East Midlands Gateway
Phase 2 (EMG2)

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ENVIRONMENTAL STATEMENT

Volume 2 Technical Appendices

Appendix 13H

Flood Risk Screening (Highway Works)

July 2025

13

The East Midlands Gateway Phase 2 and Highway Order 202X and The East Midlands Gateway Rail Freight and Highway (Amendment) Order 202X

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ADVISORY

SEGRO (Properties) Ltd
East Midlands Gateway 2
Flood Risk Screening - Highways Works

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Notice

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APPENDICES

1. INTRODUCTION

1.1 This Flood Risk Screening Report has been prepared in accordance with the requirements set out in the National Policy Statement for National Networks (NPSNN). It has been produced on behalf of SEGRO (Properties) Ltd in respect of a Development Consent Order (DCO) for the proposed East Midlands Gateway Phase 2 (EMG2) and the East Midlands Gateway Rail Freight Interchange Material Change Order (MCO).

1.2 The proposed development comprises a number of interrelated component parts as follows, and collectively they are referred to as the EMG2 Project:

- **EMG2 Works:**
  - Construction of logistics and advanced manufacturing development and ancillary buildings (DCO, Works No. 1);
  - Construction of road infrastructure (DCO, Works No. 2);
  - Construction of bus interchange (DCO, Works No. 3);
  - Construction of HGV parking (DCO Works No. 4);
  - Provision of hard and soft landscaping (DCO Works No. 5);
  - Creation of a Community Park (DCO, Work No. 21); and
  - Upgrade of the EMG1 substation (DCO, Work No. 20)[1].
- **Highways Works[2]**
  - A453 access junction works to the EMG2 Main Site (Works No. 6);
  - Hyam's Lane works (Works No. 7);
  - Works to the M1 northbound (Works No. 8);
  - Construction of link road from the M1 northbound to the A50 westbound (Works No. 9);
  - Works to the A50 westbound (Works No. 10);
  - Works to the link road from the M1 southbound and A50 eastbound to M1 Junction 24 (Works No. 11);
  - Works to the M1 Junction 24 roundabout and A453 northbound approaches (Works No. 12);
  - Improvements to the EMG1 access junction (Works No. 13);
  - Construction of the Active Travel Link between the EMG1 access junction and the A453 west of Finger Farm roundabout (Works No. 14);
  - Provision of an uncontrolled crossing of the A453 at the East Midland Airport signalised access junction (Works No. 15);
  - Works to M1 northbound signage on the approach to M1 Junction 23A (Works No. 16);
  - Works to Long Holden (Works No. 17);

[1] Note – Due to its distance from the other EMG2 Works, for the purpose of assessing flood risk the upgrade of the EMG1 substation is included in this Highway Works Flood Risk Screening Report.
[2] Note - Due to their geographical location for the purpose of assessing flood risk Works No. 6, 7, 15, 17, and 21 are included in this EMG2 Works Flood Risk Assessment.

- Works to the A42/A453 Finger Farm roundabout (Works No. 18); and
- Upgrade to public footpath L57 to a cycle track (Works No. 19).

- **EMG1 Works**
  - Construction of a new rail-served warehouse building on land adjacent to the rail-freight terminal referred to as Plot 16 (MCO, Works No. 3A) together with associated access (MCO, Works No. 5A) and landscaping (MCO, Works No. 6A).
  - Alterations to the existing rail-freight terminal to improve its operation and efficiency;
  - An expansion of the EMG1 Management Suite by the EMG1 site entrance to cater for the additional demand on management facilities resulting from EMG1 (MCO, Works No. 3B);
  - Enhancements to the Public Transport Interchange by way of the installation of EV charging infrastructure for buses and provision of a drop-off layby adjacent to the transport hub (MCO, Works No. 5B and 5C); and
  - Provision of a signalised crossing over the EMG1 exit road approach to the access junction to EMG1 (MCO, Works No. 8A).

1.3 An illustrative site location plan is provided as **Figure 1.1**, which also identities the approximate extent of the development component parts. For ease of reference and for the purpose of the Flood Risk Assessments, the individual components have been grouped together based upon the geographical location, as shown in **Figure 1.2**.

1.1 This report focuses on the 'Highway Works' removed from EMG2 Works and the EMG1 Works, as illustrated in **Figure 1.3** with summary information provided in **Table 1.1**. Due to its distance from the other EMG2 Works, for the purpose of assessing flood risk the upgrade of the EMG1 substation (Works No. 20) is also included in this assessment – the 'study site'.

1.4 The Highway Works within close proximity to the EMG2 Works (Works No. 6, 7, 15, 17 and 21) are discussed within the EMG2 Works FRA (reference: EMG2-BWB-ZZ-XX-T-W-0001). The EMG1 Works have been reviewed under separate cover (reference: EMG2-BWB-ZZ-XX-T-W-0005).

1.5 A desktop assessment of the potential flood risk sources at each location is reviewed within the forthcoming sections. As the proposals are generally associated with improvements to existing infrastructure, the principle of a road, footway or new signage in each location has not been discussed. Instead, the assessment has focused on the presence of a potential flood risk source and the potential impact of the proposals on that flood risk source.

1.6 Where available, illustrative outlines of the proposed works are provided for context, although it should be noted that these are subject to change through design and development.

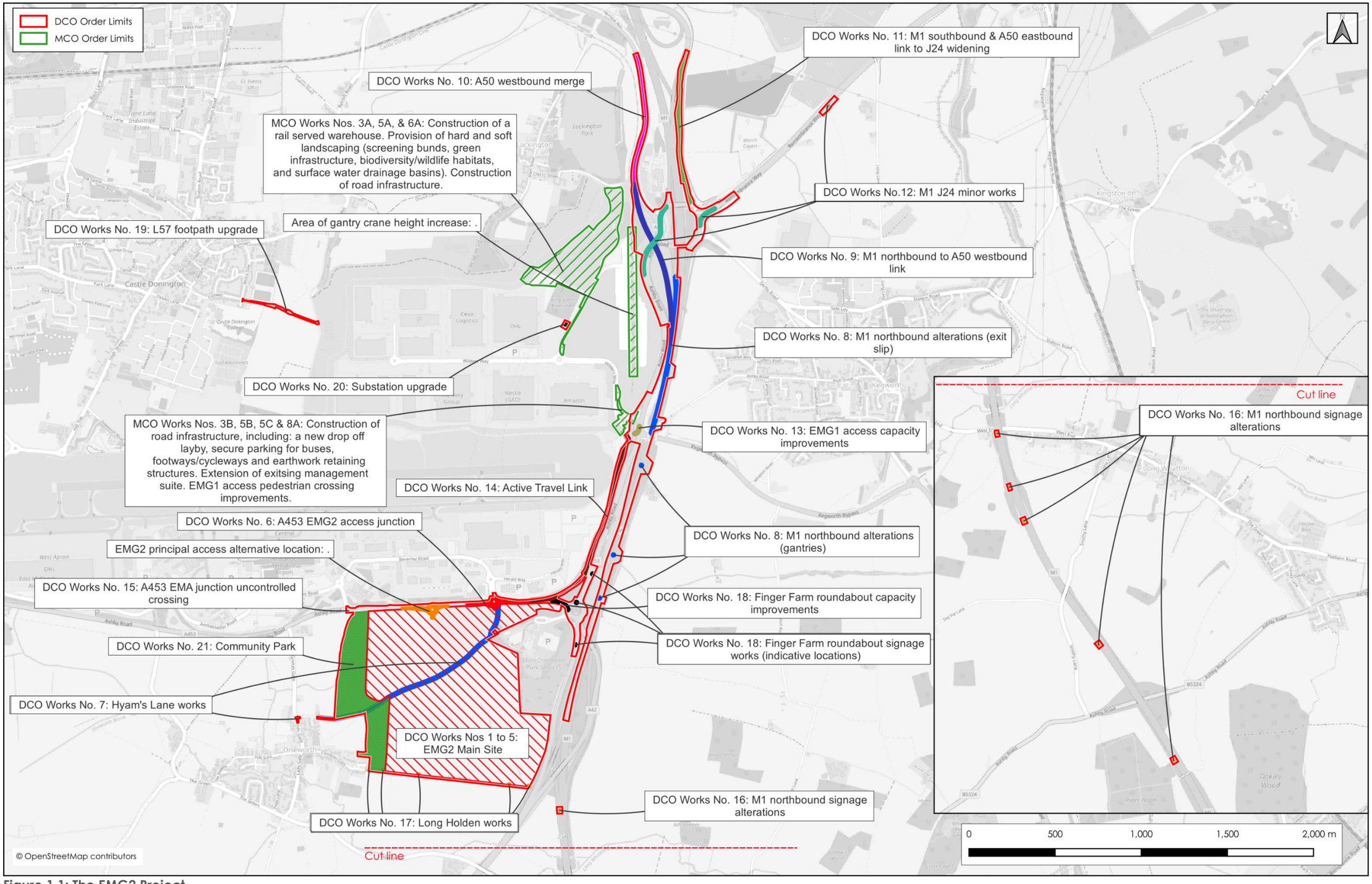


Figure 1.1: The EMG2 Project

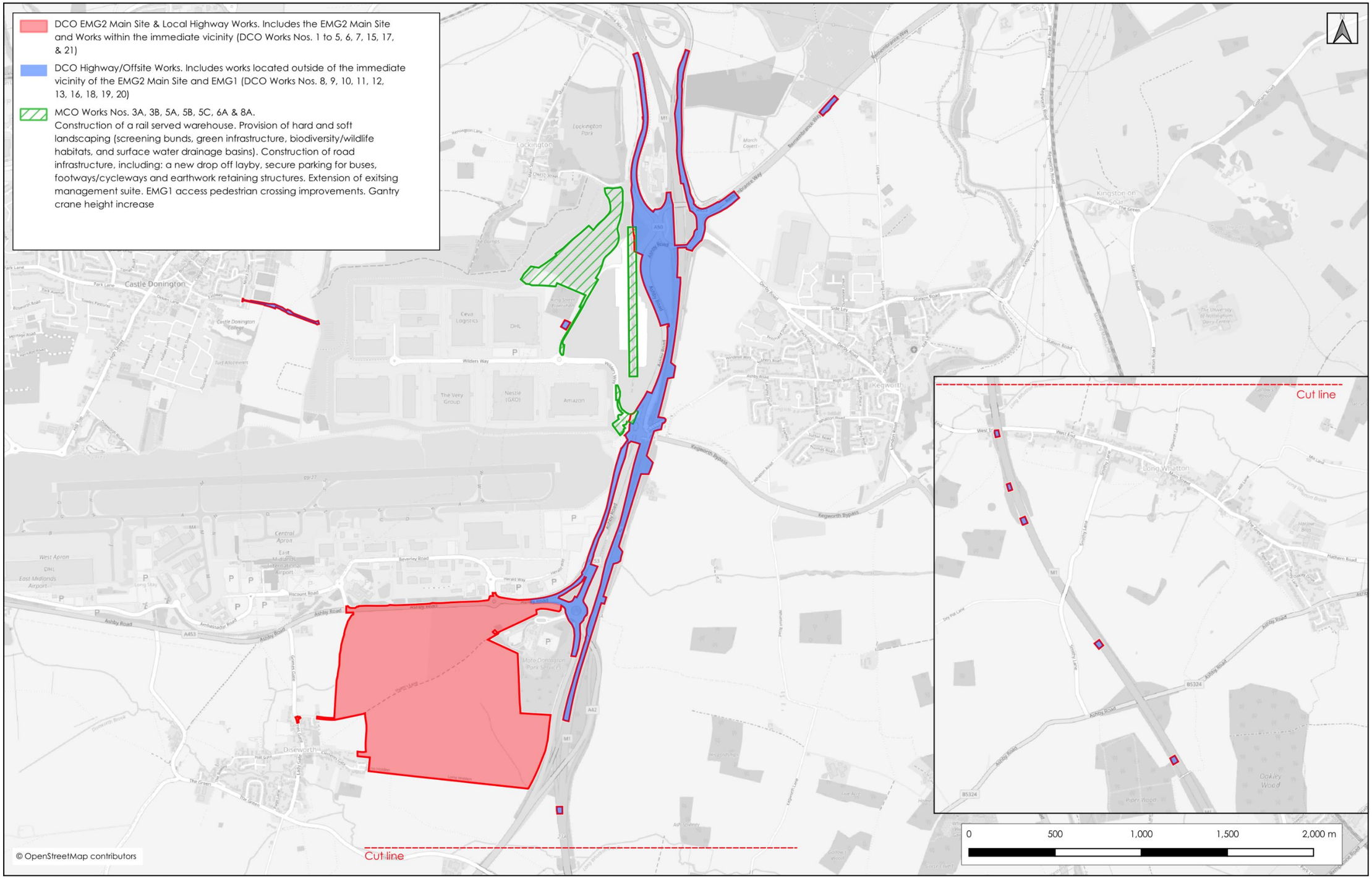


Figure 1.2: Grouping of EMG2 Project Components for the Purpose of the Flood Risk Assessments

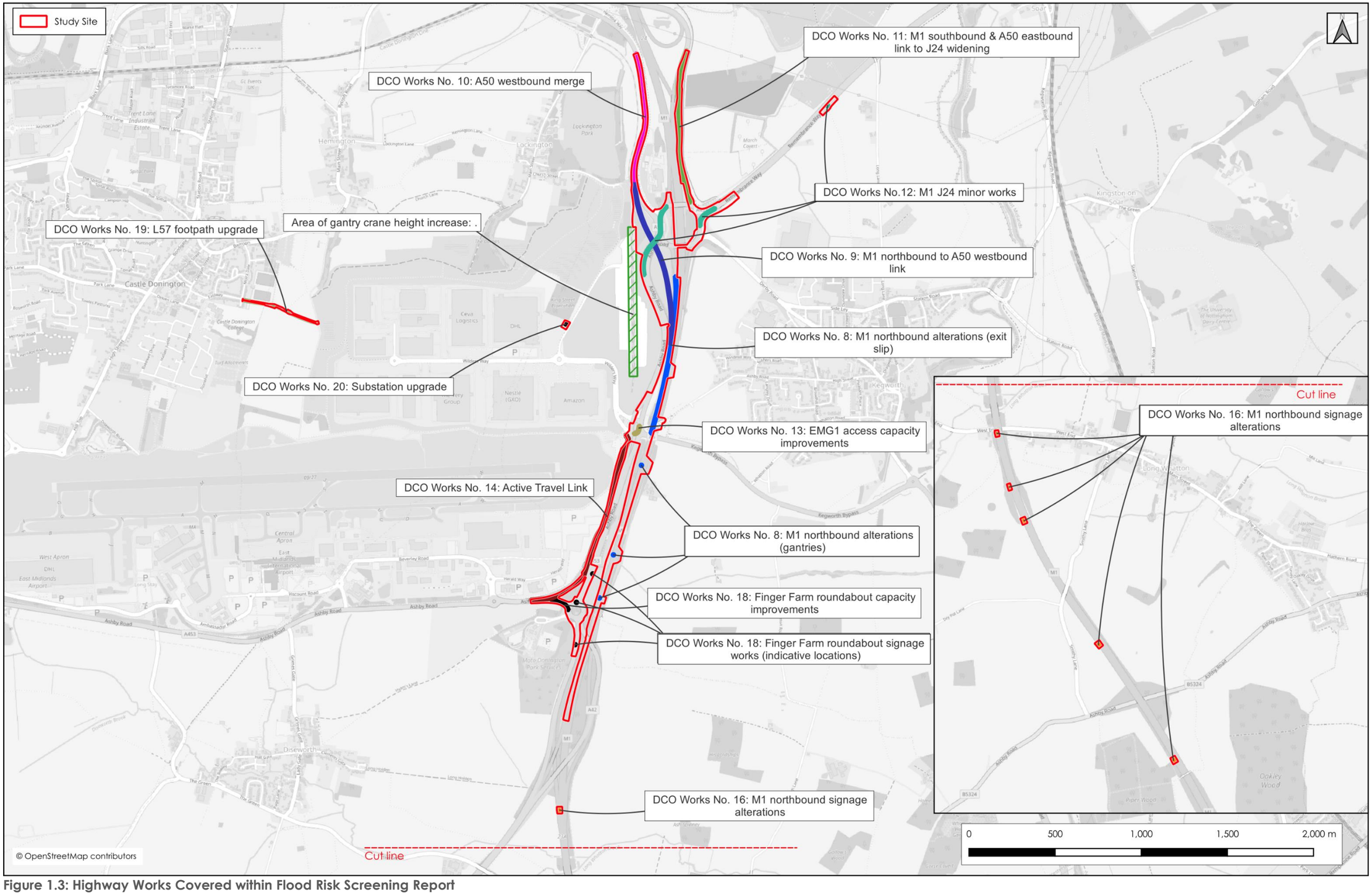


Figure 1.3: Highway Works Covered within Flood Risk Screening Report

Table 1.1: Summary of Highway Works

Works No.	Location	Description of Proposed Works
8	M1 Northbound	M1 northbound alterations. Gantry signage amendments. Hard shoulder amendments. M1 diverge to J24 lane.
9	M1 Northbound to A50 Westbound	Providing a new free-flow link road from the M1 northbound at J24 to provide a direct link to the A50 westbound, which will cross over/under the A453.
10	A50 Westbound	A50 westbound merge. Widening of the A50 to the north of the new merge from the link road (Works No. 9).
11	A50 Eastbound to M1 J24	Providing widening of the A50 eastbound link at J24 and other related works and traffic management measures in this location.
12	M1 Junction 24	Signage and lining amendments. Given the works are limited to signage and lining alterations of the existing highway, flood risk is not a material consideration. Therefore, this proposed element has not been assessed in any further detail.
13	EMG1 Access	EMG1 access improvements - widening of existing roundabout.
14	West of A453	A new shared-use cycle track north of the new toucan crossing alongside the A453 up to EMG1 connecting the two SEGRO developments for pedestrians and cyclists and providing an improved route for cyclists in the wider area such as between Kegworth and the Airport.
16	M1 south of Junction 23A	Signage amendments. Given the works are limited to signage alterations, flood risk is not a material consideration. Therefore, this proposed element has not been assessed in any further detail.
18	Finger Farm Roundabout	Signage Alterations. Given the works are limited to signage and lining alterations of the existing highway, flood risk is not a material consideration. Therefore, this proposed element has not been assessed in any further detail.
19	L57 Footpath	Upgrade of footpath L57 to the west of EMG1 to cycleway standard.
20	EMG1	Upgrade of the existing EMG1 substation. Given the works are limited to improvements to existing infrastructure, flood risk is not a material consideration. Therefore, this proposed element has not been assessed in any further detail.

Sources of Data

- Environment Agency (EA) Risk of Flooding from Surface Water (RoFSW) Data
- EA Risk of Flooding from Rivers and Sea (RoFSW) Data
- EA Flood Map for Planning

- Ordnance Survey mapping
- EA Hydraulic Model Information; 2022 Lockington Brook flood model, the 2021 Derbyshire Trent flood model and the 2012 Lower Soar flood model
- Hydraulic Assessment of an Unnamed Tributary of the River Soar (reference: EMG2-BWB-ZZ-XX-T-W-0005)
- Hydraulic Assessment of Hemmington Brook (reference: EMG2-BWB-ZZ-XX-T-W-0006)
- North West Leicestershire 2015[3] and 2024[4] Strategic Flood Risk Assessments (SFRA) Updates
- Leicestershire County Council Preliminary Flood Risk Assessment[5] (PFRA)
- British Geological Survey (BGS) Drift & Geology Maps
- Site visits undertaken by BWB Consulting across 2024 and 2025

[3] Strategic Flood Risk Assessment 2015 Update (Atkins, June 2015)
[4] Strategic Flood Risk Assessment 2024 Update (Atkins, March 2024)
[5] Preliminary Flood Risk Assessment (URS Scott Wilson, June 2011)

2. WORKS NO. 8: M1 NORTHBOUND HARD SHOULDER AND GANTRY SIGNAGE AMENDMENTS

Illustrative Proposals

2.1 The proposals include for amendments to the existing hard shoulder on the M1 Junction 24 diverge lane – this is illustrated in **Figure 2.1**. Additional works are proposed beyond those shown in **Figure 2.1**; however, these relate to changes to the gantry signage over the carriageway and will therefore have no flood risk implications.

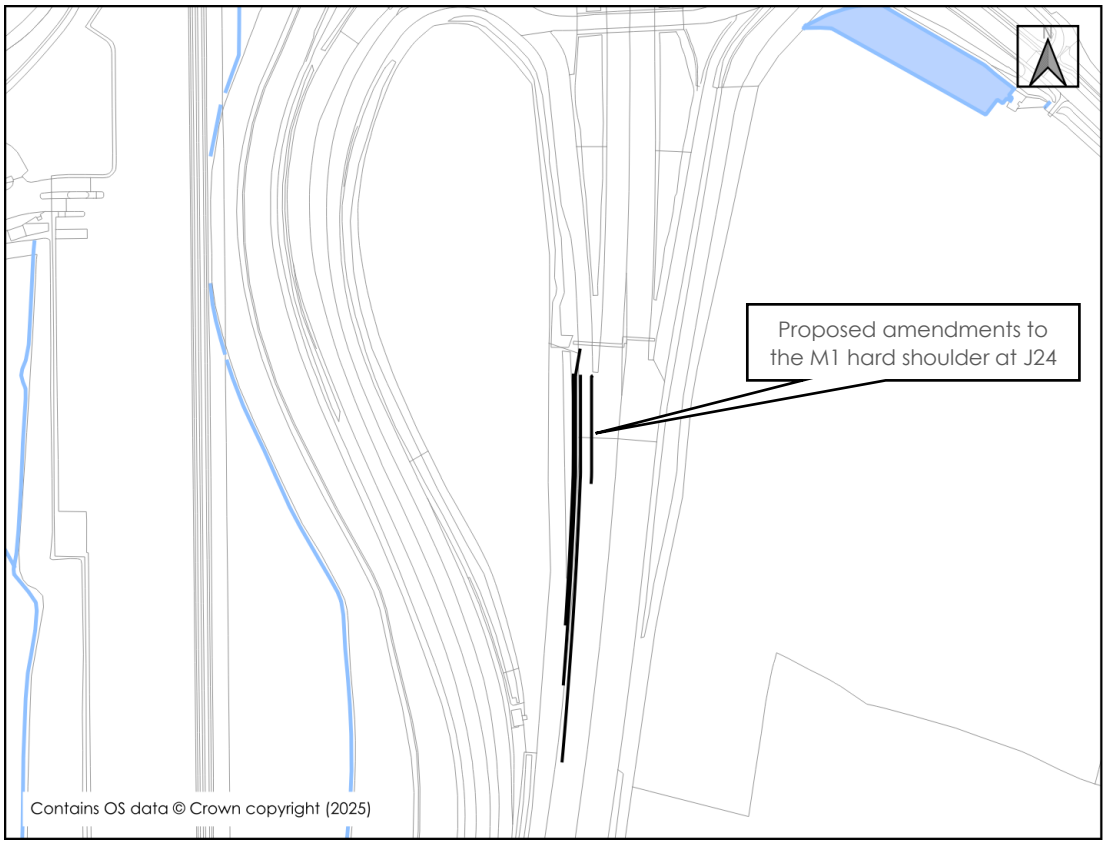


Figure 2.1: Illustrative Highway Improvements - Works No. 8

Historical Flooding Incidents

2.2 The EA Recorded Flood Outlines data does not show any recorded incidents within proximity to the proposed works. Furthermore, a review of historical incidents collated and listed in the PFRA and SFRAs also did not identify any which had affected the area.

Fluvial Flood Risk

2.3 The proposed works are located entirely within Flood Zone 1 which is land defined as having a low probability of flooding from rivers and sea. Additionally, EA RoFRS data identifies that the works are located outside of areas at fluvial risk.

Surface Water Flood Risk & Highway Drainage

2.4 The proposed works are shown to fall predominantly in an area at a very low probability of surface water flooding, although the southern extent does encroach into an area identified to have a medium to high probability of flooding, as shown in **Figure 2.2**.

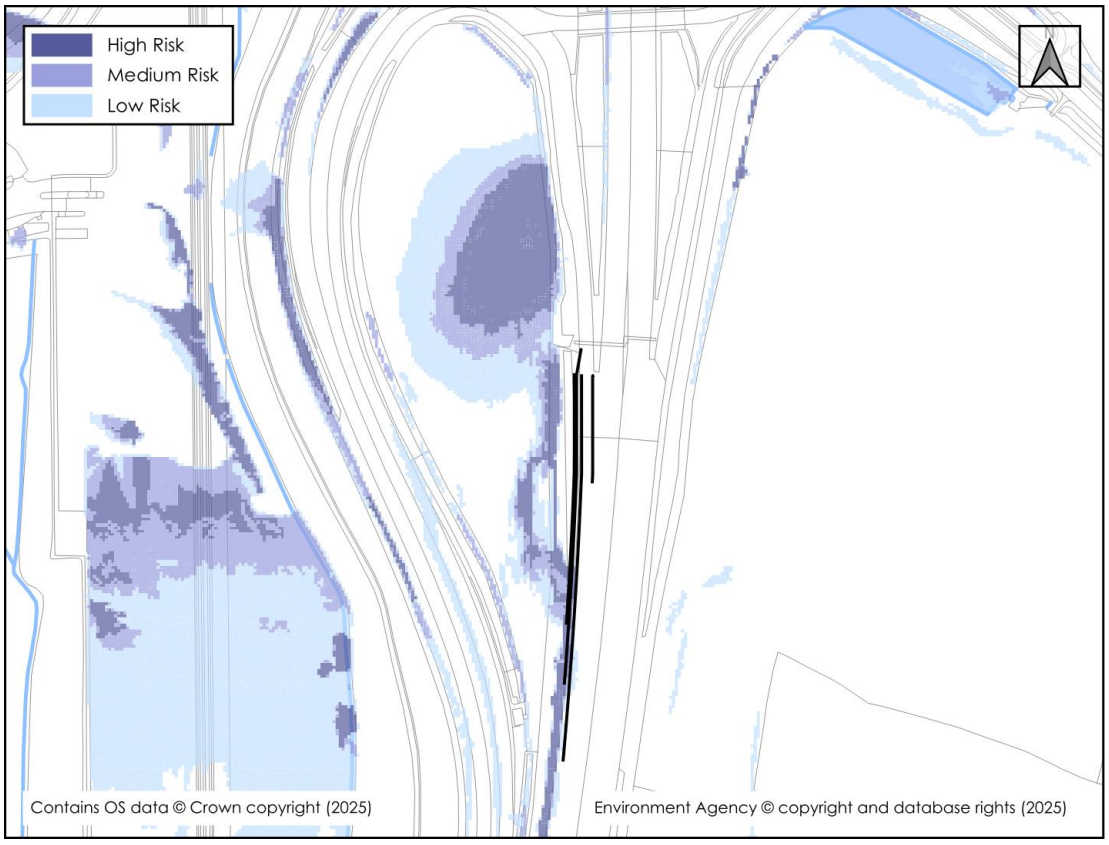


Figure 2.2: EA RoFSW data - Works No. 8

2.5 Upon review, it would appear that the flooding illustrated with the RoFSW is representative of water flowing down carriageway, before being shed into an adjoining low-lying field immediately to the west. In reality, the carriageway is positively drained which will manage the surface water runoff from the carriageway, limiting potential depths and the flood risk to road users. An example of the highway drainage is provided as **Figure 2.3**.

2.6 In the event of exceedance of the highway drainage, relatively shallow surface water would likely remain on the highway at nominal depths. It is common for the carriageway to be used to accommodate exceedance flows and so this is considered an acceptable source of flood risk. Therefore, the potential source of flood risk is not considered a barrier to the proposed works.

Figure 2.3: J24 M1 Kerb Drainage (Source: Google Street View)

2.7 The works will introduce new impermeable surfaces. The additional surface water runoff generated will be directed into the existing highway drainage. This will be accommodated through the addition of new surface water storage infrastructure constructed in the location of the works. This will allow the additional runoff to be stored at the location it is generated and drain into the downstream drainage network when capacity is available. This approach will allow the downstream drainage network to be retained and will ensure that pass on flow is retained at the existing rate (i.e.: preserving the existing conditions). There is also the option of enhancing the available storage within the existing downstream highway basins, to accommodate the additional runoff.

Groundwater Flood Risk

2.8 British Geological Survey (BGS) mapping identifies the proposed works are underlain by Helsby Sandstone Formation and Edwalton Member – Mudstone. Mapping from the 2015 SFRA shows the works to lie in a 1km^2 square grid where >75% of the area is potentially susceptible to groundwater flooding. However, it is considered the susceptible areas are most likely to comprise the lower lying surrounding land which generally comprises the floodplain of the local watercourses, including the River Soar. Given the relatively elevated nature of the highway infrastructure at this location, the risk of groundwater flooding is low.

2.9 The relatively minor proposed improvement works will not detrimentally affect the risk of groundwater flooding in the surrounding area.

Other Sources of Flood Risk

2.10 Other sources of flood risk have been reviewed including the sea, canals, reservoirs and large waterbodies, and public sewers, and none have been identified as posing a flood risk in this location.

