made to allow access through Block D or E. Vehicular access along the road to the south of the buildings to Blocks I1 and I2 will not be possible as the hazard is classified as dangerous to all in a 1 in 100 year return period with 30% climate change.

Figure 1 shows the results of the hydraulic modelling for a 1 in 25 year event for depth. The access road has been elevated by 0.1m above the existing ground level and flood storage compensation introduced adjacent to the channel. There is no flooding to the road. Figure 2 indicates that at peak in a 1 in 25 year event the hazard on the access road is moderate.

The difference map for the 1 in 100 year plus 30% climate change which shows the impact of the proposals on flood water levels is shown in Figure 25. This is a comparison between the post development and baseline scenario and shows that there is no measurable third party impact. Difference maps for the remaining return periods are shown in Appendix A.

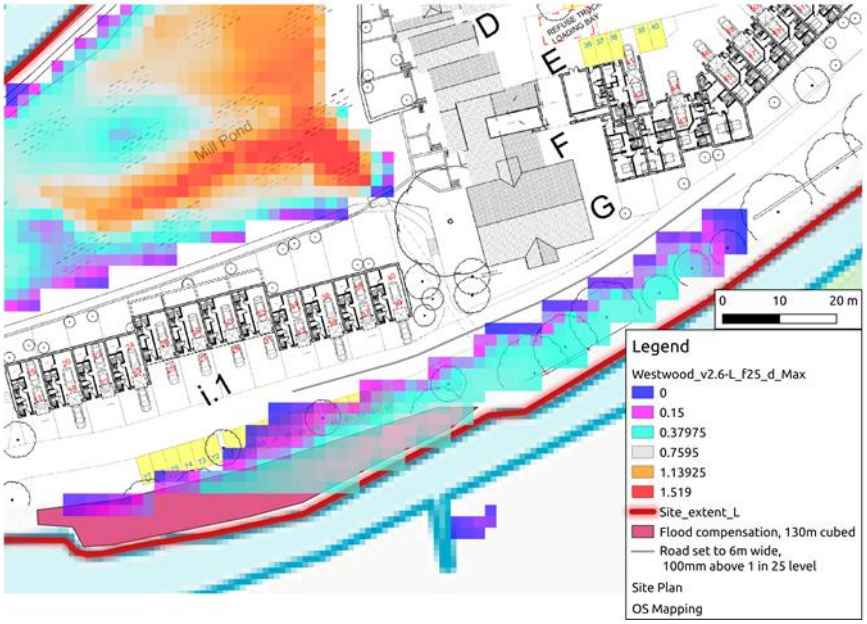

Figure 1: Maximum flood depth map for the 1 in 25 year event

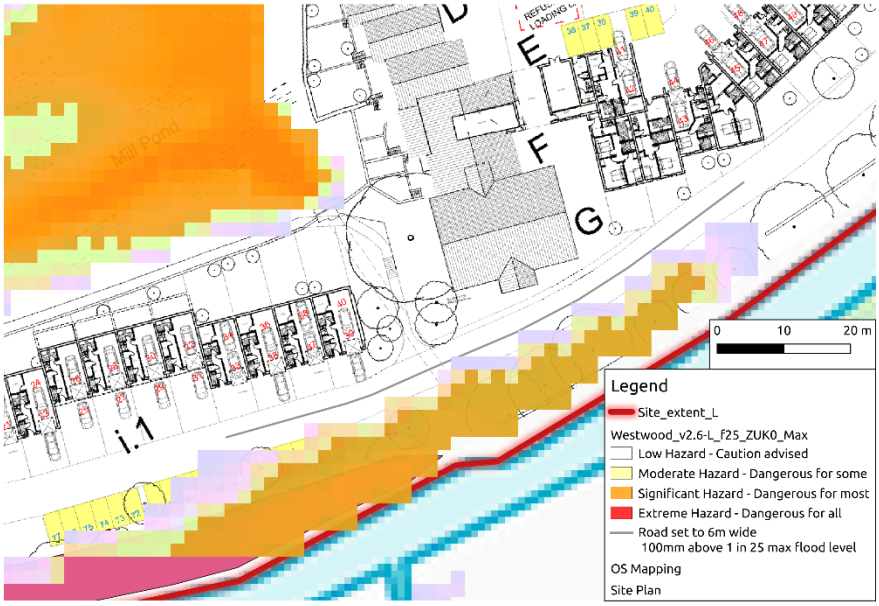

Figure 2: Maximum flood hazard for the 1 in 25 year event

4 Conclusions and Recommendations

4.1 Conclusions

Property within the development is not within the functional flood plain (Flood Zone 3b) which is defined as a 1 in 25-year event. On the assumption that finished floor levels within Blocks I and I2 are set at 0.3m above the existing ground level then only the most easterly property could be internally flooded within Block I1. Depth of flooding would be in the order of 0.88m deep in a 1 in 100 year event with a 30% allowance for climate change.

Assuming that finished floor levels are set correctly then Blocks E to K would be free of flooding in the 1 in 100 year event with allowances of 30% and 50% for climate change.

Safe access and egress from the Blocks G, I1 and I 2 can be achieved assuming provision is made for movement along the embankment to the Mill Pond and through Block D or E into the main courtyard of the development. Safe access and egress from all of the other blocks is achievable up to and including the 1 in 100 year return period.

4.2 Recommendations

It is recommended that:

- Finished Floor Levels for Blocks I1 and I2 are set at 0.3m above existing ground level.
- Ground floor within Blocks I1 and I2 are set aside for non-residential purposes (i.e. garages). All living accommodation should be on the second and third floors of Blocks I2 and not vulnerable to flooding.
- Finished Floor Levels for Blocks E to H should be set at a minimum of 117.14m AOD
- Finished Floor Levels for Block K should be set at a minimum of 114.53m AOD.

- Provision is made for safe access and egress for Blocks G, I1 and I2 is made along the Mill Pond embankment and through either Blocks D or E into the main courtyard.

