

A12 Chelmsford to A120 widening scheme

TR010060

DEVELOPMENT CONSENT ORDER CHANGE APPLICATION SURFACE WATER DRAINAGE STRATEGY ADDENDUM

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A12 Chelmsford to A120 widening scheme
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Surface Water Drainage Strategy Addendum

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1 Introduction

1.1 Background

- 1.1.1 This Change Application relates to an application submitted by National Highways (the Applicant) to the Secretary of State for Transport (through the Planning Inspectorate) for a development consent order (DCO) under the Planning Act 2008. The A12 Chelmsford to A120 Widening Scheme (the proposed scheme) involves widening the A12 to three lanes throughout (where it is not already three lanes) with a bypass between junctions 22 and 23 and a second bypass between junctions 24 and 25. It also includes safety improvements, including closing off existing private and local direct accesses onto the main carriageway, and providing alternative provision for walkers, cyclists and horse riders to existing routes along the A12, which would be removed.
- 1.1.2 A DCO application for the proposed scheme was accepted for examination by the Planning Inspectorate on the 12th of September 2022 (DCO Application). The proposed scheme is currently in examination which started on 12th January 2023 and is due to close on 12th July 2023.
- 1.1.3 Since the DCO application was made, the Applicant has continued to engage and refine designs to identify opportunities to further improve the proposals. As a result of this, the Applicant is proposing six changes to the proposed scheme during the Examination stage to address suggestions by interested parties and to implement improvements to the proposed scheme.
- 1.1.4 This Change Application comprises the Applicant's request to the Examining Authority (appointed by the Planning Inspectorate) to accept into the Examination of the DCO Application six changes to the proposed scheme for which development consent is sought.
- 1.1.5 On 30 March 2023, in accordance with paragraph 3.2 of Advice Note 16: Requests to change applications after they have been submitted for examination (AN16), the Applicant submitted its Change Notification to the Examining Authority (ExA) [REP2-031] (Change Notification). The Change Notification set out the Applicant's intention to make a change request, detailed its consultation proposals and confirmed the likely date for the Change Application to be submitted as 30th May 2023. The Change Notification also provided the details and background to the Applicant's request for the proposed changes as required by Figure 2a of AN16.
- 1.1.6 The proposed six changes to the proposed scheme in summary are:
- Junction 19 – redesign of north bound on slip road
 - Exclusion of Anglian Water pumping station from land proposed for compulsory acquisition at Hatfield Peverel
 - Changes to the provision of replacement land at Whetmead and additional consequential changes reflecting change of ownership for open space in the Witham area

- Drainage works associated with B1023 Kelvedon Road at Inworth
- Junction 24/Inworth Road B1023 - Removal of the segregated left turn lane
- Junction 25 - Removal of the signalised crossroads and partial signalisation of the existing roundabout at A120/junction 25

1.1.7 The ExA responded to the Applicant's Change Notification on 6 April 2023 [PD-011] confirming that the Applicant had satisfied the requirements of Figure 2a of AN16 and acknowledged the Applicant's intent to submit a Change Application (Rule 9 Letter). In the Rule 9 Letter the ExA also confirmed the information required by Step 2 of AN16.

1.1.8 This Surface Water Drainage Strategy (SWDS) Addendum presents an assessment undertaken of the proposed highway drainage relating to the aforementioned proposed changes, provides a summary of the differences between the new highway drainage design solutions relative to the highway drainage design that was submitted at DCO application and describes the revised highway drainage design proposals for the proposed catchments affected by the aforementioned proposed changes.

1.2 Relevant DCO Documents

1.2.1 This SWDS Addendum should be read in conjunction with the DCO documents presented in Table 1.1 below. These documents can be found in the Examination Library on the Planning Inspectorate's website for the project.