Summary

2.11 Overall, the risk of flooding from the reviewed sources in this area are all considered to be at an acceptable level; therefore, they will not pose a barrier to the proposed works. Additionally, the works are not expected to negatively affect flood risk in the surrounding area, subject to improvements being made to the local highway drainage infrastructure to accommodate the additional impermeable surfaces.

3. WORKS NO. 9: CONSTRUCTION OF A NEW MOTORWAY LINK ROAD BETWEEN THE M1 NORTHBOUND AND THE A50 WESTBOUND

Illustrative Proposals

3.1 The proposals include providing a new free-flow link road from the M1 northbound at J24 to provide a direct link to the A50 westbound, which will cross over/under the A453. The proposed works are illustrated in **Figure 3.1**.

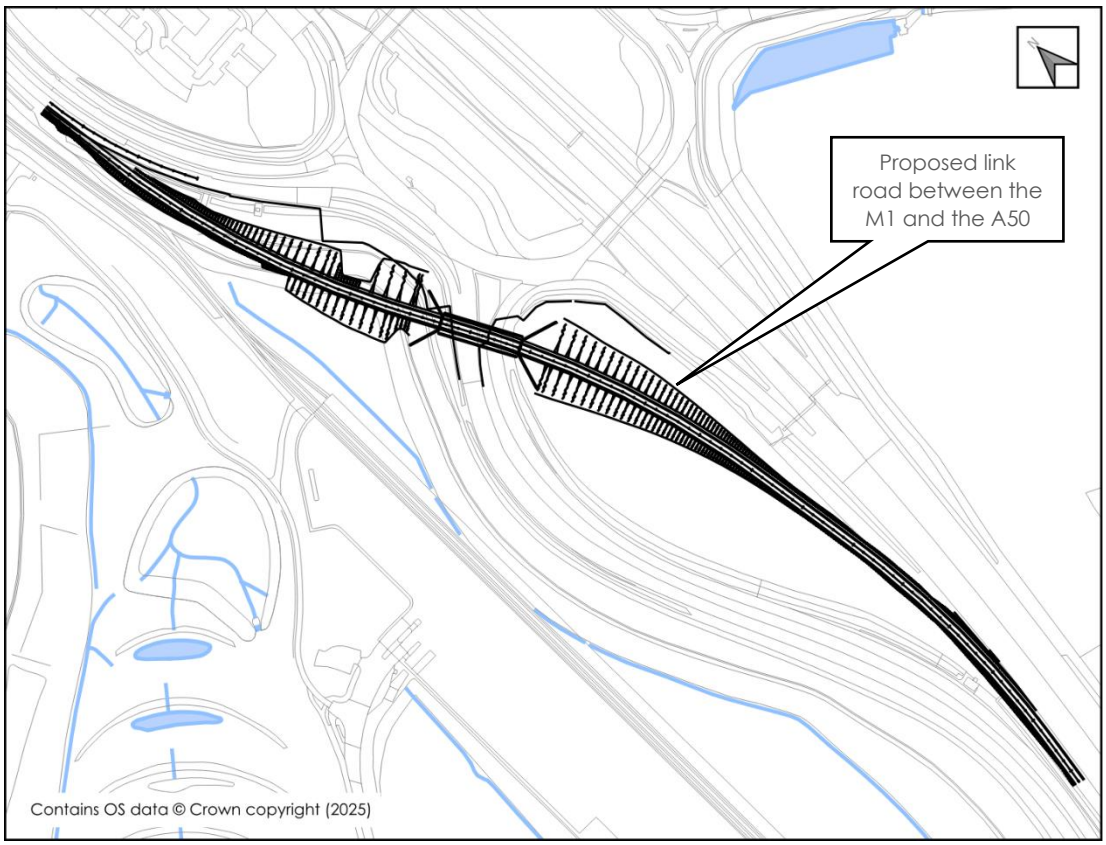


Figure 3.1: Illustrative Highway Improvements - Works No. 9

Historical Flooding Incidents

3.2 The EA Recorded Flood Outlines data does not show any recorded incidents within proximity to the proposed works. Furthermore, a review of historical incidents collated and listed in the PFRA and SFRAs did not identify any which had affected the area.

Fluvial Flood Risk

3.3 The proposed works are located entirely within Flood Zone 1, and EA RoFRS data identifies that the works are located outside of areas at fluvial risk.

Surface Water Flood Risk & Highway Drainage

3.4 The proposed works are shown to fall across two areas which are identified to be at potential flood risk in the EA RoFSW data, these are shown in **Figure 3.2**:

- Southern flooding: the flow route on the M1 carriageway and an area of ponded surface water in the adjacent field, as previously discussed in **Section 2**.
- Northern flooding: an area to the north located to the west of the A50 carriageway.

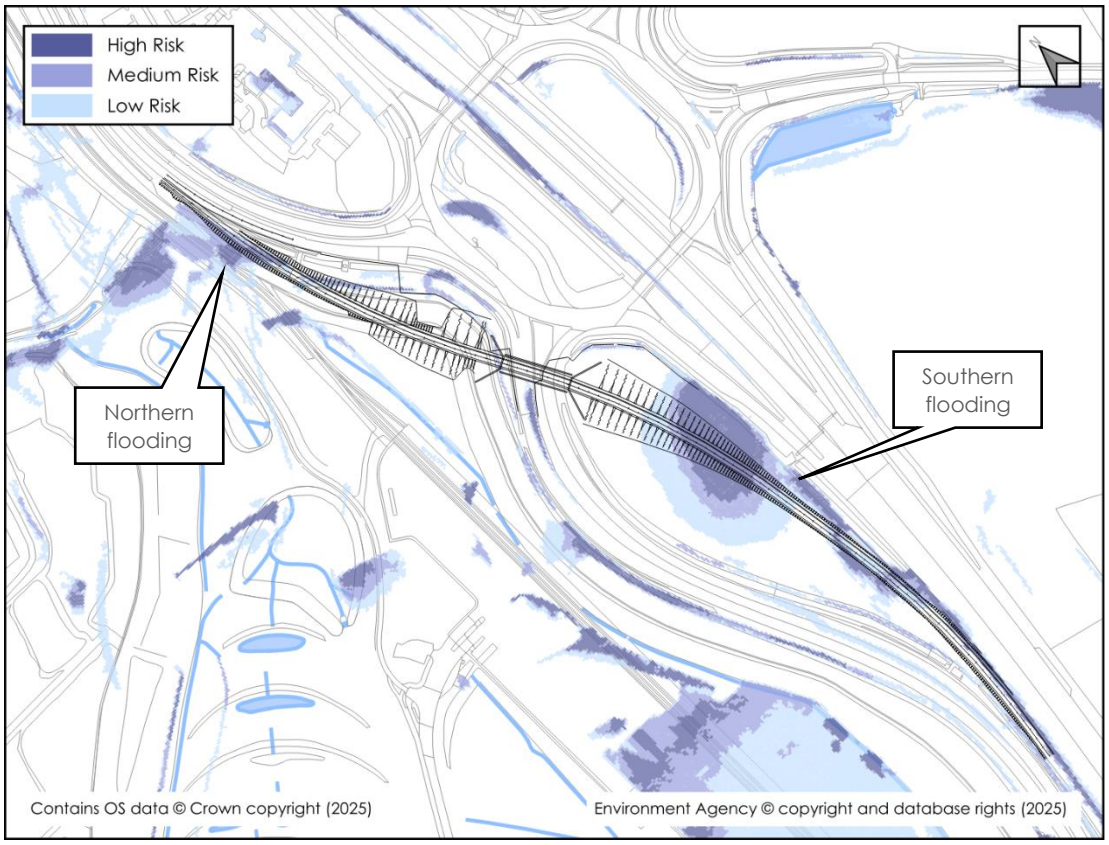


Figure 3.2: EA RoFSW - Works No. 9

Southern Surface Water Flood Route

3.5 As discussed in **Section 2**, the flooding illustrated with the RoFSW is representative of water flowing down the M1 carriageway, before being shed into an adjoining low-lying field immediately to the west. In reality, the carriageway is positively drained which will limit any contributing surface water runoff from the carriageway into the field.

3.6 Additionally, highway drainage records show the presence of filter drains at the toe of the M1/J24 embankment in the east of the field which provide a drainage connection into the highway drainage. Therefore, the illustrated surface water, which is shown to pond in the field, is likely to be overestimated. The potential level of flood risk is not considered a barrier to the proposed works.

Northern Surface Water Flooding

3.7 The potential flooding illustrated within the RoFSW at the northern extent of the link road would appear to be associated with surface water runoff from the local topography before EMG1 was constructed. As part of EMG1, the area to the west of the A50 was reprofiled and new drainage infrastructure constructed. For example, an elevated railway line now runs through the mapped area of surface water flooding isolating the A50 from EMG1 (see **Figure 3.3**), and a new highway ditch was formed to drain the area between the A50 and the railway. Therefore, the mapped RoSFW data is not considered to be accurate in this location. Given the area is positively drained, the potential level of flood risk is not considered a barrier to the proposed works.

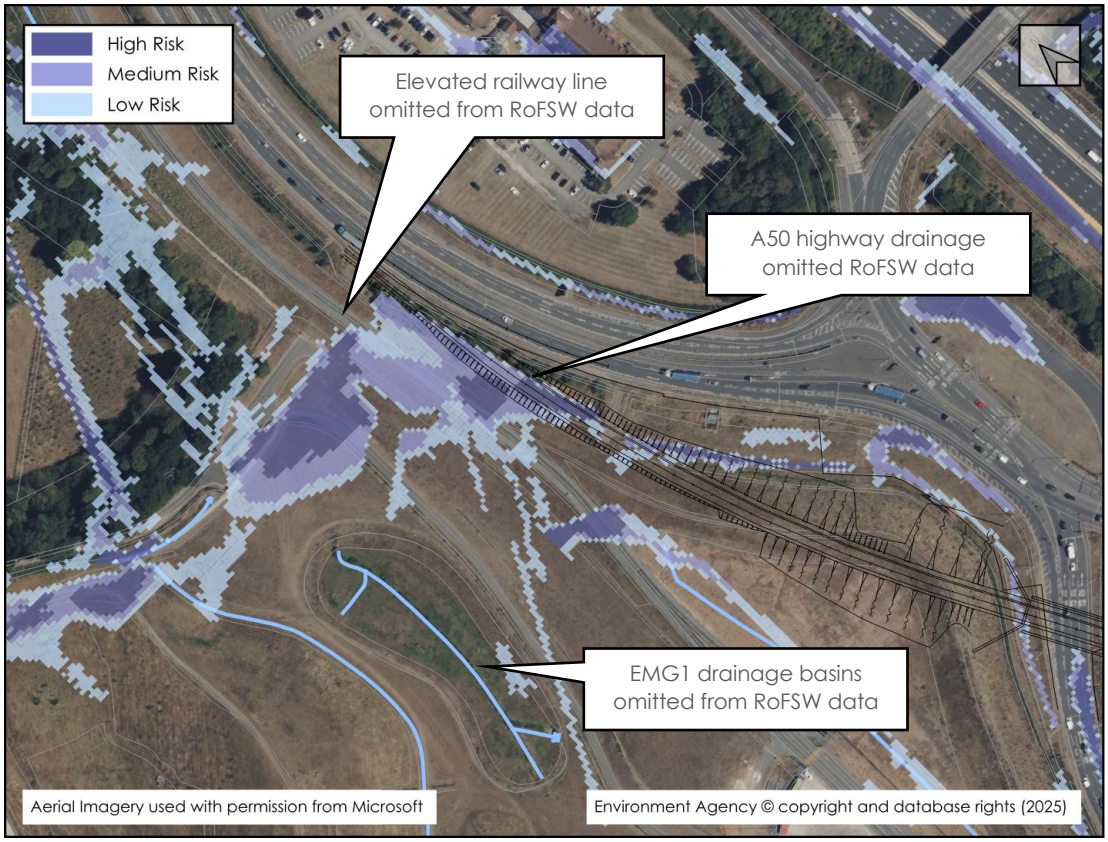


Figure 3.3: EA RoFSW - Works No. 9 – Northern Flood Risk Area

Mitigation

3.8 At this stage it is expected that the proposed link road will be located upon a raised embankment rising from the M1 to pass over the A453 before descending to meet the A50. The proposals will include new surface drainage in the form of Sustainable Drainage (SuDS) basin(s) that will provide the necessary attenuated storage for runoff from the new impermeable surfaces, preventing an adverse impact on downstream flood risk. The drainage will include an appropriately restricted discharge rate and attenuated storage for the 1 in 100-year plus climate change event.

3.9 The highway embankment will also include toe drainage that will help manage any runoff from the surrounding greenfield areas.

3.10 Any existing highway drainage features within the footprint of the link road, will either be preserved or relocated to ensure that existing drainage connectivity and capacity is not adversely affected.

Groundwater Flood Risk

3.11 British Geological Survey (BGS) mapping identifies the proposed works are underlain by Helsby Sandstone Formation and Edwalton Member – Mudstone. Mapping from the 2015 SFRA shows the works to lie in a 1km^2 square grid where >75% of the area is potentially susceptible to groundwater flooding. However, it is considered the susceptible areas are most likely to comprise the lower lying surrounding land which generally comprises the floodplain of the local watercourses, including the River Soar.

3.12 The proposed works are not expected to detrimentally affect the probability of groundwater flooding in the surrounding area.

Other Sources of Flood Risk

3.13 Other sources of flood risk have been reviewed including the sea, canals, reservoirs and large waterbodies, and public sewers, and none have been identified as posing a flood risk in this location.

Summary

3.14 Overall, the risk of flooding from the reviewed sources in this area are all considered to be at an acceptable level; therefore, they will not pose a barrier to the proposed works. Additionally, the works are not expected to negatively affect flood risk in the surrounding area, subject to appropriate surface water management.

4. WORKS NO. 10: WIDENING OF THE A50 WESTBOUND

Illustrative Proposals

4.1 In this location the proposed highway improvements include widening of the A50 westbound carriageway to the north of the new merge from the link road (Works No. 9), the extent of the widening is shown in **Figure 4.1**. In this location the highway is located upon an embankment which may also require widening.

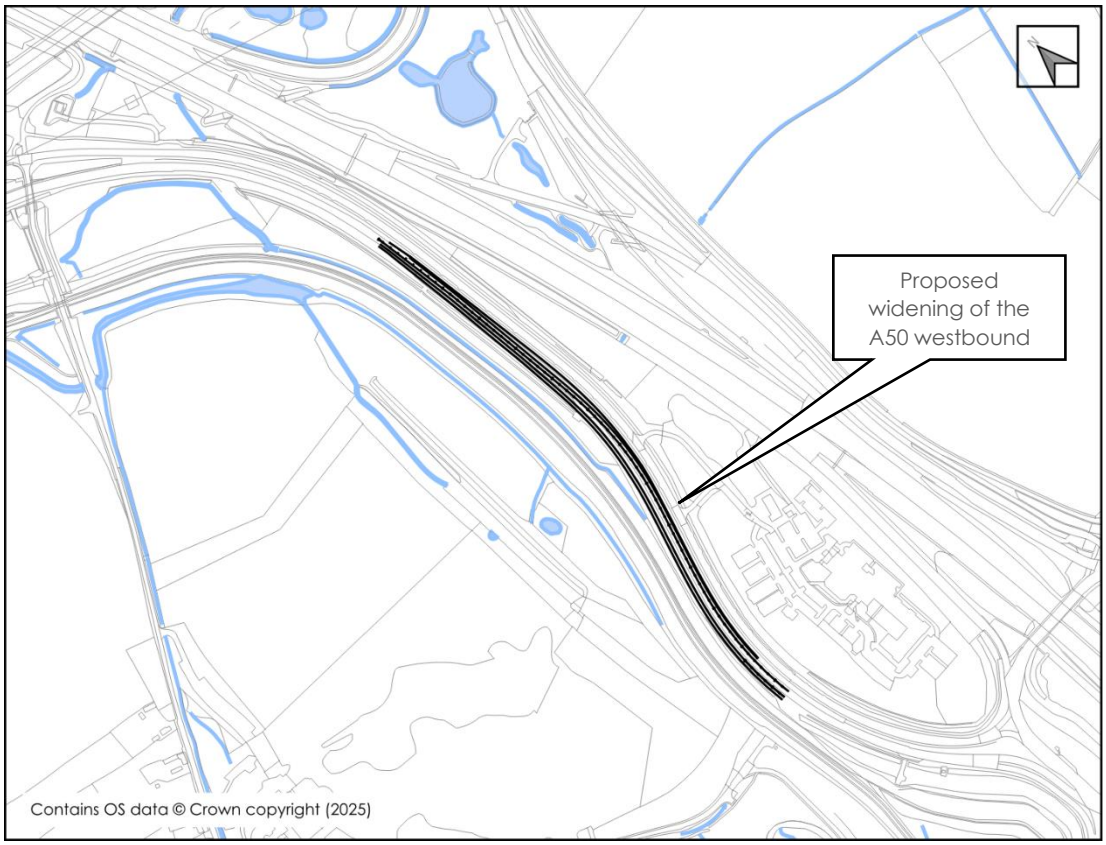


Figure 4.1: Illustrative Highway Improvements - Works No. 10

Historical Flooding Incidents

4.2 The EA Recorded Flood Outlines data does not show any recorded incidents within proximity to the proposed works. The nearest recorded flood outline is located approximately 130m north, attributed to the River Trent; however, the event dated 1932 does not represent the present-day topography of the floodplain and is not considered a reliable source of data. A review of historical incidents collated and listed in the PFRA and SFRAs also did not identify any which had affected the local area.

Fluvial Flood Risk

4.3 The proposed works are located partially within Flood Zone 2, which is land defined as having a medium probability of flooding from rivers and sea; this is shown in **Figure 4.2**. Whereas, the EA RoFRS, shown in **Figure 4.3**, indicates the works to be located in an area with a low probability of flooding from rivers and sea.

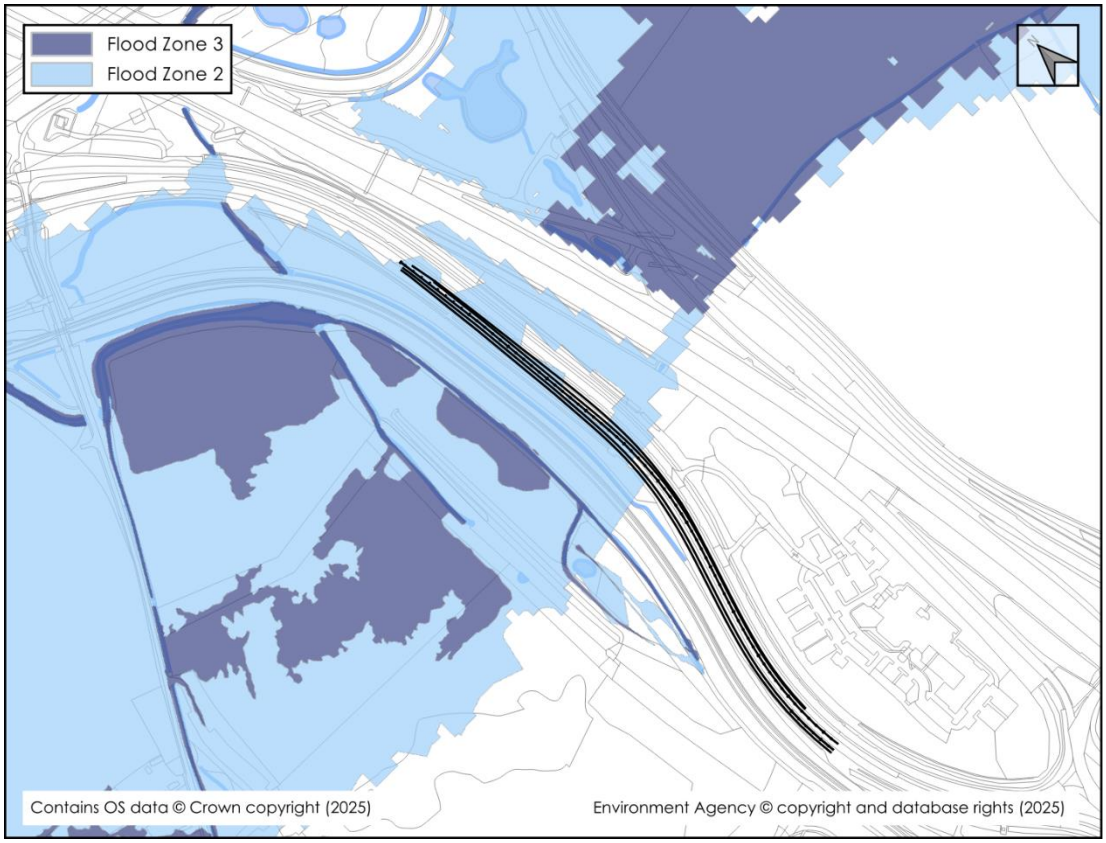


Figure 4.2: EA Flood Map for Planning - Works No. 10

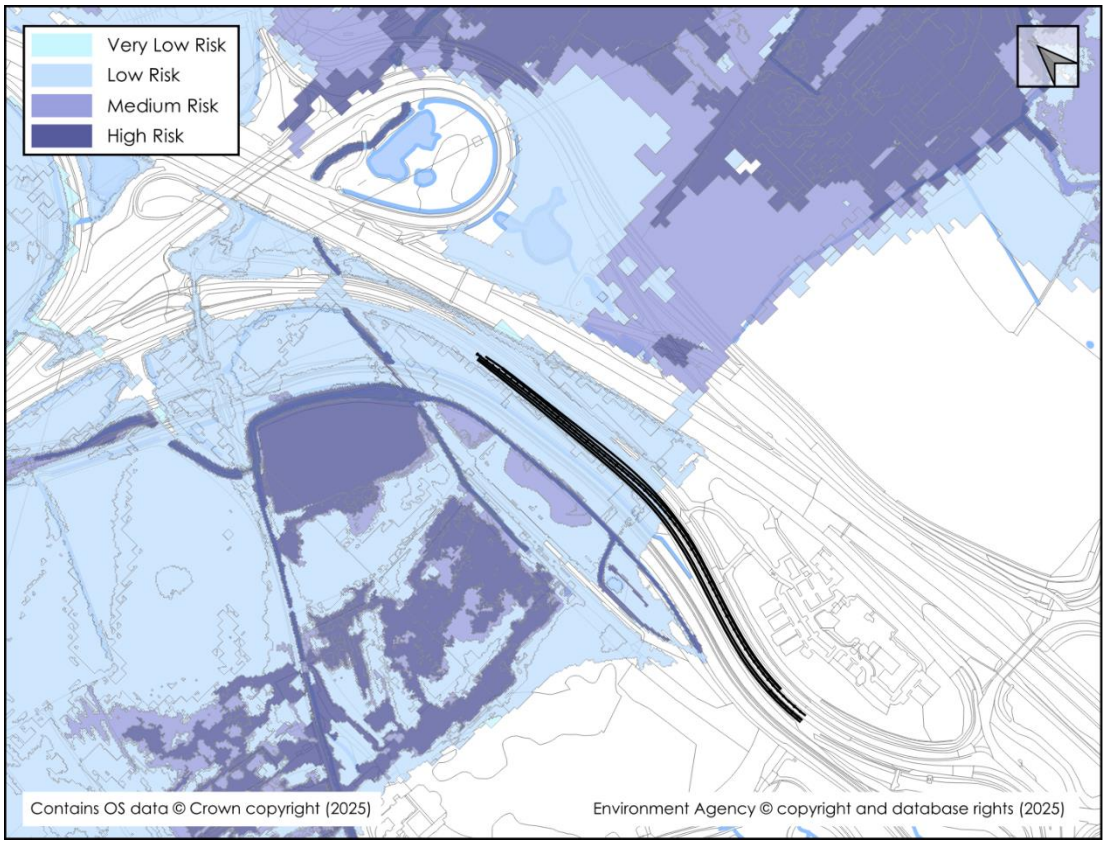


Figure 4.3: EA RoFRS - Works No. 10

4.4 The EA have provided the three local hydraulic models for the area, inclusive of the 2022 Lockington Brook flood model, the 2021 Derbyshire Trent flood model and the 2012 Lower Soar flood model. A review of the modelled flood data identifies that the River Trent generates the most precautionary flood levels in the area. The peak flood levels from the 2021 Derbyshire Trent flood model are provided within **Figure 4.4** along with the modelled floodplain outlines.

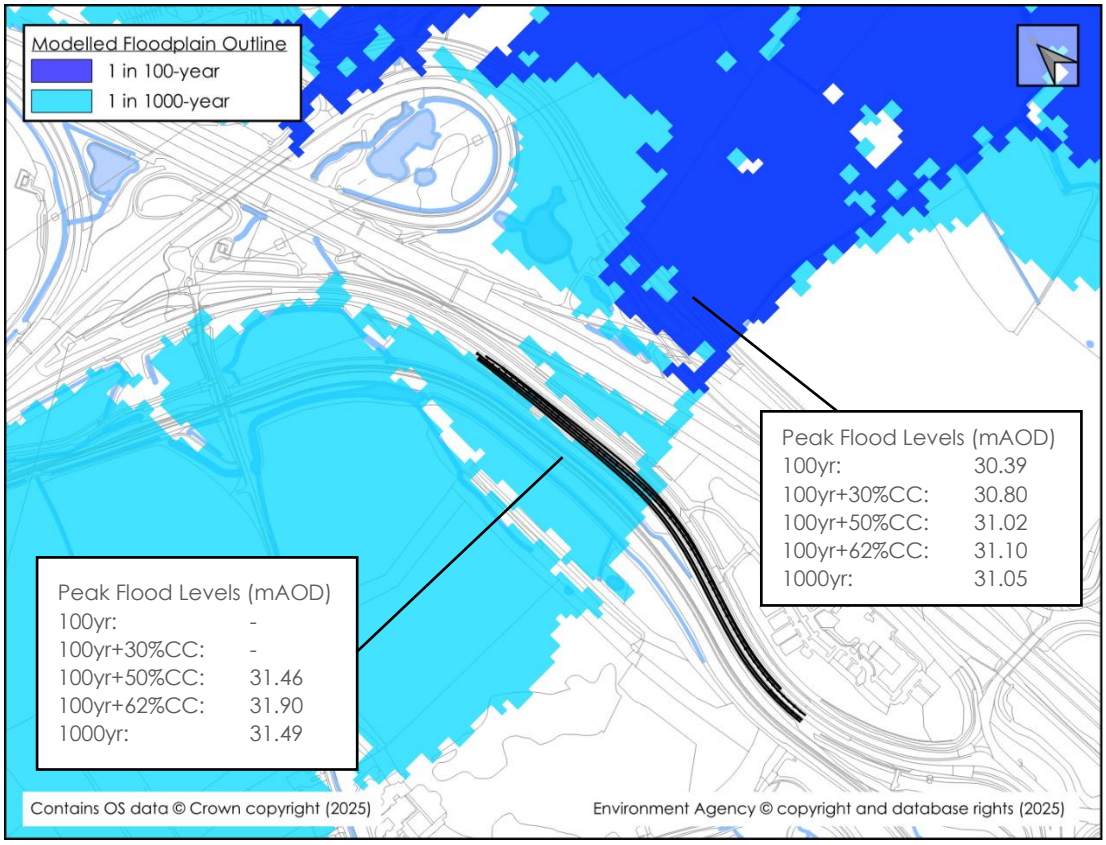


Figure 4.4: River Trent Modelled Floodplain Outlines - Works No. 10

4.5 It should be noted that the ground levels within the hydraulic model at this location are not reflective of the current topography. Therefore, the peak flood levels have been projected against the latest EA LiDAR DTM, as flown in 2022, to provide a more accurate floodplain outline. This is included as **Figure 4.5**.

4.6 This analysis has confirmed that the proposed works are located outside of the 1 in 100-year and 1 in 100-year+30% climate change (the design flood event) floodplain outlines.

4.7 The 1 in 1000-year floodplain extends to meet the A50 west boundary embankment, but it is not predicted to flow on the carriageway, confirming the A50 westbound is at a low risk of fluvial flooding.

4.8 During the 1 in 100-year+62% climate change flood event (the credible maximum climate change scenario), flood levels are predicted to reach an elevation that could overtop and flow onto the westbound carriageway, leading to approximately a 0.42m depth of flooding. However, this residual flood risk is not a barrier to the proposed improvement works.