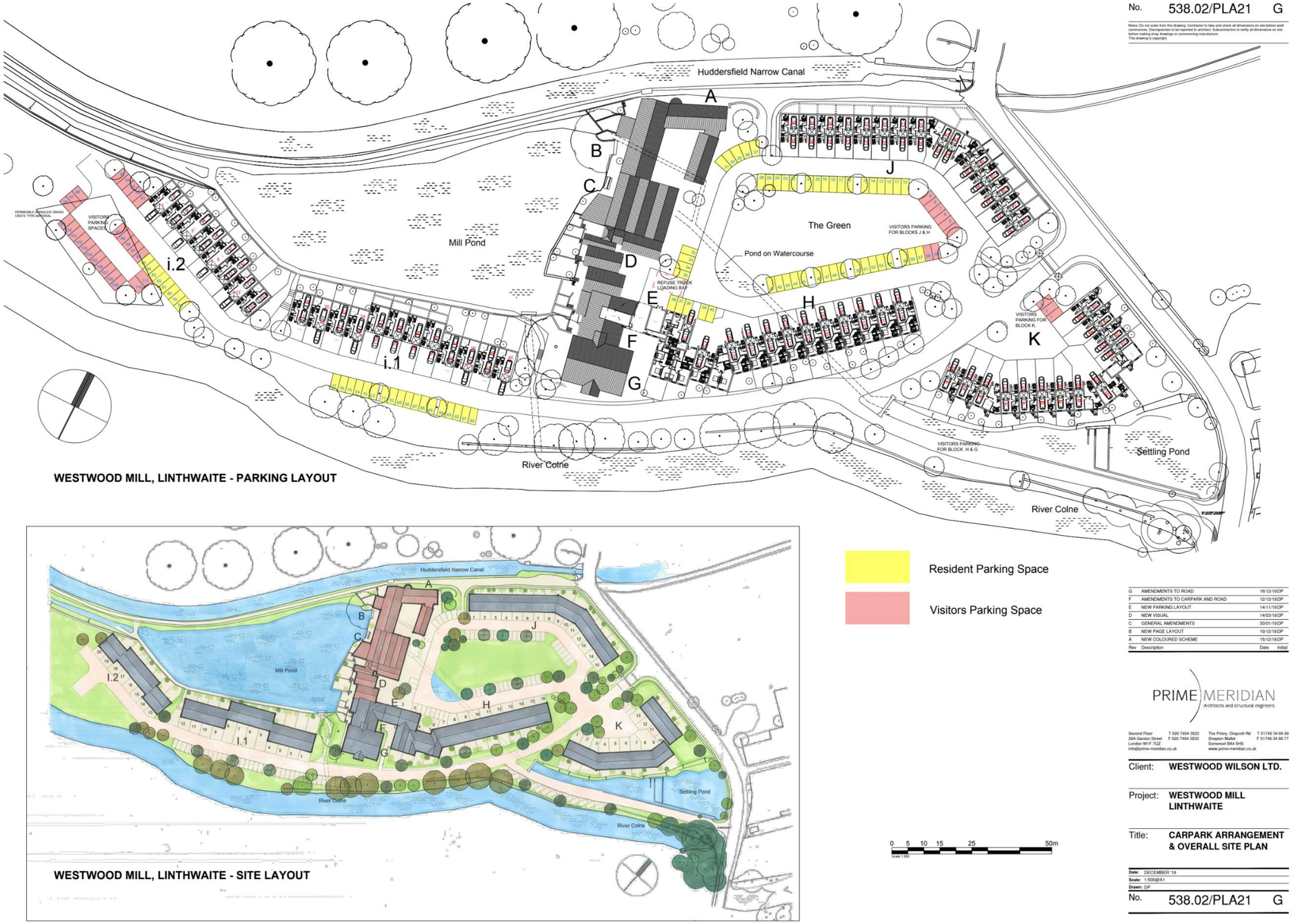

Figure 3: Proposed development at the Westwood Mill site

Figure 4: Proposed development at the Westwood Mill site

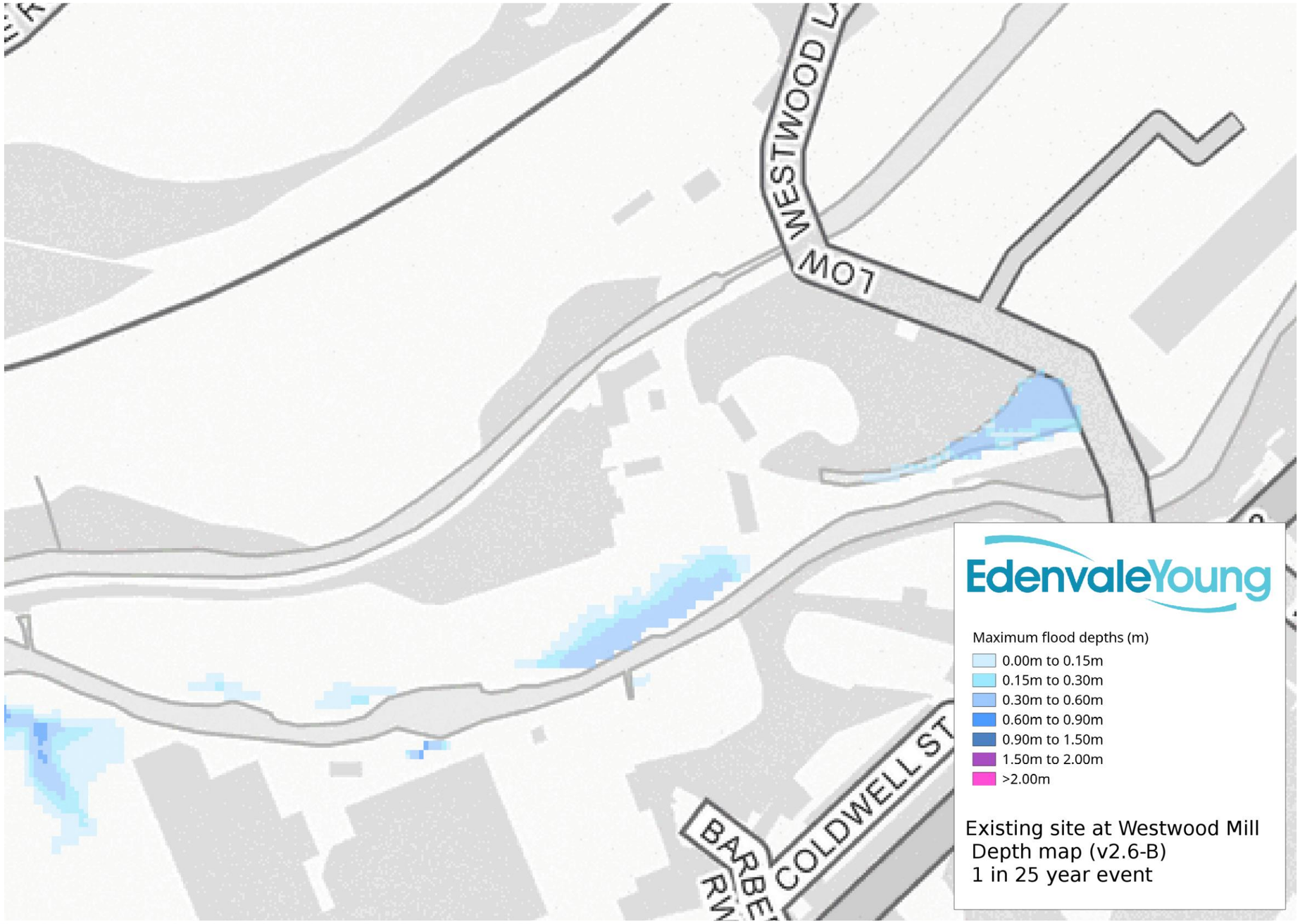

Figure 5: Pre -development Scenario: Maximum Modelled Flood Depths for the 1 in 25 year return period

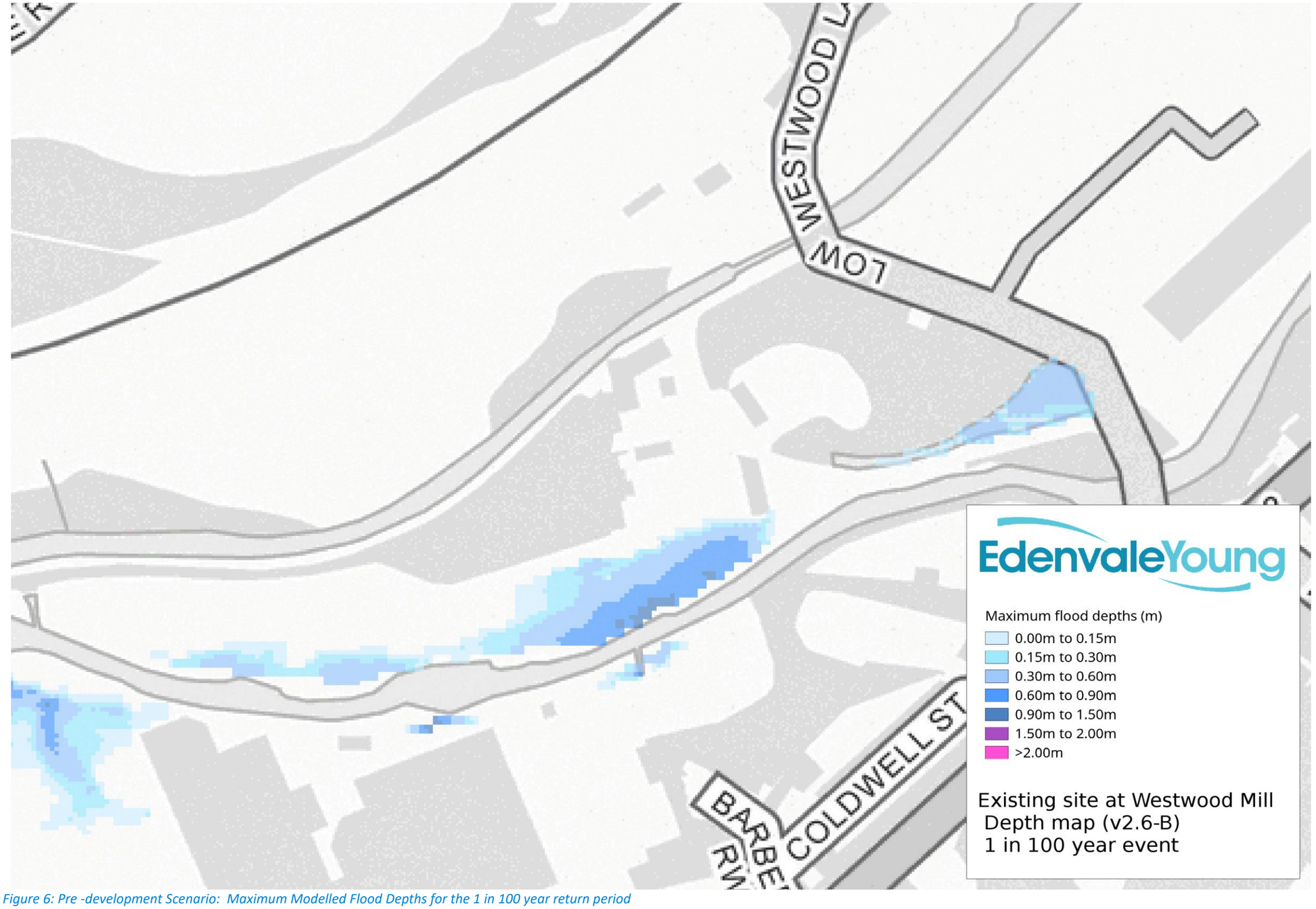

Figure 6: Pre -development Scenario: Maximum Modelled Flood Depths for the 1 in 100 year return period

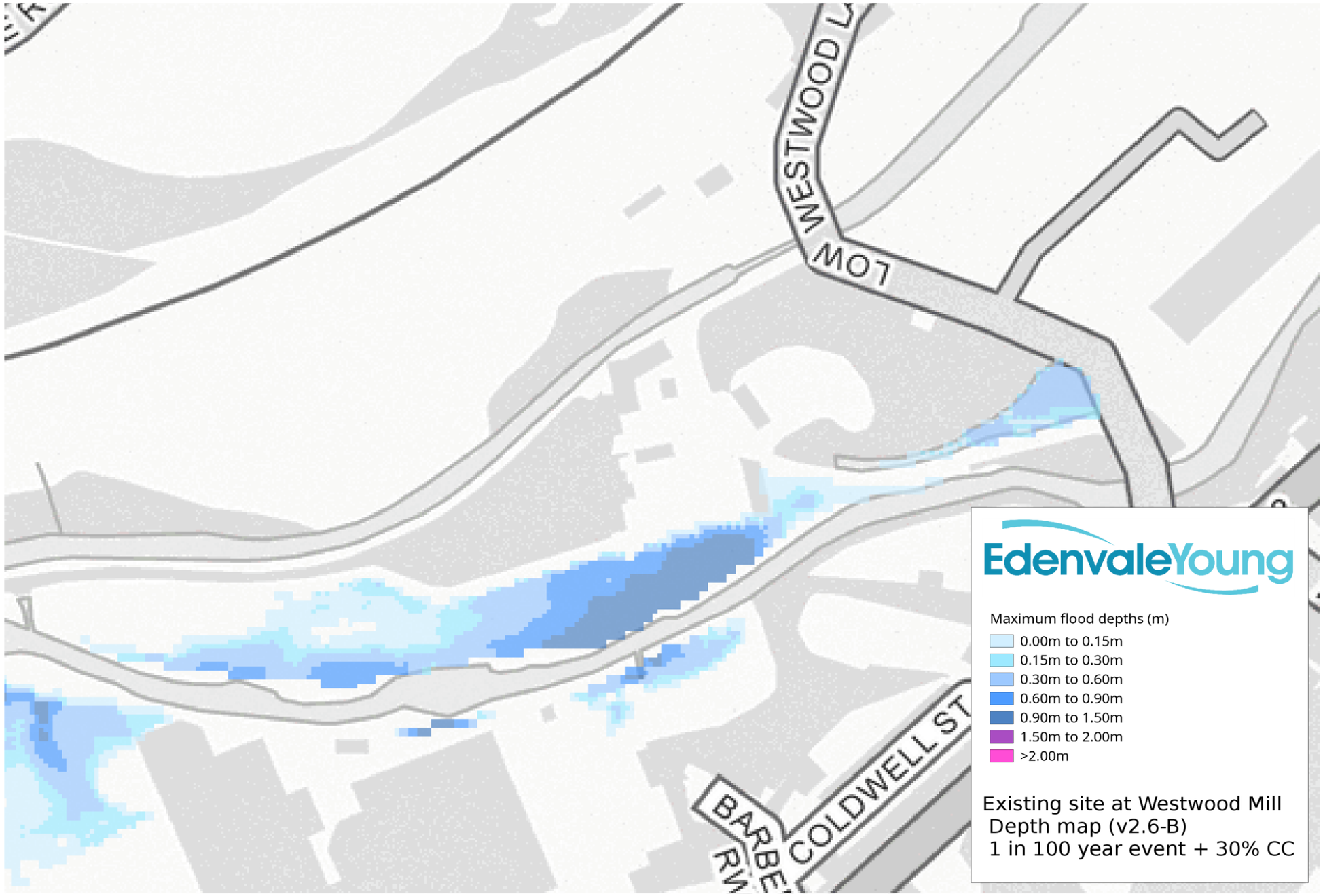

Figure 7: Pre -development Scenario: Maximum Modelled Flood Depths for the 1 in 100 year return period plus 30% allowance for climate change