Table 1.1 Key DCO documents relevant to this SWDS Addendum

Document Title	Examining Library Document Reference	DCO Application Document Reference
Surface Water Drainage Strategy	APP-174	Appendix 14.6 of the ES [TR010060/APP/6.3]
Flood Risk Assessment	APP-162	Appendix 14.5 of the ES [TR010060/APP/6.3]
Water Quality Assessment Report	APP-158	Appendix 14.1 of the ES [TR010060/APP/6.3]
Road Drainage and the Water Environment	APP-081	Appendix 14 of the ES [TR010060/APP/6.3]
Drainage and Surface Water Plans – Part 1	APP-033	TR010060/APP/2.13
Drainage and Surface Water Plans – Part 2	APP-034	TR010060/APP/2.13
Surface Water Drainage Strategy Annex A – Parts 1 to 5	APP-175 to APP-179	Appendix 14.6 of the ES [TR010060/APP/6.3]

Document Title	Examining Library Document Reference	DCO Application Document Reference
General Arrangement Plans Parts 1 to 5	APP-020 to APP-024 and AS-010 to AS-013	General Arrangement Plans Parts 1 to 5 [TR010060/APP/6.2] and [TR010060/APP/2.9]
Environmental Masterplan Parts 1 to 3	APP-086 to APP-088	ES Figure 2.1 Environmental Masterplan Parts 1 to 3 [TR010060/APP/6.2]

1.2.2 This SWDS Addendum should also be read in conjunction with the documents being submitted as part of the Change Application, as presented in Table 1.2 below.

Table 1.2 Change Application documents relevant to this SWDS Addendum

Document Title	Change Application Document Reference
Flood Risk Assessment Addendum	TR010060/EXAM/10.16
Environmental Statement Addendum	TR010060/EXAM/10.12
Map Book 1 – Junction 19 Slip Road Part 1 of 1	TR010060/EXAM/10.5
Map Book 4 – B1023 Flood Mitigation and Drainage – Part 1 of 1	TR010060/EXAM/10.8
Map Book 5 – B1023 Roundabout Part 1 of 1	TR010060/EXAM/10.9

2 Purpose of this Addendum

- 2.1.1 This SWDS Addendum provides an updated assessment of the highway drainage design proposals relating to three of the six proposed changes to the proposed scheme (i.e. stated in paragraph 1.1.6 previously) that are relevant to highway drainage, namely:
- Junction 19 - redesign of the northbound on-slip road;
 - Drainage Works associated with the B1023 Kelvedon Road at Inworth; and
 - Junction 24/Inworth Road B1023 - Removal of the segregated left turn lane
- 2.1.2 It is noted that the proposed changes regarding the exclusion of the Anglian Water pumping station from the land proposed for compulsory acquisition at Hatfield Peverel and changes to the provision of replacement land at Whetmead and additional consequential changes reflecting change of ownership for open space in the Witham area as described in paragraph 1.1.6 of this SWDS Addendum are not related to the highway drainage design proposals. It is also noted that the proposed design change at junction 25 as described paragraph 1.1.6 of this SWDS Addendum would not change the highway drainage design proposals from those presented within the Surface Water Drainage Strategy [APP-174] submitted at DCO application (refer to Environmental Statement Addendum [TR010060/EXAM/10.12] for further details on this proposed design change). Therefore, these three proposed changes are not discussed any further within this SWDS Addendum.
- 2.1.3 This SWDS Addendum is intended to supersede the information provided in the Surface Water Drainage Strategy [APP-174] submitted at DCO application relating to the three of the six proposed changes included in paragraph 2.1.1 above.
- 2.1.4 This SWDS Addendum reports on the following:
- **Section 3** – The highway drainage design assessment approach regarding the review and redesign of the proposed highway drainage affected by the proposed changes. This includes a brief summary of highway drainage design criteria that has been considered in the development of revised highway drainage solutions.
 - **Section 4** – Provides a brief overview of the proposed change that includes the redesign of the northbound on-slip road at junction 19, an assessment of its impacts to the proposed scheme highway drainage design and the resulting revised highway drainage design proposals in the vicinity of junction 19.
 - **Section 5** – Provides a brief overview of the proposed change that necessitates the provision of highway drainage and flood mitigation measures along the B1023 Kelvedon Road at Inworth and describes the specific design updates to elements of the proposed highway drainage design. The proposed change to the flood mitigation measures along the B1023 Kelvedon Road at Inworth is discussed separately within the Flood Risk Assessment (FRA) Addendum [TR010060/EXAM/10.16], submitted with the Change Application.