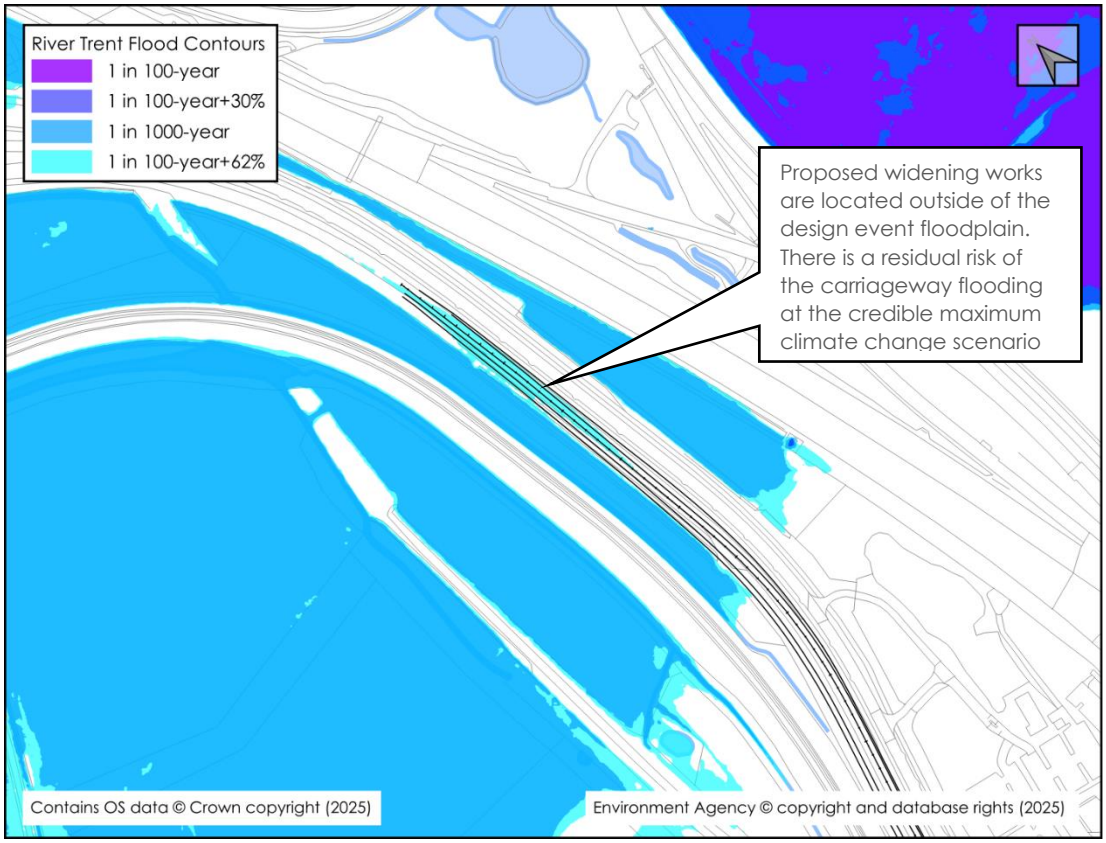


Figure 4.5: River Trent Peak Modelled Flood Levels Projected on to the Latest LiDAR DTM - Works No. 10

Surface Water Flood Risk & Highway Drainage

4.9 The proposed works are shown to fall predominantly in an area at a very low to low probability of surface water flooding, although an area of high to medium probability of flooding is illustrated at the low point of the carriageway, as shown in **Figure 4.6.** This flooding is associated with runoff from the A50 highway itself, and not an overland flow route of significance. Moreover, the highway is positively drained, which will not be fully reflected in the EA RoFSW data.

4.10 In the event of exceedance of the highway drainage, relatively shallow surface water would likely remain on the highway at nominal depths. It is common for the carriageway to be used to accommodate exceedance flows and so this is considered an acceptable source of flood risk. Therefore, the potential source of flood risk is not considered a barrier to the proposed works.

4.11 The EA RoFSW also identifies the potential for surface water to collect on land located to the west of the A50. However, this data does not reflect the topographical and drainage alterations made here as part of EMG1. The area to the west of the A50 now includes drainage channels located either side of a new railway line that provide drainage connectivity to the Lockington Brook.

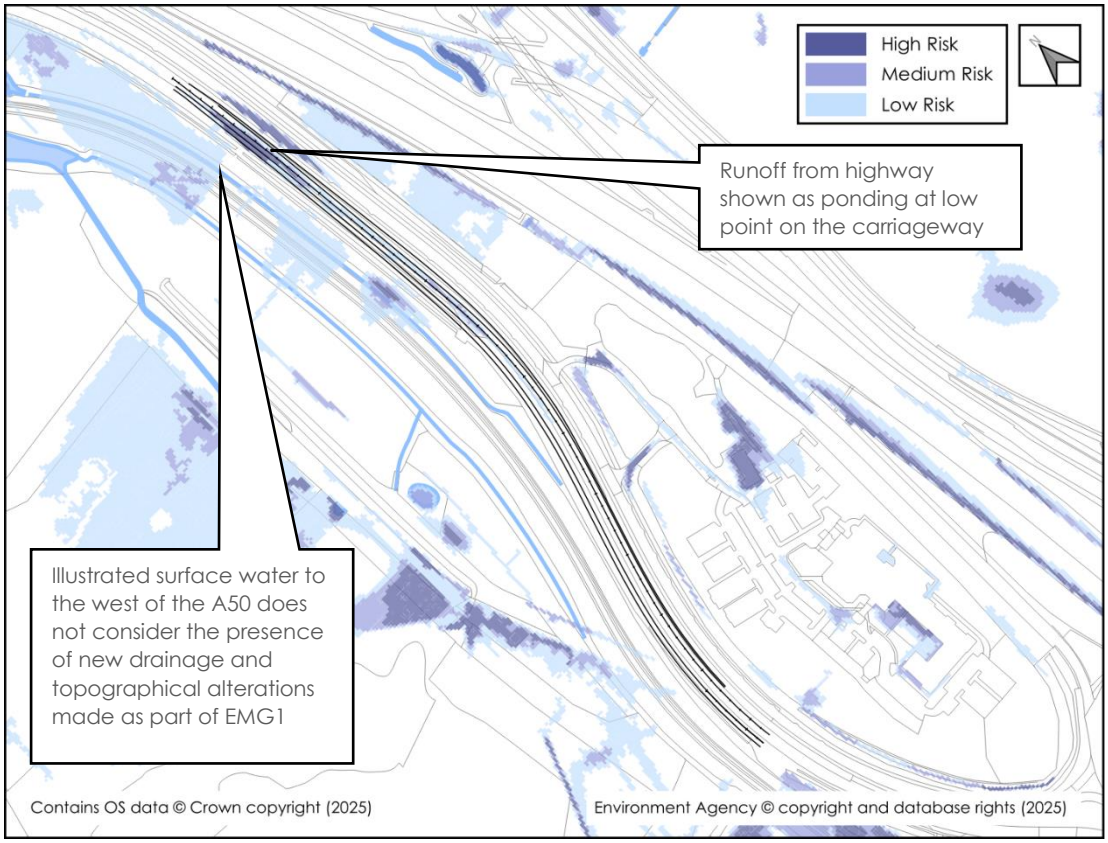


Figure 4.6: EA Risk of Flooding from Surface Water - Works No. 10

4.12 The works will introduce new impermeable surfaces. The additional surface water runoff generated will be directed into the existing highway drainage. This will be accommodated through the addition of new surface water storage infrastructure constructed in the location of the works. This will allow the additional runoff to be stored at the location it is generated and drain into the downstream drainage network when capacity is available. This approach will allow the downstream drainage network to be retained and will ensure that pass on flow is retained at the existing rate (i.e.: preserving the existing conditions). There is also the option of enhancing the available storage within the existing downstream highway basins, to accommodate the additional runoff.

Groundwater Flood Risk

4.13 British Geological Survey (BGS) mapping identifies the proposed works are underlain by Arden Sandstone Formation - Sandstone, Branscombe Mudstone Formation – Mudstone, and Edwalton Member – Mudstone. Mapping from the 2015 SFRA shows the works to lie in a 1km^2 square grid where >75% of the area is potentially susceptible to groundwater flooding. However, it is considered the susceptible areas are most likely to comprise the lower lying surrounding land which generally comprises the floodplain of the local watercourses, including the Lockington Brook and River Trent. Given the elevated nature of the highway infrastructure at this location the risk of groundwater flooding is low.

4.14 The relatively minor proposed improvement works will not detrimentally affect the risk of groundwater flooding in the surrounding area.

Flood Risk from Reservoirs and Large Waterbodies

4.15 Reservoir failure mapping prepared and published by the EA, identifies that the proposed works are located in an area at risk of inundation from reservoir failure during a 'wet-day' scenario attributed to several reservoirs. However, based on the safety legislation in place and the maintenance and repair responsibilities of responsible authority, the actual probability of a significant failure is considered to be low. Therefore, the risk of flooding from this source is also considered to be low.

4.16 The proposed works represent improvements to existing highway infrastructure, and not new development. Therefore, it will not alter the classification of any upstream reservoirs.

Other Sources of Flood Risk

4.17 Other sources of flood risk have been reviewed including, the sea, canals, and public sewers, and none have been identified as posing a flood risk in this location.

Summary

4.18 Overall, the risk of flooding from the reviewed sources in this area are all considered to be at an acceptable level; therefore, they will not pose a barrier to the proposed works. Additionally, the works are not expected to negatively affect flood risk in the surrounding area, subject to appropriate surface water management.

5. WORKS NO. 11 WIDENING OF THE A50 EASTBOUND TO M1 J24

Illustrative Proposals

5.1 In this location the proposed highway improvements include widening of the A50 eastbound link at J24 and other related works and traffic management measures, these are shown in **Figure 5.1**. In this location the highway is located upon an embankment which will also require widening to accommodate the works.

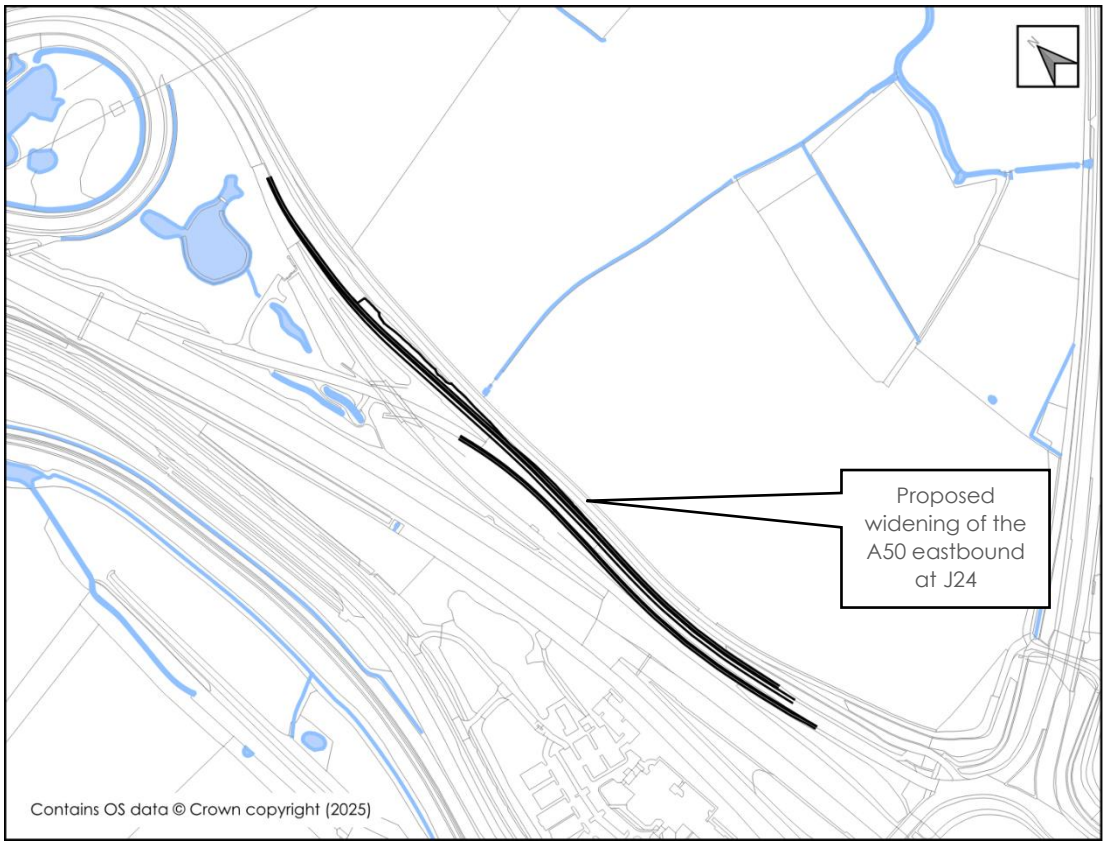


Figure 5.1: Illustrative Highway Improvements – Works No. 11

Historical Flooding Incidents

5.2 The EA Recorded Flood Outlines data does not show any recorded incidents within proximity to the proposed works. The nearest recorded flood outline is located approximately 200m north of the proposed works, attributed to the River Trent. A review of historical incidents collated and listed in the PFRA and SFRAs did not identify any which had affected the area.

Fluvial Flood Risk

5.3 The proposed works are partially located within Flood Zone 2 and Flood Zone 3, as shown in **Figure 5.2**. Flood Zone 3 is land defined as having a high probability of flooding from rivers and sea. RoFRS data, shown in **Figure 5.3**, indicates the site to be located in an area with a low to medium probability of flooding from rivers and sea.

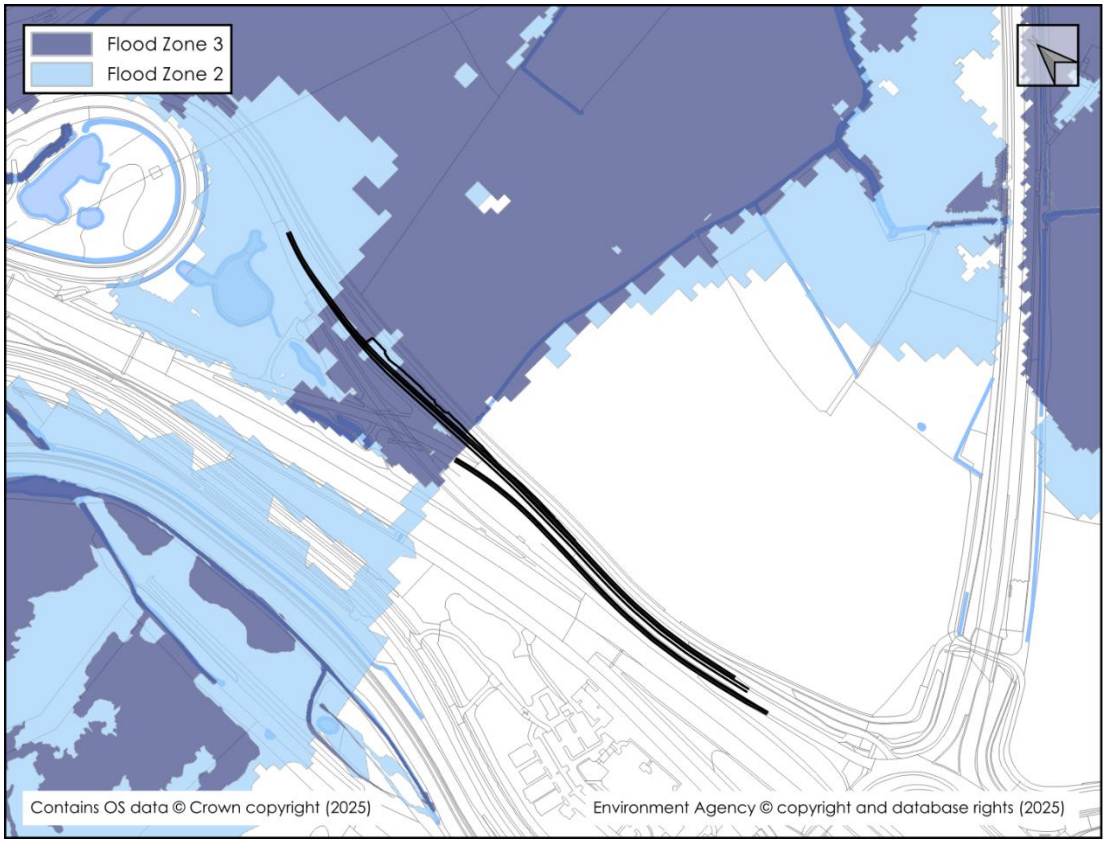


Figure 5.2: EA Flood Map for Planning - Works No. 11

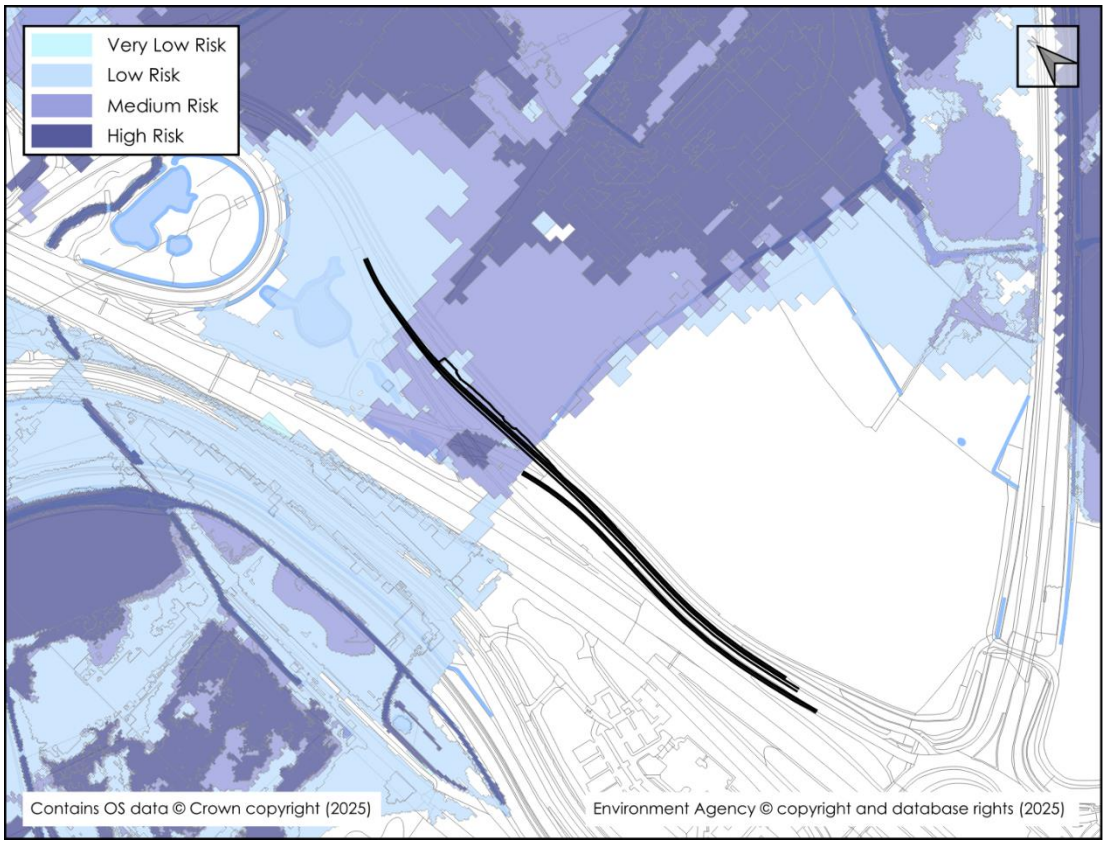


Figure 5.3: EA RoFRS - Works No. 11

5.4 A review of the previously discussed EA modelled flood data in the area has identified that the River Trent also generates the most precautionary flood levels. The peak flood levels from the 2021 Derbyshire Trent flood model are provided **Figure 5.4**, along with modelled floodplain outlines.

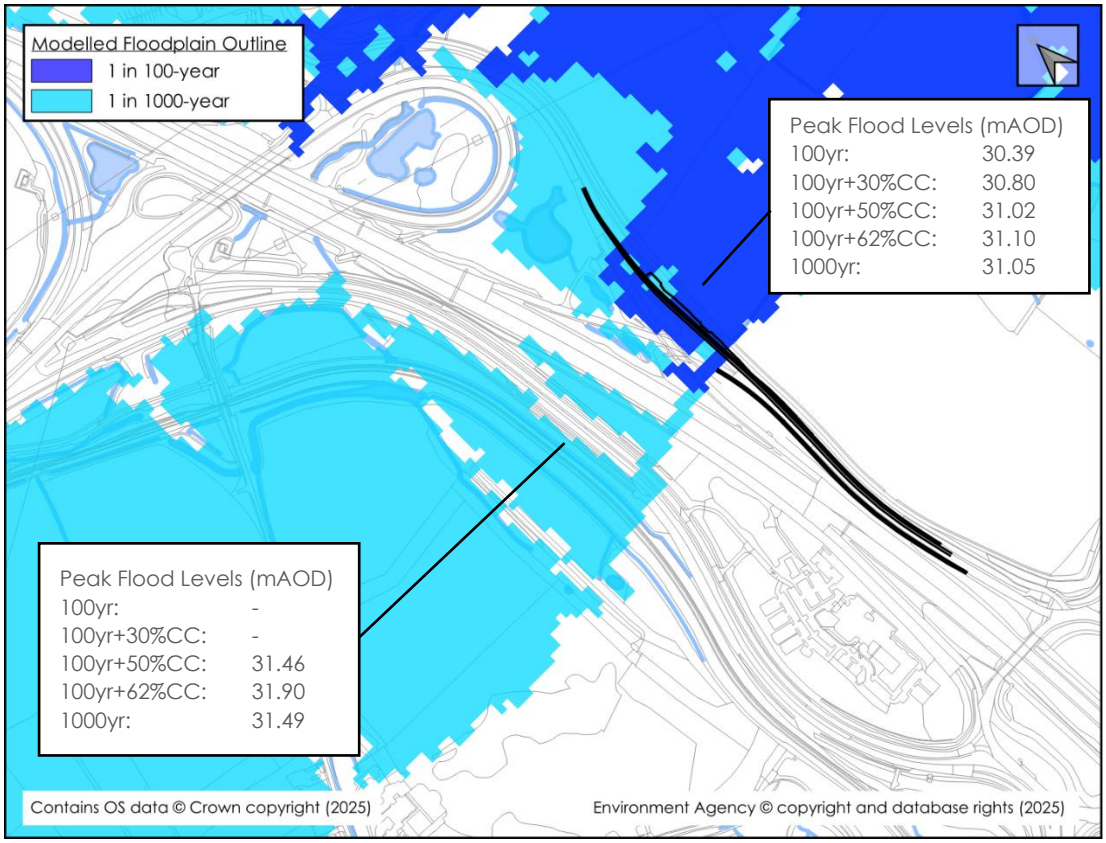


Figure 5.4: River Trent Modelled Floodplain Outlines - Works No. 11

5.5 It should be noted that the ground levels within the hydraulic model at this location are not reflective of the current topography. Therefore, the peak flood levels have been projected against the latest EA LiDAR DTM (2022), to provide a more accurate floodplain outline. This is included as **Figure 5.5**.

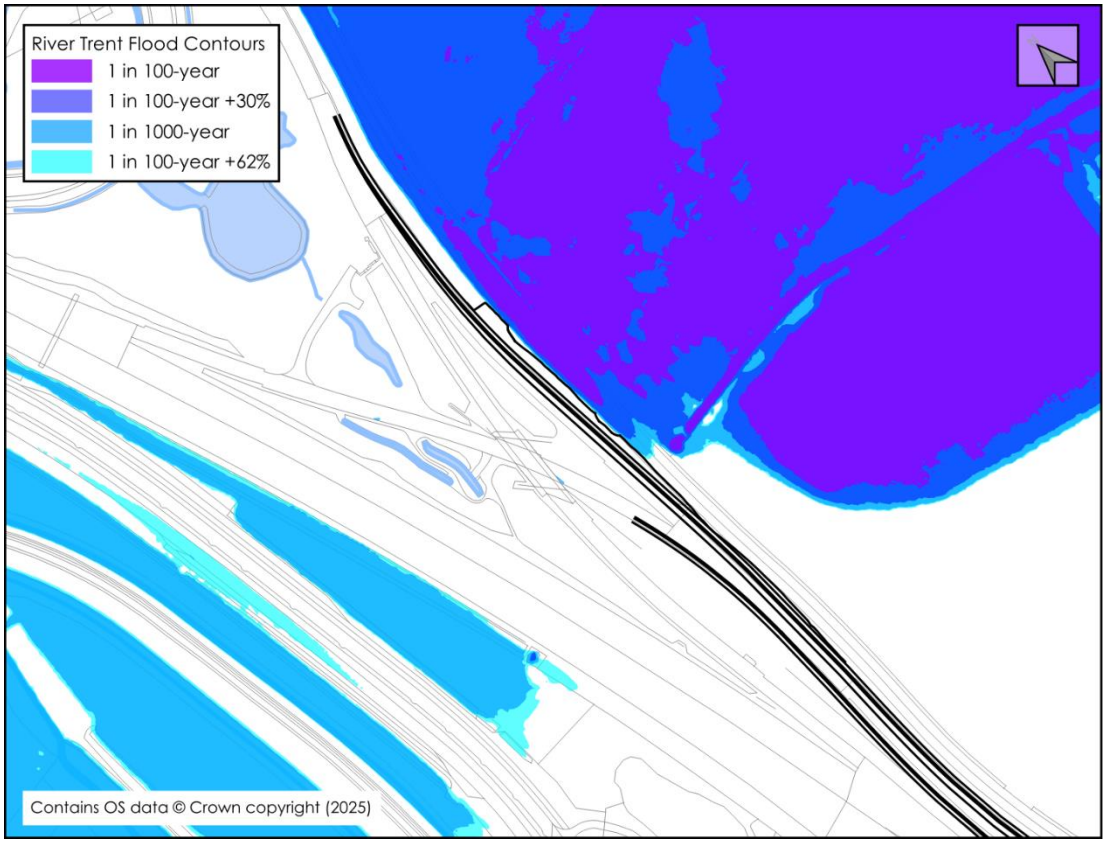


Figure 5.5: River Trent Peak Modelled Flood Levels Projected on to the Latest LiDAR DTM - Works No. 11

5.6 The existing carriageway is generally at an elevation of 32.8mAOD or above next to the Trent floodplain. This is 2m above the design flood level for the Trent (the 1 in 100-year+30% climate change event), 1.75m above the 1 in 1000-year flood level, and 1.70m above the maximum credible climate change scenario (1 in 100-year+62% climate change event).

5.7 However, the analysis has identified that the toe of the highway embankment is located on the edge of the floodplain; therefore, a review the potential alterations to embankment has been undertaken to investigate if this could result in any displacement of the design event floodplain.

5.8 The analysis included taking sections through the existing and proposed embankment (see **Figure 5.6**) and reviewing the works against the design flood level and floodplain extent (see **Figure 5.7**). The analysis has confirmed that the proposed works will occur outside of the design event floodplain, and above the design flood level.

Figure 5.6: Plan View, A50 Embankment Alterations next to the Trent Floodplain - Works No. 11

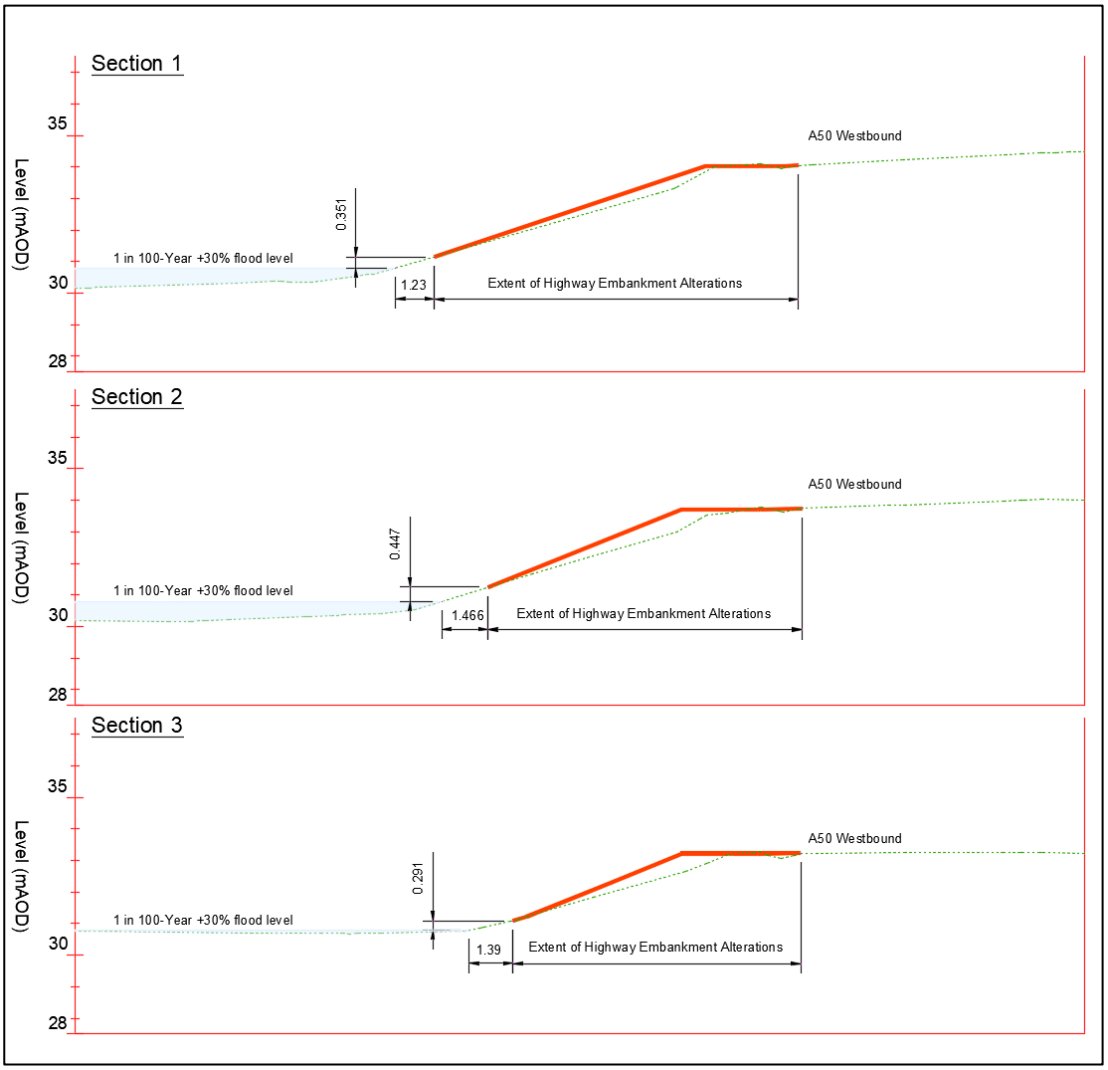


Figure 5.7: Section View, A50 Highway Embankment Alterations next to the Trent Floodplain - Works No. 11

Surface Water Flood Risk & Highway Drainage

5.9 EA RoFSW data identifies that the extent of the proposed works are at a very low to low risk of surface water flooding, as shown in **Figure 5.8**.