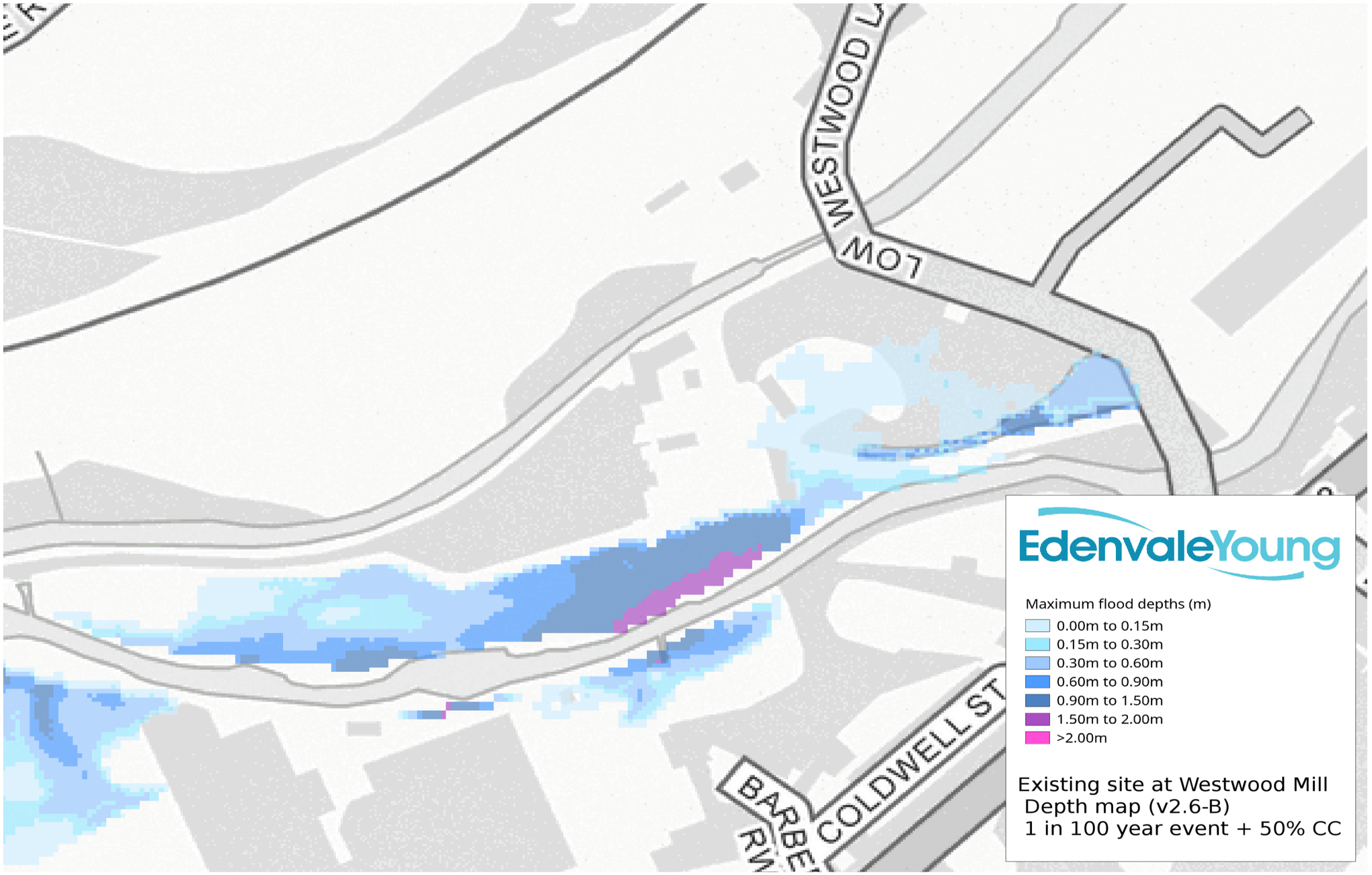

Figure 8: Pre -development Scenario: Maximum Modelled Flood Depths for the 1 in 100 year return period plus 50% allowance for climate change

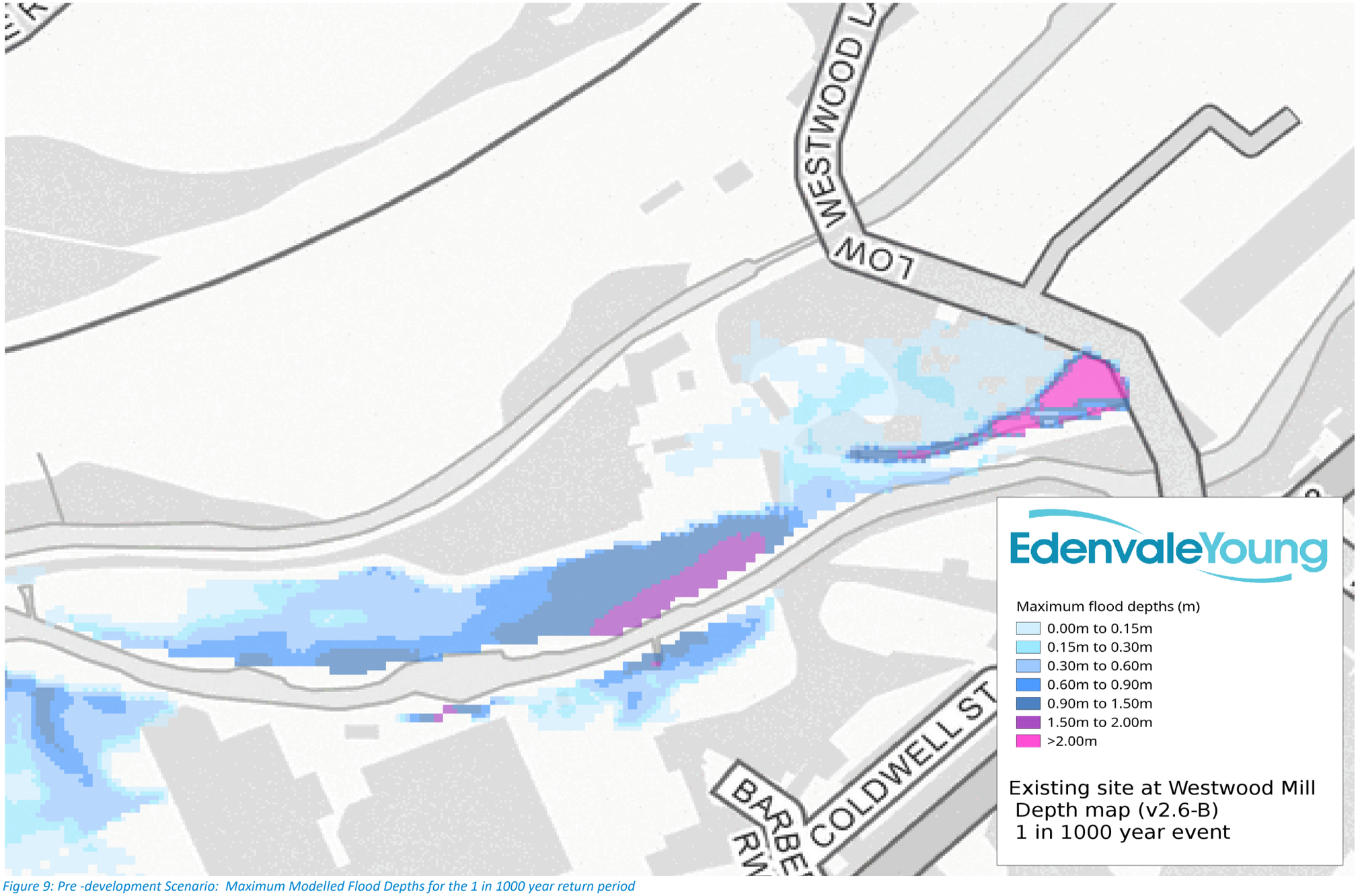

Figure 9: Pre -development Scenario: Maximum Modelled Flood Depths for the 1 in 1000 year return period