- **Section 6** – Provides a brief overview of the proposed change that includes the removal of the segregated left turn lane from the proposed Junction 24/Inworth Road B1023 and an assessment of its impacts to the proposed scheme highway drainage design

2.1.5 An assessment of the environmental impacts from the proposed changes has been undertaken and is presented in the Environmental Statement (ES) Addendum [TR010060/EXAM/10.12], submitted with the Change Application. This includes the water quality assessment (i.e. Section 14 of the ES Addendum), construction impact (i.e. Section 2.11 of the ES Addendum), impacts to the land acquired for the permanent land acquisition (i.e. Section 2.8 of the ES Addendum) and any other impacts as a result of the revised highway drainage design proposals.

2.1.6 This SWDS Addendum also includes appendices which contain the relevant information for the updated assessment of the highway drainage design relating to the proposed changes included in paragraph 2.1.1 above, namely;

- **Annex A** – Updated Paved and Permeable Catchment Areas Summary Table associated with the revised highway drainage design.
- **Annex B** – Updated Discharge Rates and Attenuation Storage Volume Summary Table associated with the revised highway drainage design.
- **Annex C** – Preliminary Ground Investigation Data Summary Table associated with the revised highway drainage design for the B1023 Kelvedon Road at Inworth.

3 Highway drainage design assessment approach and design criteria

3.1 Highway drainage design assessment approach

- 3.1.1 The overarching highway drainage design principles and the proposed highway drainage design assessment approach outlined in Section 4 of the Surface Water Drainage Strategy [APP-174] have been used in the assessment of implications from the proposed changes on the highway drainage design submitted at DCO application.
- 3.1.2 The assessment approach has taken into account the additional information that has become available post-DCO submission through further site surveys, in particular the additional existing drainage network survey, but also the topographic and utility surveys. Where practicable, the revised highway drainage design, described in Section 4 to Section 6 of this SWDS Addendum, has addressed the concerns raised by local landowners within the relevant representations with regards to land take associated with the proposed attenuation ponds for the highway drainage design submitted at DCO application in August 2022.

3.2 Highway drainage design criteria summary

- 3.2.1 The revised proposed highway drainage design adheres to the highway drainage design criteria presented in Section 4 of the Surface Water Drainage Strategy [APP-174] submitted at DCO application. The key highway drainage design criteria and the associated specific references to sub-sections within Section 4 of the Surface Water Drainage Strategy [APP-174] are summarised below:
- Retention of the general location of the discharge points from the existing highway drainage where feasible in order to maintain flows in receiving watercourses as far as reasonably practicable. The allowable discharge rates criteria is specified in Sections 4.8 to 4.10, Section 7 and Section 10 of the Surface Water Drainage Strategy [APP-174].
 - The provision of adequate attenuation storage measures. The attenuation storage design criteria is specified in Section 4.9 of the Surface Water Drainage Strategy [APP-174].
 - The climate change allowance applied to the proposed highway drainage over the design life of the proposed scheme is specified in Section 4.4 of the Surface Water Drainage Strategy [APP-174].
 - The hydraulic design criteria for the piped drainage systems is specified in Section 4.5.7 and Section 4.5.8 of the Surface Water Drainage Strategy [APP-174].
 - Where feasible, Sustainable Drainage Systems (SuDS) flow conveyance and attenuation features (e.g. filter drains, attenuation storage ponds, underground geocellular attenuation storage systems, etc.) are employed to minimise the water quality and flood risk impact of surface water runoff

being discharged to the natural environment from the proposed highway drainage systems. The SuDS philosophy and water quality treatment measures are as specified in Section 4.2 and Section 11 of the Surface Water Drainage Strategy [APP-174].

- The proposed highway is to remain operational and safe for users during major rainfall events and not increase flood risk elsewhere. The exceedance flows assessment methodology is specified in Section 9 of the Surface Water Drainage Strategy [APP-174].