5.10 In the event of exceedance of the highway drainage, relatively shallow surface water would likely remain on the highway at nominal depths. It is common for the carriageway to be used to accommodate exceedance flows and so this is considered an acceptable source of flood risk. Therefore, the potential source of flood risk is not considered a barrier to the proposed works.

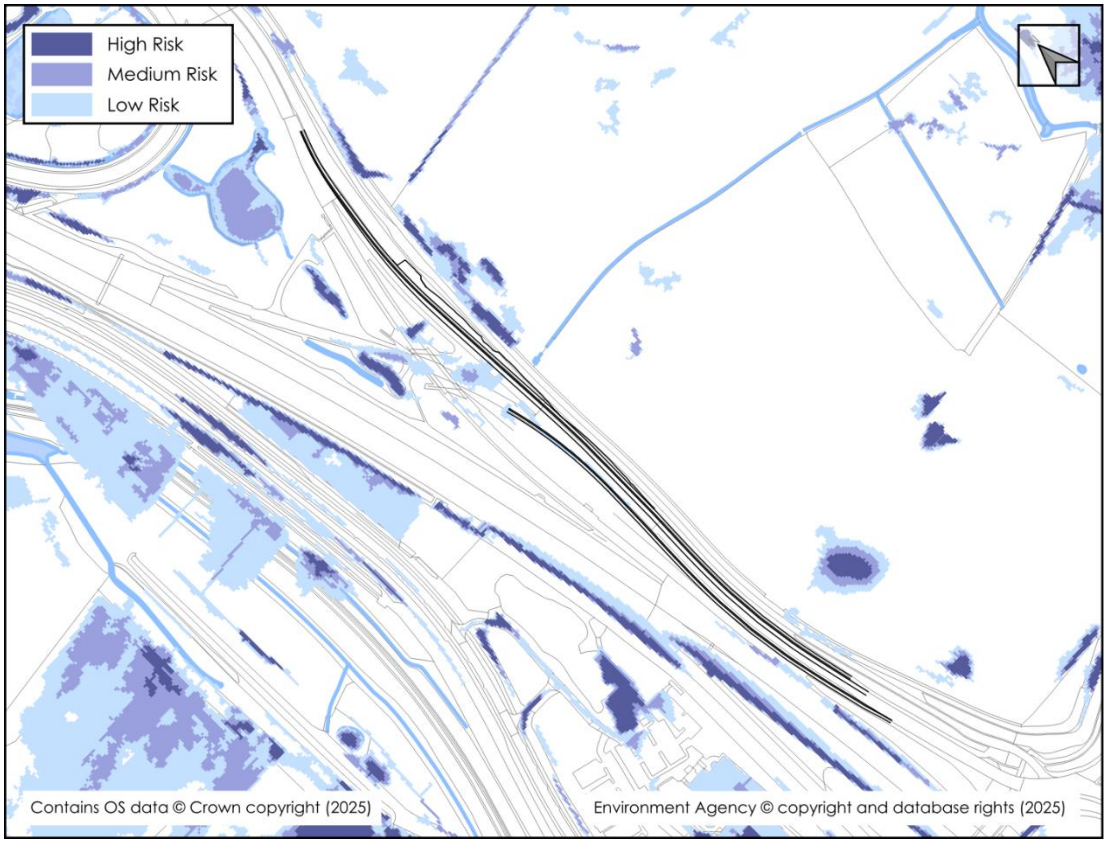


Figure 5.8: EA RoFSW - Works No. 11

5.11 The works will introduce new impermeable surfaces. The additional surface water runoff generated will be directed into the existing highway drainage. This will be accommodated through the addition of new surface water storage infrastructure constructed in the location of the works. This will allow the additional runoff to be stored at the location it is generated and drain into the downstream drainage network when capacity is available. This approach will allow the downstream drainage network to be retained and will ensure that pass on flow is retained at the existing rate (i.e.: preserving the existing conditions). There is also the option of enhancing the available storage within the existing downstream highway basins, to accommodate the additional runoff.

Groundwater Flood Risk

5.12 British Geological Survey (BGS) mapping identifies the proposed works are underlain by Arden Sandstone Formation - Sandstone, Branscombe Mudstone Formation – Mudstone, and Edwalton Member – Mudstone. Mapping from the 2015 SFRA shows the works to lie in a 1km^2 square grid where >75% of the area is potentially susceptible to groundwater flooding. However, it is considered the susceptible areas are most likely to comprise the lower lying surrounding land which generally comprises the floodplain of the local watercourses, including the River Trent. Given the elevated nature of the highway infrastructure at this location the risk of groundwater flooding is low.

5.13 The relatively minor proposed improvement works will not detrimentally affect the risk of groundwater flooding in the surrounding area.

Flood Risk from Reservoirs and Large Waterbodies

5.14 Reservoir failure mapping prepared and published by the EA, identifies that the proposed works are located in an area at risk of inundation from reservoir failure during a 'wet-day' scenario attributed to several reservoirs. However, based on the safety legislation in place and the maintenance and repair responsibilities of responsible authority, the actual probability of a significant failure is considered to be low. Therefore, the risk of flooding from this source is also considered to be low.

5.15 The proposed works represent improvements to existing highway infrastructure, and not new development. Therefore, it will not alter the classification of any upstream reservoirs.

Other Sources of Flood Risk

5.16 Other sources of flood risk have been reviewed including, the sea, canals, and public sewers, and none have been identified as posing a flood risk in this location.

Summary

5.17 Overall, the risk of flooding from the reviewed sources in this area are all considered to be at an acceptable level; therefore, they will not pose a barrier to the proposed works. Additionally, the works are not expected to negatively affect flood risk in the surrounding area, subject to appropriate surface water management.

6. WORKS NO. 13: EMG1 ACCESS IMPROVEMENTS - WIDENING OF EXISTING ROUNDABOUT.

Illustrative Proposals

6.1 The proposals include for improvements to the existing EMG1 access roundabout through the provision of an additional lane, this is shown in **Figure 6.1**.

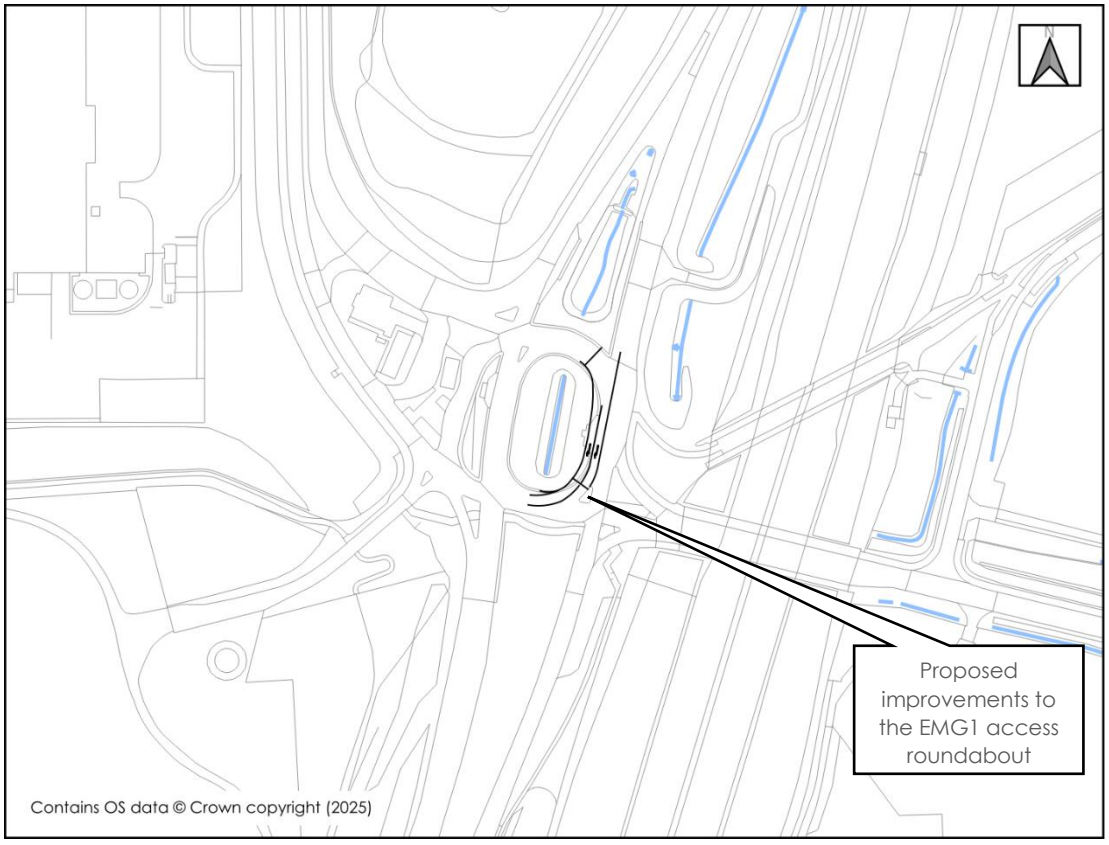


Figure 6.1: Illustrative Highway Improvements - Works No. 13

Historical Flooding Incidents

6.2 The EA Recorded Flood Outlines data does not show any recorded incidents within proximity to the proposed works. Furthermore, a review of historical incidents collated and listed in the PFRA and SFRAs did not identify any which had affected the area.

Fluvial Flood Risk

6.3 The proposed works are located entirely within Flood Zone 1 and EA RoFRS data identifies that the works are located outside of areas at fluvial risk.

Surface Water Flood Risk

6.4 EA RoFSW data identifies that the extent of the proposed works are at a very low to low risk of surface water flooding, as shown in **Figure 6.2**.

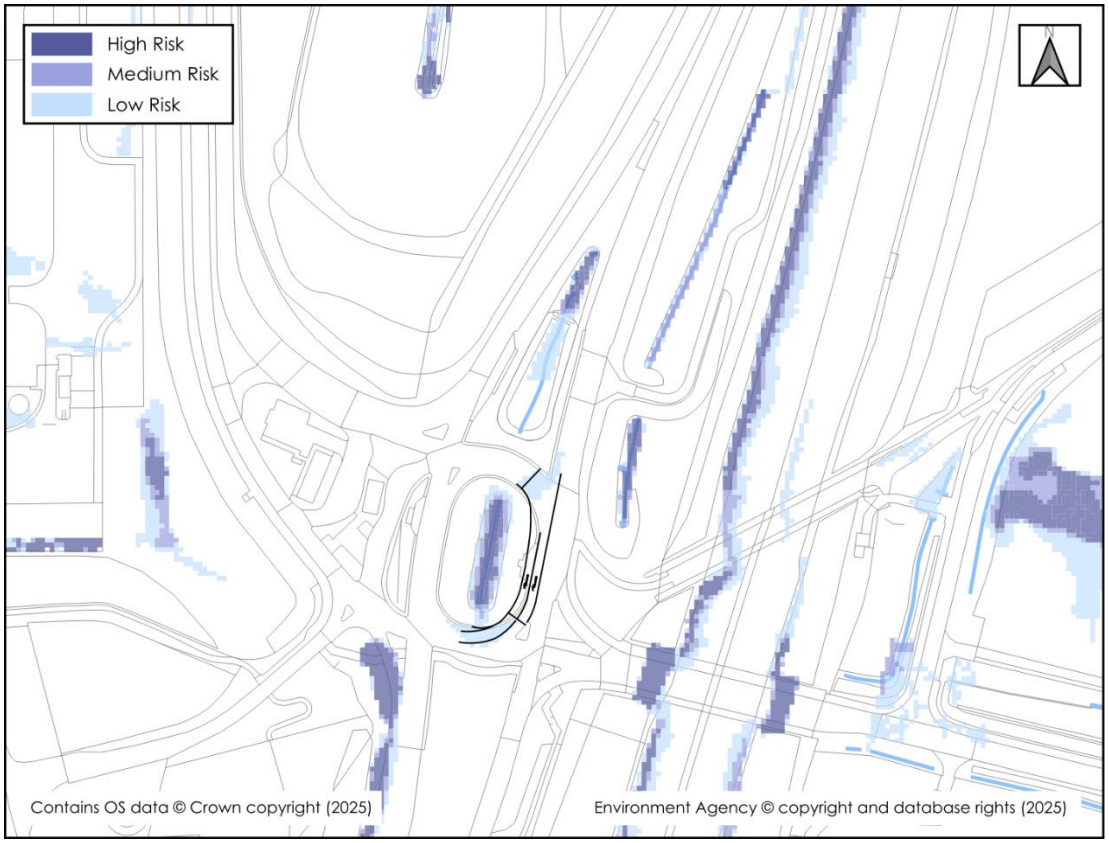


Figure 6.2: EA RoFSW - Works No. 13

6.5 In the event of exceedance of the highway drainage, relatively shallow surface water would likely remain on the highway at nominal depths. It is common for the carriageway to be used to accommodate exceedance flows and so this is considered an acceptable source of flood risk. Therefore, the potential source of flood risk is not considered a barrier to the proposed works.

6.6 The works will introduce new impermeable surfaces. The additional surface water runoff generated will be directed into the existing highway drainage. This will be accommodated through the addition of new surface water storage infrastructure constructed in the location of the works. This will allow the additional runoff to be stored at the location it is generated and drain into the downstream drainage network when capacity is available. This approach will allow the downstream drainage network to be retained and will ensure that pass on flow is retained at the existing rate (i.e.: preserving the existing conditions). There is also the option of enhancing the available storage within the existing downstream highway basins, to accommodate the additional runoff.

Groundwater Flood Risk

6.7 BGS mapping identifies the proposed works are underlain by Tarporley Siltstone Formation - Siltstone, Mudstone and Sandstone and Gunthorpe Member Mudstone. It is considered the susceptible areas are most likely to comprise the lower lying surrounding land which generally comprises the floodplain of the local watercourses. Given the relatively elevated nature of the highway infrastructure at this location the risk of groundwater flooding is low.

6.8 The relatively minor proposed improvement works will not detrimentally affect the risk of groundwater flooding in the surrounding area.

Other Sources of Flood Risk

6.9 Other sources of flood risk have been reviewed including, the sea, canals, reservoirs and large waterbodies, and public sewers, and none have been identified as posing a flood risk in this location.

Summary

6.10 Overall, the risk of flooding from the reviewed sources in this area are all considered to be at an acceptable level; therefore, they will not pose a barrier to the proposed works. Additionally, the works are not expected to negatively affect any flood risk in the surrounding area, subject to appropriate surface water management.

7. WORKS NO. 14: A NEW FOOT/CYCLE WAY ALONGSIDE THE A453 BETWEEN EMG1 & EMG2

Illustrative Proposals

7.1 The proposed improvements in this location include a new shared use foot/cycle way connecting EMG1 with EMG2. The extent of the works is illustrated in **Figure 7.1**.

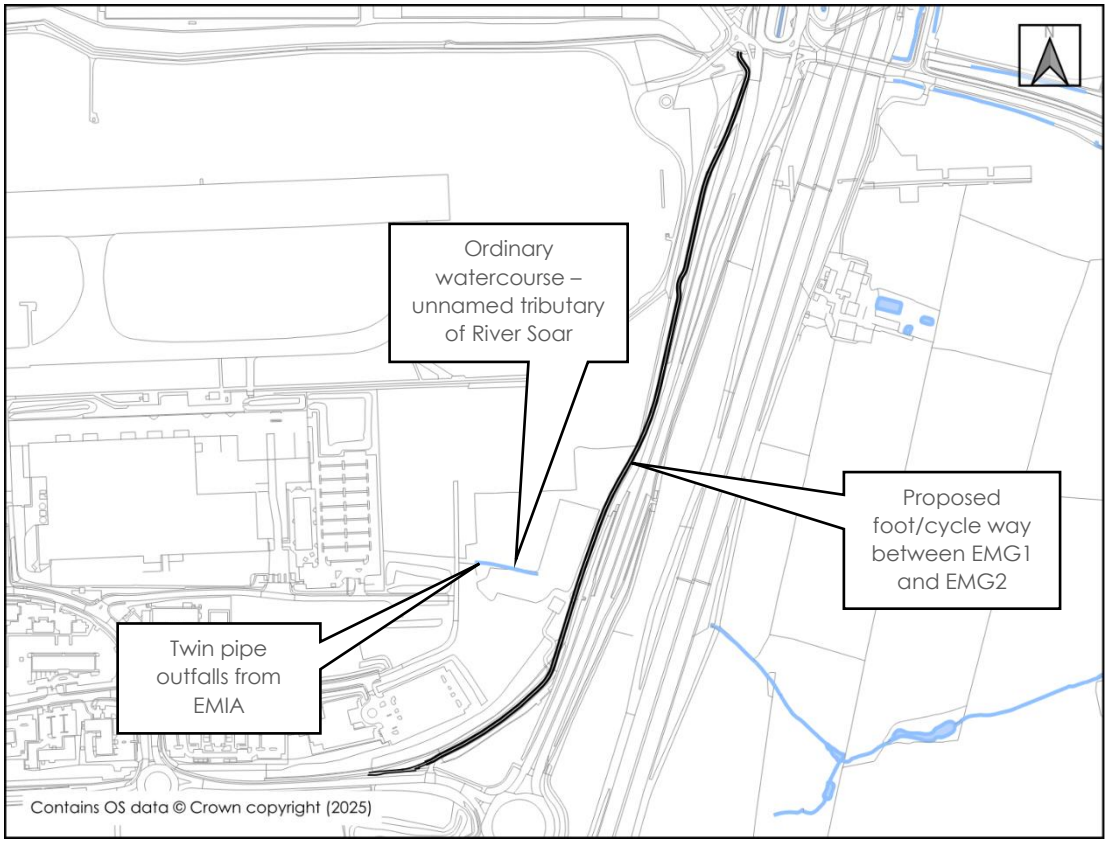


Figure 7.1: Illustrative Highway Improvement - Works No. 14

Historical Flooding Incidents

7.2 The EA Historical Flood Map does not show any recorded flood outlines within close proximity to the proposed works. Furthermore, a review of historical incidents collated and listed in the PFRA and SFRAs did not identify any which had affected the area.

Fluvial Flood Risk

7.3 The proposed works are located entirely within Flood Zone 1 and EA RoFRS data identifies that the works are located outside of areas at fluvial risk.

7.4 The route of the foot/cycle way runs in close proximity to a small ordinary watercourse which issues from the eastern side of the East Midlands Internal Airport (EMIA) via twin pipe outfalls (500mm and 700mm diameter pipes). After a very short open reach the watercourse is then culverted beneath the A453 and the M1, before outfalling to open

fields on the eastern side of the M1. The watercourse continues to flow towards the east, eventually outfalling to the River Soar.

7.5 The watercourse is not included in the Flood Map for Planning or RoFRS data due to its small size (<3km^2), and there is no known hydraulic model available from the EA or Lead Local Flood Authority (LLFA). In such instances EA RoFSW data can provide a proxy to the potential floodplain. However, in this instance this data does not include for the A453 or M1 culverts and consequently flood water is shown to unrealistically pond to the west of the A453 – this is illustrated within **Figure 7.2**.

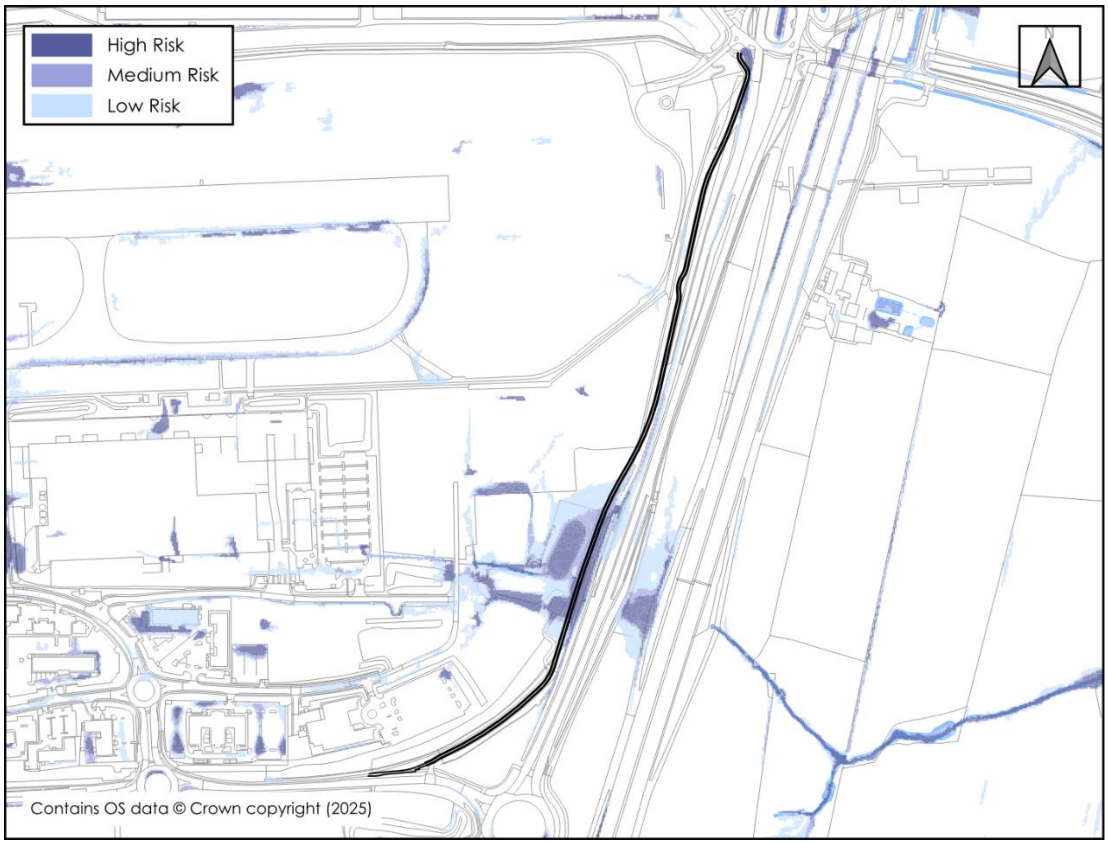


Figure 7.2: EA RoFSW - Works 14

7.6 Therefore, an assessment of the capacity of the A453 and M1 culverts against the predicted peak flows generated in the catchment has been undertaken to improve upon the understanding of potential flood risk. This is documented within the Technical Note (reference: EMG2-BWB-ZZ-XX_T-W-0005), included as **Appendix 1**.

7.7 The hydraulic assessment has identified that there is capacity for the 1 in 30-year and 1 in 100-year with the culvert A453/M1 culvert. There is potential for surcharging to occur at the culvert inlet during the 1 in 100-year +28% and 1 in 100-year +60% climate change flood events; however, this was not shown to result in overtopping of the culvert and flood levels were predicted to remain in channel upstream of the culvert. Therefore, the watercourse poses a low risk of flooding to the proposed works.

7.8 To accommodate the proposed foot/cycle way it will be necessary to extend the existing 500mm/700mm diameter outfalls from the west a short distance to allow the proposed footway/cycleway to run on top. This approach ensures that conveyance of

flows towards the A453 culvert will be unaffected. This was confirmed as part of the hydraulic assessment (see **Appendix 1**). Therefore, the proposed works will have no detrimental impact on the fluvial flood risk of third parties.

Surface Water Flood Risk & Highway Drainage

7.9 The surface water flood risk in the area, as mapped by the EA, is considered to be a representation of the floodplain associated with the River Soar tributary and as such, considered to be fluvial in nature and is discussed above. Away from the watercourse, the proposed improvement works are considered to be at a very low to low probability of flooding from surface water.

7.10 A site visit to the area identified the presence of highway drainage channels at the toe of the A453. Any existing highway drainage features within the footprint foot/cycle way, will either be preserved or relocated to ensure that existing drainage connectivity and capacity is not adversely affected by the proposed foot/cycle way.

Groundwater Flood Risk

7.11 BGS mapping identifies the proposed works are underlain by Diseworth Sandstone – Sandstone, Gunthorpe Member - Siltstone, Dolomitic and Gunthorpe Member Mudstone. Mapping from the 2015 SFRA shows the works to lie in a 1km^2 square grid where <25% of the area is potentially susceptible to groundwater flooding. It is considered the susceptible areas are most likely to comprise the lower lying surrounding land which generally comprises the floodplain of the local watercourses. Any groundwater emergence would likely occur with the local watercourse and drained away beneath the A453 and M1 is the same manner as the fluvial and surface water.

7.12 The relatively minor proposed improvement works will not detrimentally affect the risk of groundwater flooding in the surrounding area.

Other Sources of Flood Risk

7.13 Other sources of flood risk have been reviewed including, the sea, canals, reservoirs and large waterbodies, and public sewers, and none have been identified as posing a flood risk in this location.

Summary

7.14 Overall, the risk of flooding from the reviewed sources in this area are all considered to be at an acceptable level; therefore, they will not pose a barrier to the proposed works. Additionally, the proposed highway works are not expected to negatively affect any flood risk in the surrounding area, subject to appropriate surface water management.

8. WORKS NO 19: UPGRADE OF FOOTPATH L57 TO THE WEST OF EMG1 TO CYCLEWAY STANDARD

Illustrative Proposals

8.1 It is proposed to upgrade an existing footpath located to the east of Castle Donnington to a shared foot/cycleway. The route of the foot/cycleway crosses the upper reach of the Hemington Brook, as shown in **Figure 8.1**.

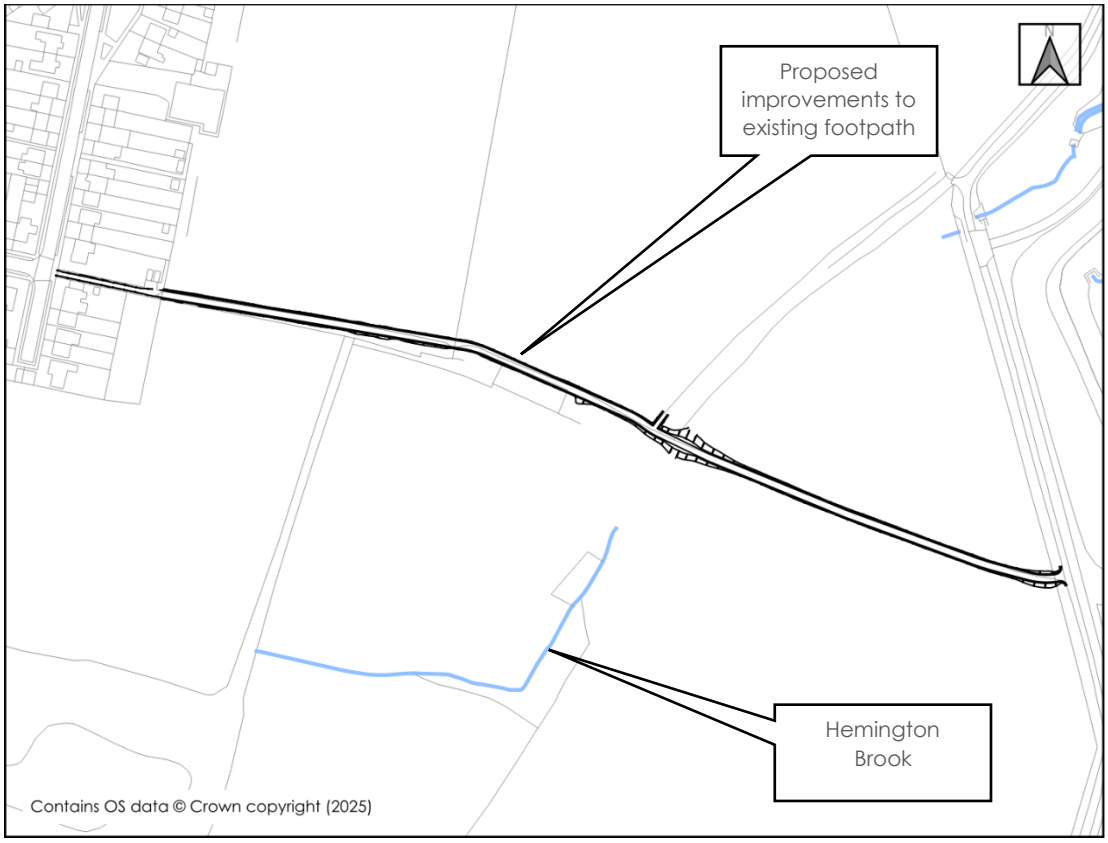


Figure 8.1: Illustrative Highway Improvements - Works No. 19

Historical Flood Incidents

8.2 The EA Recorded Flood Outlines data does not show any recorded incidents within proximity to the proposed works. Furthermore, a review of historical incidents collated and listed in the PFRA and SFRAs did not identify any which had affected the area.