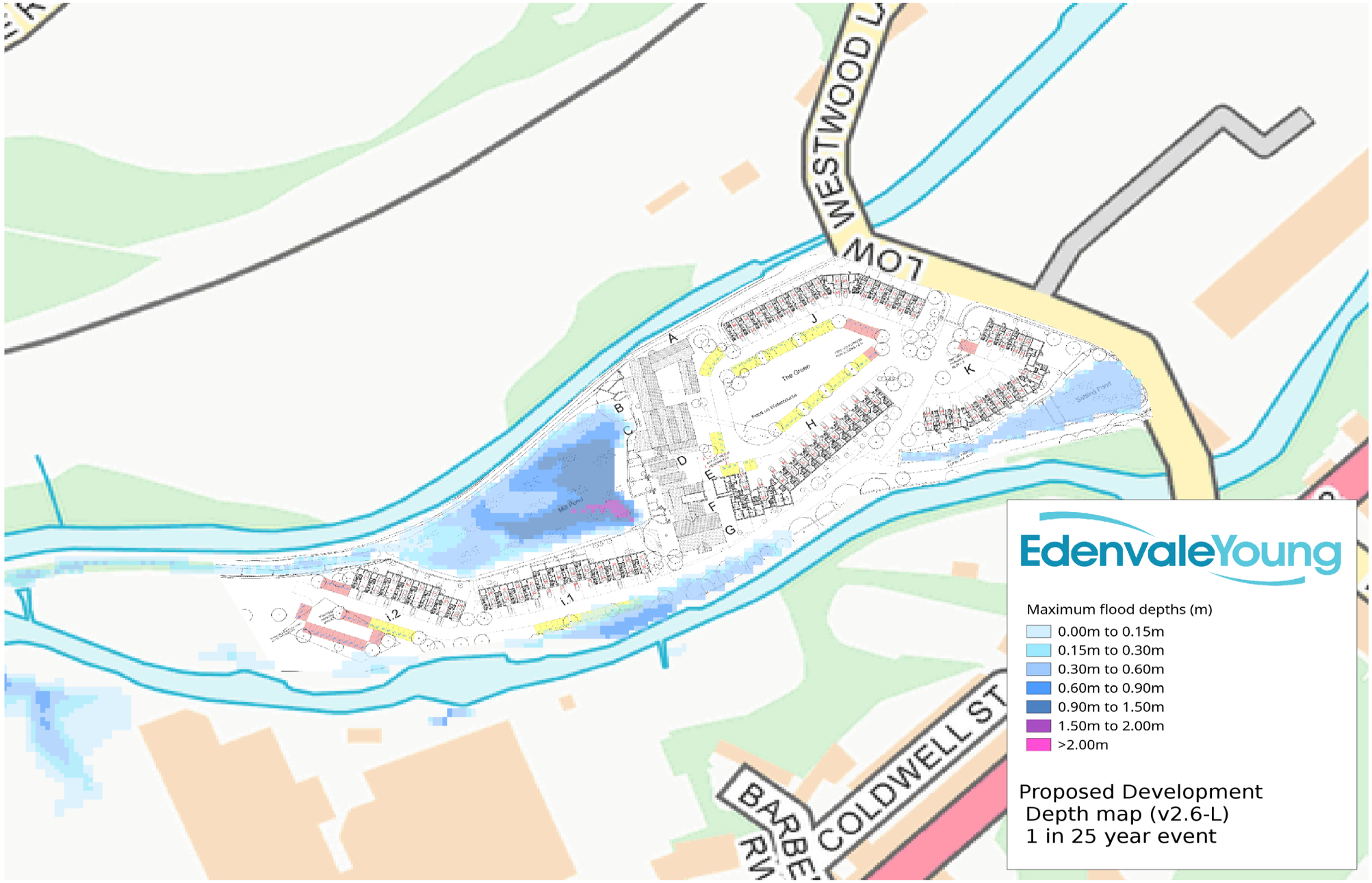

Figure 10: Post -development Scenario: Maximum Modelled Flood Depths for the 1 in 25 year Event

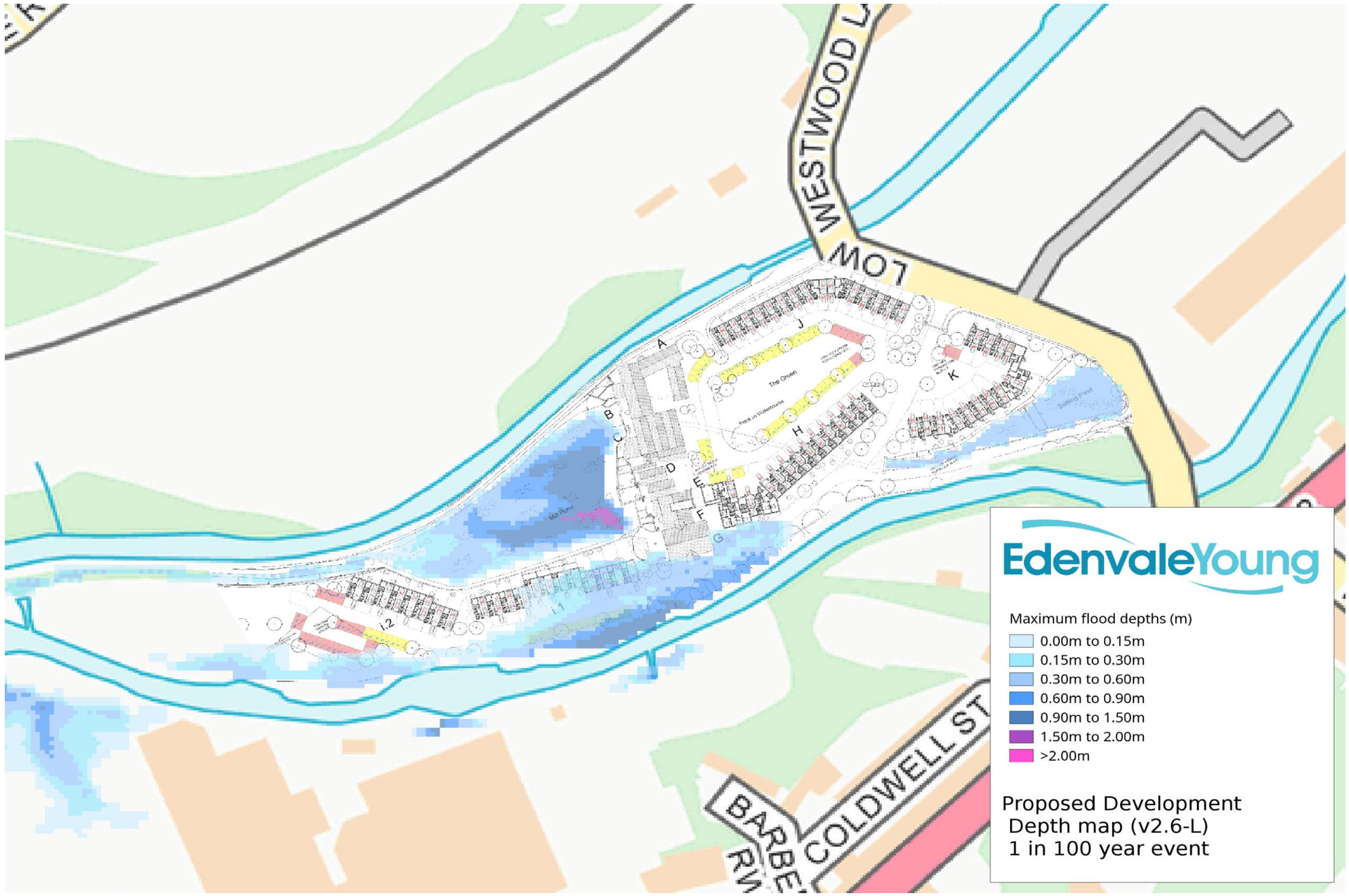

Figure 11: Post -development Scenario: Maximum modelled flood depths for the 1 in 100 year event

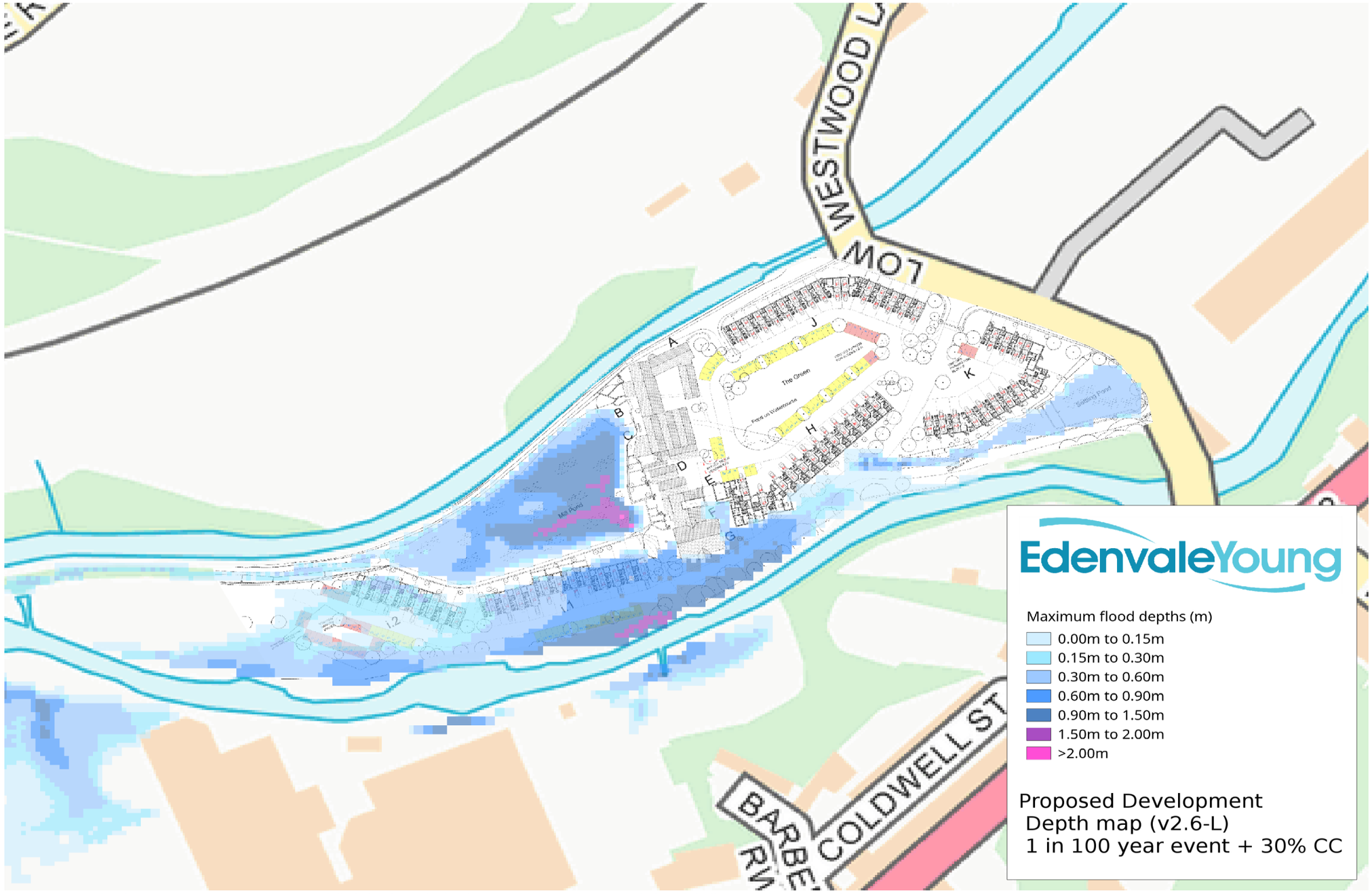

Figure 12: Post -development Scenario: Maximum Modelled Flood Depths for the 1 in 100 year return period plus 30% allowance for climate change

