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# Oxford FAS – Western Conveyance Channel Review

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| **DATE:** | August 05, 2022 – Revision 15 |
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## 1. Introduction & Background

The design for the Oxford Flood Alleviation scheme is based on creating a new wide and shallow two stage channel through the floodplain to the west of Oxford, with improvements to the conveyance of existing channels along with new raised defences and control structures.

This technical note summarises the findings of the investigations of removing the majority of the proposed western conveyance channel whilst retaining the other main elements of the design such as all the key structures.

This note was originally produced in June 2017 to present the findings of this review at the outline design stage of the scheme. Following completion of the detailed design stage a similar review was undertaken to ascertain any changes resulting from the refinement of the scheme during the detailed design stage. This note was then updated in June 2019 to include the detailed design review.

Following the withdrawal of the planning application for the scheme in March 2020 further updates to the hydraulic model have been undertaken to incorporate changes to the proposed scheme in the A423 Southern Bypass area and also incorporate the latest climate change guidance published by the Environment Agency in July 2021 for Estimating Peak River Flow Climate Change Allowances by Management Catchment. Reference Peak river flow climate change allowances by management catchment - GOV.UK (www.gov.uk).

Following these updates to the model, the potential opportunity for removal of the channel from the scheme was investigated again and is reported in this note. Section 2 summarises these recent investigations using the latest 2021 model. These investigations build on the previous reviews using the latest model. The changes and updates to the model and hydrology have been reviewed by an independent third-party specialist consultant to ensure best practice was utilised to simulating the scheme within the model.

Information on the previous investigations has been removed from this note as the models used and hence the results are superseded by latest modelling and in the interests of simplifying the information presented. Details of the results of the previous investigation are available in earlier revisions of this note.

Revision 15 of this note has been issued following separate work undertaken by the Environment Agency to update the scheme costs and benefits in line with the current economic situation and to consider the impact inflation may have prior to start of construction. The economic analysis has been updated to reflect these new figures.

# 2. Scenarios tested

Based on the findings of the previous modelling reported in earlier revisions of this note the detailed design for the scheme was progressed with the full channel included. Following the updates to the model and hydrology in 2021 the possibility of omitting sections of the proposed channel works was tested again.

The following scenarios were tested and compared to the existing and the detailed design conditions:

- Scenario A1 – North Hinksey Meadow section removed: represents the detailed design option with only the removal of the proposed second stage channel between the National Grid Pylon 200m downstream of Botley Road and Willow Walk.

- Scenario A2 - No Channel: represents removal of the proposed channel between Seacourt Stream to Old Abingdon Road. The proposed works on Seacourt Stream down to the National Grid Pylon 200m downstream of Botley Road and south of Old Abiningdon Road are retained.

For this review a full suite of flood return periods were used to give a full understanding of the changes across a range of predicted flood events.

The elements of the preferred option from the detailed design which have been retained for the scenarios tested are detailed in Figure 1 overleaf and listed below. These include the proposed Osney Mead defence and the temporary defences at Osney Island and New Hinksey.

The following elements of the detailed design were retained in all scenarios tested;

1. All raised defences (upstream of Botley Road, New Hinksey and South Hinksey). The defences do not include the freeboard allowance and are set at 1% AEP flood level for consistency with the modelling of other options for economic assessment.
2. Channel improvements on Seacourt Stream upstream and extending 200m downstream of Botley Road (including the new West Way Cycle Bridge).
3. New bridge at Willow Walk (bed level as existing ground levels (i.e. no channel), soffit level 57.12m (as per detailed design including freeboard allowance).
4. Control structure on Eastwyke Ditch.
5. New bridge at Devils backbone (bed level as existing ground levels (i.e. no channel), soffit level 56.92m (as per detailed design including freeboard allowance).
6. Network Rail culvert.
7. New bridges under Old Abingdon Road and Kennington Road.
8. Network Rail clearance of Stroud's Bridge.
9. Enlarged channels under A423 bypass.
10. Clearance of Munday's Bridge.
11. New bridge on North Hinksey Causeway (not retained for Scenario A2)
12. Osney Mead Defence.
13. Temporary defences mobilised to Osney Island and New Hinksey.
14. Bank raised to block channel up to 1 in 100-year level at Redbridge Stream (between railways).

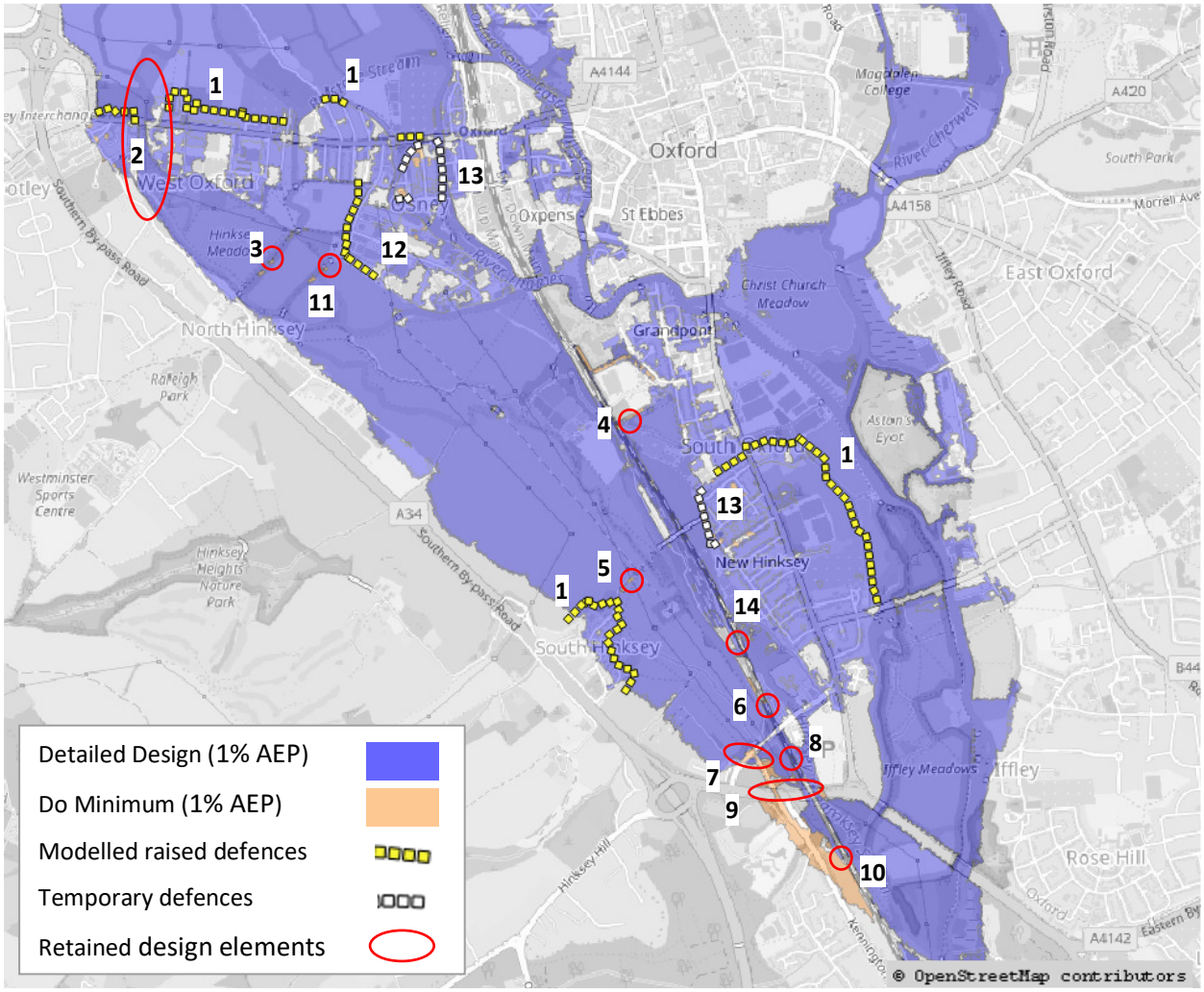


**Figure 1: Design elements retained for all scenarios tested**

The scenarios have been tested for the whole range of return period events to review the impact on peak flood levels compared to the preferred option from the detailed design stage.

The runs also include the mobilisation of temporary defences to Osney Island and New Hinksey for all flood events over the entire 100-year design life of the proposed scheme.

# 3. Results

The results of each of the scenarios are presented in a tabular form in Table 1 (20% Annual Exceedance Probability event (AEP), Table 2 (5% AEP), Table 3 (2% AEP) and Table 4 (1% AEP). The 1% AEP+30% climate change scenario is not assessed as this exceeds the design standard for the scheme and all scenarios would show extensive flooding across the area. The change in peak water levels for each scenario compared to the Detailed Design Preferred Option (referred to as the 'Base' scenario) are presented in the tables. For comparison purposes the existing situation pre-scheme modelled peak water levels are also provided in the tables, these appear in the 'Do Min' column.

The tables also include the 1D river channel flows which are shown on the right-hand side of the table for the various scenarios to indicate how the flow splits have changed. Locations of interest are detailed in Figure 2 and flagged in the far-left column of the tables.

Figures 3 (20% AEP), 4 (5% AEP), 5 (2% AEP) and 6 (1% AEP) show predicted flood maps with the maximum flood extents for each scenario plotted (red and green areas plus the blue areas of the flood maps) and compared to the detailed design preferred option (blue areas of the flood maps).