Fluvial Flood Risk

8.3 The proposed works are located entirely within Flood Zone 1 and EA RoFRS data identifies that the works are located outside of areas at fluvial risk.

8.4 The Hemington Brook in this location is not included in the Flood Map for Planning or RoFRS due to its small size, and the hydraulic model coverage available from the EA only starts 550m downstream. In such instances, EA RoFSW data can be used to provide

a proxy of the potential floodplain, this is illustrated in **Figure 8.2**. The data suggests that the floodplain associated with the watercourse remains in close proximity to the channel.

Figure 8.2: EA RoFSW - Works No. 19

8.5 Topographical survey of the area identifies that a 500mm diameter pipe provides hydraulic connectivity beneath the existing footpath and that exceedance flows, in excess of the culvert's capacity, can overtop the footpath, which is set 400mm above the culvert soffit.

8.6 As part of the proposed works, there is an opportunity to improve the capacity of the culvert and decrease the risk of the footpath being made impassible during a flood event.

8.7 A hydraulic assessment of the local watercourse reach has been prepared and is included as **Appendix 2**. This was prepared to estimate the potential flood flows generated in the upstream catchment, estimate the capacity of the existing culvert, and assess the impact of raising the footpath and installing a larger 750mm diameter pipe.

8.8 The assessment identified that the existing culvert is readily overtopped during flood events. The proposed improvements will raise the footpath above modelled flood levels.

8.9 A comparison between the baseline and proposed conditions identified that upstream flood levels would increase by up to 0.40m; however, due to the relatively steep gradient the increase in flood levels dissipates within 38m from the footpath, an impact

that is contained within the wider land ownership of the applicant. Therefore, the localised increase in upstream flood levels is not considered significant.

8.10 Modelled water levels downstream of the proposed improvements were predicted to be unaffected, and a comparison of modelled flow hydrographs at the downstream section confirmed that there would not be a significant change in pass on flows.

Surface Water Flood Risk

8.11 The EA RoFSW mapping (**Figure 8.2**) shows areas of a high probability of flooding associated with the Hemington Brook, this is discussed in the **Fluvial Flood Risk** section above. Beyond this, the proposed improvements are at a low to very low probability of flooding from surface water.

8.12 The minor alterations to the existing footpath are not expected to have a significant impact on the existing surface water regime.

Groundwater Flood Risk

8.13 BGS mapping identifies the proposed works are underlain by Helsby Sandstone Formation – Sandstone and Tarporley Siltstone Formation - Siltstone, Mudstone and Sandstone. Mapping from the 2015 SFRA shows the works to lie in a 1km^2 square grid where >= 25% to <50% of the area is potentially susceptible to groundwater flooding. It is considered the susceptible areas are most likely to comprise the lower lying surrounding land which generally comprises the floodplain of the local watercourses. Any groundwater emergence would likely occur with the local watercourse and be drain away from the proposed works.

8.14 The relatively minor proposed improvement works will not detrimentally affect the risk of groundwater flooding in the surrounding area.

Other Sources of Flood Risk

8.15 Other sources of flood risk have been reviewed including the sea, canals, reservoirs and large waterbodies, and public sewers, and none have been identified as posing a flood risk in this location.

Summary

8.16 Overall, the risk of flooding from the reviewed sources in this area are all considered to be at an acceptable level; therefore, they will not pose a barrier to the proposed works. Additionally, the proposed improvements are not expected to negatively affect flood risk in the surrounding area.

9. SUMMARY

9.1 This Flood Risk Screening report has been prepared in accordance with the requirements set out in the National Policy Statement for National Networks (NPSNN). It has been prepared in accordance with the requirements set out in the National Policy Statement for National Networks (NPSNN). It has been produced on behalf of SEGRO (Properties) Ltd in respect of a Development Consent Order (DCO) for the proposed East Midlands Gateway Phase 2 (EMG2) and the East Midlands Gateway Rail Freight Interchange Material Change Order (MCO). The proposed development comprises a number of interrelated components, and collectively they are referred to as the EMG2 Project.

9.2 This report focuses on the 'Highway Works' which are removed from EMG2 Works and the EMG1 Works. Due to its distance from the other EMG2 Works, for the purpose of assessing flood risk the upgrade of the EMG1 substation (Works No. 20) is also included in this assessment. The Highway Works within close proximity to the EMG2 Works (Works No. 6, 7, 15, 17 and 21) are discussed within the EMG2 Works FRA (reference: EMG2-BWB-ZZ-XX-T-W-0001).

9.3 A desktop review of the potential flood risk sources at each location has been undertaken. As the proposals are generally associated with improvements to existing infrastructure, the principle of a road, footway or new signage in each location has not been discussed. Instead, the assessment has reviewed the presence of a potential flood risk source and the potential impact of the proposals on that flood risk source.

9.4 The results of the desktop review are summarised within Table 9.1. Given the proposed works are anticipated to have a negligible impact on flood risk, it is not considered necessary to undertake a more detailed assessment of flood risk.

Table 9.1: Summary of Flood Risk Screening

Works No.	Flood Risk Source						
	Fluvial	Surface Water & Highway Drainage	Groundwater	Reservoirs	Canal	Public Sewers	Sea
8	No Risk	Low Risk – subject to improvements being made to the local highway drainage infrastructure, where capacity improvements are identified as necessary.	Low Risk	No Risk	No Risk	No Risk	No Risk
9	No Risk	Low Risk – subject to preservation or relocation of existing highway drainage infrastructure, and improvements being made to the local highway drainage infrastructure, where capacity improvements are identified as necessary.	Low Risk	No Risk	No Risk	No Risk	No Risk
10	Low Risk	Low Risk – subject to improvements being made to the local highway drainage infrastructure, where capacity improvements are identified as necessary.	Low Risk	Low Risk	No Risk	No Risk	No Risk
11	Low Risk	Low Risk – subject to improvements being made to the local highway drainage infrastructure, where capacity improvements are identified as necessary.	Low Risk	Low Risk	No Risk	No Risk	No Risk
12	Proposed improvement works limited to signage and lining improvements, there will be no impact on flood risk.						
13	No Risk	Low Risk – subject to improvements being made to the local highway drainage infrastructure, where capacity improvements are identified as necessary.	Low Risk	No Risk	No Risk	No Risk	No Risk
14	Low Risk	Low Risk – subject to preservation or relocation of existing highway drainage infrastructure, and improvements being made to the local highway drainage infrastructure, where capacity improvements are identified as necessary.	Low Risk	No Risk	No Risk	Low Risk	No Risk

Works No.	Flood Risk Source						
	Fluvial	Surface Water & Highway Drainage	Groundwater	Reservoirs	Canal	Public Sewers	Sea
16	Proposed works limited to signage improvements, there will be no impact on flood risk.						
18	Proposed works limited to signage improvements, there will be no impact on flood risk.						
19	Low Risk, subject to upgrading the existing culvert beneath the footpath	Low Risk	Low Risk	No Risk	No Risk	No Risk	No Risk
20	Proposed works limited to improvements to an existing sub-station, there will be no impact on flood risk.						

APPENDICES

Appendix 1: River Soar Tributary Culvert Capacity Hydraulic Review

Introduction:

As part of the works associated with the East Midlands Gateway Phase 2 (EMG2) development it is proposed to create a new footway/cycleway to the west of the A453 that will improve active travel between the East Midlands Gateway Phase 1 (EMG1) and EMG2 sites. The route of the footway/cycleway runs in close proximity to a small ordinary watercourse which issues from the eastern side of the East Midlands Internal Airport (EMIA) via twin pipe outfalls (500mm and 700mm dia pipes). After a very short open reach the watercourse is culverted beneath the A453 and the M1, before outfalling to open fields on the eastern side of the M1. The watercourse continues to flow towards the east, eventually outfalling to the River Soar.

The watercourse is not included in the Flood Map for Planning due to its small size, and there is no known hydraulic model available from the Environment Agency (EA) or Lead Local Flood Authority (LLFA). In such instances EA Risk of Flooding from Surface Water (RoFSW) data can provide a proxy to the potential floodplain. However, in this instance this data does not include for the A453 or M1 culverts and consequently flood water is shown to unrealistically pond to the west of the A453 on the proposed route of the footway/cycle – this is illustrated within **Figure 1**.

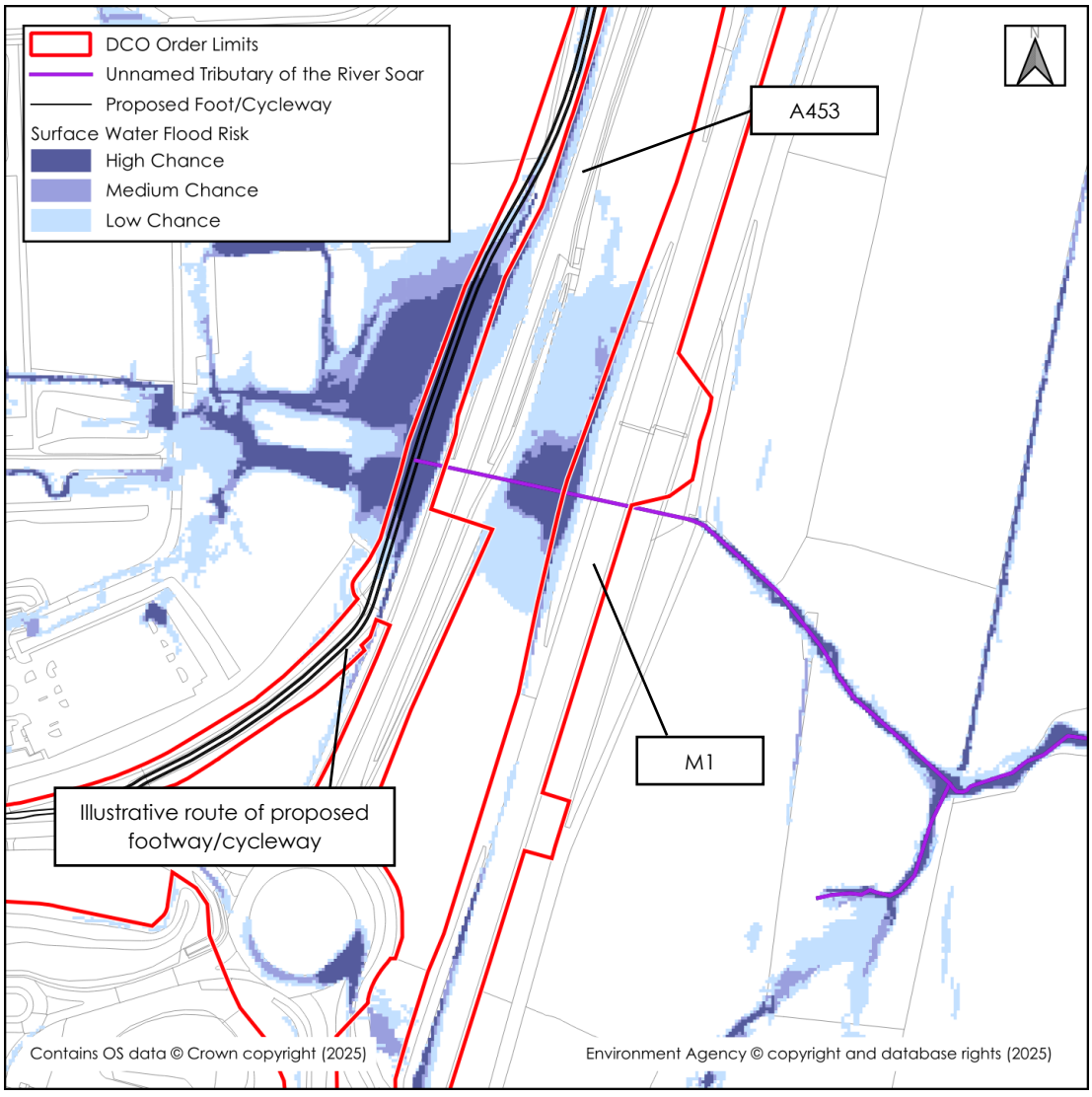


Figure 1 - EA RoFSW Flood Data

Therefore, this note has been prepared to review the capacity of the A453 and M1 culverts against the predicted peak flows generated in the catchment to improve upon the understanding of potential flood risk.

Estimation of Peak Flows:

Catchment descriptors for the headwaters of the watercourse were obtained from the FEH web service. These are illustrated within **Figure 2**.

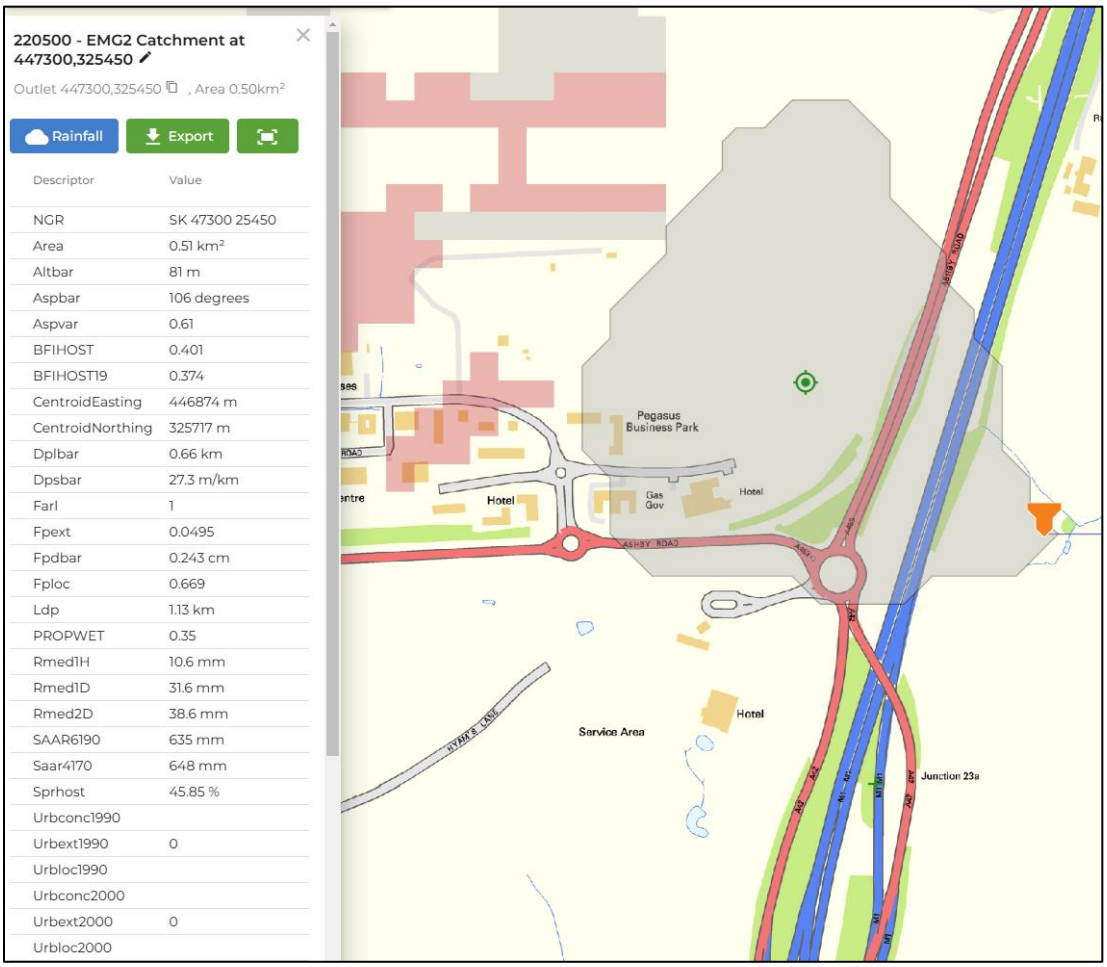


Figure 2 - FEH Web Service Catchment Descriptors

A watershed analysis was undertaken in QGIS using EA 2020 Composite LiDAR DTM to identify the topographical catchment upstream of the M1 northbound carriageway. National Highway drainage records identify that the south bound carriageway outfalls directly to the open channel to the east rather than into the culverted watercourse beneath the M1, so this area was omitted from the catchment analysis. A total catchment area of 0.53km^2 was identified.

The EMIA drainage catchments (see **Figure 3**) are shown to overlap with this area (see **Figure 4**). These intercept and redirect 0.18km^2 of this catchment to the Diseworth Brook and which is accounted for in the Diseworth and Long Whatton flood model. Therefore, the catchment of the study watercourse is limited to the south-eastern corner of the airport associated with airport long term parking and a proportion of the Pegasus Business Park, an area of 0.35km^2.

Figure 3 – East Midlands Airport Surface Water Catchments
(Image extracted from the Diseworth and Long Whatton flood model report[1])

The urban area within the remaining catchment has been measured at 0.17km^2, giving an effective URBEXT2000 of 0.31. It is understood that the EMIA long term parking and Pegasus Business Park are served by attenuated storage, which is evidenced by the detention basin located next to the pipe outfalls. However, as no information of the restricted rates are available, this has been discounted for the purpose of this analysis.

The measured catchment and urban areas are illustrated within **Figure 4**.

An estimation of peak flows was undertaken using the FEH catchment data within the ReFH2 rainfall-runoff software (v4.1) and in WINFAP (v5) statistical analysis software, after its area and URBEXT2000 had been updated. The resultant peak flow estimates are provided in **Table 1**.

This shows that ReFH2 provides the more precautionary flow estimates. Therefore, this has been taken forward for analysis against the culvert capacities. A design event peak flow of 1.16m^3/s has been idenftied.

Table 1 – Peak Flow Estimates

Return Period	Peak Flows (m^3/s)	
	ReFH2 (v3.2)	FEH Statistical (WINFAP v5)
1 in 30	0.66	0.36
1 in 100	0.91	0.50
1 in 100+28%CC	1.16	0.64
1 in 100+60%CC	1.46	0.80
1 in 1000	1.71	0.97

[1] 2020, Arcadis. Long Whatton & Diseworth Flood Risk Mitigation & Resilience Study.

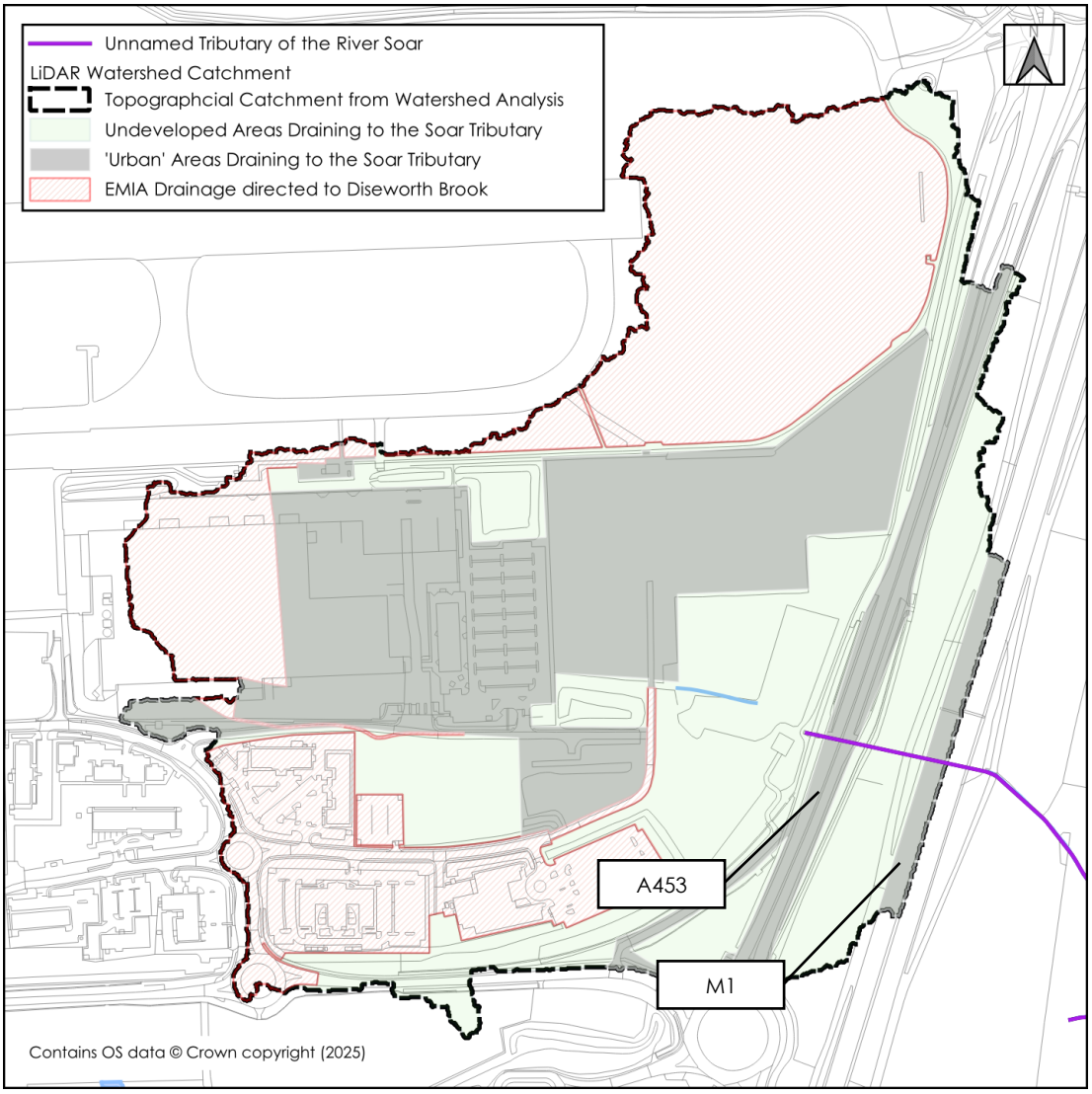


Figure 4 – Watershed Analysis & Measured Urban Areas

HEC-RAS Model

Topographical survey of the local area has captured the culvert inlet on the western side of the A453 and the culvert outfall on the eastern side of the M1, as well as a manhole chamber between the two roads. This shows that the watercourse is culverted within a continuous run, though the gradient changes at the manhole. The key culvert parameters from the topographical survey are illustrated within **Figure 5**.

The topographical survey has been used to derive a number of cross-sections of the watercourse which are located in magenta within **Figure 5**. These sections have been used to develop a relatively simple 1D hydraulic model of the local reach through the EMG2 order limits, a reach of 236m.

A Manning's 'n' of 0.05 was adopted for the river channel to reflect the relatively straight channel with medium to heavy vegetated banks. The culvert was modelled with a base Manning's 'n' roughness of 0.015 and a top roughness of 0.012, which reflects the observed conditions (see **Figure 6**). An entrance loss of coefficient of 0.5 was adopted which is reflective of a square edge inlet with headwall.

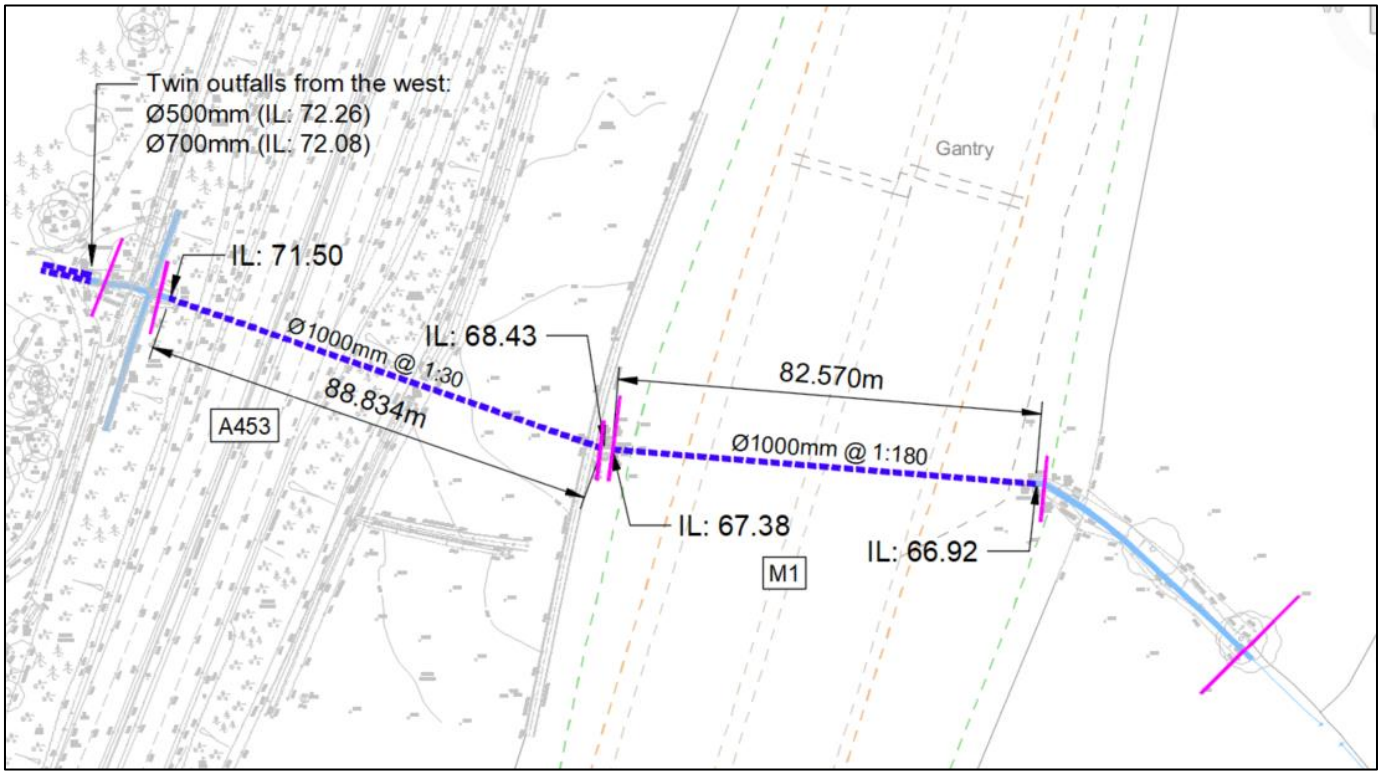


Figure 5 – Surveyed Culvert Parameters

Figure 6 – A453 Culvert Inlet

The survey identifies that the A453 culvert has a diameter of 1000mm at the inlet, which was confirmed during site visit undertaken by BWB Consulting Ltd in March 2025 as demonstrated by **Figure 6**.

A channel gradient of 1:36 was adopted for the downstream normal depth boundary, which reflects the surveyed gradient of the downstream channel from the culvert outlet to the downstream most surveyed invert level of the channel. The flow hydrographs have been derived using ReFH2 software (Version 4.1) and applied to the upstream extent of the modelled reach. The model was simulated against the 1 in 30-year, 1 in 100-year, 1 in 100-year+28%CC, and the 1 in 100-year+60%CC return period flood events.