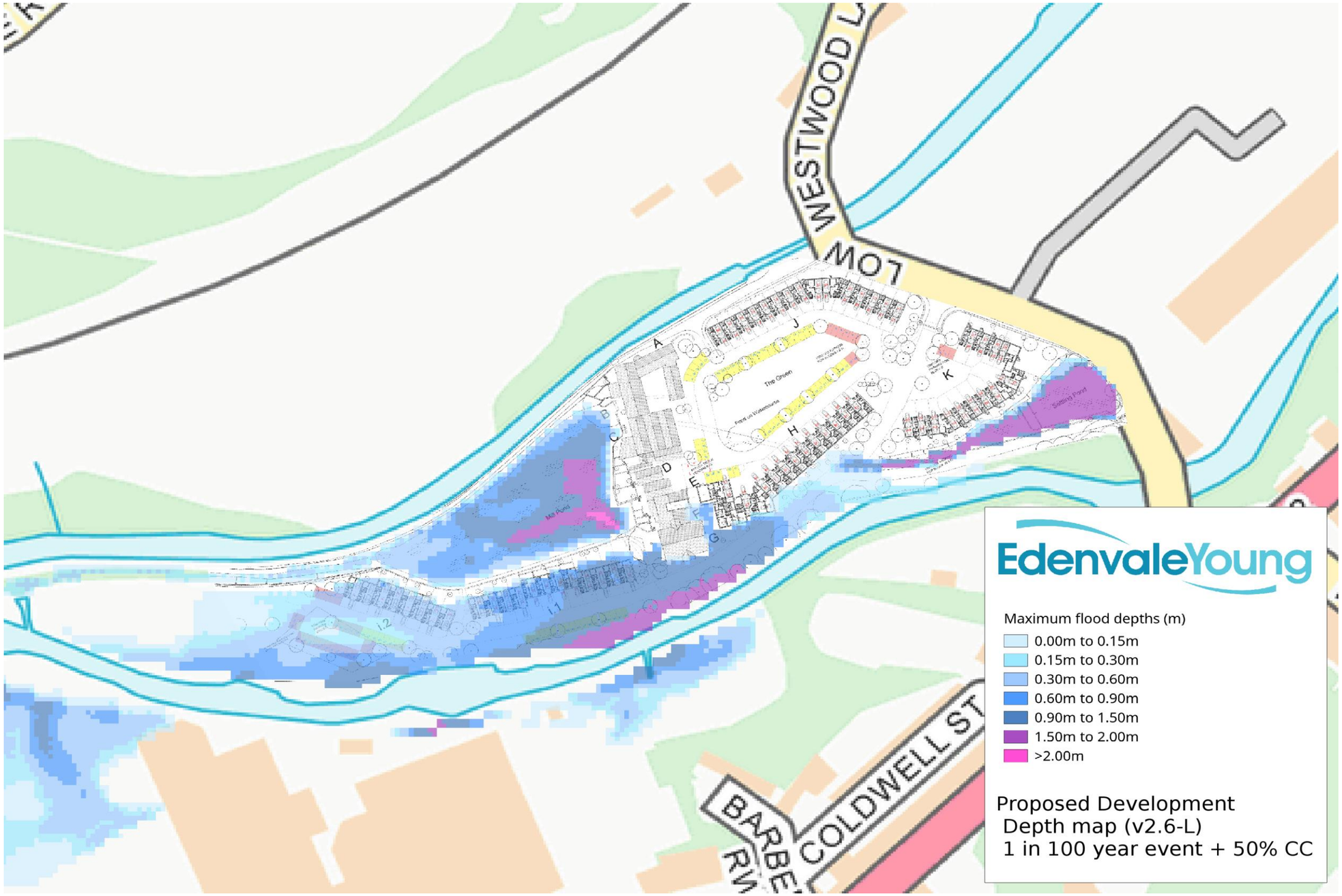

Figure 13: Post -development Scenario: Maximum Modelled Flood Depths for the 1 in 100 year return period plus 50% allowance for climate change

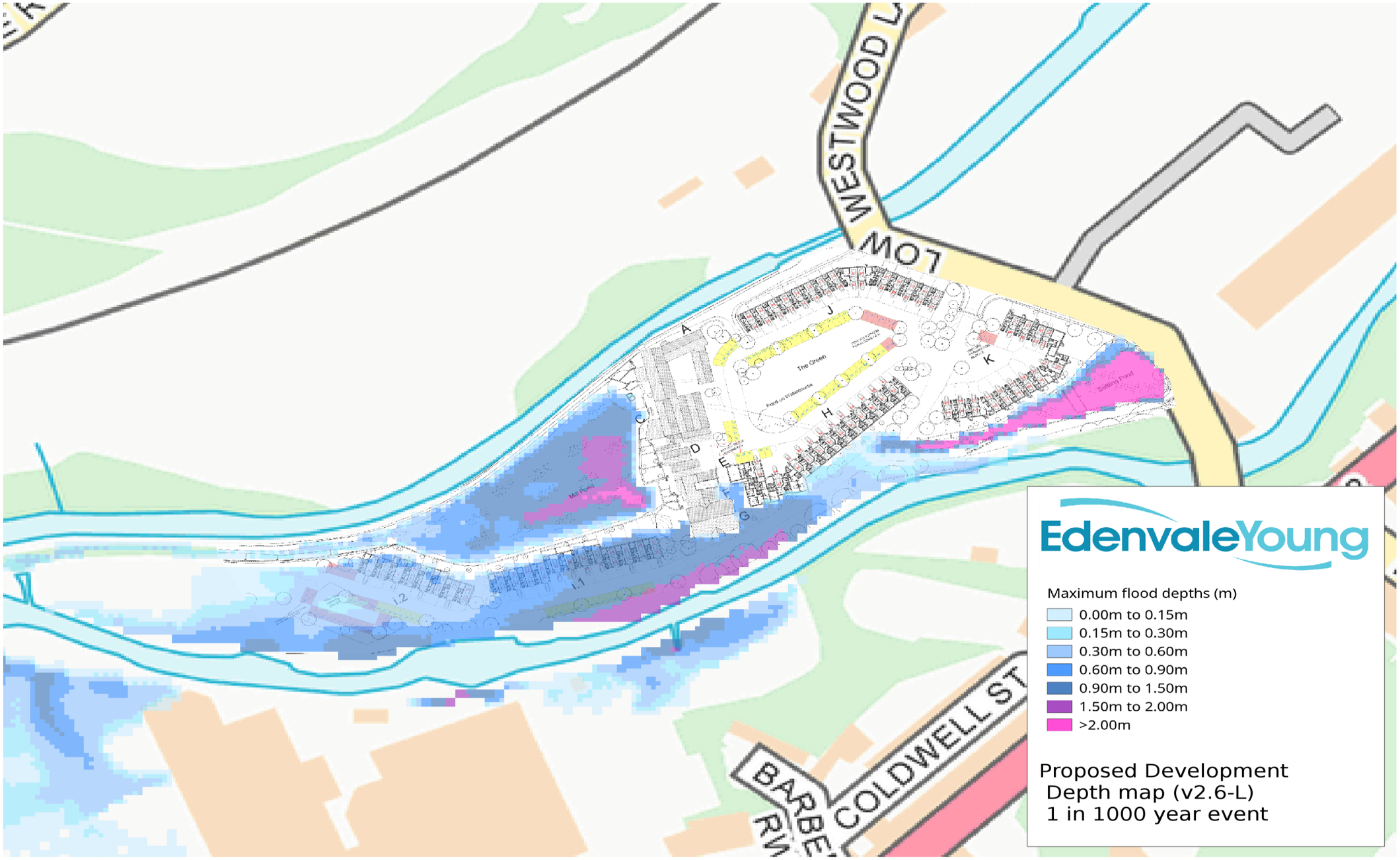

Figure 14 : Post -development Scenario: Maximum Modelled Flood Depths for the 1 in 1000 year return period

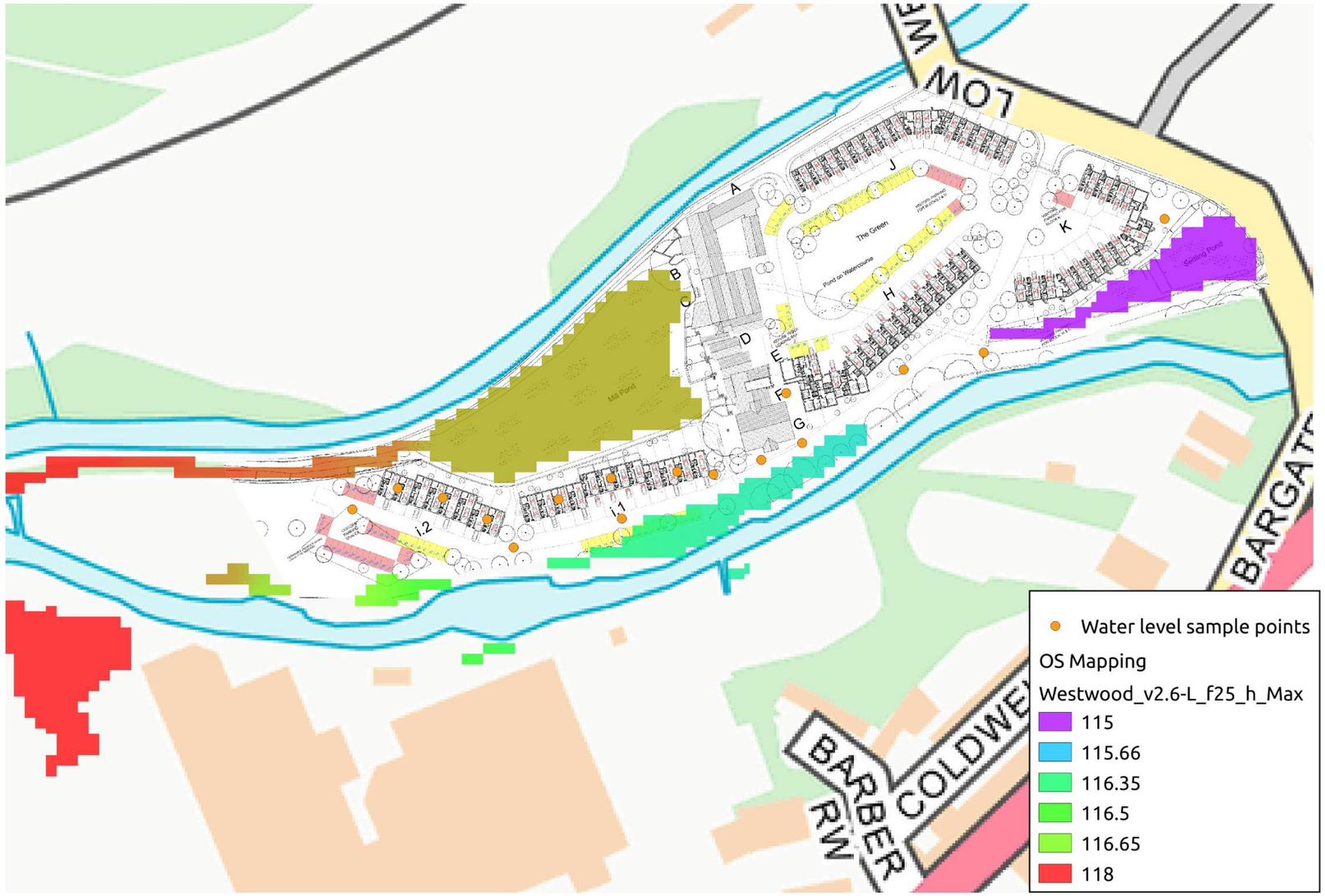

Figure 15: Post -development Scenario: Maximum Modelled Flood Level for the 1 in 25 year return period