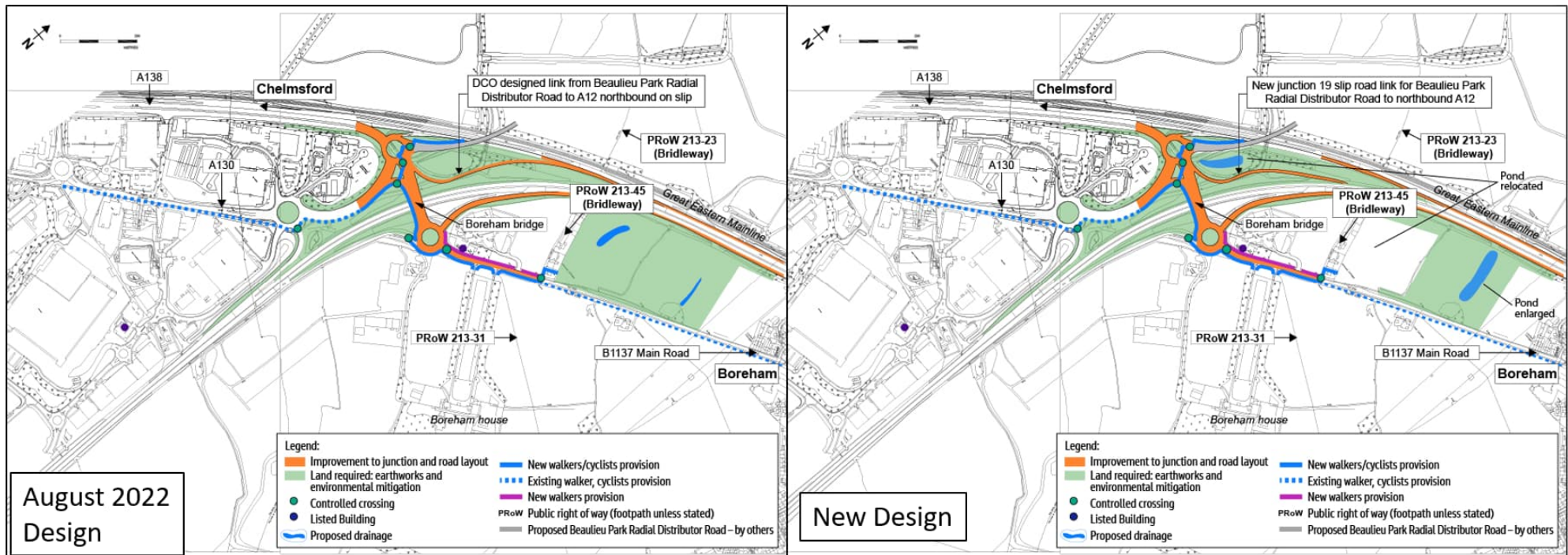
3.2.2 Hydraulic modelling has been undertaken to determine the allowable discharge rates and attenuation storage volumes. The hydraulic modelling methodology employed is described in Section 5 of the Surface Water Drainage Strategy [APP-174]. The rainfall data and the various hydraulic modelling parameters that inform the hydraulic modelling are those presented in Section 4.6 of the Surface Water Drainage Strategy [APP-174].

4 Junction 19 redesign of northbound on-slip road

4.1 Overview of highway design change

- 4.1.1 The proposed highway design change includes an alteration to the configuration of the northbound on-slip road at junction 19 to allow traffic to merge directly with the A12 mainline and thereby improving the safety to road users when joining the A12 northbound at junction 19. Refer to Section 2.2 of the ES Addendum [TR010060/EXAM/10.12] for further details on the proposed design change, including the detailed reasons as to why this design change is being proposed. Plate 4.1 presents a schematic comparison of the proposed change in highway design of junction 19 northbound on-slip road compared to the design submitted for the DCO application in August 2022.