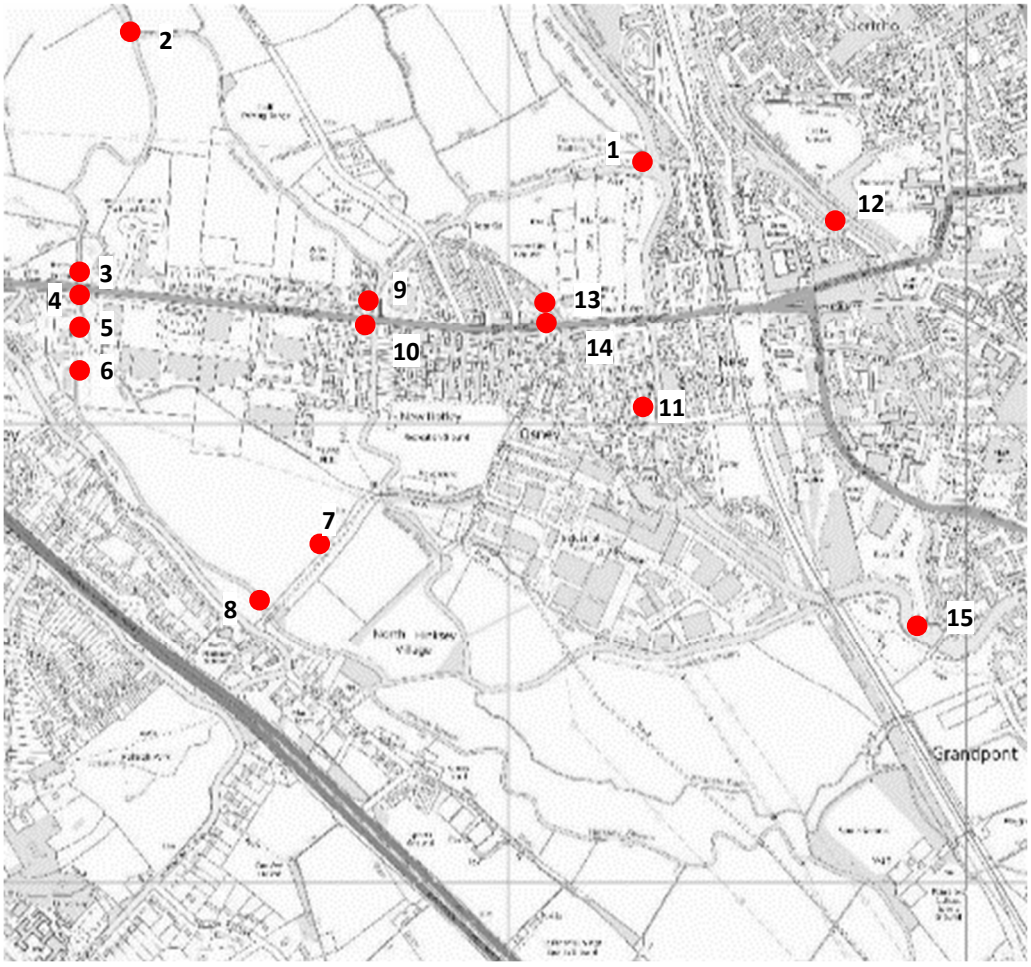


**Figure 2: Reporting locations used in Tables 1 to 4, continued overleaf**

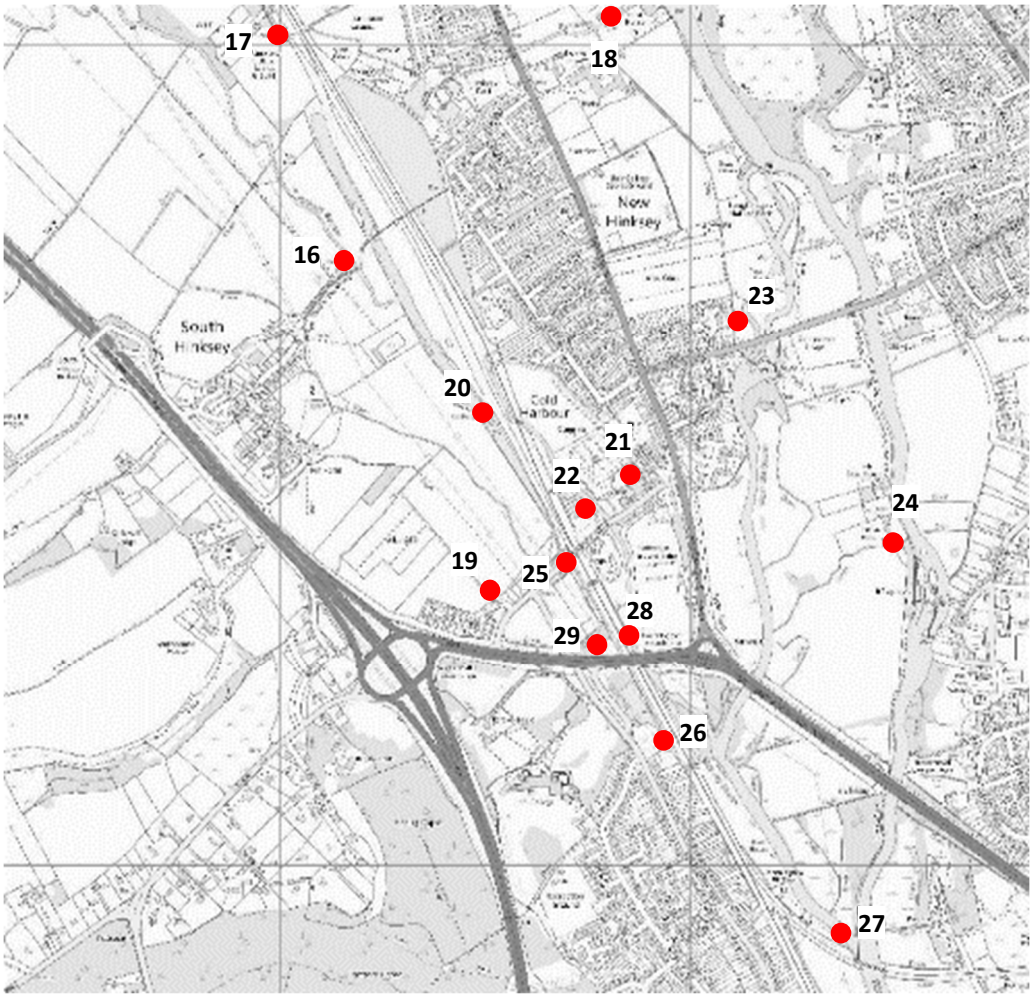


**Figure 2 continued: Reporting locations used in Tables 1 to 4**

**Table 1: 20% AEP event, peak water levels, differences and 1D flows, compared to detailed design preferred option (Base scenario)**

| | Location | Peak Water Level (mAOD) | | | | Water Level diff (m) | | Peak flows ($m^3/s$) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Do Min | Base | A1 | A2 | A1 | A2 | Base | A1 | A2 |
| | Godstow Weir U/S | 58.25 | 58.25 | 58.25 | 58.25 | 0.00 | 0.00 | 54.2 | 54.2 | 54.2 |
| | Thames adjacent to Binsey | 57.61 | 57.61 | 57.61 | 57.62 | 0.00 | 0.01 | 66.0 | 66.0 | 66.0 |
| | Thames at Cherwell conf | 55.75 | 55.64 | 55.64 | 55.71 | 0.00 | 0.07 | 117.8 | 118.0 | 126.4 |
| 1 | Thames at Bulstake Stream | 57.22 | 57.14 | 57.15 | 57.17 | 0.01 | 0.03 | 61.0 | 60.6 | 60.0 |
| | Seacourt S D/S Thames | 59.60 | 59.60 | 59.60 | 59.60 | 0.00 | 0.00 | 8.5 | 8.5 | 8.5 |
| | Seacourt Stream A34 | 57.67 | 57.65 | 57.65 | 57.66 | 0.00 | 0.01 | 43.6 | 43.6 | 43.6 |
| 2 | Seacourt S/Botley Stream | 57.23 | 57.02 | 57.08 | 57.11 | 0.06 | 0.09 | 17.3 | 15.8 | 15.7 |
| 3 | Seacourt S - Botley Rd U/S | 57.14 | 56.79 | 56.98 | 57.02 | 0.19 | 0.23 | 42.9 | 38.2 | 38.8 |
| 4 | Seacourt S - Botley Rd D/S | 57.12 | 56.71 | 56.93 | 56.97 | 0.22 | 0.26 | 42.9 | 38.2 | 38.8 |
| 5 | Seacourt Stream - New Bridge | 56.99 | 56.64 | 56.90 | 56.94 | 0.26 | 0.30 | 42.9 | 37.7 | 38.1 |
| 6 | Seacourt S - spillway u/s pylon | 56.83 | 56.54 | 56.87 | 56.91 | 0.33 | 0.37 | 42.9 | 32.9 | 32.7 |
| 7 | New Willow Walk Bridge | #N/A | 56.20 | 56.19 | #N/A | -0.01 | #N/A | 35.9 | 32.5 | #N/A |
| 8 | Willow Walk Bridge | 56.60 | 56.26 | 56.26 | 56.54 | 0.00 | 0.28 | 12.1 | 12.2 | 22.5 |
| 9 | Bulstake S - Botley Road U/S | 57.02 | 56.80 | 56.87 | 56.92 | 0.07 | 0.12 | 32.9 | 36.3 | 35.9 |
| 10 | Bulstake S - Botley Road D/S | 56.99 | 56.78 | 56.84 | 56.89 | 0.06 | 0.11 | 32.9 | 36.3 | 35.9 |
| 11 | Thames - Osney US | 56.77 | 56.66 | 56.67 | 56.71 | 0.01 | 0.05 | 43.3 | 43.2 | 42.2 |
| 12 | Castle Mill Stream | 57.19 | 57.11 | 57.12 | 57.14 | 0.01 | 0.03 | 11.9 | 12.0 | 12.0 |
| 13 | Osney Ditch - Botley Road U/S | 57.08 | 56.81 | 56.88 | 56.94 | 0.07 | 0.13 | 12.0 | 12.9 | 13.0 |
| 14 | Osney Ditch - Botley Road D/S | 56.88 | 56.69 | 56.74 | 56.77 | 0.05 | 0.08 | 12.0 | 12.9 | 12.9 |
| 15 | Thames - Osney DS | 56.03 | 55.87 | 55.88 | 55.98 | 0.01 | 0.11 | 78.3 | 78.3 | 88.0 |
| 16 | Devils Backbone | 56.06 | 55.78 | 55.78 | 55.92 | 0.00 | 0.14 | 19.1 | 19.1 | 24.4 |
| 20 | Hinksey Str - Railway Br U/S | 55.97 | 55.62 | 55.62 | 55.61 | 0.00 | -0.01 | 13.5 | 13.5 | 13.1 |
| | Hinksey Str - Railway Br D/S | 55.91 | 55.59 | 55.59 | 55.58 | 0.00 | -0.01 | 13.5 | 13.5 | 13.1 |
| 21 | Redbridge S - Abingdon Rd u/s | 55.70 | 55.19 | 55.19 | 55.18 | 0.00 | -0.01 | 0.1 | 0.1 | 0.0 |
| | Redbridge S - Abingdon Rd d/s | 55.53 | 55.19 | 55.19 | 55.18 | 0.00 | -0.01 | 0.1 | 0.1 | 0.0 |
| 22 | Mayweed Br - Abingdon Rd u/s | 55.82 | 55.48 | 55.48 | 55.47 | 0.00 | -0.01 | 22.3 | 22.3 | 22.4 |
| | Mayweed Br - Abingdon Rd d/s | 55.53 | 55.21 | 55.21 | 55.21 | 0.00 | 0.00 | 22.3 | 22.3 | 22.4 |
| | Hinksey Dr - Abingdon Rd U/S | 55.92 | 55.53 | 55.53 | 55.49 | 0.00 | -0.04 | 8.8 | 8.8 | 13.1 |
| | Hinksey Dr - Abingdon Rd D/S | 55.75 | 55.48 | 55.48 | 55.37 | 0.00 | -0.11 | 8.8 | 8.8 | 13.1 |
| 25 | Stroud's Bridge U/S | 55.58 | 55.35 | 55.35 | 55.25 | 0.00 | -0.10 | 8.7 | 8.6 | 7.0 |
| | Stroud's Bridge D/S | 55.48 | 55.29 | 55.29 | 55.21 | 0.00 | -0.08 | 8.7 | 8.6 | 7.0 |
| 26 | Mundays Bridge U/S | 55.00 | 55.01 | 55.01 | 55.00 | 0.00 | -0.01 | 36.9 | 37.1 | 29.6 |
| | Mundays Bridge D/S | 55.00 | 55.01 | 55.01 | 55.00 | 0.00 | -0.01 | 36.9 | 37.1 | 29.6 |
| 28 | Hinksey Stream A423 Bypass | 55.21 | 55.03 | 55.03 | 55.02 | 0.00 | -0.01 | 33.0 | 32.9 | 31.0 |
| 29 | Hinksey ditch A423 Bypass | 55.25 | 55.25 | 55.25 | 55.16 | 0.00 | -0.09 | 38.0 | 38.1 | 30.4 |
| 23 | Weirs MS - Donnington Br D/S | 55.18 | 55.13 | 55.13 | 55.16 | 0.00 | 0.03 | 64.2 | 64.3 | 69.8 |
| | Weirs Mill Stream | 55.09 | 55.06 | 55.06 | 55.07 | 0.00 | 0.01 | 52.2 | 52.3 | 56.2 |
| 18 | Eastwyke_Ditch | 55.76 | 55.63 | 55.63 | 55.70 | 0.00 | 0.07 | 0.5 | 0.5 | 1.2 |
| 17 | Eastwyke_Ditch - Railway | 56.09 | 55.96 | 55.96 | 56.08 | 0.00 | 0.12 | 0.0 | 0.0 | 0.1 |
| 24 | Thames - Iffley Lock U/S | 55.37 | 55.29 | 55.29 | 55.34 | 0.00 | 0.05 | 63.7 | 63.8 | 67.9 |
| | Thames - Iffley Lock D/S | 55.06 | 55.03 | 55.03 | 55.05 | 0.00 | 0.02 | 64.2 | 64.3 | 68.8 |
| 27 | Thames - Railway | 54.66 | 54.66 | 54.66 | 54.66 | 0.00 | 0.00 | 178.5 | 178.8 | 179.1 |
| | Thames - Rose Isle | 53.71 | 53.71 | 53.71 | 53.71 | 0.00 | 0.00 | 172.0 | 172.1 | 172.3 |
| | Thames - Sandford Weir U/S | 54.31 | 54.31 | 54.31 | 54.31 | 0.00 | 0.00 | 86.0 | 86.1 | 86.2 |
| | Thames - Sandford Weir D/S | 53.87 | 53.87 | 53.87 | 53.87 | 0.00 | 0.00 | 156.0 | 156.0 | 156.2 |
| | Thames - Sandford Lock D/S | 53.71 | 53.71 | 53.71 | 53.71 | 0.00 | 0.00 | 174.5 | 174.7 | 175.0 |
| | Thames Outflow | 53.37 | 53.36 | 53.36 | 53.37 | 0.00 | 0.01 | 200.7 | 201.0 | 201.5 |
| 19 | New Abingdon Road Channel | #N/A | 55.54 | 55.54 | 55.35 | 0.00 | -0.19 | 34.2 | 34.4 | 18.4 |
| | Hinksey Ditch | 55.17 | 55.22 | 55.22 | 55.14 | 0.00 | -0.08 | 34.8 | 35.0 | 28.2 |
| | Redbridge Brook | 55.78 | 55.19 | 55.19 | 55.18 | 0.00 | -0.01 | 0.0 | 0.0 | 0.0 |