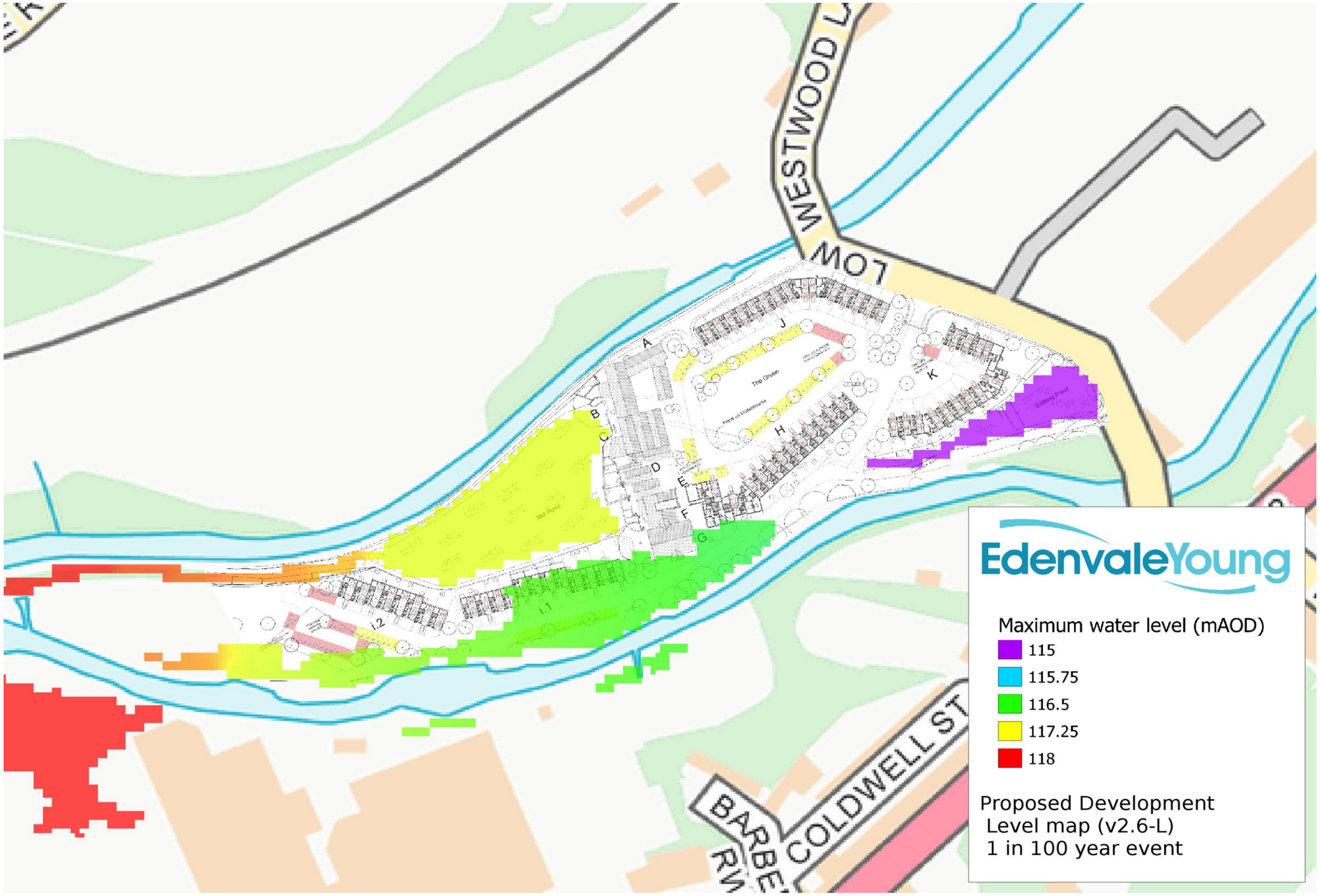

Figure 16: Post -development Scenario: Maximum Modelled Flood Level for the 1 in 100 year return period

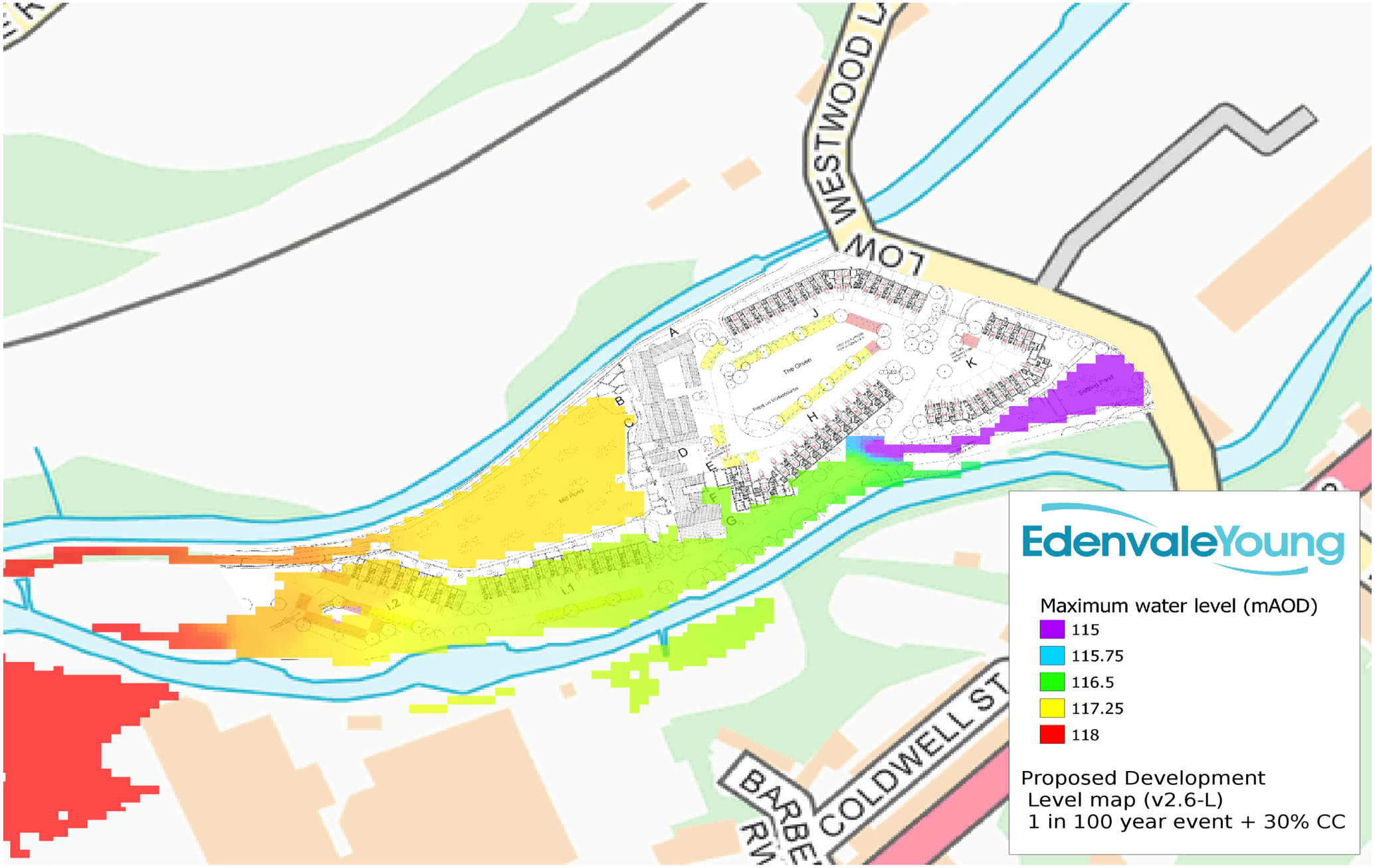

Figure 17: Post -development Scenario: Maximum Modelled Flood Level for the 1 in 100 year return period plus 30% allowance for climate change

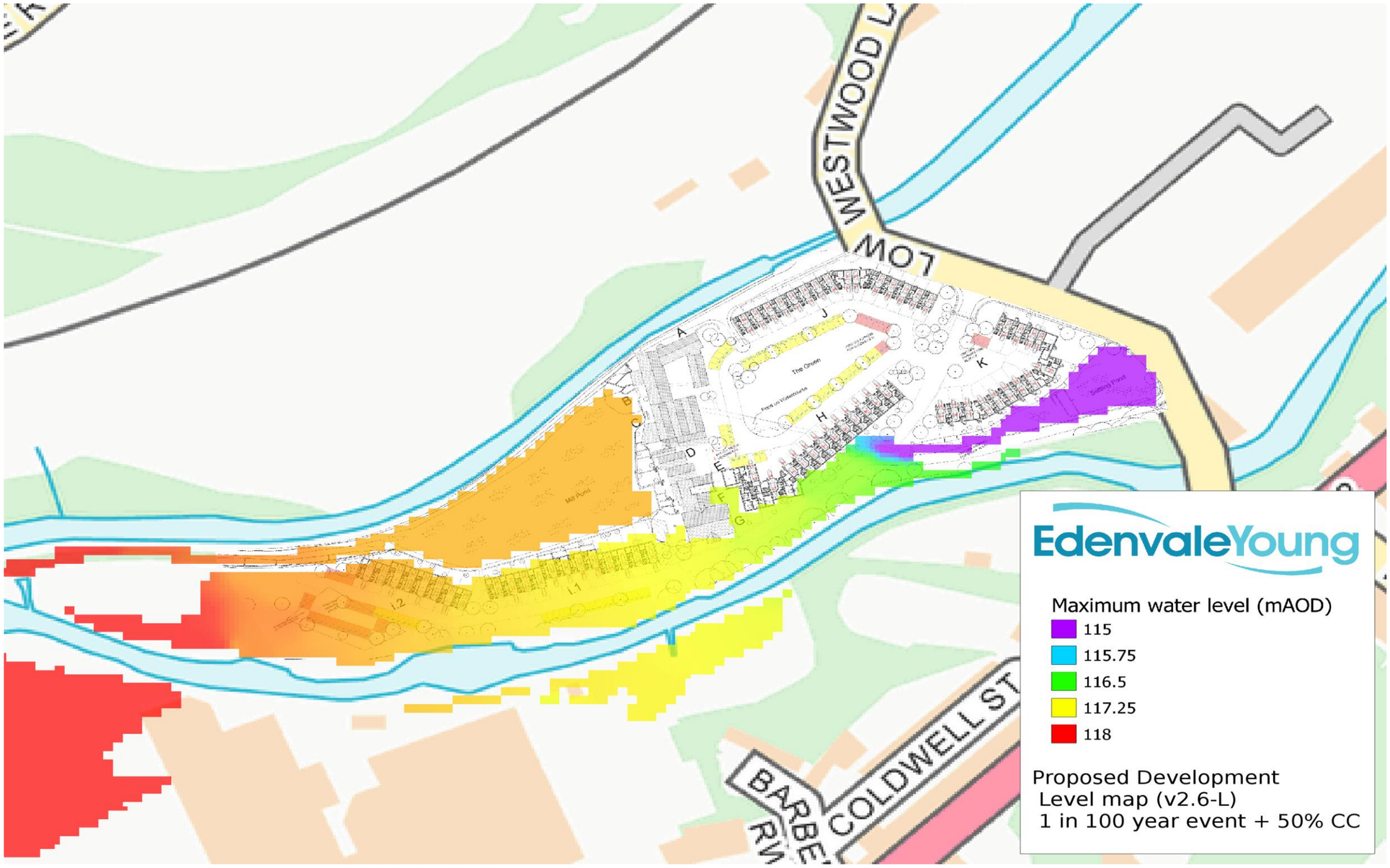

Figure 18: Post -development Scenario: Maximum Modelled Flood Level for the 1 in 100 year return period plus 50% allowance for climate change