Plate 4.1 Proposed design changes to the junction 19 northbound on-slip road compared with the design submitted in August 2022



4.2 Updated highway drainage design in the vicinity of junction 19

Design changes for the revised proposed highway drainage design in the vicinity of junction 19

- 4.2.1 The proposed design change to the northbound on-slip road at junction 19 impacts the highway drainage design proposals submitted at DCO application. This is primarily due to the altered configuration of the new on-slip road design which now connects into the A12 mainline as opposed to the DCO application design which had a connection to the existing A12 northbound on-slip road. This design alteration to the slip road and its connection to the existing A12 mainline provides hydraulic constraints meaning that the highway drainage proposals in the vicinity of junction 19 that were provided within the Surface Water Drainage Strategy [APP-174] submitted at DCO application are no longer feasible.
- 4.2.2 The proposed highway drainage catchments affected by the above-described highway design change are proposed catchments S1-OU1, S1-OU11 and S1-OU12, located in the vicinity of junction 19. Refer to Sheet 2 of 21 of updated Drainage and Surface Water Plans in Map Book 1 [TR010060/EXAM/10.5], submitted with the Change Application for the revised highway drainage design proposals and the updated proposed catchment extents.
- 4.2.3 The following report sections describe the assessment undertaken for the highway drainage elements for the affected proposed catchments S1-OU1, S1-OU11 and S1-OU12 and summarises the revised highway drainage design proposals in the vicinity of junction 19. Plate 4.2 presents schematic comparisons for the revised highway drainage design elements in the vicinity of junction 19 compared to those submitted in August 2022. Table 4.1 provides a summary of the key design changes in comparison to the highway drainage design submitted in August 2022. The changes to the proposed highway drainage design result in a reduction in extent of permanent acquisition of land take due to the removal of the proposed S1-OU11 catchment attenuation pond.

Plate 4.2 Revised highway drainage design proposals in the vicinity of junction 19 compared with the design submitted in August 2022

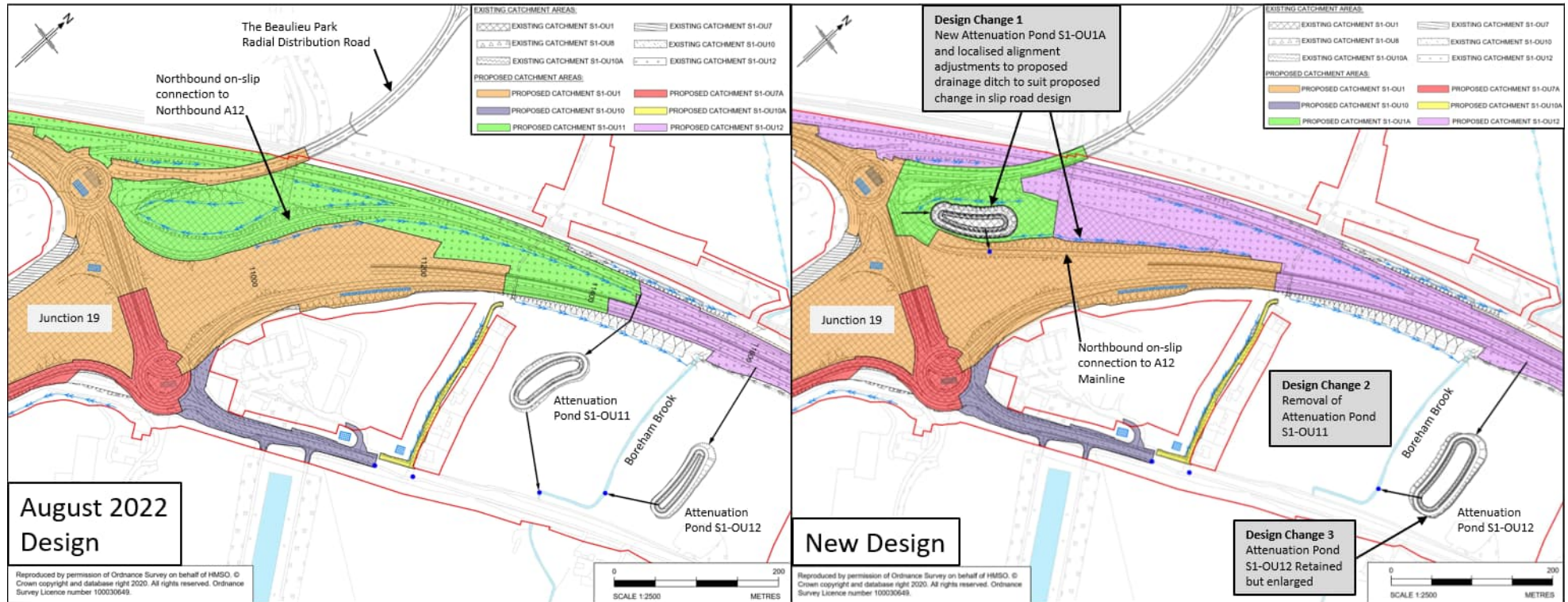


Table 4.1 Summary of the design changes for the revised proposed highway drainage design in the vicinity of junction 19