Results

A long section of the modelled reach is provided in **Figure 7**. The section shows there to be available capacity for the 1 in 30-year and 1 in 100-year with the culvert. There is potential for surcharging of the inlet during the 1 in 100-year +28%CC and 1 in 100-year +60%CC flood events; however, this is not shown to result in overtopping of the culvert and flows continue to remain in channel upstream of the culvert, this is illustrated by the upstream cross section shown in **Figure 8**. During the 1 in 100-year +28%CC flood event the flood level within the upstream reach peak at 72.55mAOD, which increases to 72.68mAOD in the 1 in 100-year +60%CC flood event

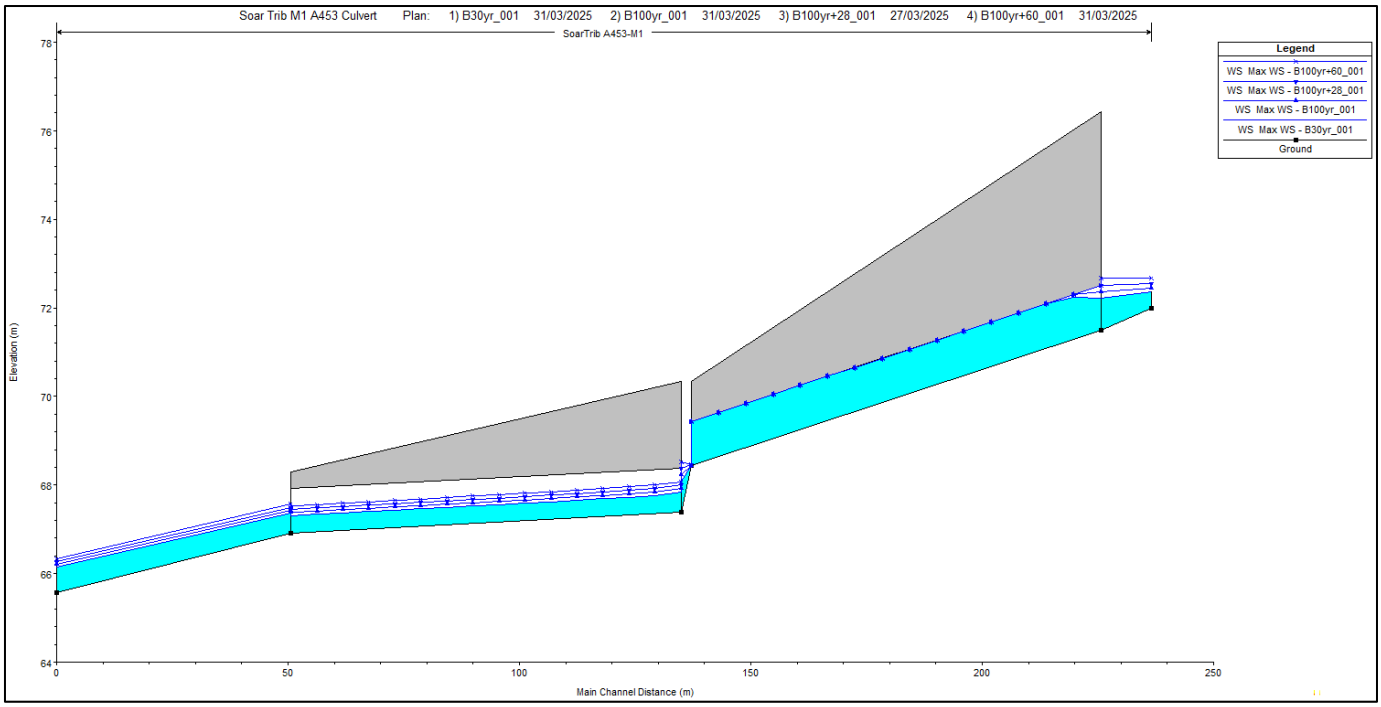


Figure 7 – Baseline Model Long Section

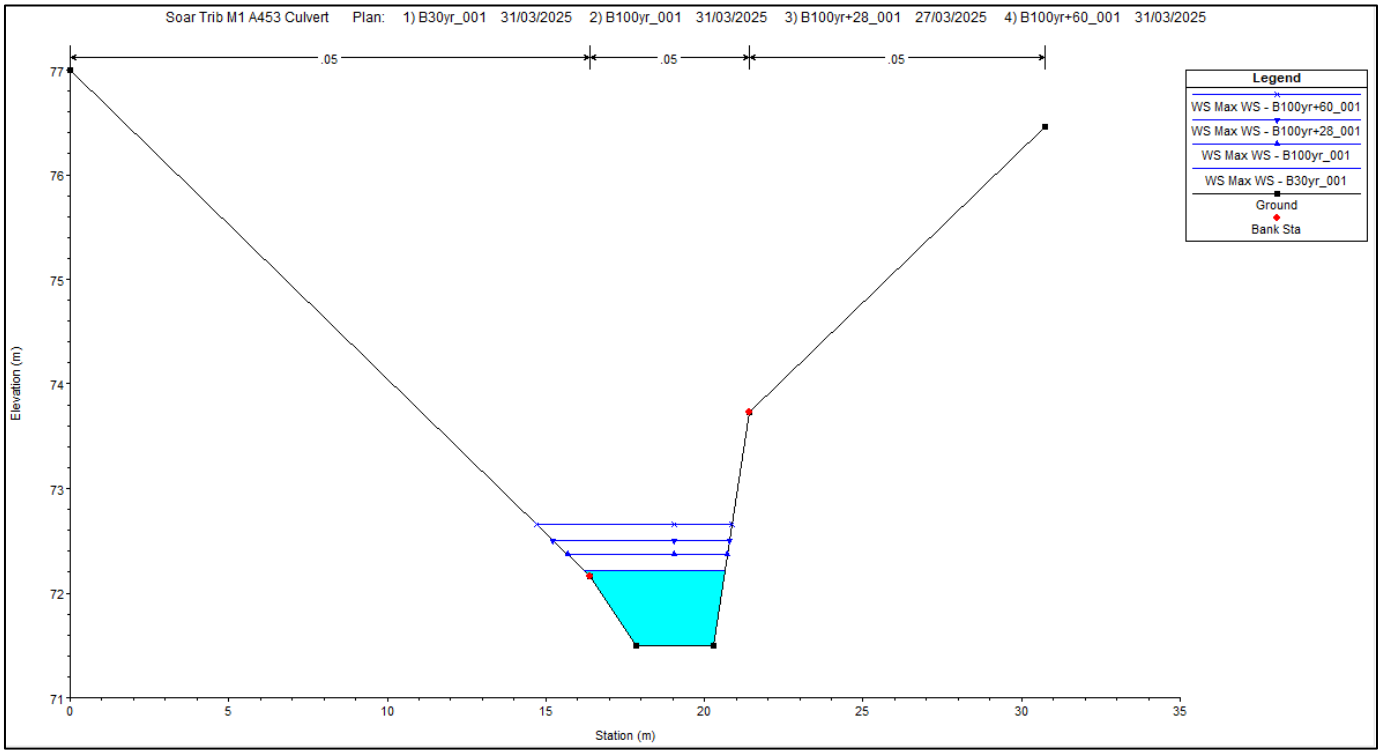


Figure 8 – Baseline Model Cross Section (228)

Alterations to Accommodate the Footway/Cycleway

At this stage, it is expected that the existing 500mm/700mm diameter outfalls from the west will be extended a short distance to allow the proposed footway/cycleway to run on top – this concept is illustrated within **Figure 9**. This approach ensures that conveyance of flows towards the A453 culvert will be unaffected.

A review of the topographical survey shows that the proposed footway/cycleway follows a route with a low point of 72.76mAOD (excluding the channel that is to be culverted). Therefore, the footway/cycleway will be located above the 1 in 100-year +28%CC design event flood level, and outside of the design event floodplain.

To assess the potential impact of the extended pipe lengths beneath the footway/cycleway, the open channel reach upstream of the A453 culvert was reduced by 6m from the upstream extent of the model – thereby removing any online flood storage that the length of channel that is to be culvert currently offers.

The food events were re-run and the proposed peak water levels compared to the equivalent baseline events. This is illustrated within **Figure 10** to **Figure 13**. The comparisons confirm that there is no significant change between the baseline and proposed conditions.

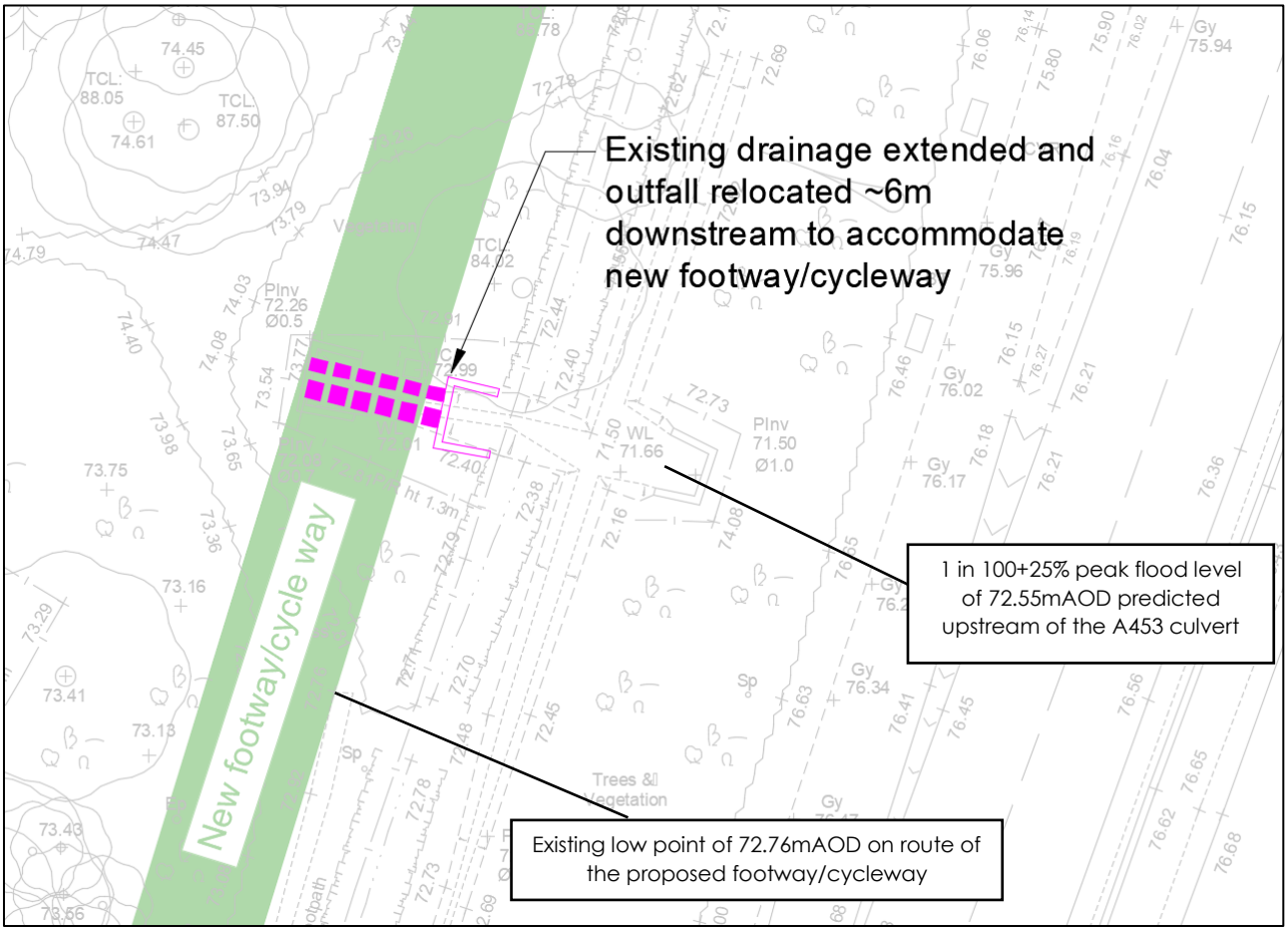


Figure 9 – Concept Culvert Extension Beneath New Footway/Cycleway

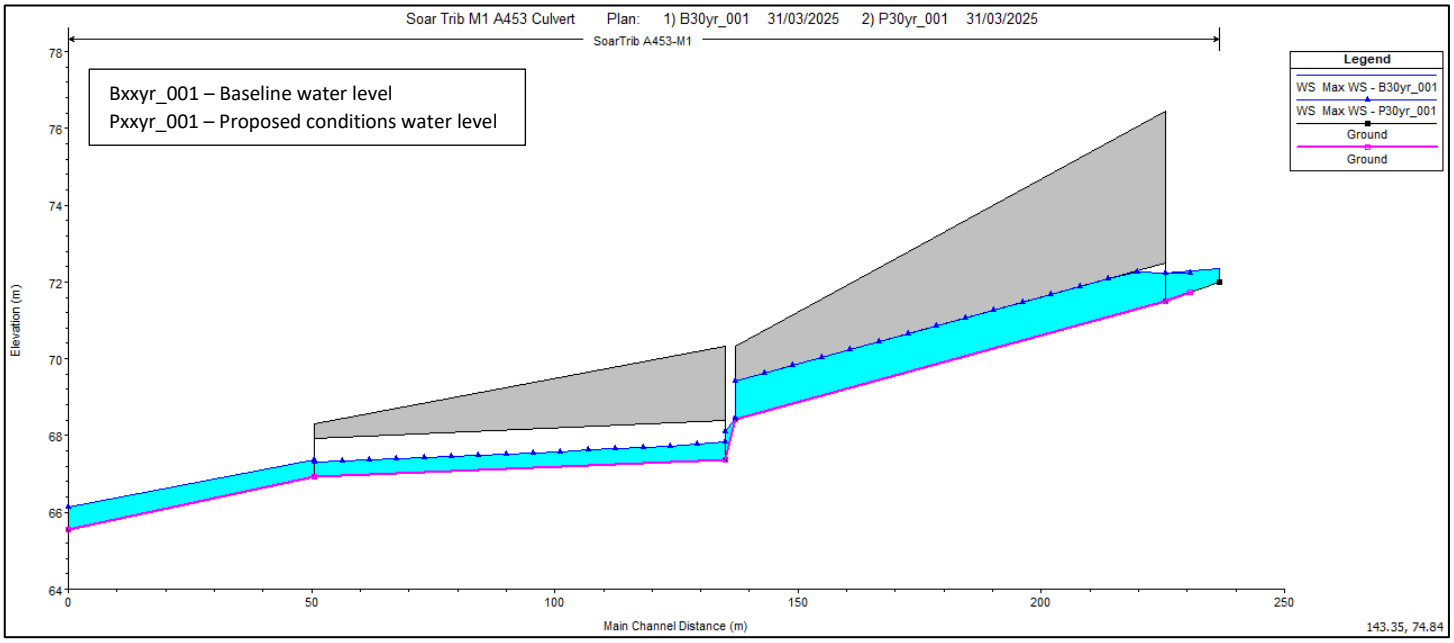


Figure 10 - 1 in 30-Year Long Section Comparison

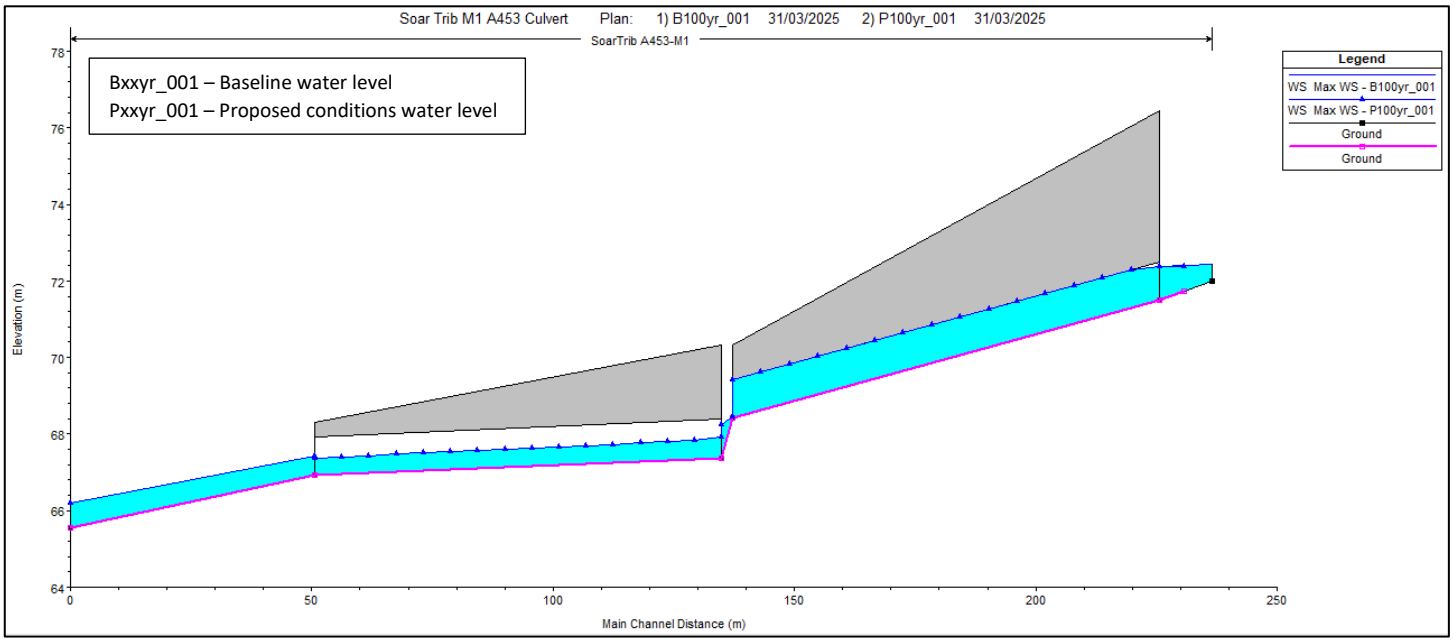


Figure 11 - 1 in 100-Year Long Section Comparison

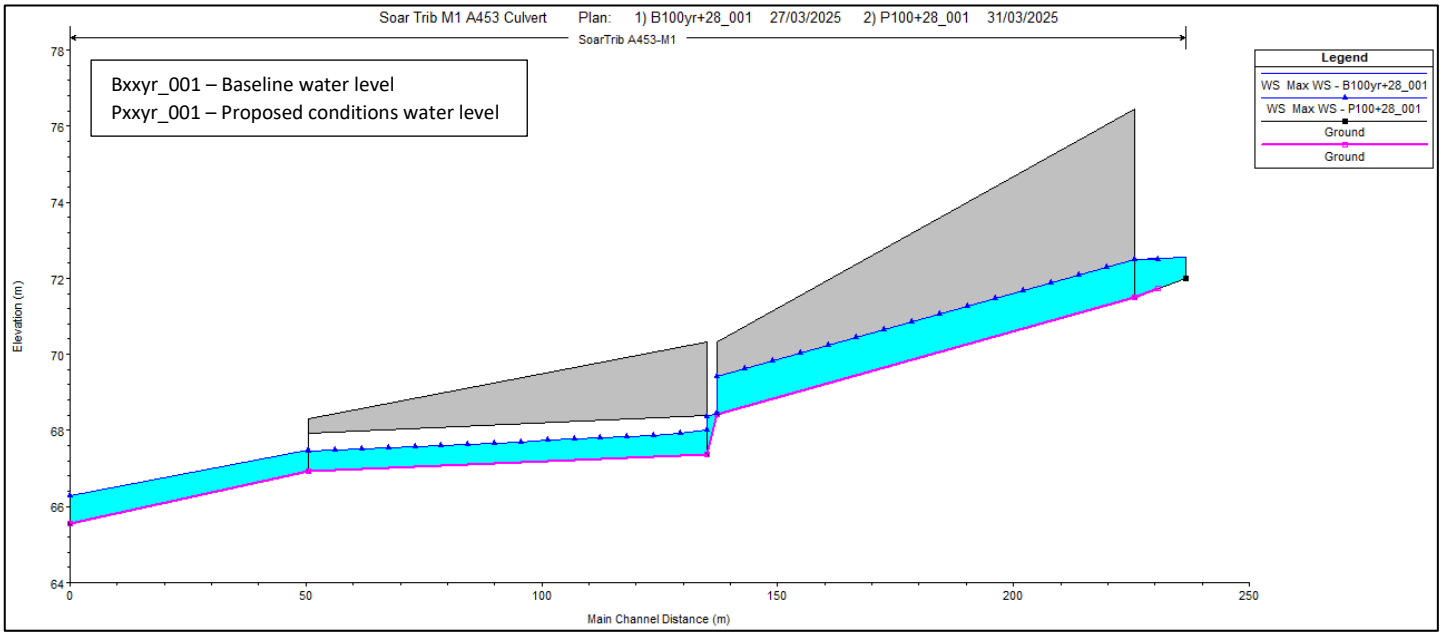


Figure 12 - 1 in 100-Year +28%CC Long Section Comparison

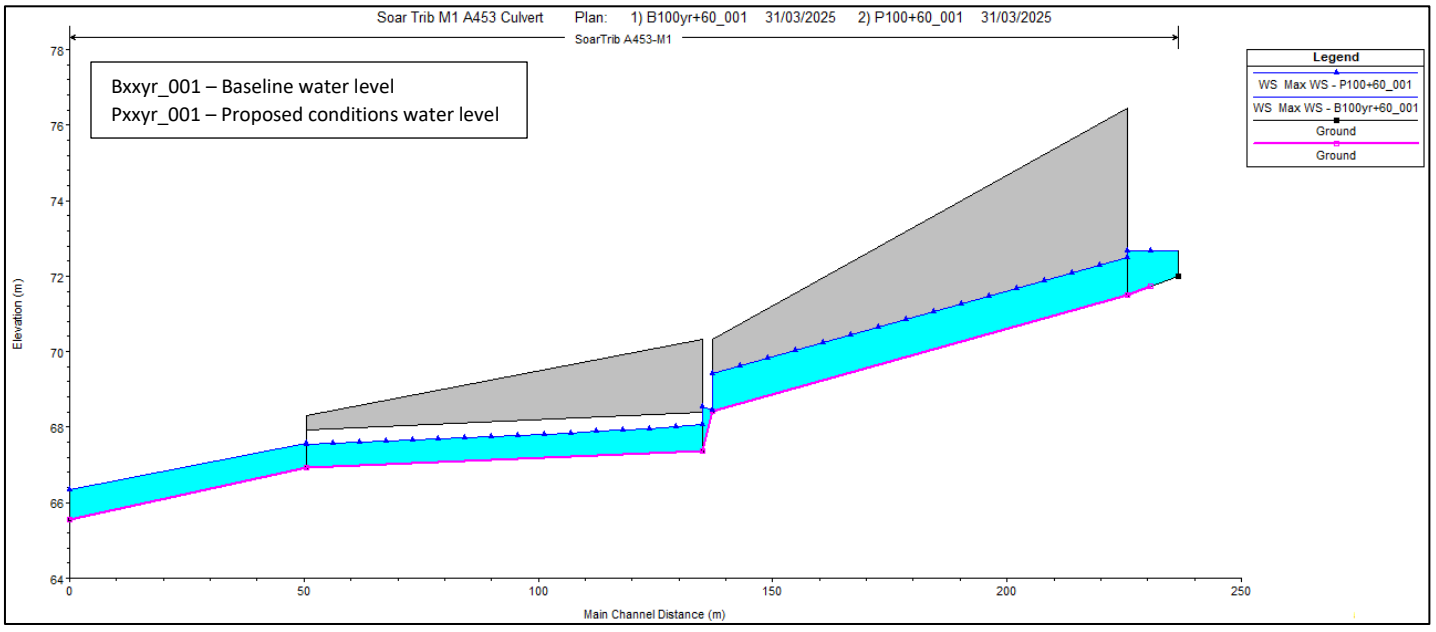


Figure 13 - 1 in 100-Year +60%CC Long Section Comparison

Appendix 2: Hemington Brook Culvert Capacity Hydraulic Review

Introduction:

As part of the works associated with the East Midlands Gateway Phase 2 (EMG2) development it is proposed to upgrade an existing footpath located to the east of Castle Donnington to a shared footway/cycleway. The route of the footway/cycleway crosses the upper reach of the Hemington Brook.

The Hemington Brook in this location is not included in the Flood Map for Planning due to its small size, and the hydraulic model coverage available from the Environment Agency (EA) only starts 550m further downstream. In such instances Environment Agency (EA) Risk of Flooding from Surface Water (RoFSW) data can provide a proxy to the potential fluvial floodplain – the latest flood mapping from NaFRA2 is illustrated within **Figure 1**. This suggests that the floodplain is likely to be restricted to the channel and the corridor immediately next to the channel.

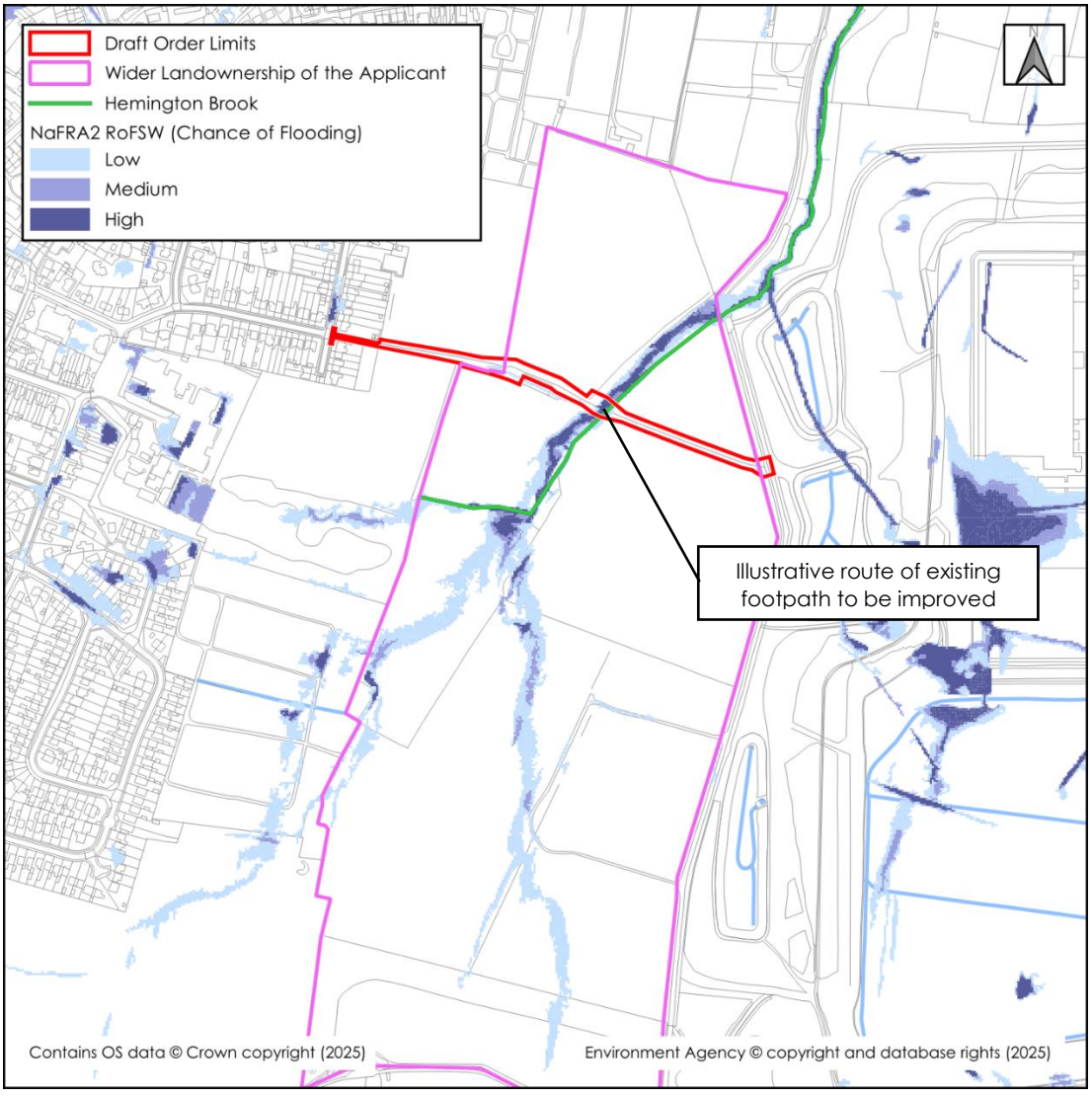


Figure 1 - EA RoFSW Flood Data

Topographical survey of the area identifies that a 500mm diameter pipe provides hydraulic connectivity beneath the existing footpath and that exceedance flows, in excess of the culvert's capacity, can overtop the footpath, which is set 400mm above the culvert soffit. As part of the proposed works, there is an opportunity to improve the capacity of the culvert and decrease the risk of the footpath being made impassible during a flood event.

Therefore, this note has been prepared to estimate potential flood flows generated in the upstream catchment and review the potential impact of the proposals on downstream flood risk. During consultation with the Environment Agency (EA) it was recommended that a simple one-dimensional (1D) Hec-Ras model was developed to confirm that there would be no significant downstream impacts.

Estimation of Peak Flows:

The footpath is located at NGR: 445270, 327105, upstream of the start of the EA's Hemington Brook hydraulic model. The EA model includes adopted flood hydrology for the Hemington Brook catchment. The model inflow 'HEM01' is located at NGR: 445554, 327575.

The FEH Web Service identifies a catchment area of 1.47km^2 at HEM01, and a catchment area of 0.7km^2 at the footpath location.

The peak flows applied within the downstream EA model can be prorated on an area basis to provide an estimate of the peak flows at the footpath location. These are illustrated within **Table 1**.

Table 1 – Peak Flow Estimates

Return Period	Peak Flows (m^3/s)	
	EA Peak flows at HEM01 (1.47km^2)	Prorated peak flows at L57 footpath (0.7km^2)
1 in 30	0.90	0.43
1 in 100	1.30	0.62
1 in 100+28%CC	1.67	0.80
1 in 100+60%CC	2.08	1.00
1 in 1000	2.33	1.12

Baseline HEC-RAS Model:

Topographical survey of the area has captured the culvert beneath the footpath. The key culvert parameters from the topographical survey are illustrated within **Figure 2**.

Additionally, cross-sections through the watercourse channel upstream and downstream of the footpath have been surveyed at regular intervals – the watercourse survey accompanies this note, drawing ref: *34529A_T_REV5-34529F*. The surveyed cross-sections confirm the incised nature of the valley in which the watercourse flows. The surveyed reach has a steep average gradient of 1:17; this means that there will be little backwater influence from downstream structures. For example, the footpath at the next downstream culvert is approximately 4m below the invert of the L57 culvert. Therefore, development of an extensive hydraulic model was not necessary, and a model of the local reach next to the study area was prepared. This extends 45m upstream of the L57 footpath and 92m downstream.