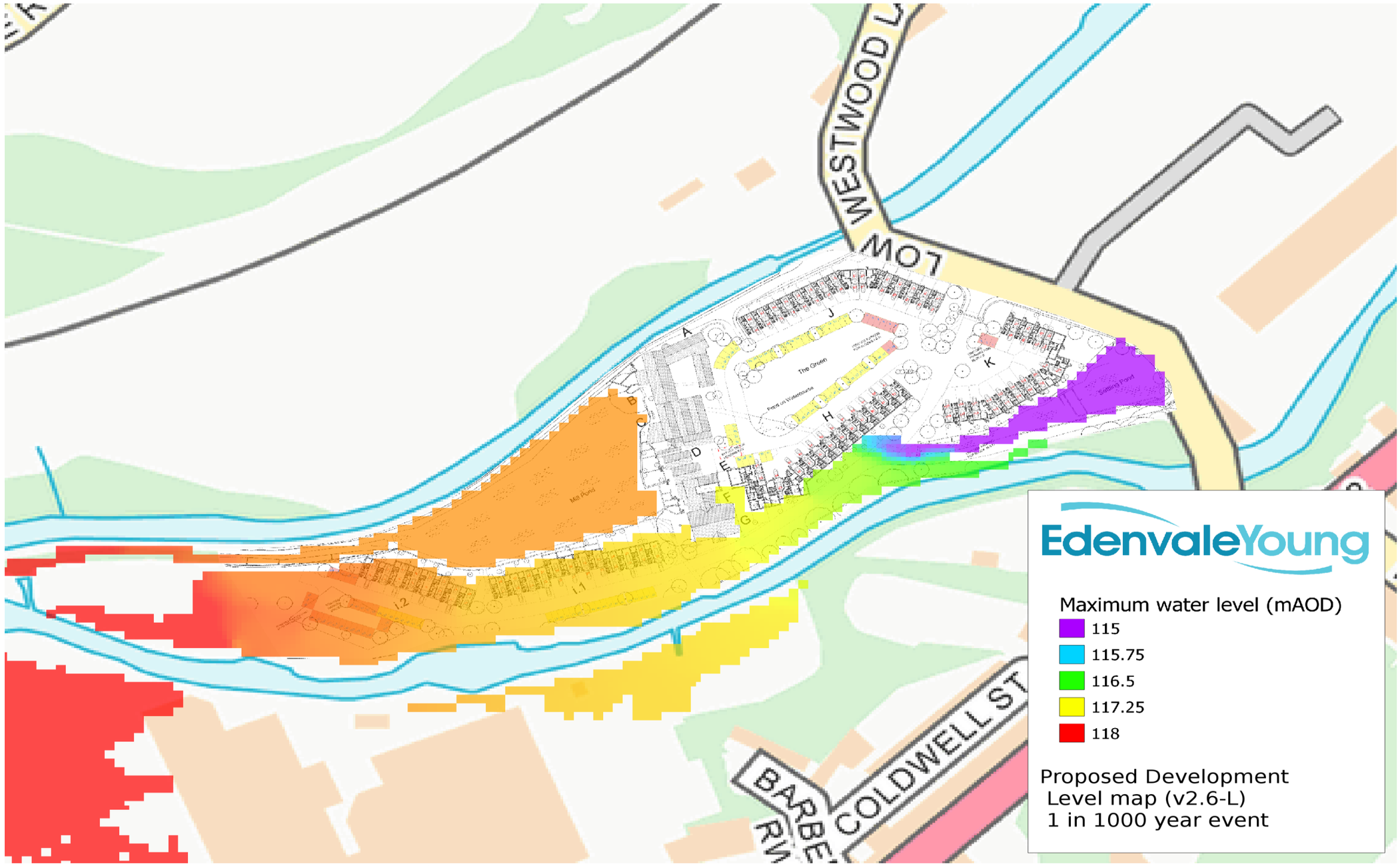

Figure 19: Post -development Scenario: Maximum Modelled Flood Level for the 1 in 1000 year return period

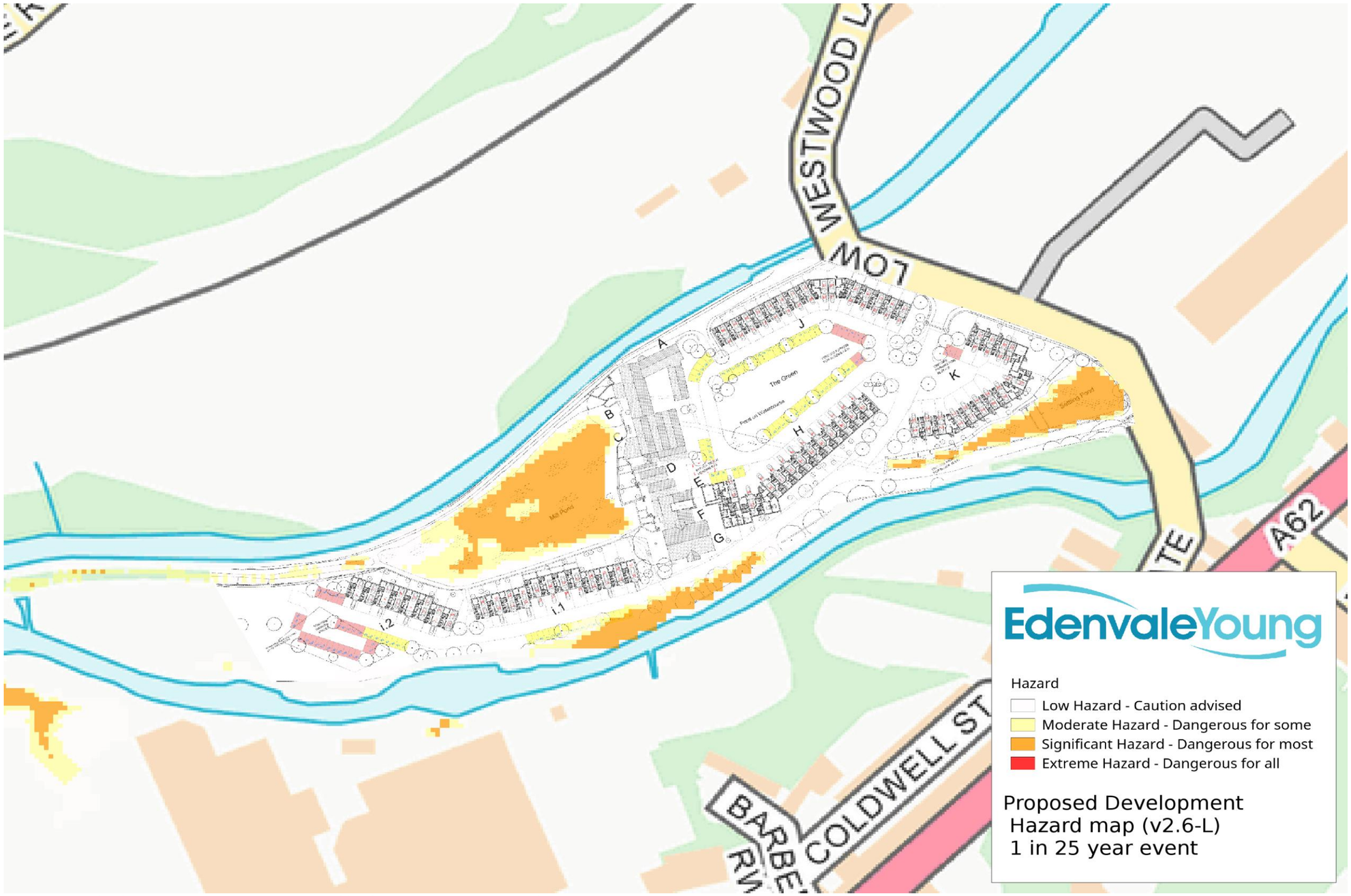

Figure 20: Post -development Scenario: Maximum Hazard for the 1 in 25 year return period

Figure 21: Post -development Scenario: Maximum Hazard for the 1 in 100 year return period