**Table 2: 5% AEP event, peak water levels, differences and 1D flows, compared to detailed design preferred option (Base scenario)**

| | Location | Peak Water Level (mAOD) | | | | Water Level diff (m) | | Peak flows ($m^3/s$) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Do Min | Base | A1 | A2 | A1 | A2 | Base | A1 | A2 |
| | Godstow Weir U/S | 58.39 | 58.39 | 58.39 | 58.39 | 0.00 | 0.00 | 58.2 | 58.2 | 58.2 |
| | Thames adjacent to Binsey | 57.73 | 57.70 | 57.71 | 57.71 | 0.01 | 0.01 | 71.8 | 71.4 | 71.1 |
| | Thames at Cherwell conf | 55.98 | 55.89 | 55.89 | 55.92 | 0.00 | 0.03 | 140.9 | 140.9 | 146.2 |
| 1 | Thames at Bulstake Stream | 57.40 | 57.27 | 57.32 | 57.34 | 0.05 | 0.07 | 61.3 | 60.8 | 60.3 |
| | Seacourt S D/S Thames | 59.67 | 59.67 | 59.67 | 59.67 | 0.00 | 0.00 | 8.5 | 8.5 | 8.5 |
| | Seacourt Stream A34 | 57.81 | 57.80 | 57.80 | 57.80 | 0.00 | 0.00 | 59.4 | 59.4 | 59.4 |
| 2 | Seacourt S/Botley Stream | 57.44 | 57.28 | 57.34 | 57.36 | 0.06 | 0.08 | 17.4 | 15.8 | 15.7 |
| 3 | Seacourt S - Botley Rd U/S | 57.34 | 57.14 | 57.25 | 57.28 | 0.11 | 0.14 | 63.2 | 55.9 | 55.4 |
| 4 | Seacourt S - Botley Rd D/S | 57.31 | 56.99 | 57.13 | 57.17 | 0.14 | 0.18 | 63.2 | 55.9 | 55.4 |
| 5 | Seacourt Stream - New Bridge | 57.17 | 56.91 | 57.10 | 57.14 | 0.19 | 0.23 | 62.4 | 54.4 | 53.7 |
| 6 | Seacourt S - spillway u/s pylon | 56.97 | 56.76 | 57.05 | 57.09 | 0.29 | 0.33 | 61.3 | 44.8 | 43.8 |
| 7 | New Willow Walk Bridge | #N/A | 56.50 | 56.48 | #N/A | -0.02 | #N/A | 51.9 | 48.4 | #N/A |
| 8 | Willow Walk Bridge | 56.76 | 56.54 | 56.52 | 56.73 | -0.02 | 0.19 | 21.1 | 20.2 | 29.7 |
| 9 | Bulstake S - Botley Road U/S | 57.22 | 57.06 | 57.10 | 57.15 | 0.04 | 0.09 | 46.6 | 50.5 | 50.0 |
| 10 | Bulstake S - Botley Road D/S | 57.16 | 57.01 | 57.05 | 57.10 | 0.04 | 0.09 | 46.6 | 50.5 | 50.0 |
| 11 | Thames - Osney US | 56.96 | 56.83 | 56.86 | 56.88 | 0.03 | 0.05 | 43.3 | 44.8 | 45.3 |
| 12 | Castle Mill Stream | 57.37 | 57.24 | 57.29 | 57.31 | 0.05 | 0.07 | 13.0 | 13.5 | 13.7 |
| 13 | Osney Ditch - Botley Road U/S | 57.33 | 57.15 | 57.21 | 57.24 | 0.06 | 0.09 | 15.2 | 16.0 | 16.2 |
| 14 | Osney Ditch - Botley Road D/S | 57.10 | 56.93 | 56.96 | 56.99 | 0.03 | 0.06 | 15.2 | 16.0 | 16.2 |
| 15 | Thames - Osney DS | 56.29 | 56.15 | 56.15 | 56.20 | 0.00 | 0.05 | 94.2 | 94.3 | 101.6 |
| 16 | Devils Backbone | 56.37 | 56.16 | 56.15 | 56.20 | -0.01 | 0.04 | 19.9 | 19.9 | 24.6 |
| 20 | Hinksey Str - Railway Br U/S | 56.33 | 56.04 | 56.04 | 56.01 | 0.00 | -0.03 | 19.0 | 18.9 | 17.7 |
| | Hinksey Str - Railway Br D/S | 56.21 | 55.97 | 55.97 | 55.96 | 0.00 | -0.01 | 18.3 | 18.3 | 17.7 |
| 21 | Redbridge S - Abingdon Rd u/s | 56.02 | 55.44 | 55.43 | 55.43 | -0.01 | -0.01 | 0.1 | 0.1 | 0.1 |
| | Redbridge S - Abingdon Rd d/s | 55.77 | 55.44 | 55.43 | 55.43 | -0.01 | -0.01 | 0.1 | 0.1 | 0.1 |
| 22 | Mayweed Br - Abingdon Rd u/s | 56.14 | 55.90 | 55.89 | 55.88 | -0.01 | -0.02 | 29.4 | 29.4 | 29.2 |
| | Mayweed Br - Abingdon Rd d/s | 55.74 | 55.47 | 55.46 | 55.46 | -0.01 | -0.01 | 29.4 | 29.4 | 29.2 |
| | Hinksey Dr - Abingdon Rd U/S | 56.28 | 55.97 | 55.96 | 55.92 | -0.01 | -0.05 | 13.1 | 13.0 | 15.4 |
| | Hinksey Dr - Abingdon Rd D/S | 55.99 | 55.86 | 55.86 | 55.77 | 0.00 | -0.09 | 13.1 | 13.0 | 15.4 |
| 25 | Stroud's Bridge U/S | 55.82 | 55.72 | 55.72 | 55.64 | 0.00 | -0.08 | 13.5 | 13.4 | 12.0 |
| | Stroud's Bridge D/S | 55.68 | 55.56 | 55.56 | 55.51 | 0.00 | -0.05 | 13.5 | 13.4 | 12.0 |
| 26 | Mundays Bridge U/S | 55.23 | 55.28 | 55.28 | 55.26 | 0.00 | -0.02 | 49.8 | 49.7 | 44.9 |
| | Mundays Bridge D/S | 55.20 | 55.22 | 55.21 | 55.21 | -0.01 | -0.01 | 49.8 | 49.7 | 44.9 |
| 28 | Hinksey Stream A423 Bypass | 55.39 | 55.25 | 55.25 | 55.24 | 0.00 | -0.01 | 45.4 | 45.2 | 43.6 |
| 29 | Hinksey ditch A423 Bypass | 55.50 | 55.60 | 55.60 | 55.53 | 0.00 | -0.07 | 51.1 | 51.0 | 46.1 |
| 23 | Weirs MS - Donnington Br D/S | 55.43 | 55.35 | 55.35 | 55.37 | 0.00 | 0.02 | 81.6 | 81.6 | 84.5 |
| | Weirs Mill Stream | 55.34 | 55.29 | 55.29 | 55.29 | 0.00 | 0.00 | 58.6 | 58.6 | 60.7 |
| 18 | Eastwyke_Ditch | 55.99 | 55.89 | 55.89 | 55.93 | 0.00 | 0.04 | 4.1 | 4.1 | 4.7 |
| 17 | Eastwyke_Ditch - Railway | 56.32 | 56.23 | 56.23 | 56.29 | 0.00 | 0.06 | 0.0 | 0.0 | 0.1 |
| 24 | Thames - Iffley Lock U/S | 55.63 | 55.55 | 55.55 | 55.57 | 0.00 | 0.02 | 71.2 | 71.2 | 73.3 |
| | Thames - Iffley Lock D/S | 55.32 | 55.28 | 55.27 | 55.28 | -0.01 | 0.00 | 72.9 | 72.9 | 75.1 |
| 27 | Thames - Railway | 54.81 | 54.81 | 54.81 | 54.81 | 0.00 | 0.00 | 215.6 | 215.3 | 215.4 |
| | Thames - Rose Isle | 53.99 | 53.99 | 53.99 | 53.99 | 0.00 | 0.00 | 196.5 | 196.4 | 196.4 |
| | Thames - Sandford Weir U/S | 54.46 | 54.46 | 54.45 | 54.45 | -0.01 | -0.01 | 93.6 | 93.5 | 93.5 |
| | Thames - Sandford Weir D/S | 54.16 | 54.16 | 54.16 | 54.16 | 0.00 | 0.00 | 167.2 | 167.2 | 167.2 |
| | Thames - Sandford Lock D/S | 53.99 | 53.99 | 53.99 | 53.99 | 0.00 | 0.00 | 208.0 | 207.7 | 207.8 |
| | Thames Outflow | 53.66 | 53.66 | 53.66 | 53.66 | 0.00 | 0.00 | 255.9 | 255.6 | 255.7 |
| 19 | New Abingdon Road Channel | #N/A | 55.98 | 55.97 | 55.84 | -0.01 | -0.14 | 47.0 | 46.9 | 37.0 |
| | Hinksey Ditch | 55.43 | 55.58 | 55.58 | 55.51 | 0.00 | -0.07 | 45.7 | 45.6 | 41.4 |
| | Redbridge Brook | 56.11 | 55.44 | 55.43 | 55.43 | -0.01 | -0.01 | 0.1 | 0.1 | 0.0 |