A Manning's 'n' of 0.05 was adopted for the river channel to reflect the relatively straight channel with medium to heavy vegetated banks. The culvert was modelled with a base manning's 'n' roughness of 0.020 and a top roughness of 0.015. An entrance loss of coefficient of 0.5 was adopted which is reflective of a square cut concrete pipe projecting from fill.

A channel gradient of 1:50 was adopted for the downstream normal depth boundary, which reflects the surveyed gradient to the next downstream surveyed section (i.e.: between section 10 and 9 on 34529A_T_REV5-34529F). The flow hydrographs at "HEM01" from the EA's Hemington Brook hydraulic model were prorated on an areas basis and applied to the upstream extent of the modelled reach. The model was simulated against the 1 in 30-year, 1 in 100-year, 1 in 100-year+28%CC, and the 1 in 100-year+60%CC return period flood events.

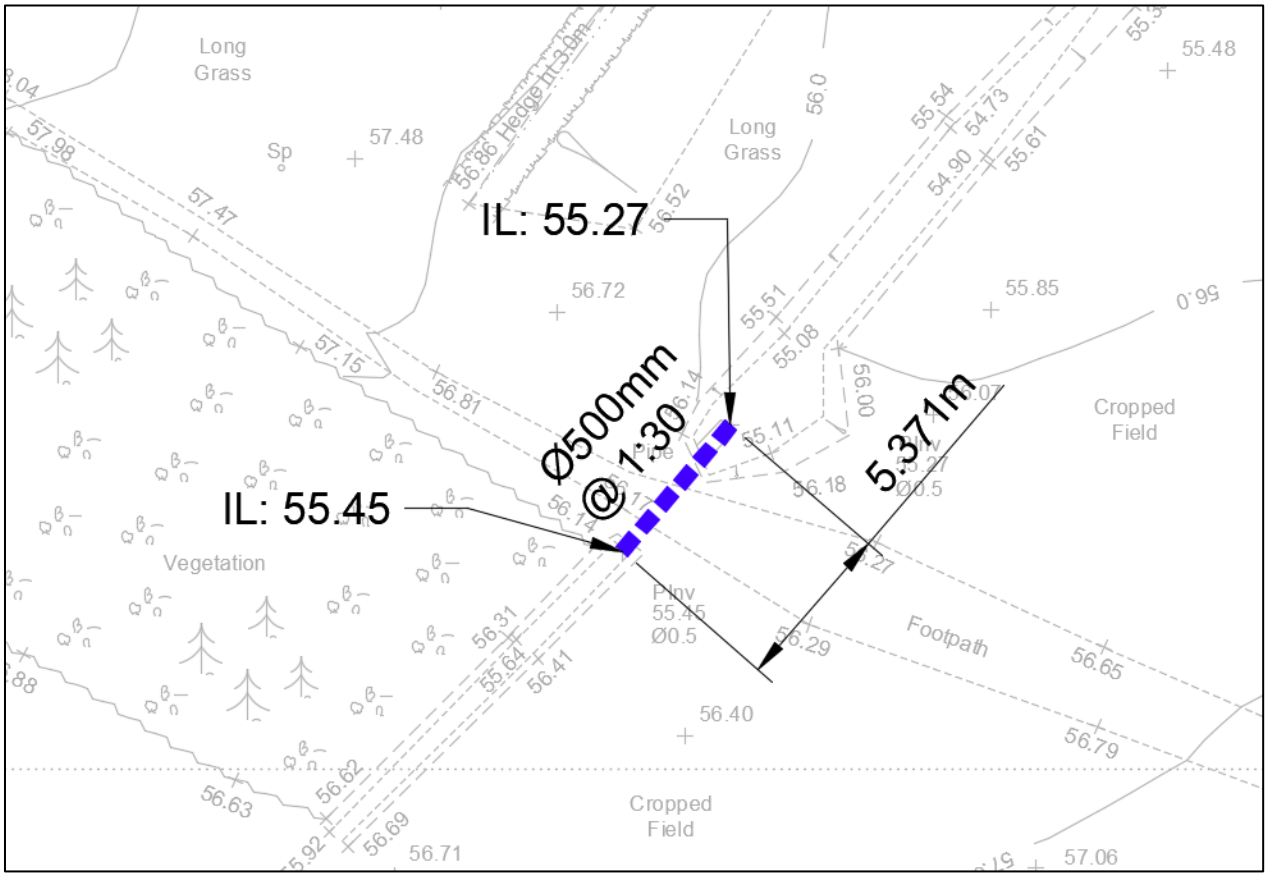


Figure 2 – Baseline Surveyed Culvert Parameters

Alterations to Accommodate the Footway/Cycleway

To achieve the necessary geometry for a shared footway/cycleway it will be necessary to raise the existing footpath circa 950mm at the culvert. This also provides an opportunity to reduce the risk of the footpath being overtopped in a flood event.

It is understood that Leicestershire County Highways, the authority responsible for footpath maintenance, will not accept a footbridge structure in this location due to the additional maintenance burden. Therefore, a 750mm diameter culvert is proposed. This will provide additional flow capacity when compared to the existing 500mm diameter culvert, without increasing the maintenance burden.

Due to the additional height of the footpath, the culvert will need to be extended to a length of approximately 13.8m. Plans illustrating the preliminary design of the footpath and culvert accompany this note (ref: EMG2-BWB-HGT-04-DR-H-0600-S3-P03 & EMG2-BWB-HDG-04-DR-W-0501-S3-P02.

These changes were made to the hydraulic model geometry and the flood events were re-simulated.

Results

A long section of the baseline modelled reach is provided in **Figure 3**, which confirms that the existing culvert is readily overtopped in flood events. A long section of the proposed modelled reach is provided in **Figure 4**, which shows that the increased footpath height and larger culvert will decrease the risk of flooding to the footpath.

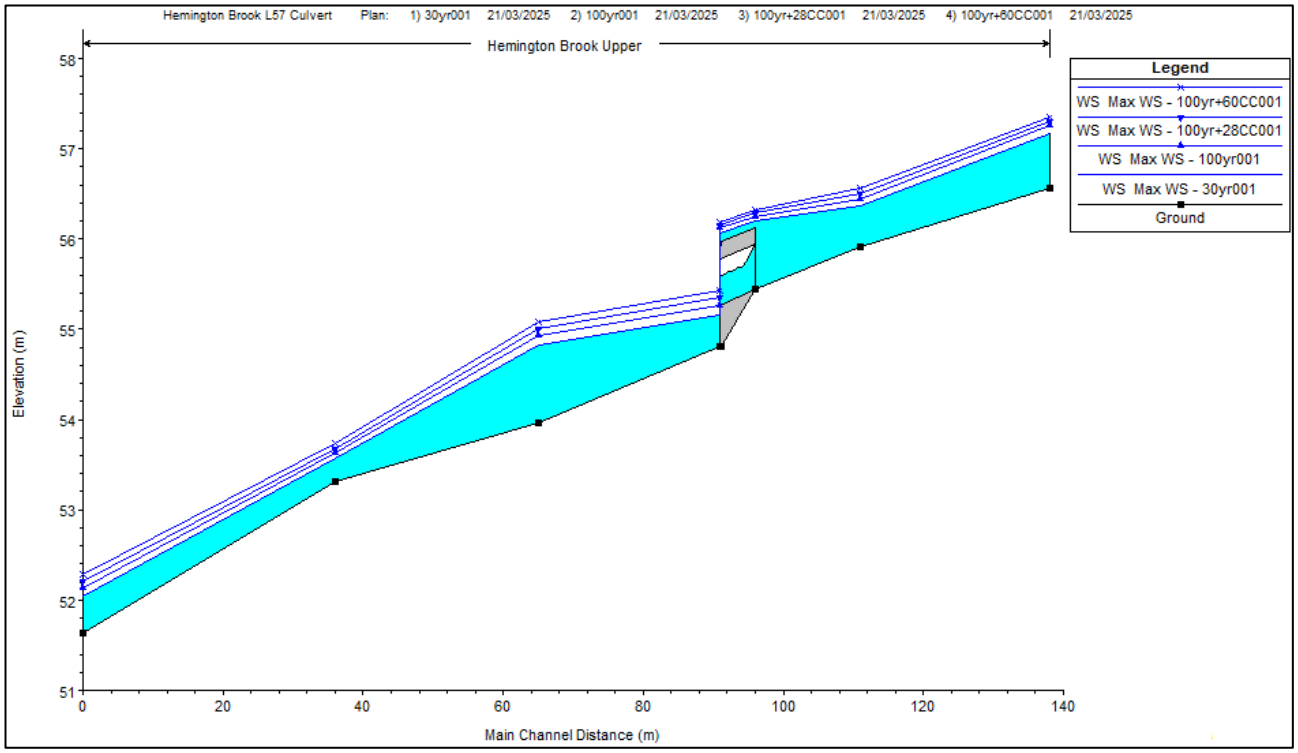


Figure 3 – Baseline Model Long Section

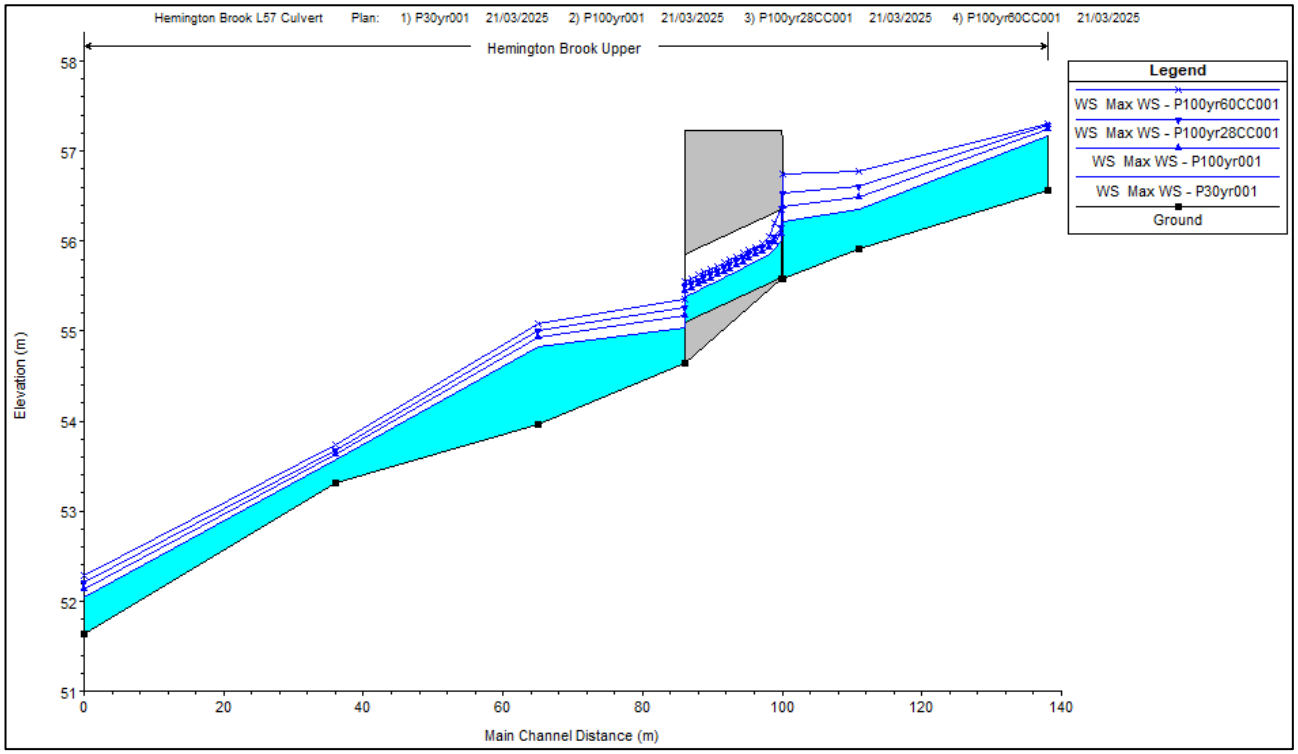


Figure 4 - Proposed Model Long Section

The baseline and proposed flood levels are compared at each return period event in the long sections included as **Figure 5** to **Figure 8**. These show that in flood events greater than a 1 in 30-year, an increase in flood levels would be expected within the reach immediately upstream of the culvert. An increase in peak flood levels of up to 0.09m is predicted in the 1 in 100-year event, and up to 0.40m in the 1 in 100-year+28%CC and +60%CC events. However, due to the relatively steep gradient the increase in flood levels dissipates within 38m from the footpath, and, as shown in **Figure 1**, an upstream reach of approximately 230m falls within the wider land ownership of the applicant. Therefore, the localised increase in upstream flood levels is not considered significant.

Modelled water levels downstream of the culvert are generally unaffected. To confirm that pass-on flows are also not significantly affected, a comparison of modelled flow hydrographs at the downstream section was undertaken - this is included as **Figure 9**. The comparison confirms that there is no significant change in downstream flows between the baseline and proposed conditions.

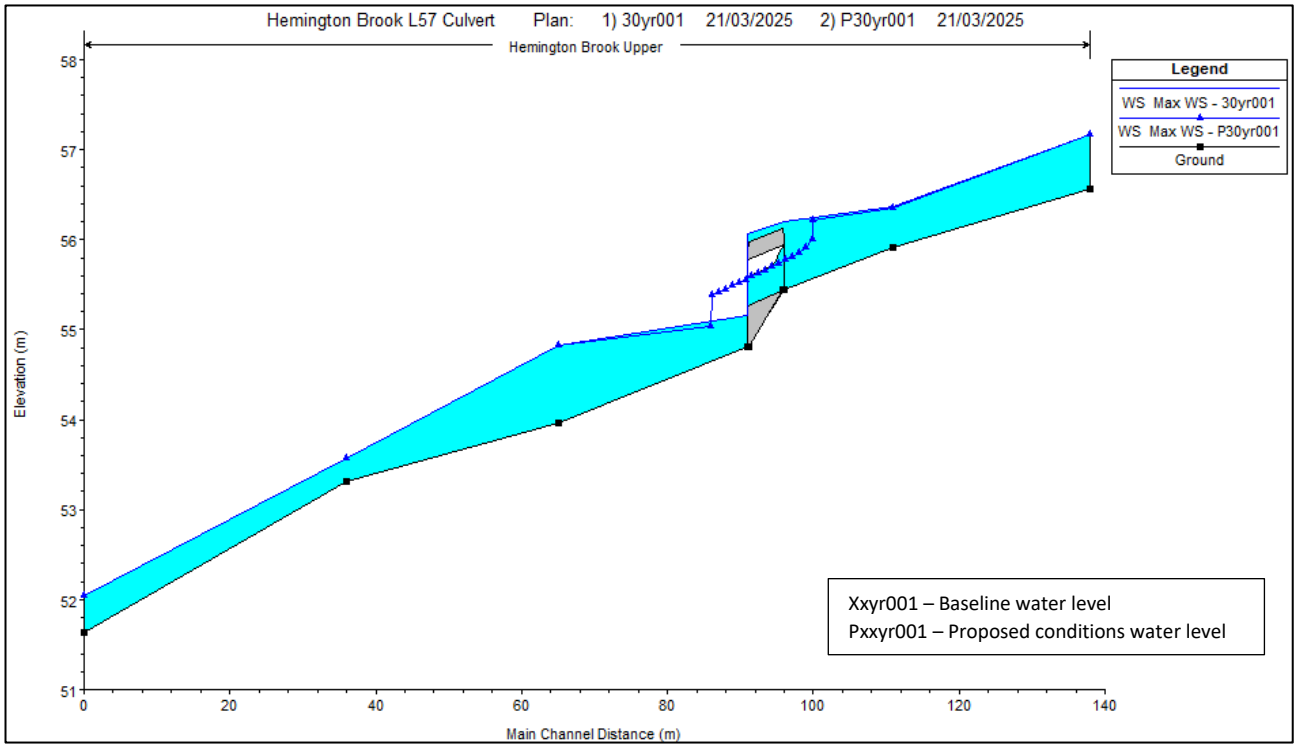


Figure 5 – 1 in 30-Year Long Section Comparison

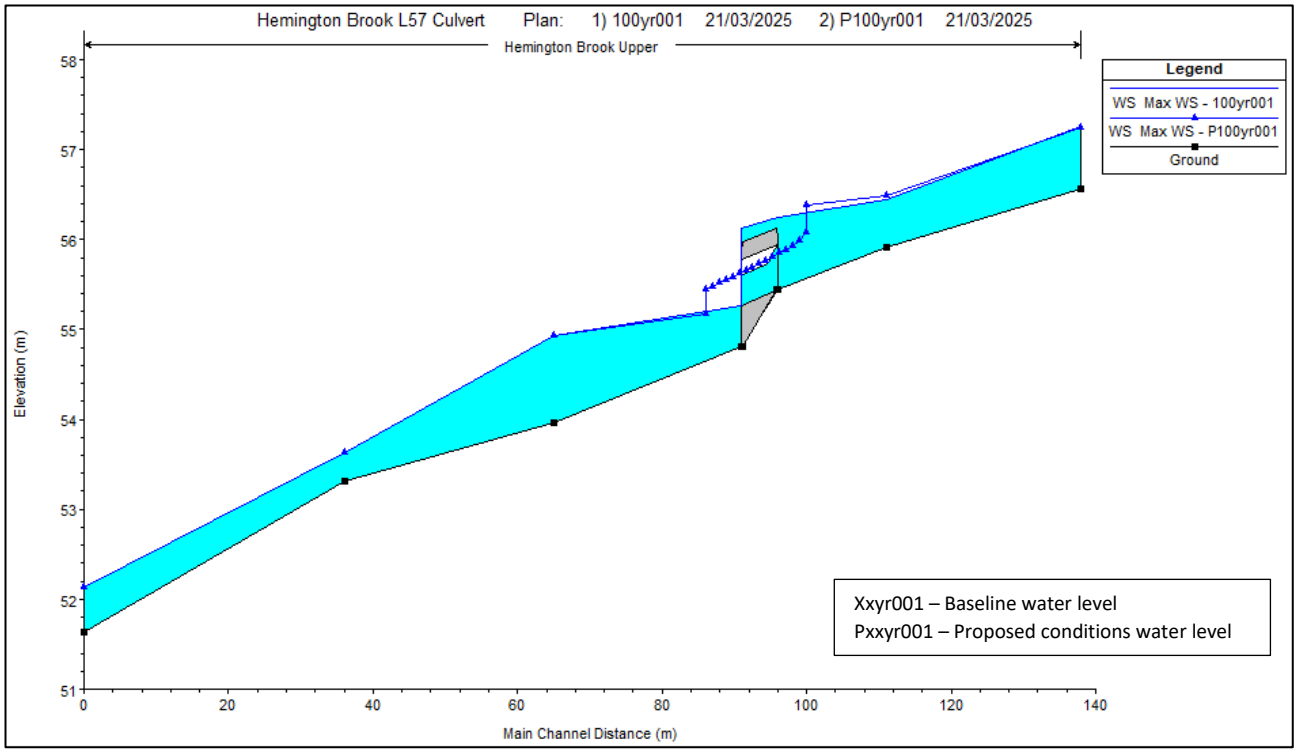


Figure 6 – 1 in 100-Year Long Section Comparison

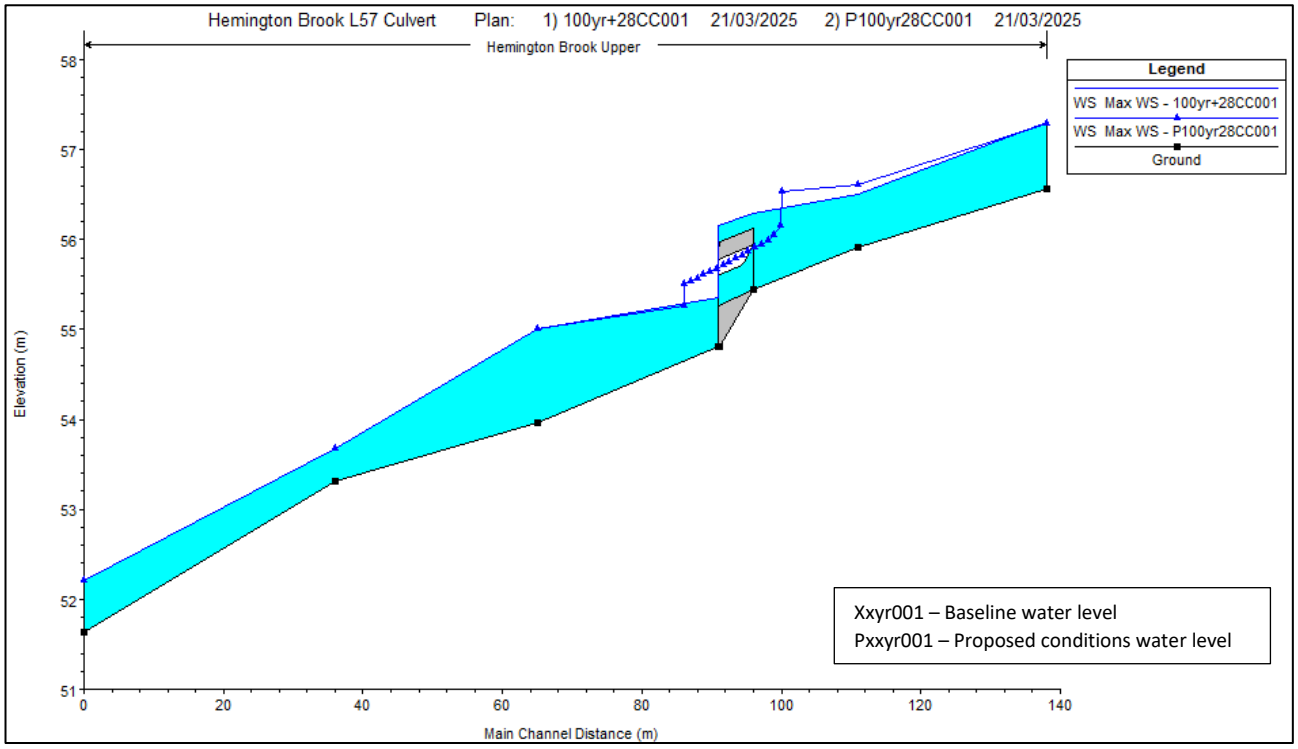


Figure 7 – 1 in 100-Year+28%CC Long Section Comparison

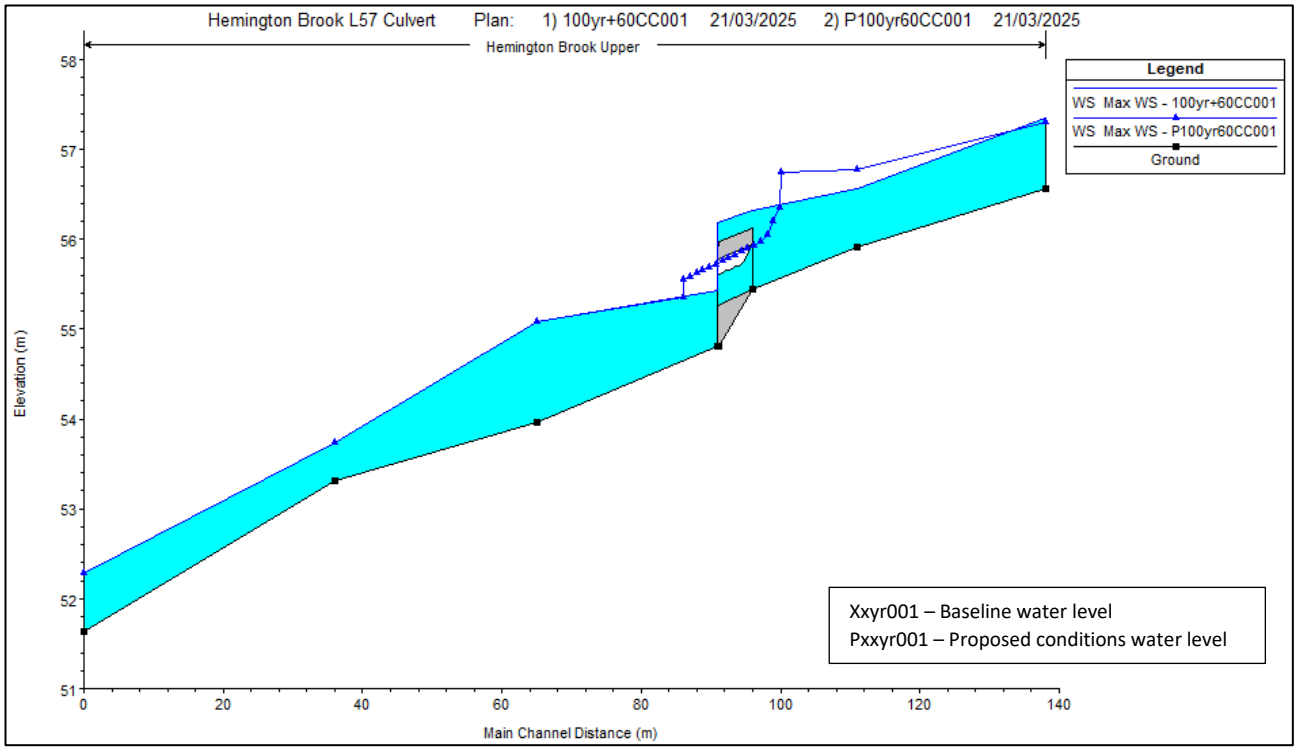


Figure 8 – 1 in 100-Year+60%CC Long Section Comparison

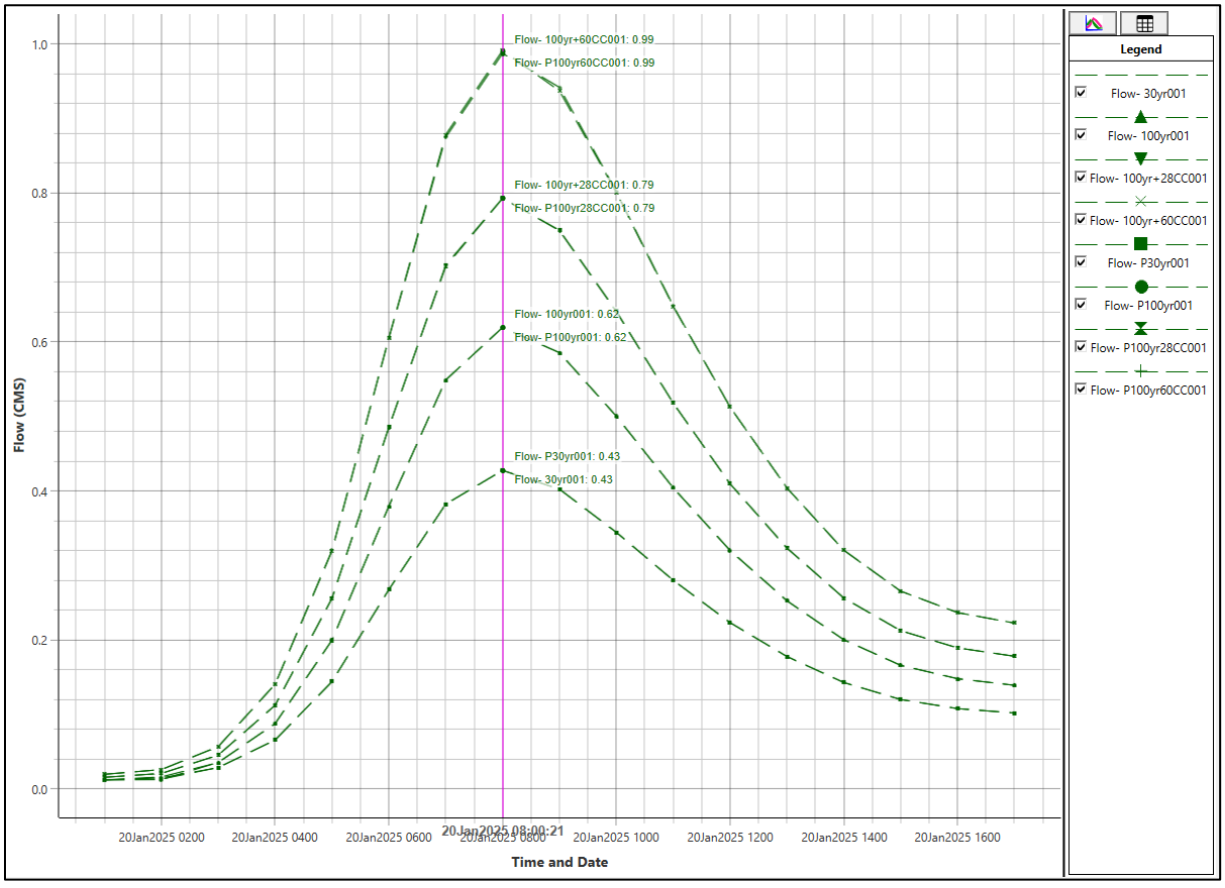
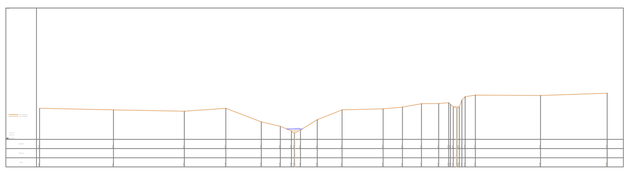


Figure 9 – Modelled Downstream Flow Hydrographs

REACH 1



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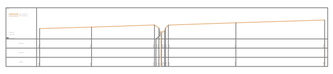

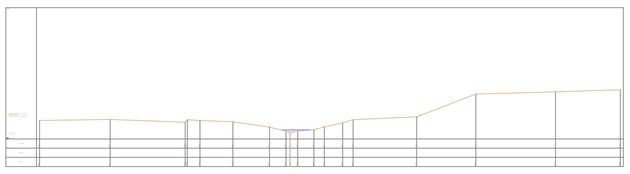

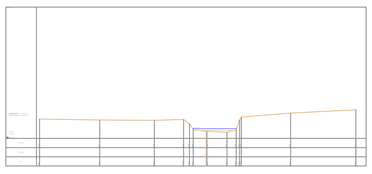

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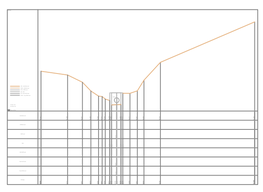

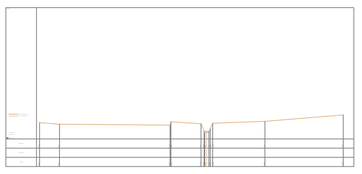

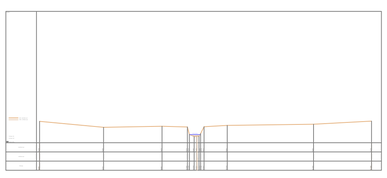

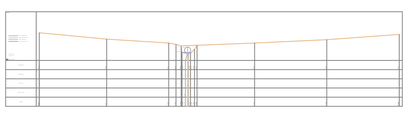

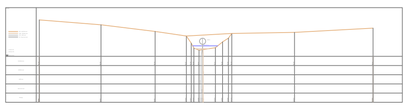

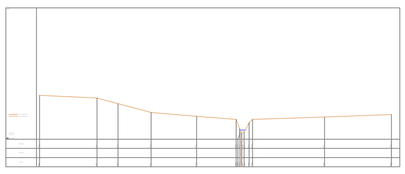

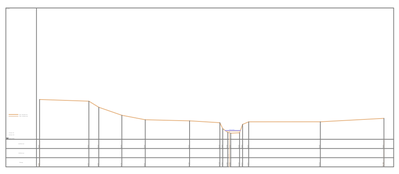

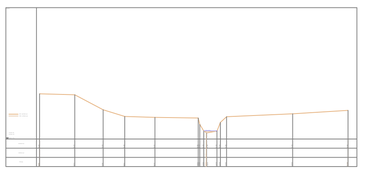

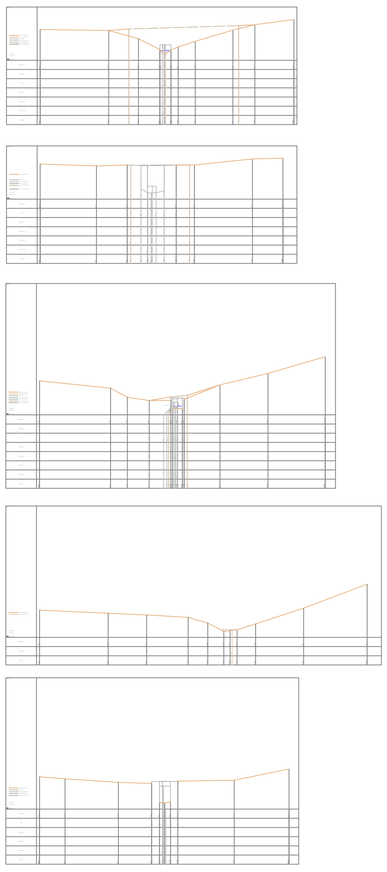

N

OS Note:

This survey has been orientated to the Ordnance Survey (O.S) National Grid OSGB36(15) via Global Navigation Satellite Systems (GNSS) and the O.S. Active Network (OS Net).