Reference to design change in Plate 4.2	New highway drainage design solution
Design Change 1	<p>New proposed S1-OU1A catchment attenuation pond – This new attenuation pond is proposed to attenuate the surface water runoff from the proposed highway drainage catchments associated with the northbound on-slip road at junction 19 (i.e. new slip road connection to A12 mainline) and the catchment associated with the realigned Beaulieu Park Radial Distribution Road. Additional online attenuation storage in the form of oversized pipes along the new slip road will also be required. The attenuated highway drainage runoff will discharge into the A12 mainline existing highway drainage system at controlled discharge rates. The design requirement for the new proposed S1-OU1A catchment attenuation pond and online attenuation storage due to highway and drainage design constraints is discussed in paragraph 4.2.4 to paragraph 4.2.8.</p> <p>Proposed drainage ditches – The proposed drainage ditches are retained although they require localised alignment adjustments to suit the design change for the new on-slip road connection to the A12 mainline.</p>
Design Change 2	<p>Proposed S1-OU11 catchment attenuation pond removal – This previously proposed attenuation pond has been removed.</p> <p>The highway drainage catchment portion associated with the previously proposed S1-OU11 catchment is now partially diverted to the proposed S1-OU12 catchment attenuation pond (i.e. Design Change 3 described subsequently within this summary table).</p> <p>Due to the highway design change in the on-slip road configuration (i.e. on-slip road connection now proposed to the A12 mainline), it is not practicable to retain the proposed highway drainage arrangement for the previously proposed S1-OU11 catchment attenuation pond. Therefore, the above-described affected proposed catchments are now proposed to be drained by the mitigation measures outlined in Design Change 1 above (i.e. the new proposed S1-OU1A catchment attenuation pond).</p> <p>The reduction in aforementioned proposed catchments associated with the S1-OU11 catchment has offered an opportunity to assess combining the S1-OU11 catchment with the S1-OU12 catchment (i.e. Design Change 3). The design development process for the combined S1-OU11 and S1-OU12 catchment is discussed in paragraph 4.2.9 to paragraph 4.2.11.</p>

Reference to design change in Plate 4.2	New highway drainage design solution
Design Change 3	<p>Proposed S1-OU12 catchment attenuation pond retention – It should be noted that there has been an increase in the attenuation storage volume for the proposed S1-OU12 catchment attenuation pond and associated footprint in comparison to the highway drainage design submitted in August 2022. This is because a portion of the highway drainage catchment associated with the S1-OU11 catchment is now draining to the proposed S1-OU12 catchment attenuation pond (i.e. Design Change 2 described above). However, the increased attenuation pond footprint is still contained within the proposed scheme Order Limits.</p>

Proposed S1-OU1 catchment and the requirement for the new proposed S1-OU1A sub-catchment (Design Change 1, Table 4.1)