**Table 3: 2% AEP event, peak water levels, differences and 1D flows, compared to detailed design preferred option (Base scenario)**

| | Location | Peak Water Level (mAOD) | | | | Water Level diff (m) | | Peak flows ($m^3/s$) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Do Min | Base | A1 | A2 | A1 | A2 | Base | A1 | A2 |
| | Godstow Weir U/S | 58.48 | 58.48 | 58.48 | 58.48 | 0.00 | 0.00 | 61.3 | 61.3 | 61.3 |
| | Thames adjacent to Binsey | 57.82 | 57.78 | 57.79 | 57.80 | 0.01 | 0.02 | 73.8 | 72.9 | 72.4 |
| | Thames at Cherwell conf | 56.08 | 56.01 | 56.01 | 56.03 | 0.00 | 0.02 | 158.0 | 157.9 | 161.8 |
| 1 | Thames at Bulstake Stream | 57.51 | 57.41 | 57.45 | 57.47 | 0.04 | 0.06 | 61.4 | 60.9 | 60.3 |
| | Seacourt S D/S Thames | 59.72 | 59.72 | 59.72 | 59.72 | 0.00 | 0.00 | 8.7 | 8.7 | 8.7 |
| | Seacourt Stream A34 | 57.90 | 57.88 | 57.88 | 57.89 | 0.00 | 0.01 | 69.3 | 69.2 | 69.2 |
| 2 | Seacourt S/Botley Stream | 57.55 | 57.44 | 57.48 | 57.50 | 0.04 | 0.06 | 17.5 | 15.9 | 15.8 |
| 3 | Seacourt S - Botley Rd U/S | 57.45 | 57.31 | 57.38 | 57.41 | 0.07 | 0.10 | 72.4 | 65.5 | 64.6 |
| 4 | Seacourt S - Botley Rd D/S | 57.40 | 57.12 | 57.24 | 57.26 | 0.12 | 0.14 | 72.4 | 65.5 | 64.6 |
| 5 | Seacourt Stream - New Bridge | 57.27 | 57.05 | 57.20 | 57.23 | 0.15 | 0.18 | 70.7 | 62.9 | 61.8 |
| 6 | Seacourt S - spillway u/s pylon | 57.04 | 56.89 | 57.14 | 57.18 | 0.25 | 0.29 | 68.8 | 50.9 | 49.8 |
| 7 | New Willow Walk Bridge | #N/A | 56.65 | 56.64 | #N/A | -0.01 | #N/A | 59.2 | 56.6 | #N/A |
| 8 | Willow Walk Bridge | 56.83 | 56.69 | 56.67 | 56.82 | -0.02 | 0.13 | 25.8 | 25.0 | 30.9 |
| 9 | Bulstake S - Botley Road U/S | 57.32 | 57.20 | 57.24 | 57.26 | 0.04 | 0.06 | 56.2 | 59.5 | 59.4 |
| 10 | Bulstake S - Botley Road D/S | 57.24 | 57.15 | 57.17 | 57.20 | 0.02 | 0.05 | 56.2 | 59.5 | 59.4 |
| 11 | Thames - Osney US | 57.06 | 56.96 | 56.98 | 57.01 | 0.02 | 0.05 | 47.8 | 49.3 | 49.7 |
| 12 | Castle Mill Stream | 57.47 | 57.38 | 57.42 | 57.44 | 0.04 | 0.06 | 14.6 | 15.0 | 15.2 |
| 13 | Osney Ditch - Botley Road U/S | 57.45 | 57.33 | 57.37 | 57.39 | 0.04 | 0.06 | 16.9 | 17.3 | 17.2 |
| 14 | Osney Ditch - Botley Road D/S | 57.22 | 57.05 | 57.08 | 57.10 | 0.03 | 0.05 | 16.9 | 17.3 | 17.2 |
| 15 | Thames - Osney DS | 56.41 | 56.31 | 56.31 | 56.34 | 0.00 | 0.03 | 108.3 | 108.2 | 113.8 |
| 16 | Devils Backbone | 56.50 | 56.36 | 56.35 | 56.37 | -0.01 | 0.01 | 20.0 | 20.0 | 24.7 |
| 20 | Hinksey Str - Railway Br U/S | 56.45 | 56.27 | 56.26 | 56.25 | -0.01 | -0.02 | 19.3 | 19.3 | 19.0 |
| | Hinksey Str - Railway Br D/S | 56.30 | 56.18 | 56.17 | 56.16 | -0.01 | -0.02 | 19.3 | 19.1 | 18.8 |
| 21 | Redbridge S - Abingdon Rd u/s | 56.15 | 55.62 | 55.61 | 55.62 | -0.01 | 0.00 | 1.7 | 1.5 | 1.9 |
| | Redbridge S - Abingdon Rd d/s | 55.86 | 55.59 | 55.59 | 55.59 | 0.00 | 0.00 | 1.7 | 1.5 | 1.9 |
| 22 | Mayweed Br - Abingdon Rd u/s | 56.25 | 56.12 | 56.11 | 56.10 | -0.01 | -0.02 | 32.5 | 32.3 | 32.2 |
| | Mayweed Br - Abingdon Rd d/s | 55.83 | 55.62 | 55.61 | 55.61 | -0.01 | -0.01 | 32.5 | 32.3 | 32.2 |
| | Hinksey Dr - Abingdon Rd U/S | 56.41 | 56.21 | 56.20 | 56.17 | -0.01 | -0.04 | 15.3 | 15.2 | 17.2 |
| | Hinksey Dr - Abingdon Rd D/S | 56.08 | 56.06 | 56.06 | 55.99 | 0.00 | -0.07 | 15.3 | 15.2 | 17.2 |
| 25 | Stroud's Bridge U/S | 55.94 | 55.95 | 55.95 | 55.86 | 0.00 | -0.09 | 16.4 | 16.3 | 14.9 |
| | Stroud's Bridge D/S | 55.78 | 55.71 | 55.70 | 55.66 | -0.01 | -0.05 | 16.4 | 16.3 | 14.9 |
| 26 | Mundays Bridge U/S | 55.37 | 55.43 | 55.43 | 55.41 | 0.00 | -0.02 | 57.2 | 57.2 | 53.0 |
| | Mundays Bridge D/S | 55.33 | 55.35 | 55.34 | 55.34 | -0.01 | -0.01 | 57.2 | 57.2 | 53.0 |
| 28 | Hinksey Stream A423 Bypass | 55.49 | 55.39 | 55.39 | 55.38 | 0.00 | -0.01 | 52.7 | 52.3 | 51.1 |
| 29 | Hinksey ditch A423 Bypass | 55.64 | 55.79 | 55.79 | 55.73 | 0.00 | -0.06 | 58.7 | 58.6 | 54.4 |
| 23 | Weirs MS - Donnington Br D/S | 55.60 | 55.50 | 55.50 | 55.51 | 0.00 | 0.01 | 87.9 | 87.9 | 89.5 |
| | Weirs Mill Stream | 55.51 | 55.44 | 55.44 | 55.45 | 0.00 | 0.01 | 61.6 | 61.7 | 63.1 |
| 18 | Eastwyke_Ditch | 56.10 | 56.03 | 56.03 | 56.05 | 0.00 | 0.02 | 5.7 | 5.7 | 5.9 |
| 17 | Eastwyke_Ditch - Railway | 56.44 | 56.41 | 56.40 | 56.44 | -0.01 | 0.03 | 0.0 | 0.0 | 0.1 |
| 24 | Thames - Iffley Lock U/S | 55.74 | 55.68 | 55.68 | 55.69 | 0.00 | 0.01 | 71.5 | 71.5 | 72.9 |
| | Thames - Iffley Lock D/S | 55.48 | 55.43 | 55.43 | 55.43 | 0.00 | 0.00 | 72.9 | 73.0 | 74.7 |
| 27 | Thames - Railway | 54.91 | 54.92 | 54.91 | 54.91 | -0.01 | -0.01 | 239.4 | 239.0 | 238.9 |
| | Thames - Rose Isle | 54.16 | 54.16 | 54.15 | 54.15 | -0.01 | -0.01 | 209.4 | 209.1 | 209.2 |
| | Thames - Sandford Weir U/S | 54.55 | 54.56 | 54.55 | 54.55 | -0.01 | -0.01 | 98.8 | 98.7 | 98.7 |
| | Thames - Sandford Weir D/S | 54.33 | 54.33 | 54.33 | 54.33 | 0.00 | 0.00 | 172.3 | 172.2 | 172.2 |
| | Thames - Sandford Lock D/S | 54.16 | 54.16 | 54.15 | 54.15 | -0.01 | -0.01 | 227.6 | 227.2 | 227.0 |
| | Thames Outflow | 53.84 | 53.84 | 53.83 | 53.83 | -0.01 | -0.01 | 293.5 | 292.8 | 292.5 |
| 19 | New Abingdon Road Channel | #N/A | 56.21 | 56.20 | 56.09 | -0.01 | -0.12 | 54.5 | 54.4 | 46.0 |
| | Hinksey Ditch | 55.59 | 55.77 | 55.77 | 55.71 | 0.00 | -0.06 | 52.1 | 52.1 | 49.0 |
| | Redbridge Brook | 56.22 | 55.63 | 55.62 | 55.64 | -0.01 | 0.01 | 0.1 | 0.1 | 0.1 |

**Table 4: 1% AEP event, peak water levels, differences and 1D flows, compared to detailed design preferred option (Base scenario)**