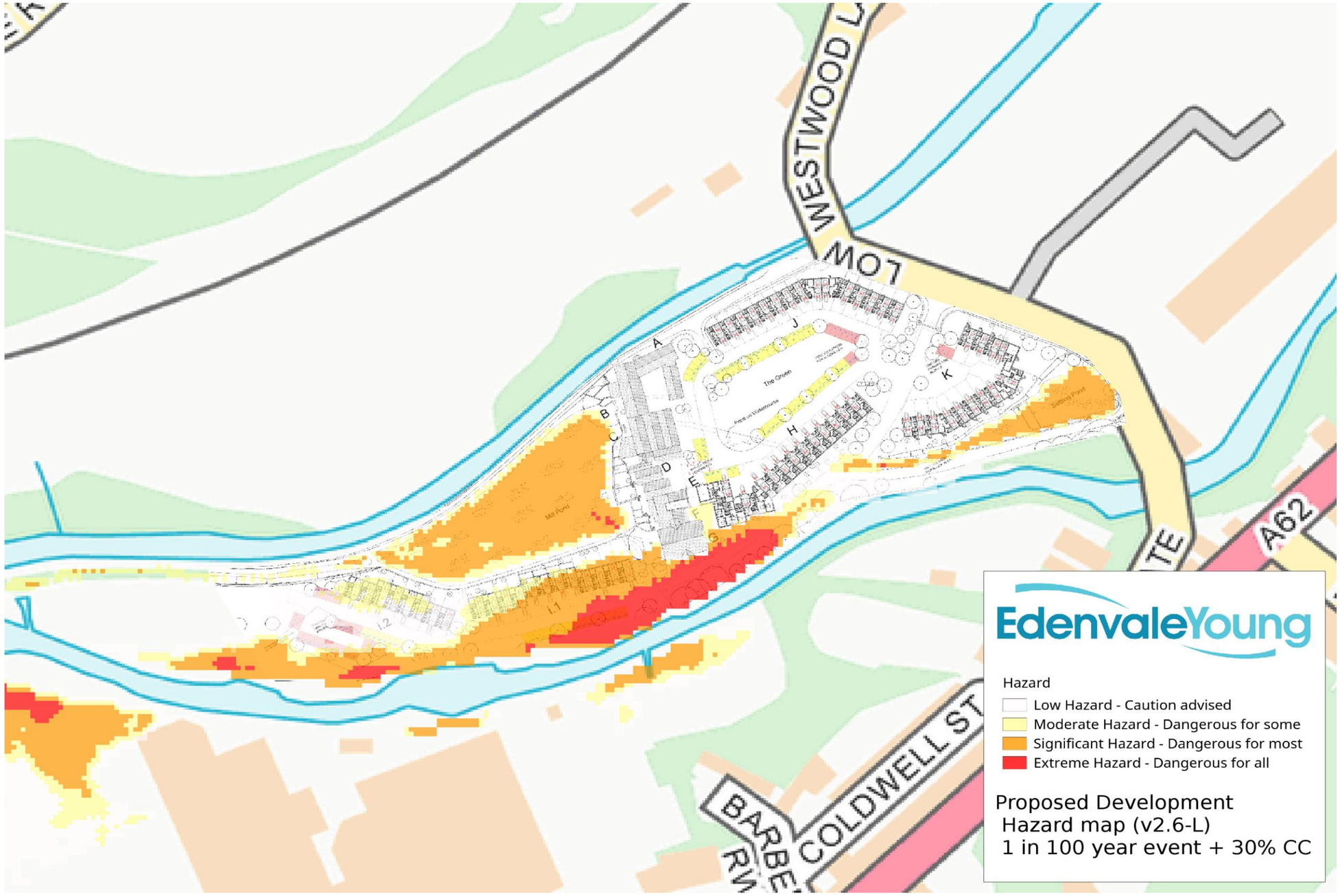

Figure 22: Post -development Scenario: Maximum Hazard for the 1 in 100 year return period plus 30% allowance for climate change

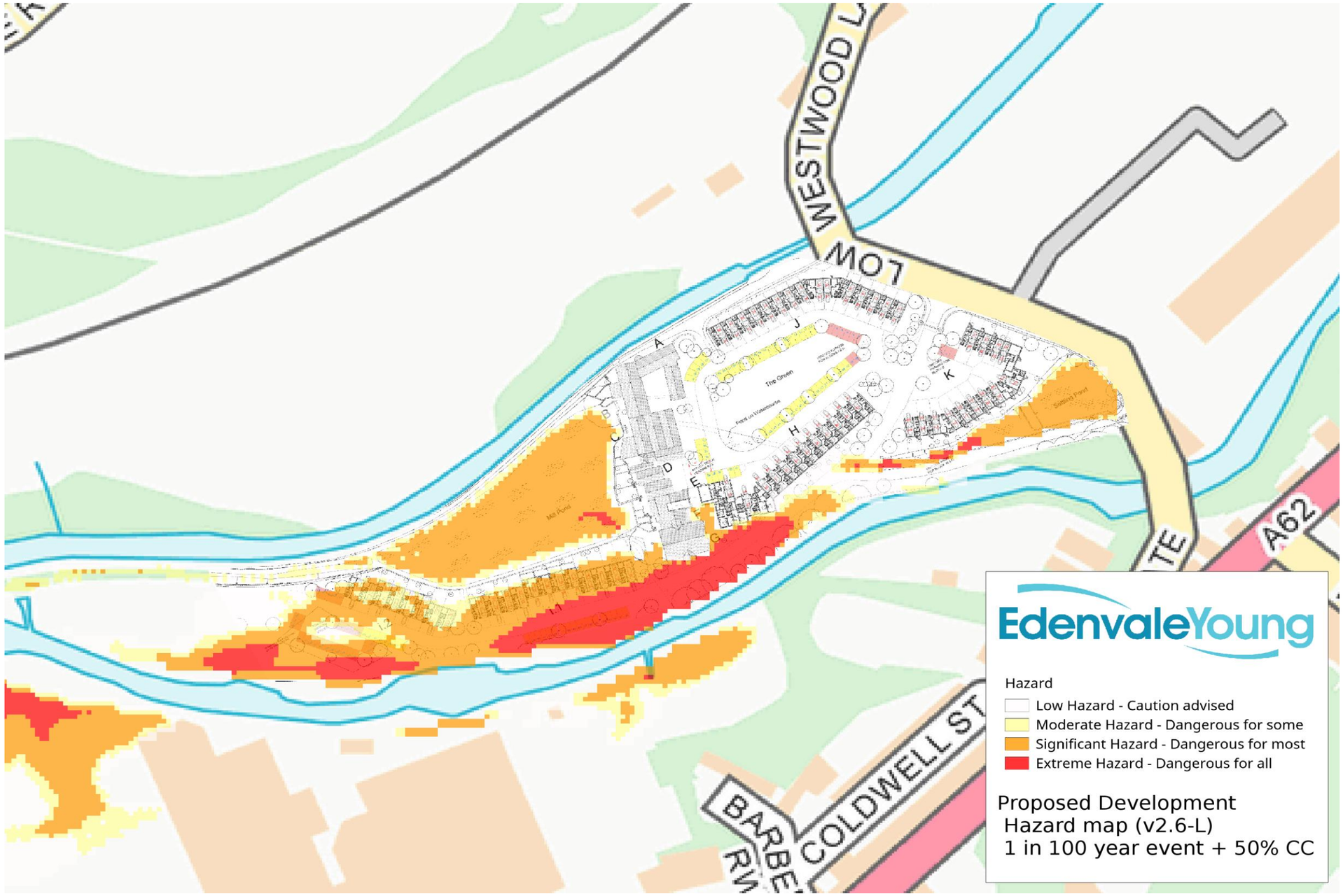

Figure 23: Post -development Scenario: Maximum Hazard for the 1 in 100 year return period plus 50% allowance for climate change

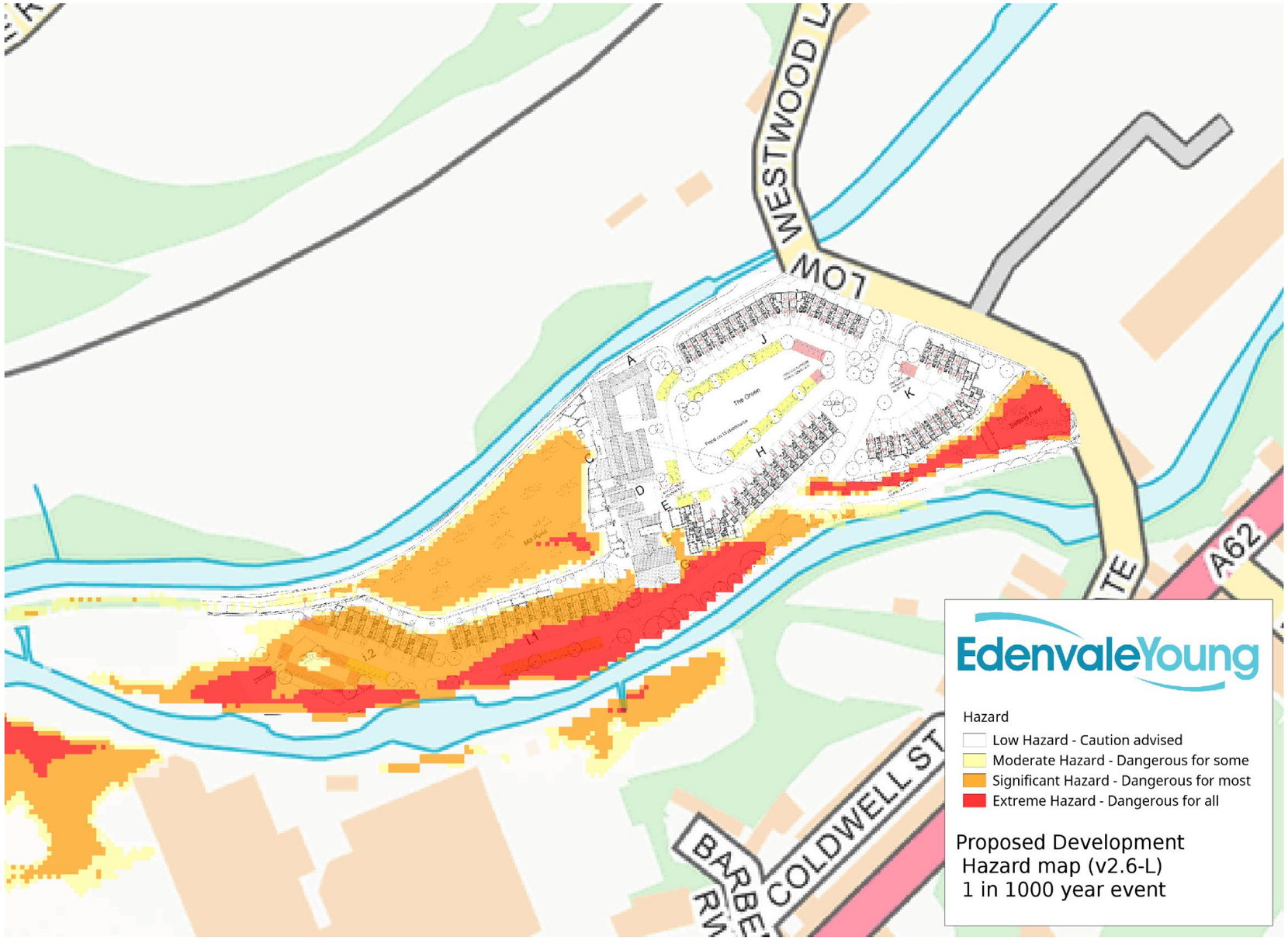

Figure 24: Post -development Scenario: Maximum Hazard for the 1 in 1000 year return period

Figure 25: Difference map for the 1 in 100 year plus 30% climate change return period