A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN15GB & OSGM15GB transformation models.

The survey has been correlated to this point and a further one or more OSGB36 (15) points established to create a true O.S. bearing for angle orientation.

No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.

Please refer to Survey Station Table to enable establishment of the on-site grid and datum.

Legend:

Buildings	Overhead Cable	CVR	Cover (generic)	DrDuct	Drainage duct
Wall	Concrete edge	IC	Inspection chamber	Bo	Bollard
Kerb line	Tarmac edge	PInv	Pipe invert	IB	Illuminated bollard
Line marking	Grass verge	Gy	Gully	Bin	Rubbish bin
Drop kerb	Canopy/Overhang	Bg	Back gully	Vp	Vent pipe
Centre line	Verge	Dp	Down pipe	Grl	Ground light
Top of bank	Bottom of bank	Pipe	Pipe above ground	Lbox	Letter box
100.000	Station and Name / Station Level	MH	Manhole	Stmp	Tree Stump
		WL	Water level	Sty	Stile
		Fl	Flood light	IFL	Internal floor level
	Tree / Bush / Sapling	Lp	Lamp post	THL	Threshold level
	Area of Undergrowth	Tp	Telegraph post	Sp	Sign post
	Woodland	Ep	Electricity post	TH	Trialhole
R:	Ridge Level	Ti	Traffic light	BH	Borehole
E:	Eaves Level	Bus	Bus stop	ELC	Electric
F:	Flat Roof Level	Sv	Stop valve	BT	British Telecom
	Gate	St	Stop tap	Cbox	Control box
Fence types:		Er	Earth rod	TT	Tactile
IW	Interwoven	Wm	Water meter	BP	Brick paved
IR	Iron Railings	Gas	Gas valve	CPS	Concrete paving slabs
WM	Wire Mesh	Av	Air valve	CVR	Cover
PR	Post & Rail	ICU	Unidentified inspection	RWall	Retaining wall
PW	Post & Wire	Wo	Wash out	TWL	Top of Wall Level
CL	Chain Link	Re	Rodding eye	TCL	Tree canopy level
WF	Wooden Panels	BB	Bellsha beacon	G:	Girth
CB	Close Boarded	CTV	Cable tv	MG	Multi girth
SP	Steel Palisade	Mkr	Marker post	IC	Inspection chamber
		Gmkr	Gas marker post	CL:	Cover level
		So	Soffit	IL:	Invert level
		Fh	Fire hydrant	UTR	Unable to raise

Rev	Date	Description	Drawn	Q. Ref

greenhatch group

- Topographical Surveys
- Site Engineering
- Utility / CCTV Surveys
- Measured Building Surveys
- 3D Laser Scanning
- Revit & BIM Models

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CLIENT

SEGRO

PROJECT

EMG 2, Watercourse Sections
Hemington Hill
DE74 2RA

TITLE

Watercourse Section Survey

SCALE	DATE
A0@ 1: 200	16.12.24
DRAWN	QUALITY REF.
JOS	GH23225

Level datum	See note
Grid orientation	See note
Job number	34529A

Drawing No.	Rev.
34529A_SECTION	0

Comments

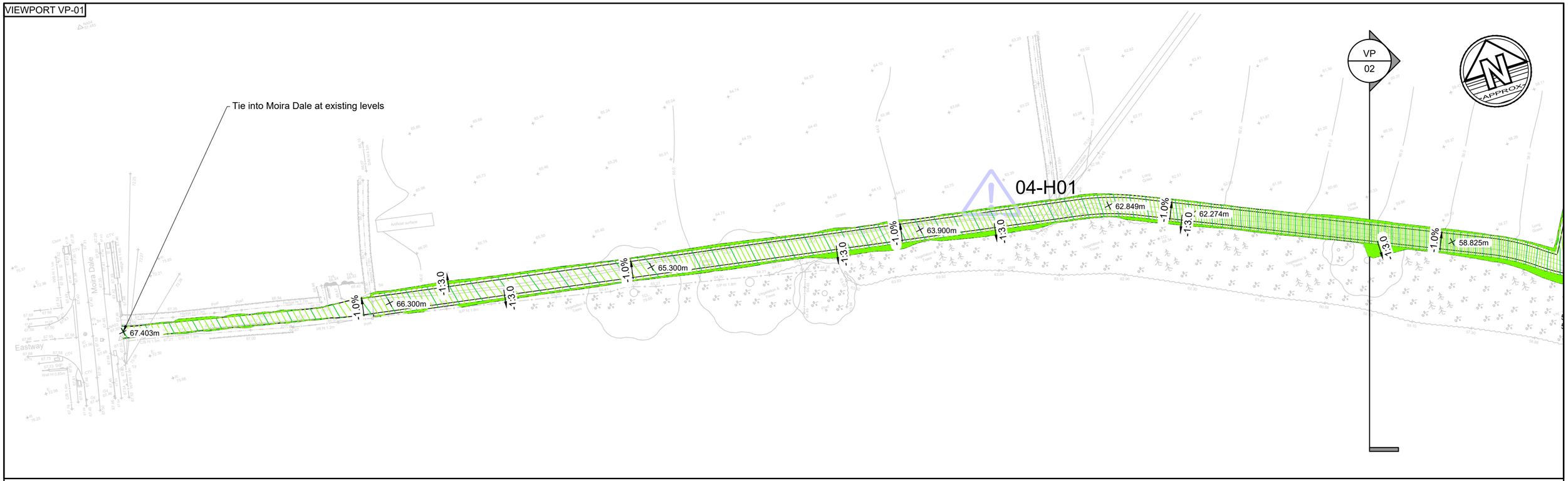
This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

All dimensions should be checked on site prior to design and construction.

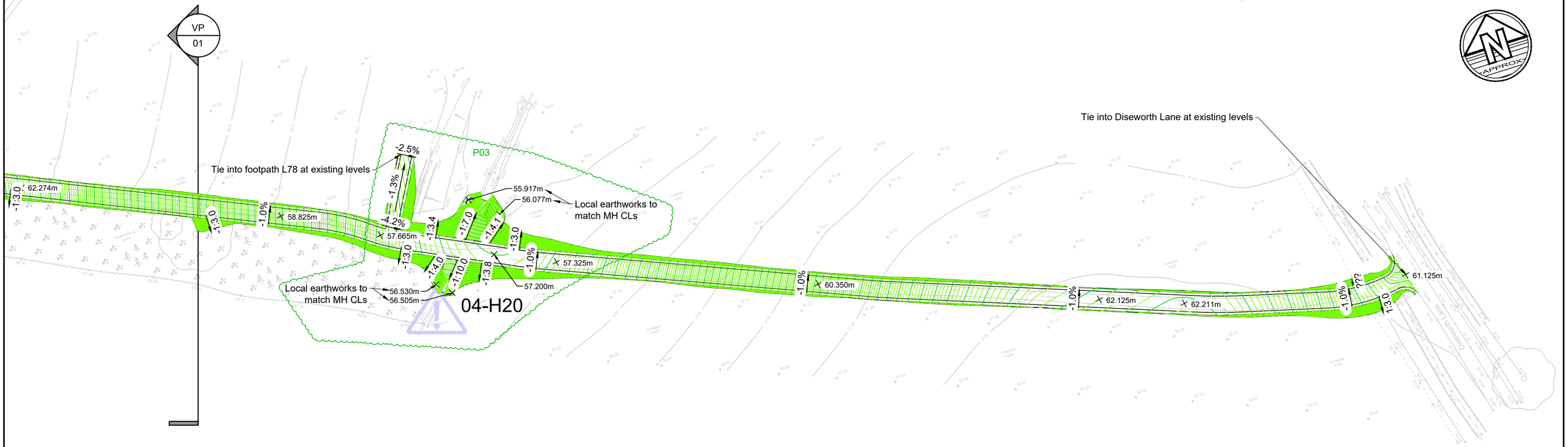
Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

VIEWPORT VP-01



VIEWPORT VP-02



Notes

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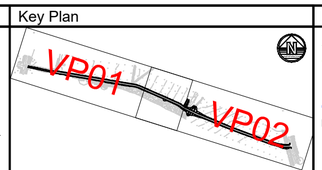
3. All dimensions in metres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.

Key Plan



Legend

- Major contour 0.100m interval
- Minor contour 0.025m interval
- 1:3.0 Gradient as 1:X
- 3% Gradient as X%
- Bagwork Headwall

Hazards

04-HXX

Significant Construction Hazard. To be read in conjunction with; EMG-BWB-HGN-04-SH-H-0100_L57 Footpath DRA

Issues & Revisions

Rev	Date	Details of issue / revision	Drw	Rev
P01	14.01.25	Preliminary Issue	JB	RAL
P02	16.01.25	Note to refer to drainage drawings	JB	RAL
P03	12.02.25	L78 Link and culvert earthworks updated	JB	RAL

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Nottingham | 0115 924 1100
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Client: SEGRO

Project Title: EAST MIDLANDS GATEWAY 2 L57 FOOTPATH

Drawing Title: FINISHED LEVEL CONTOURS

Drawn:	J. Bethell		Reviewed:	R. Leyland	
BWB Ref:	233445	Date:	14.01.25	Scale@A2:	1:500

Drawing Status: PRELIMINARY

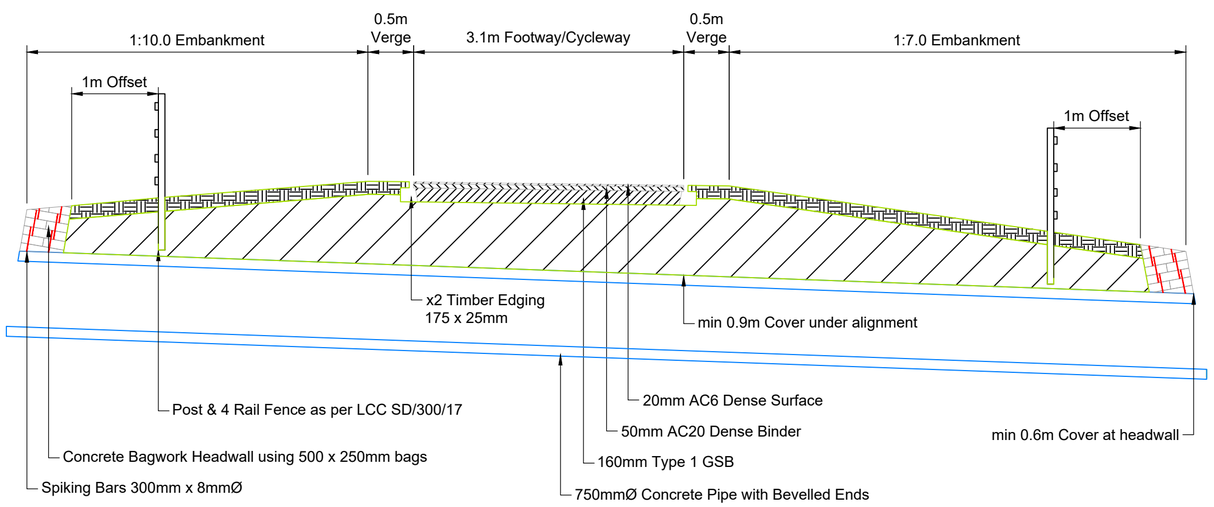
Project - Originator - Zone - Level - Type - Role - Number: EMG2-BWB-HGT-04-DR-C-0600

Status: S3

Rev: P03

J:\2023\233445-EMG\ProjectDelivery\01-WIP\Drawings\EMG2-BWB-HGT-04-DR-H-0600_L57 Footpath Finished Level Contours.dwg

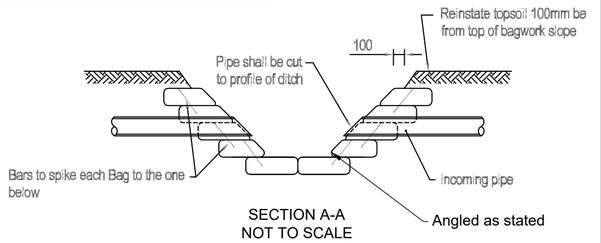
CROSS SECTION; 1:50



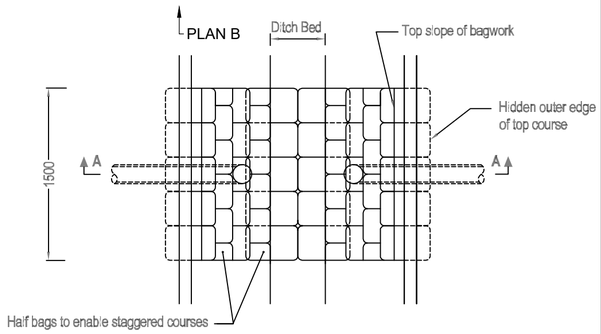
Chainage 285.00m

Culvert cross-section
Facing North-West

SECTION A-A, PLAN A; NOT TO SCALE

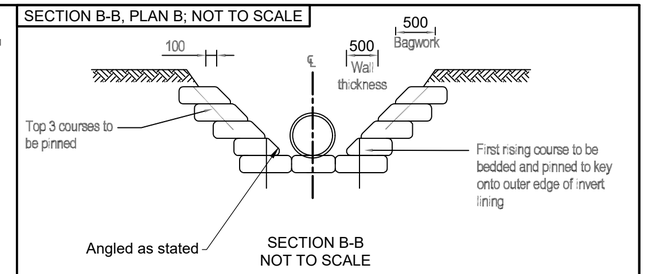


SECTION A-A
NOT TO SCALE

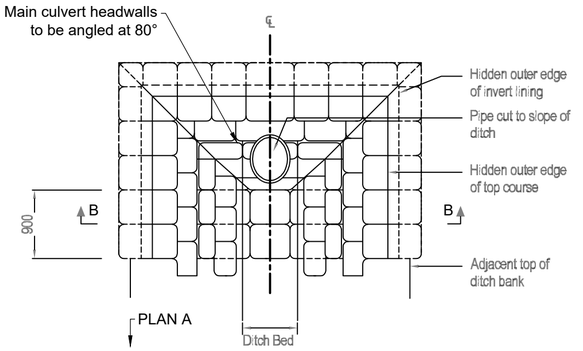


PLAN A
NOT TO SCALE

SECTION B-B, PLAN B; NOT TO SCALE

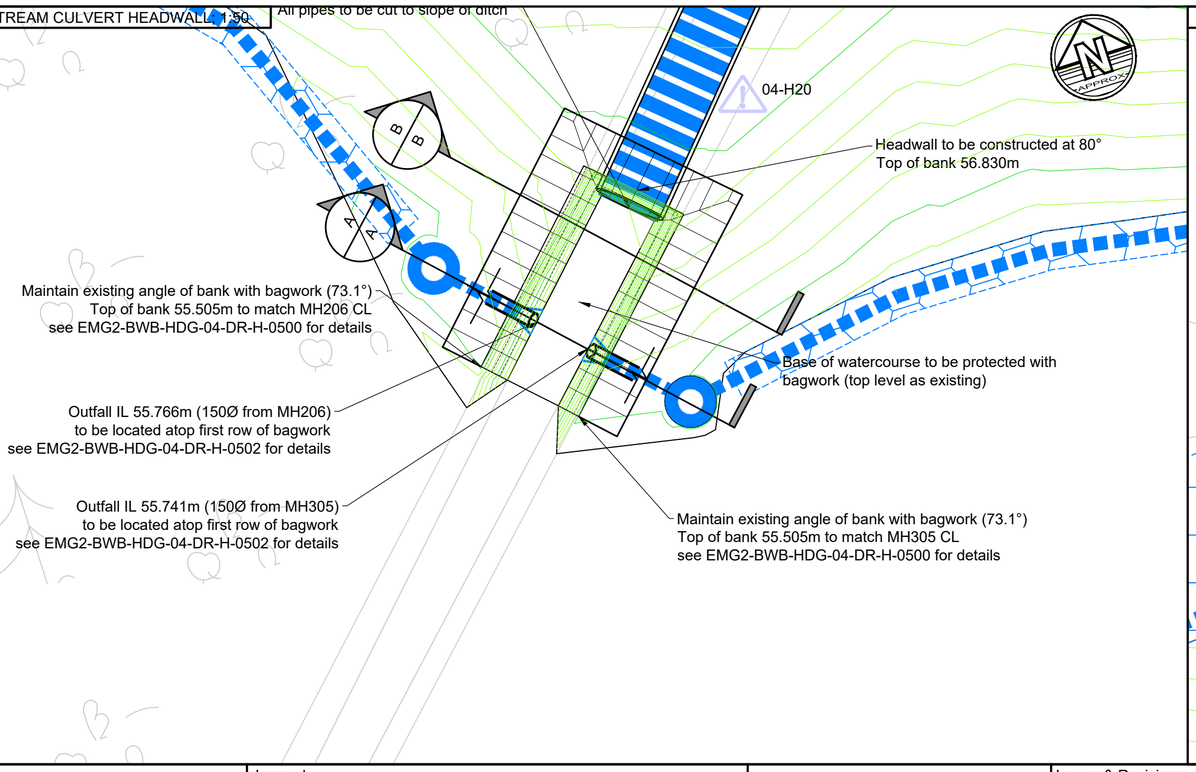


SECTION B-B
NOT TO SCALE

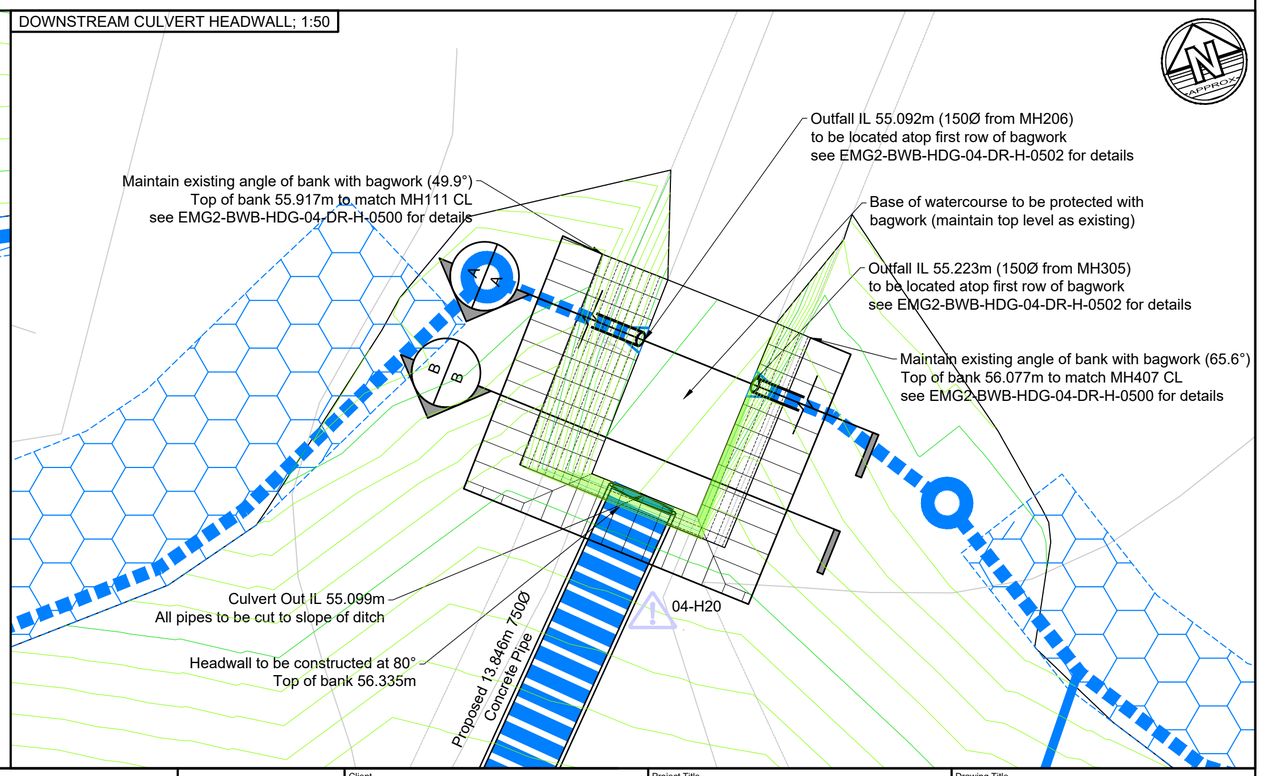


PLAN B
NOT TO SCALE

UPSTREAM CULVERT HEADWALL; 1:50



DOWNSTREAM CULVERT HEADWALL; 1:50



Notes

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Legend

Hazards

04-HXX

Significant Construction Hazard. To be read in conjunction with;
EMG-BWB-HGN-04-SH-H-0100_L57 Footpath DRA

Issues & Revisions

Rev	Date	Details of issue / revision	Drw	Rev
P01	17.01.25	Preliminary issue	JB	RAL
P02	12.02.25	Culvert upsized to 750mm, general edits	JB	RAL

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Client: SEGRO

Project Title: EAST MIDLANDS GATEWAY 2 L57 FOOTPATH

Drawing Title: PROPOSED CULVERT

Drawn:	J. Bethell	Reviewed:	R. Leyland	
BWB Ref:	233445	Date:	17.01.25	Scale@A2: As Shown

Drawing Status: PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
EMG2-BWB-HDG-04-DR-W-0501	S3	P02

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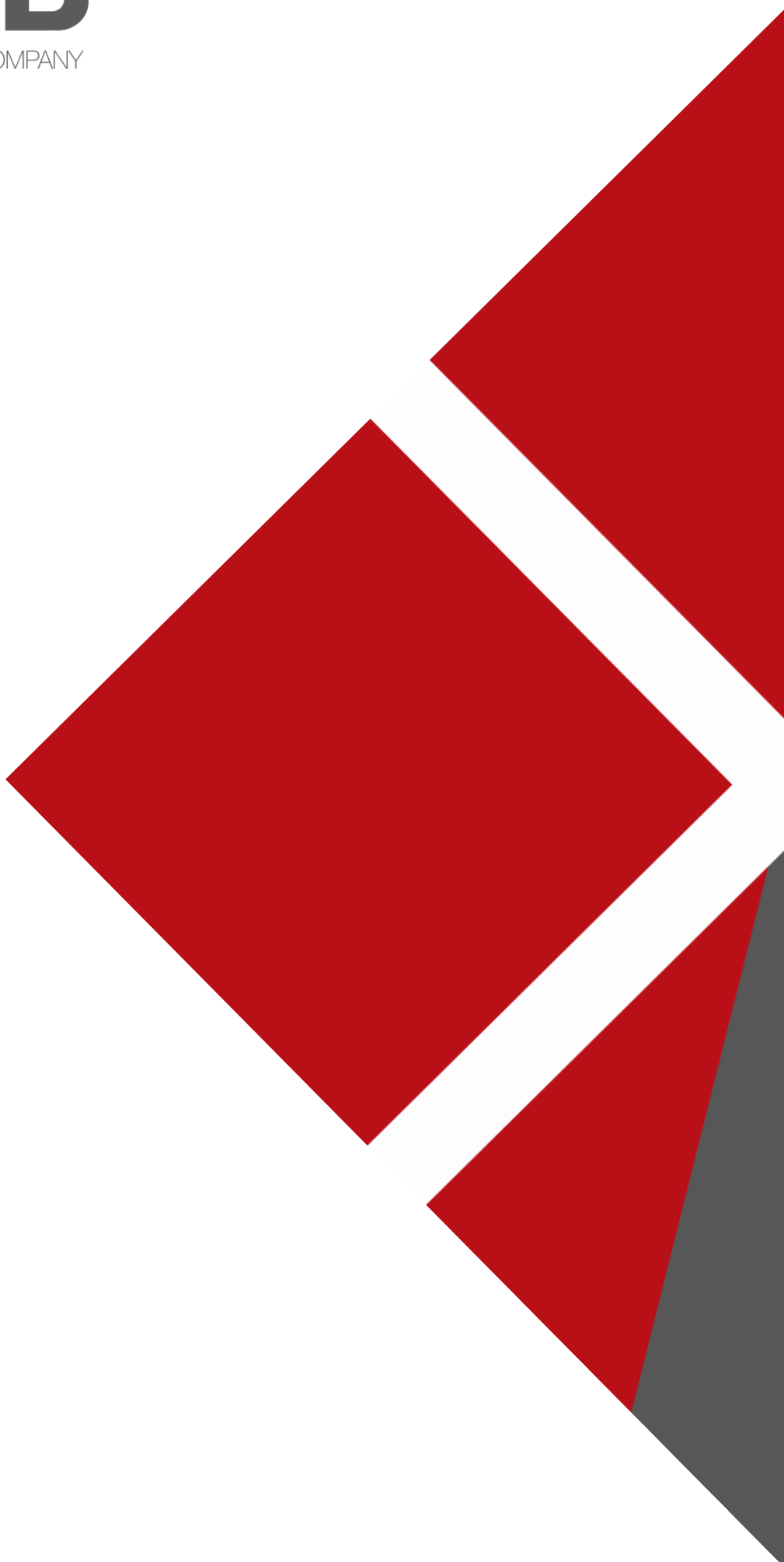

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