| | Location | Peak Water Level (mAOD) | | | | Water Level diff (m) | | Peak flows ($m^3/s$) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Do Min | Base | A1 | A2 | A1 | A2 | Base | A1 | A2 |
| | Godstow Weir U/S | 58.57 | 58.57 | 58.57 | 58.57 | 0.00 | 0.00 | 64.1 | 64.1 | 64.1 |
| | Thames adjacent to Binsey | 57.89 | 57.86 | 57.87 | 57.87 | 0.01 | 0.01 | 74.5 | 73.6 | 73.2 |
| | Thames at Cherwell conf | 56.15 | 56.09 | 56.09 | 56.11 | 0.00 | 0.02 | 169.6 | 169.6 | 173.1 |
| 1 | Thames at Bulstake Stream | 57.58 | 57.51 | 57.54 | 57.56 | 0.03 | 0.05 | 61.5 | 61.0 | 60.4 |
| | Seacourt S D/S Thames | 59.75 | 59.75 | 59.75 | 59.75 | 0.00 | 0.00 | 8.8 | 8.8 | 8.8 |
| | Seacourt Stream A34 | 57.96 | 57.94 | 57.94 | 57.95 | 0.00 | 0.01 | 76.3 | 76.3 | 76.4 |
| 2 | Seacourt S/Botley Stream | 57.62 | 57.54 | 57.57 | 57.58 | 0.03 | 0.04 | 17.6 | 16.1 | 16.0 |
| 3 | Seacourt S - Botley Rd U/S | 57.52 | 57.41 | 57.47 | 57.49 | 0.06 | 0.08 | 78.7 | 71.6 | 70.8 |
| 4 | Seacourt S - Botley Rd D/S | 57.46 | 57.19 | 57.30 | 57.32 | 0.11 | 0.13 | 78.7 | 71.6 | 70.8 |
| 5 | Seacourt Stream - New Bridge | 57.33 | 57.12 | 57.26 | 57.29 | 0.14 | 0.17 | 76.4 | 68.3 | 67.2 |
| 6 | Seacourt S - spillway u/s pylon | 57.10 | 56.96 | 57.21 | 57.24 | 0.25 | 0.28 | 73.7 | 55.0 | 53.8 |
| 7 | New Willow Walk Bridge | #N/A | 56.75 | 56.73 | #N/A | -0.02 | #N/A | 60.6 | 58.4 | #N/A |
| 8 | Willow Walk Bridge | 56.89 | 56.78 | 56.76 | 56.88 | -0.02 | 0.10 | 27.1 | 26.3 | 31.5 |
| 9 | Bulstake S - Botley Road U/S | 57.38 | 57.29 | 57.32 | 57.35 | 0.03 | 0.06 | 63.4 | 65.5 | 64.5 |
| 10 | Bulstake S - Botley Road D/S | 57.29 | 57.22 | 57.24 | 57.26 | 0.02 | 0.04 | 63.4 | 65.5 | 64.5 |
| 11 | Thames - Osney US | 57.13 | 57.06 | 57.08 | 57.10 | 0.02 | 0.04 | 51.4 | 52.8 | 53.1 |
| 12 | Castle Mill Stream | 57.54 | 57.48 | 57.51 | 57.52 | 0.03 | 0.04 | 15.9 | 16.4 | 16.6 |
| 13 | Osney Ditch - Botley Road U/S | 57.52 | 57.44 | 57.47 | 57.49 | 0.03 | 0.05 | 17.4 | 17.6 | 17.4 |
| 14 | Osney Ditch - Botley Road D/S | 57.30 | 57.15 | 57.17 | 57.20 | 0.02 | 0.05 | 17.4 | 17.6 | 17.4 |
| 15 | Thames - Osney DS | 56.49 | 56.41 | 56.41 | 56.44 | 0.00 | 0.03 | 120.3 | 120.2 | 125.2 |
| 16 | Devils Backbone | 56.57 | 56.47 | 56.47 | 56.49 | 0.00 | 0.02 | 20.1 | 20.1 | 24.7 |
| 20 | Hinksey Str - Railway Br U/S | 56.52 | 56.39 | 56.39 | 56.38 | 0.00 | -0.01 | 22.0 | 21.8 | 21.3 |
| | Hinksey Str - Railway Br D/S | 56.35 | 56.28 | 56.28 | 56.27 | 0.00 | -0.01 | 21.9 | 21.8 | 21.3 |
| 21 | Redbridge S - Abingdon Rd u/s | 56.22 | 56.01 | 56.00 | 56.02 | -0.01 | 0.01 | 4.9 | 4.8 | 5.0 |
| | Redbridge S - Abingdon Rd d/s | 55.93 | 55.76 | 55.75 | 55.75 | -0.01 | -0.01 | 4.9 | 4.8 | 5.0 |
| 22 | Mayweed Br - Abingdon Rd u/s | 56.31 | 56.23 | 56.23 | 56.22 | 0.00 | -0.01 | 33.5 | 33.4 | 33.4 |
| | Mayweed Br - Abingdon Rd d/s | 55.89 | 55.73 | 55.73 | 55.72 | 0.00 | -0.01 | 33.5 | 33.4 | 33.4 |
| | Hinksey Dr - Abingdon Rd U/S | 56.48 | 56.34 | 56.33 | 56.31 | -0.01 | -0.03 | 16.5 | 16.5 | 18.1 |
| | Hinksey Dr - Abingdon Rd D/S | 56.14 | 56.17 | 56.16 | 56.11 | -0.01 | -0.06 | 16.5 | 16.5 | 18.1 |
| 25 | Stroud's Bridge U/S | 56.01 | 56.09 | 56.08 | 56.02 | -0.01 | -0.07 | 17.8 | 17.7 | 16.6 |
| | Stroud's Bridge D/S | 55.85 | 55.79 | 55.79 | 55.76 | 0.00 | -0.03 | 17.8 | 17.7 | 16.6 |
| 26 | Mundays Bridge U/S | 55.48 | 55.54 | 55.54 | 55.53 | 0.00 | -0.01 | 61.5 | 61.6 | 57.5 |
| | Mundays Bridge D/S | 55.44 | 55.45 | 55.45 | 55.44 | 0.00 | -0.01 | 61.5 | 61.6 | 57.5 |
| 28 | Hinksey Stream A423 Bypass | 55.57 | 55.49 | 55.49 | 55.49 | 0.00 | 0.00 | 58.7 | 58.4 | 57.2 |
| 29 | Hinksey ditch A423 Bypass | 55.75 | 55.92 | 55.91 | 55.86 | -0.01 | -0.06 | 63.0 | 63.3 | 58.9 |
| 23 | Weirs MS - Donnington Br D/S | 55.74 | 55.63 | 55.63 | 55.64 | 0.00 | 0.01 | 88.8 | 88.9 | 90.1 |
| | Weirs Mill Stream | 55.66 | 55.58 | 55.57 | 55.58 | -0.01 | 0.00 | 64.8 | 64.6 | 66.0 |
| 18 | Eastwyke_Ditch | 56.17 | 56.11 | 56.11 | 56.12 | 0.00 | 0.01 | 6.4 | 6.3 | 6.6 |
| 17 | Eastwyke_Ditch - Railway | 56.51 | 56.52 | 56.52 | 56.55 | 0.00 | 0.03 | 0.1 | 0.1 | 0.4 |
| 24 | Thames - Iffley Lock U/S | 55.81 | 55.76 | 55.76 | 55.77 | 0.00 | 0.01 | 71.0 | 71.1 | 72.4 |
| | Thames - Iffley Lock D/S | 55.61 | 55.55 | 55.55 | 55.55 | 0.00 | 0.00 | 72.5 | 72.5 | 74.0 |
| 27 | Thames - Railway | 55.00 | 55.00 | 55.00 | 55.00 | 0.00 | 0.00 | 257.3 | 256.8 | 256.7 |
| | Thames - Rose Isle | 54.29 | 54.29 | 54.29 | 54.28 | 0.00 | -0.01 | 217.3 | 217.1 | 217.1 |
| | Thames - Sandford Weir U/S | 54.64 | 54.64 | 54.64 | 54.64 | 0.00 | 0.00 | 104.0 | 103.8 | 103.8 |
| | Thames - Sandford Weir D/S | 54.46 | 54.46 | 54.46 | 54.46 | 0.00 | 0.00 | 176.8 | 176.7 | 176.7 |
| | Thames - Sandford Lock D/S | 54.29 | 54.29 | 54.29 | 54.28 | 0.00 | -0.01 | 242.1 | 241.7 | 241.7 |
| | Thames Outflow | 53.97 | 53.97 | 53.97 | 53.97 | 0.00 | 0.00 | 322.9 | 322.3 | 322.1 |
| 19 | New Abingdon Road Channel | #N/A | 56.34 | 56.33 | 56.23 | -0.01 | -0.11 | 58.5 | 58.5 | 50.5 |
| | Hinksey Ditch | 55.70 | 55.90 | 55.90 | 55.85 | 0.00 | -0.05 | 54.8 | 54.8 | 51.5 |
| | Redbridge Brook | 56.29 | 56.06 | 56.05 | 56.07 | -0.01 | 0.01 | 0.1 | 0.1 | 0.1 |

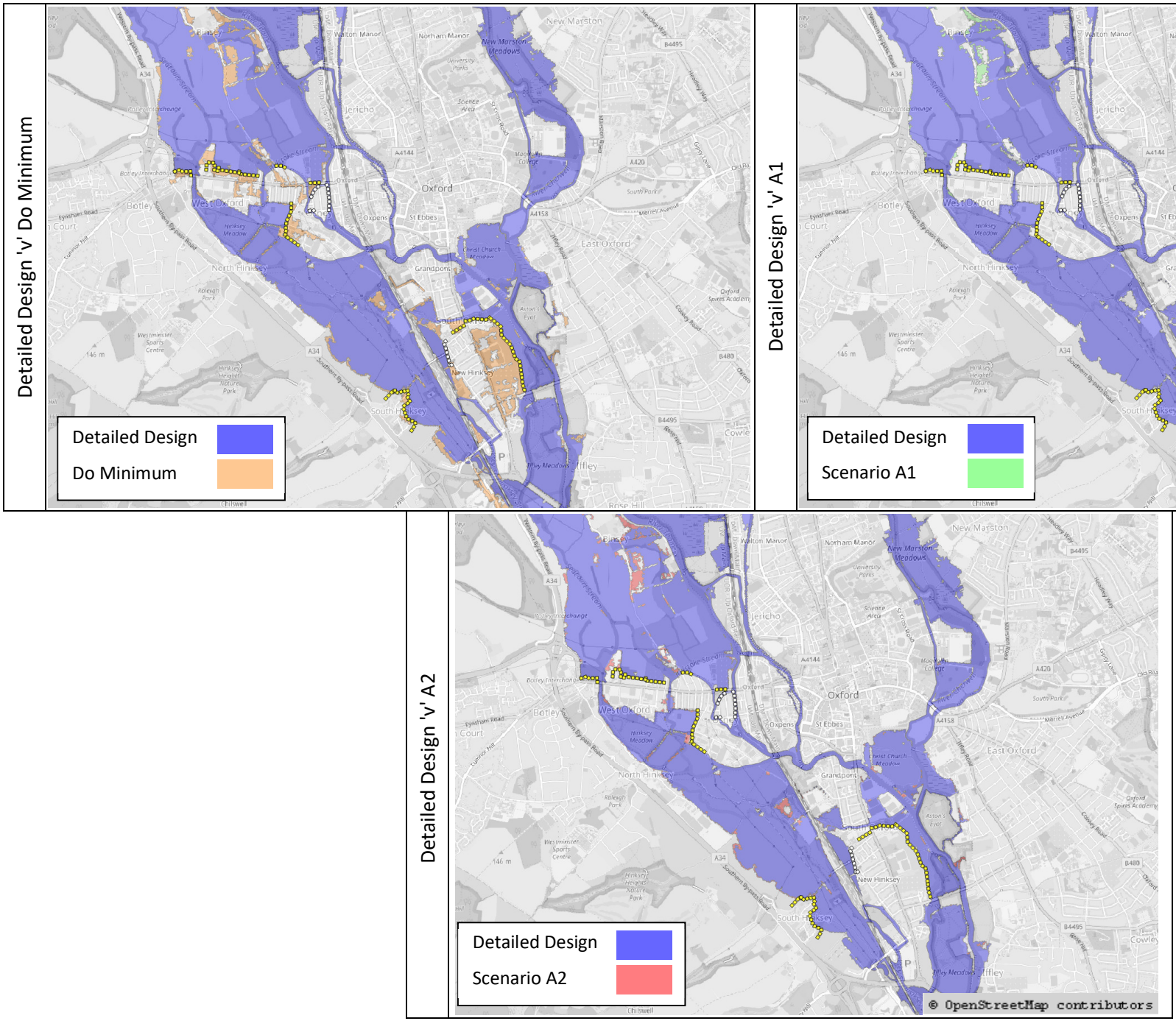


**Figure 3: Detailed Design 'v' Scenario A1 and A2 (20% AEP event)**

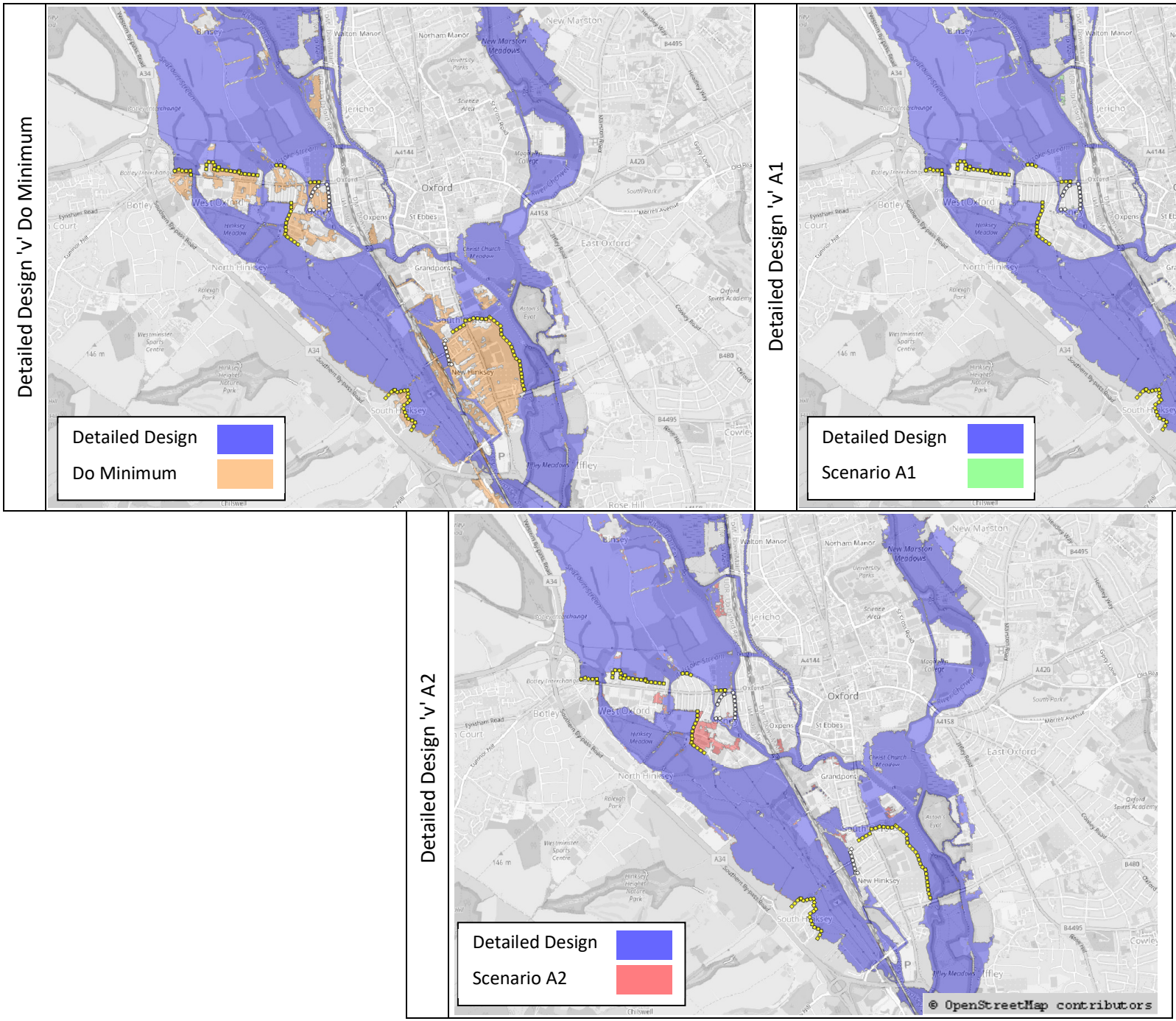


**Figure 4: Detailed Design 'v' Scenario A1 and A2 (5% AEP event)**

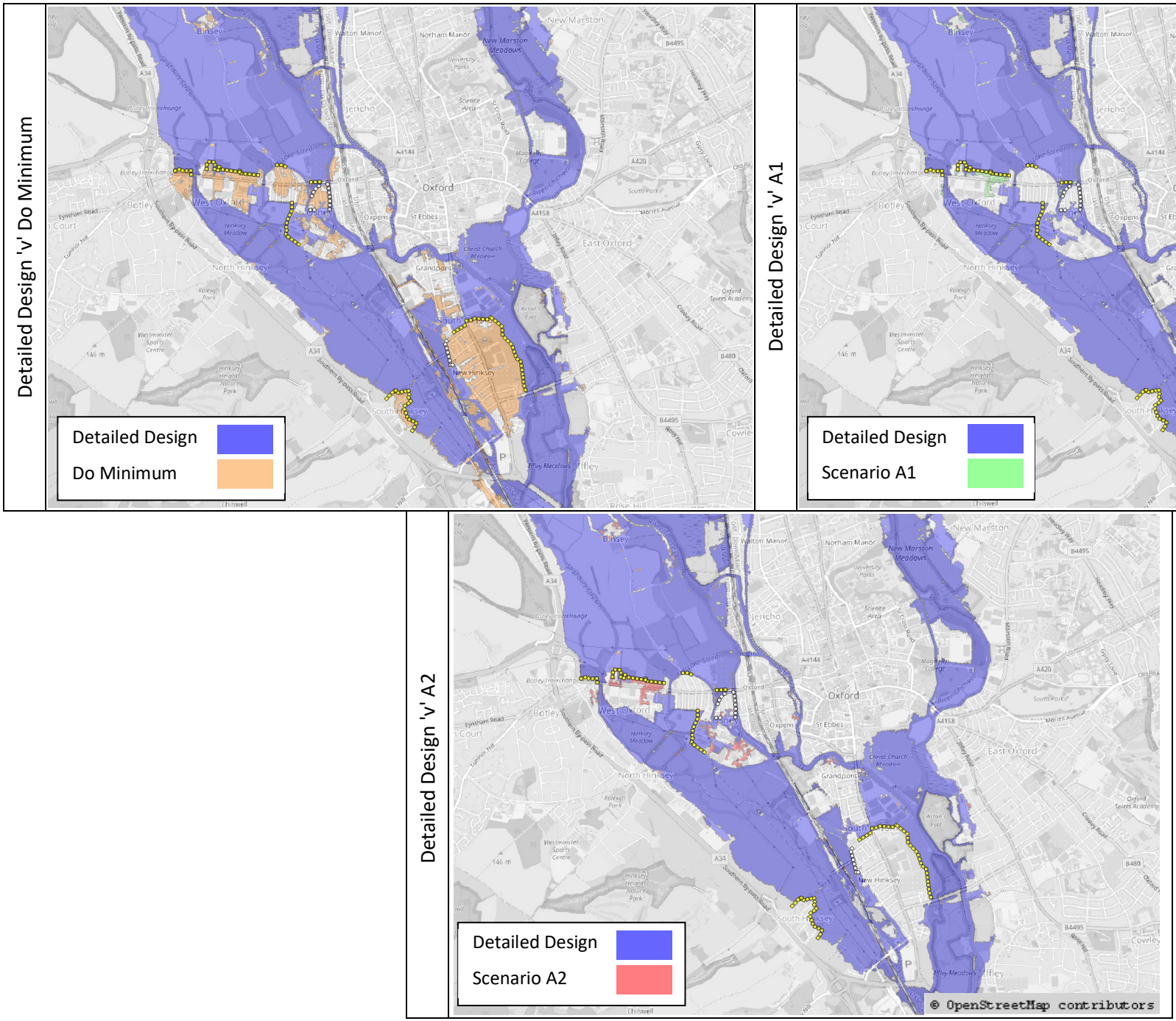


**Figure 5: Detailed Design 'v' Scenario A1 and A2 (2% AEP event)**

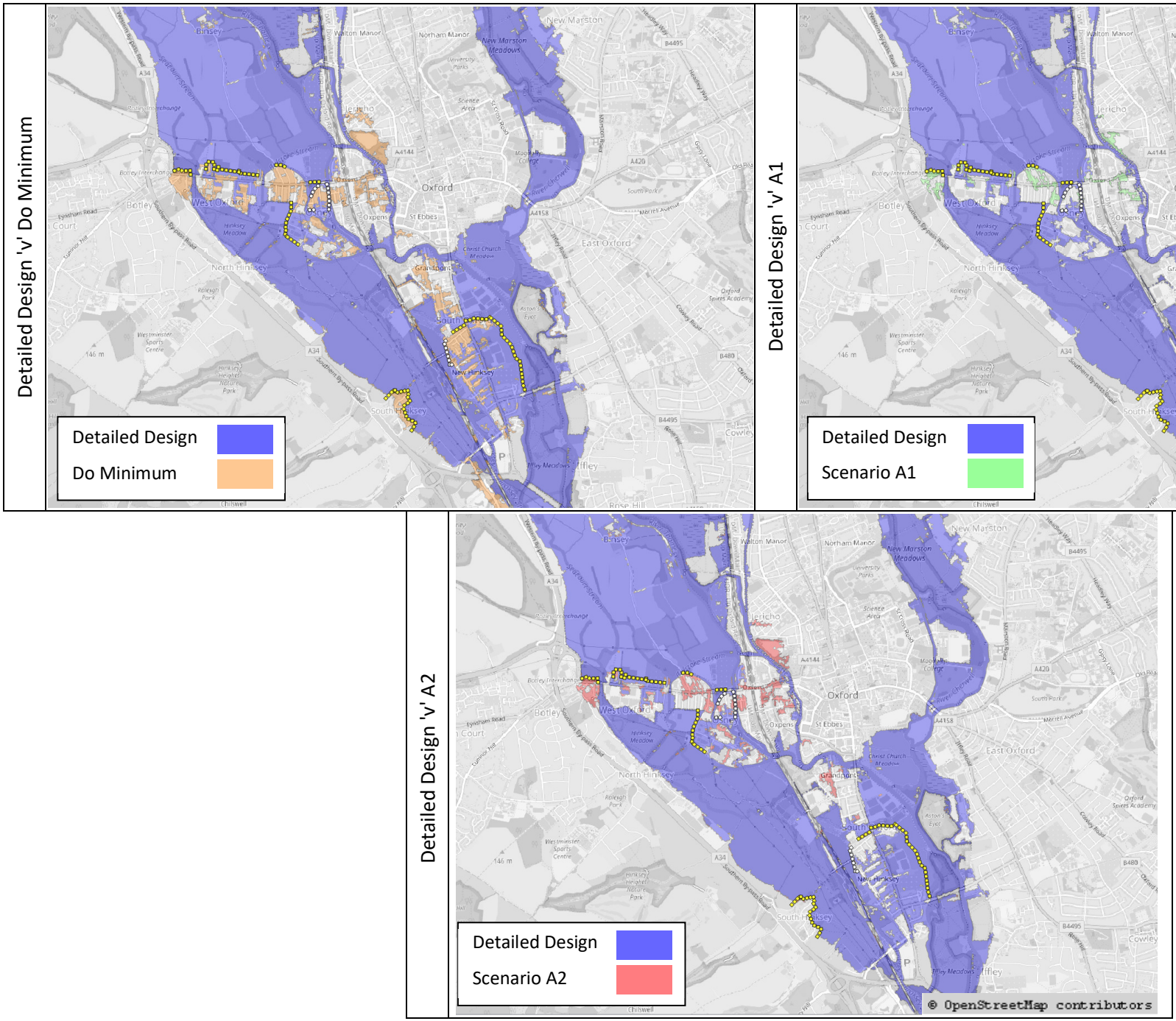


**Figure 6: Detailed Design 'v' Scenario A1 and A2 (1% AEP event)**

If either of the Scenarios A1 or A2 were to be implemented then the height of all the proposed defences, with the exception of the Osney Mead defence (The Osney Mead defence height is restricted by adjacent ground levels and the need to avoid negative flood risk impacts on nearby properties), should be increased to reflect the change in water levels and maintain the same level of freeboard as incorporated into the proposed scheme. For all the scenarios, raising the defences to accommodate increases in water levels would require the defences to also be significantly longer in most locations due to the flat topography of the area. Increasing the length of defences has been reviewed and is not practical due to existing infrastructure such as roads and buildings.

Based on the results presented in Tables 1 to 4, Scenarios A1 and A2 are generally not as effective at reducing flood levels as the detailed design preferred option although there are localised areas where some improvements are noted due to the flood flows redistributing themselves through the rest of the network. It is noted that Scenarios A1 and A2 decrease flood levels slightly below the Do Minimum (existing) levels in the area south of Botley Road.

At higher return periods the effectiveness of all the Scenarios is reduced compared to the detailed design preferred option resulting in the scheme not achieving the same standard of overall protection across the area. This results in more properties remaining at risk at the 1 in 100-year event than for the detailed design preferred option.

One additional consideration is that the levels on the Seacourt Park car park access road are the limiting factor for flood defence heights at the western end of the Botley Road defences and will be one of the first places flooding occurs once the scheme is in place. Under the detailed design preferred option, this flow path would become active between the 2% AEP and 1.33 AEP events and cause flooding to the road. This will occur earlier in a flood event for both Scenarios A1 and A2.

# 4. Flow Comparison

In addition to checking the implications on flood levels a further check has also been made to ensure that there are no implications on the pass forward flows at Sandford which could adversely impact on downstream communities. Modelled outflows at Sandford at the downstream end of the fluvial model are compared in Figure 7 (1% AEP).

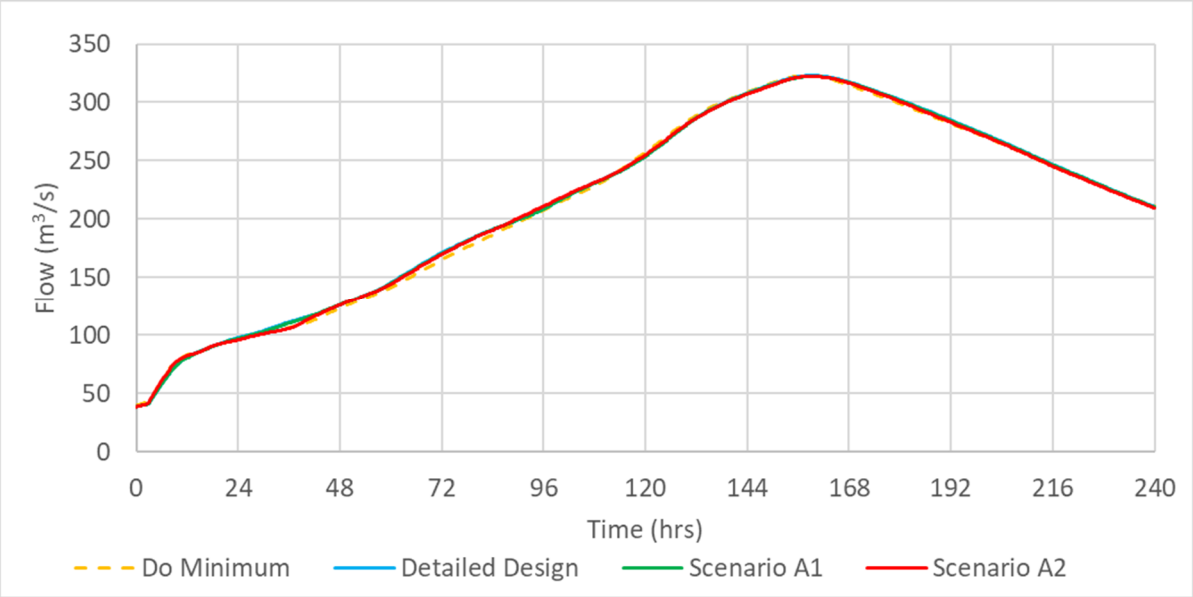


**Figure 7: Model outflows 1% AEP event**

Note in Figure 7 the lines are coincidental for much of the graph, the red line is shown over the top of the other lines.

# 5. Economic Review

Table 5 shows a high-level economic review of the scenarios considered, incorporating modelling of all return periods. The FCERM-AG decision process (Section 8.3 – decision criteria and decision process) has been used to select the preferred option. For the purposes of the economic assessment the models were run with no freeboard on new defences to enable a direct comparison with the figures presented in the overall project business case economic analysis and as recommended in the guidance.

Options have been organised in terms of reduced probability of flooding, using increasing benefits as a proxy for reduced probability of flooding as described on p253 of the FCRM-AG. In accordance with this process, Do Minimum has the highest benefit cost ratio, and is initially selected as the leading option. Costs for the different scenarios were provided by the clients cost consultant based on 2018 tender returns, adjusted to account for recent changes to the scheme and uplifted to account for inflation.

Although all the scenarios tested in this note and presented in Table 5 are economically viable, the FCERM-AG decision process utilises an incremental benefit Cost Ratio (iBCR) approach to determine the preferred option. Referring to Table 5 the options are arranged by increasing benefits and we move up through them as long as the iBCR is greater than 1 (meaning the additional benefits of the next option are greater than the additional costs of doing it). Using this methodology the Proposed Channel Scheme is the preferred option. In addition, this choice is reinforced by the Proposed Channel Scheme having the highest scheme Net Present Value (NPV) which is the Treasury's preferred measure.

**Table 5: High level Economic Review.**

| Scenario | 1 | 2a | 2b | A2 | A1 | |
|---|---|---|---|---|---|---|
| **Option** | Do Nothing (Baseline) | Do Minimum no Temp Defences | Do Minimum Temp Defences for 25 years | No Channel North Hinksey Meadow to Old Abingdon Road | No Channel in North Hinksey Meadow | Proposed Channel Scheme |
| **Benefits (£M)** | - | 1,288.40 | 1,303.9 | 1,501.2 | 1,528.5 | 1,536.4 |
| **Costs (£M)** | - | 19.6 | 19.7 | 120.7 | 142.0 | 144.6 |
| **BCR** | - | 65.7 | 66.3 | 12.4 | 10.8 | 10.6 |
| **iBCR** | - | - | **545.6** | **2.0** | **1.3** | **3.1** |
| **NPV (£M)** | - | 1,268.7 | 1,284.2 | 1,380.5 | 1,386.5 | 1,391.8 |

In addition, a brief review of residual properties remaining at flood risk for each of the scenarios has been undertaken and the results shown in Tables 6 and 7.

**Table 6: Residual Flood Risk Property Numbers (Residential)**

| **RESIDENTIAL PROPERTIES** | | **Return Period (x% AEP event)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Option** | | **50** | **20** | **10** | **5** | **2** | **1.33** | **1** | **0.5** | **0.1** |
| **2b** | **Do Minimum Temp Defences for 25 years** | 0 | 77 | 266 | 486 | 862 | 1,126 | 1,319 | 1,896 | 3,302 |
| | **Proposed Channel Scheme** | 0 | 1 | 7 | 25 | 105 | 180 | 367 | 1,005 | 2,742 |
| **A1** | **No Channel in North Hinksey Meadow** | 0 | 1 | 7 | 30 | 128 | 196 | 438 | 1,100 | 2,826 |
| **A2** | **No Channel North Hinksey Meadow to Old Abingdon Road** | 0 | 1 | 37 | 79 | 156 | 234 | 524 | 1,193 | 2,898 |

**Table 7: Residual Flood Risk Property Numbers (Non - Residential)**

| NON-RESIDENTIAL PROPERTIES | | Return Period (x% AEP event) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Option | | 50 | 20 | 10 | 5 | 2 | 1.33 | 1 | 0.5 | 0.1 |
| 2b | Do Minimum Temp Defences for 25 years | 2 | 49 | 98 | 130 | 201 | 253 | 284 | 336 | 491 |
| | Proposed Channel Scheme | 2 | 8 | 27 | 38 | 92 | 122 | 151 | 258 | 438 |
| A1 | No Channel in North Hinksey Meadow | 2 | 8 | 26 | 40 | 97 | 130 | 172 | 272 | 444 |
| A2 | No Channel North Hinksey Meadow to Old Abingdon Road | 2 | 12 | 56 | 84 | 116 | 147 | 210 | 285 | 455 |

Note that the above tables utilise the results from the models with no freeboard as required in the published guidance.

# 6. Discussion

The results presented in this note provide an outline of the changes to flood risk as a result of the omission of the proposed new main channel from areas of the scheme. The following sections discuss other implications of the channel removal on the overall performance of the scheme.

## 6.1 Freeboard levels on defences/soffits

As presented in the results tables, the scenarios tested all increase the predicted flood levels to a varying degree over the proposed with channel scheme. This would result in the proposed raised defences needing to be higher and longer to account for this. In some locations, such as the Botley Road area the surrounding flat topography means that increasing the length of the defences would not be practical for a number of reasons such as existing road levels, buildings and other infrastructure, and a reduced standard of protection would result.

In addition, the freeboard below bridge soffits would also need to be increased to meet the agreed consenting requirements for this scheme. This would make the raised bridges more visually intrusive in the landscape and increase the length of approach ramps to bridges which then creates additional restrictions across the floodplain.

## 6.2 Maintenance

The proposed two stage channel provides a clear and unimpeded route for flood water to pass through the floodplain to the west of Oxford. This ensures additional floodwater entering the system at Seacourt Bridge on the Botley Road will follow a defined route as it passes through the floodplain, away from communities. It will provide this benefit throughout a range of different sizes of floods, as the lowered ground does not store static water but provides additional space for it to flow through, even when the existing floodplain starts to fill, moving water efficiently through the system in a controlled manner along a predetermined route and away from properties and businesses.

The design is for the second stage to be clear of cross fences, hedges or large stands of trees. This enables maintenance to be focused in a strip which can be readily kept clear of debris. This also allows small debris to flush through the system and not build up on obstructions and create blockages. This allows the land outside of the two stage channel to remain unchanged.

Without the channel the scheme would rely on a similar volume of flood water to pass unhindered across the existing western floodplain. The existing network of hedges and fences would create a risk of random blockages by collecting small debris which would buildup, increase upstream water levels and consequently lead to flood water redistributing through the watercourse system resulting in an unintended increase in flood risk elsewhere. See photograph 1 overleaf for an example of the type of problem fences and hedges can create.

A localised problem such as that shown in the photograph would negate any benefits achieved by the scheme and result in properties remaining at risk of flooding. Due to the width of the floodplain and depth of flooding during major events it is not practical or safe to gain access across the floodplain to clear random blockages during flood events.

Without the channel the scheme relies on water flowing across the whole width of the floodplain in a uniform manner. To ensure this happens reliably it would be neccesary to maintain the whole width of the floodplain more intensively including removing cross hedges and fencing throughout the area for at least a 50m wide section to maintain a flow route.

To gain an understanding of the risk around increased flooding associated with maintenance and debris accumulating within the system a sensitivity test has been undertaken for both the detailed design scheme and Scenario A2. This was undertaken to gain a general understanding of the potential impacts of debris across the wider scheme area so Scenario A1 was not included in the assessement.

The model simulates growth in the channel and surrounding floodplain using a roughness coefficient in the hydraulic calculations known as the Mannings ‘n’ number. A higher ‘n‘ number represents a rougher surface and a lower number a less rough or better maintained surface. To simulate the risk of increased roughness in the floodplain and potential impacts on flood levels the Mannings roughness values in the models was increased by 20%, this was assessed for the 1% AEP event only.

**Photograph 1 – Example of a fence creating upstream flood risk**

For the design model this was achieved by a 20% increase in the roughness values for the 1D channel which represents the proposed new channel from 200m downstream of Botley Road to Old Abingdon Road. Roughness values in the rest of the model were unchanged.

The results of the assessment are shown overleaf in Figure 8.

The model for Scenario A2 does not include the 1D channel from 200m downstream of Botley Road to Old Abingdon Road. Therefore the floodplain roughness in the 2D element of the model was increased by 20% across the whole model to provide a comparison. Roughness values in the 1D elements of the model were unchanged. Note that the models used for this testing did not include freeboard on the proposed new defences in line with the other modelling.

The results of this assessment are shown in Figure 9. This shows Scenario A2 being more sensitive to changes in flood plain roughness and hence maintenance regimes than the proposed channel option.

Due to the different ways the two models used for this test are constructed a direct comparison of impacts is not possible. The results presented in Figures 8 and 9 are an approximation of possible sensitivity and risk associated reduced maintenance, blockages or debris build up in the proposed new channel or within the floodplain. A sensitivity test was not conducted on Scenario A1.

It should be noted this analysis is provided for guidance only. The way the floodplain is represented in the 2D domain of the model is with the application of a global roughness value with the hedges represented as raised porous features across the area to give an overall representation of the behaviour over a wide area. The value of the roughness of the floodplain was refined during the model development and calibration process.

The application of a global roughness value is standard modelling practice and could have a direct influence on the final design levels depending on the vegetation and levels of maintenance implemented. The proposed channel is modelled in 1D and assumed to be kept clear of cross fencing to provide a robust modelling result for this option although the surrounding floodplain is still modelled using the same 2D domain. The uncertainty around the results associated with the no channel scenarios are much greater and should be borne in mind when considering the alternative scenarios.

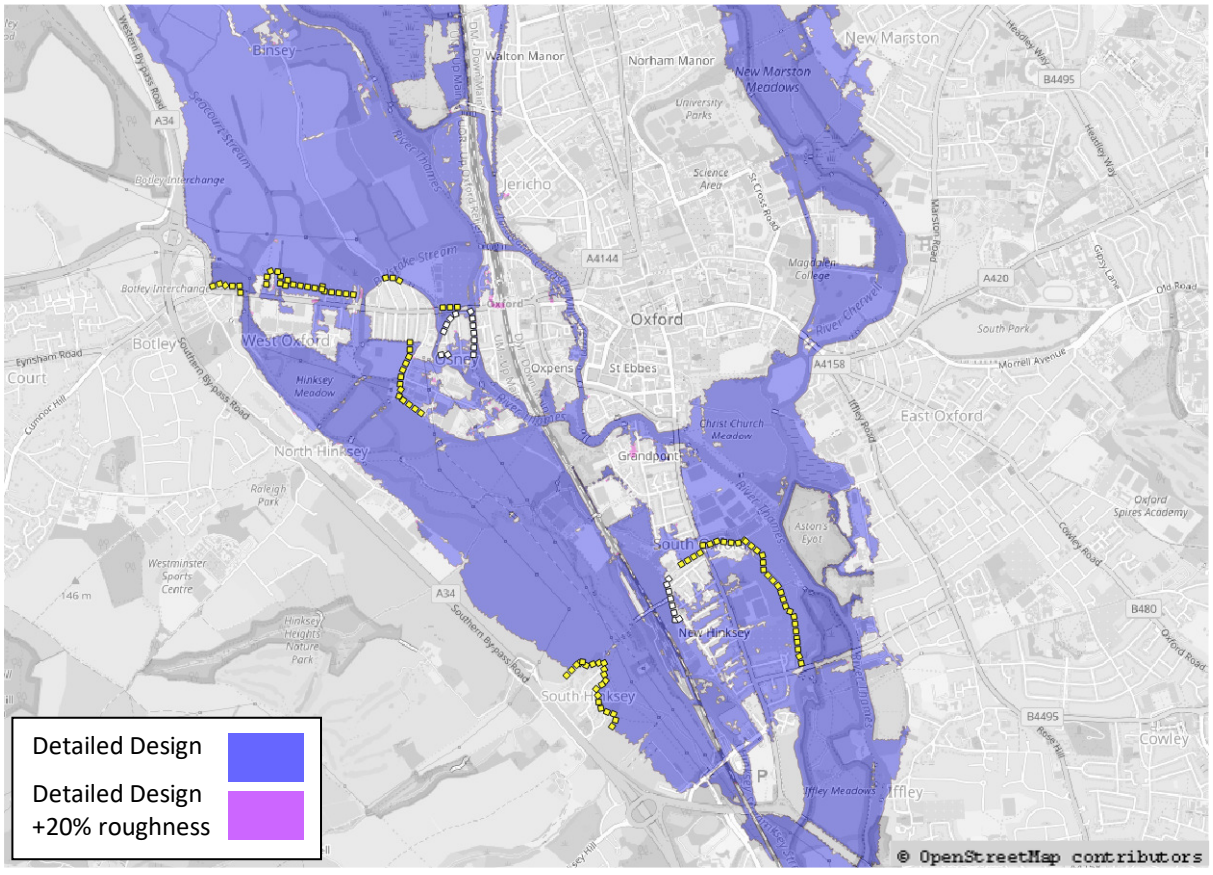


**Figure 8: Detailed Design with proposed 2 stage channel roughness increased by 20% (1% AEP)**

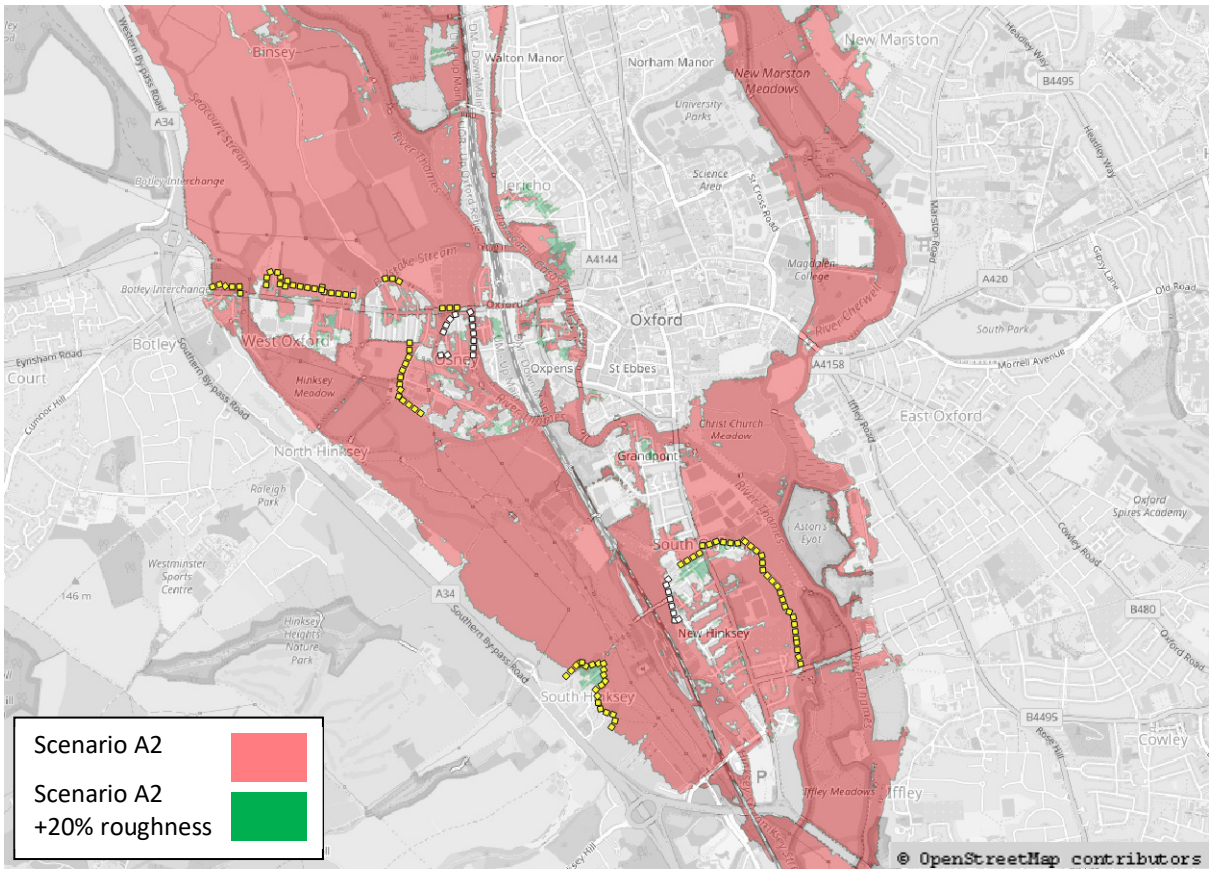


**Figure 9: Scenario A2 with floodplain roughness increased by 20% (1% AEP)**

## 6.3 Groundwater and sewer flooding

The groundwater modelling of the area and the proposed scheme demonstrates that ground water flood levels in the Grandpont area will be reduced. This area is known to have groundwater flooding problems. The alternative options do not lower flood levels to the same extent as the proposed scheme and therefore will not provide the same level of benefits with respect to groundwater flooding.

A reduction in groundwater flood levels for any given event will also reduce the infiltration of buried drains and pipes in the area which reduces flood risk from the foul and surface water systems.

## 6.4 Wider Project Objectives

In addition to the direct flood risk reduction objectives which contribute to the economic analysis in Section 3.4 the project partners also identified a number of wider objectives for the project. These are listed below;

- Reduce flood impacts on transport infrastructure and utilities in Oxford, particularly to the Botley and Abingdon Road, the railway line and the sewerage service,
- Safeguard Oxford's reputation as a thriving centre of commerce that is open for business. This would be achieved by the reduction of risk of flooding to utility infrastructure assets and by improving the potential for growth by reducing the flood risk to existing brownfield industrial land with redevelopment potential,
- Create and maintain new recreational amenities, wildlife habitat and naturalised watercourses accessible from the centre of Oxford. This includes creating a net increase of water-dependent habitat that meets the objectives of the Water Framework Directive and creating at least 2km of naturalised watercourses and improving accessible paths within the scheme area.

Based on the predicted flood outlines presented in Figures 3 to 6, Scenarios A1 and A2 reduce the effectiveness of the scheme to meet the above wider objectives and increase flood risk to key infrastructure such as electricity sub-stations, Botley and Abingdon Roads and the railway line when compared to the with the channel option.

By not constructing the proposed new channel the wider positive environmental objectives related to water dependant habitat and naturalised watercourses would be reduced as the features designed into the second stage will not be delivered.

Scenarios A1 and A2 presented in this note do not feature in our economic analysis for the business case because after careful consideration of engineering certainty and operational factors an option without a structured channel would not be pursued by the Environment Agency.