- 4.2.4 The highway drainage design submitted at DCO in August 2022 included the previously proposed S1-OU11 drainage catchment associated with the northbound on-slip road at junction 19 (i.e. previously proposed on-slip road connection to existing A12 northbound on-slip road) and the realigned Beaulieu Park Radial Distribution Road. Refer to paragraphs 6.2.12 and 6.2.13 of the Surface Water Drainage Strategy [APP-174] which describes the proposed S1-OU11 catchment highway drainage submitted at DCO application.
- 4.2.5 The proposed design change in the slip road configuration (i.e. new on-slip road connection to the existing A12 mainline) requires the proposed highway drainage from these aforementioned new highway catchments to be drained into the existing A12 mainline highway drainage system and therefore they become part of proposed S1-OU1 catchment. It should be noted that the updated edge collection proposals for the above-described new on-slip road configuration include combined kerb drainage (CKDs) and filter drains which will discharge via carrier drains to the existing A12 mainline highway drainage system. The new re-configured on-slip road catchment will result in an increase in the volume of highway surface water runoff to be collected that drains into the existing A12 mainline highway drainage system contained within the proposed S1-OU1 catchment which was previously not accounted for in the highway drainage design submitted at DCO.
- 4.2.6 Further to the “Design Change 1” description in Table 4.1, an assessment has been undertaken through the hydraulic modelling of the revised proposed S1-OU1 catchment including the additional proposed S1-OU1A catchment areas draining into the existing A12 mainline highway drainage system due to the change in the on-slip road design configuration. The hydraulic modelling has confirmed that the discharge of surface water runoff from the additional proposed S1-OU1A catchment to the retained existing A12 mainline highway drainage system would exceed its conveyance capacity thereby resulting in larger exceedance flows and increased surface water drainage flood risk. This increased flood risk would be unacceptable as it does not comply with the highway drainage design criteria described in Section 3 of this SWDS Addendum and would also potentially put road users at increased risk of a

driving hazard associated with floodwater. Therefore, the increase in surface water runoff rates requires the provision of attenuation storage measures to ensure that there will not be any increased flood risk associated with the retained existing A12 mainline highway drainage system or any associated potential increase in flood risk to road users.

- 4.2.7 The additional surface water runoff arising from the additional paved area from the new proposed S1-OU1A catchment and the applied climate change allowance could not be sufficiently attenuated through the use of online attenuation storage in oversized pipework unless a significant amount of existing highway drainage network was upgraded. Oversized pipework would likely require larger diameter pipes that would increase the depth of the proposed highway drainage system, thereby preventing from its connection into the existing A12 mainline highway drainage system. Therefore, attenuation storage by means of oversized pipework only is considered to be an unfeasible option.
- 4.2.8 Due to the above-described design constraints associated with attenuation storage provision, the additional catchment associated with the on-slip road and the Beaulieu Park Radial Distribution Road is separated out to create a new drainage sub-catchment (i.e. the proposed S1-OU1A catchment). Attenuation storage is provided with a new proposed S1-OU1A catchment attenuation pond. Refer to updated Sheet 2 of 21 of Drainage and Surface Water Plans in Map Book 1 [TR010060/EXAM/10.5], submitted with the Change Application for the location of the new proposed S1-OU1A attenuation pond. A portion of the on-slip road catchment would need to be attenuated through online attenuation storage via oversized pipework due to highway geometry constraints (i.e. portion of the proposed highway extends beyond the proposed attenuation pond extent). The attenuated surface water flows are restricted prior to connecting back into the existing A12 mainline highway drainage system. These local interventions for the new proposed S1-OU1A catchment ensure that the proposed S1-OU1 catchment including its associated attenuation measures (e.g. proposed underground attenuation storage) submitted at DCO application in August 2022 remain largely unaffected.

Proposed S1-OU11 catchment attenuation pond removal (Design Change 2, Table 4.1) and the Proposed S1-OU12 catchment attenuation pond volume increase (Design Change 3, Table 4.1)

- 4.2.9 As described in paragraphs 4.2.4 & 4.2.5, the highway design change in the on-slip road configuration (i.e. on-slip road connection now proposed to the existing A12 mainline as opposed to the existing A12 northbound on-slip road) has resulted in a reduction to the previously proposed S1-OU11 drainage catchment area. This reduction in the previously proposed S1-OU11 catchment area provides an opportunity to combine the reduced proposed S1-OU11 catchment with the adjacent proposed S1-OU12 catchment with a view to potentially removing proposed S1-OU11 catchment attenuation pond previously provided for the DCO highway drainage design submission. This is feasible as the reduction in the proposed S1-OU11 catchment would result in smaller diameter pipework for the proposed S1-OU11 highway drainage system which enables adequate vertical clearance for the proposed highway drainage system to traverse over the existing Boreham Brook Culvert crossing (i.e. this was

previously a design constraint that enforced the separating out the proposed S1-OU11 catchment and S1-OU12 catchment for the proposed highway drainage design submitted at DCO application). It should be noted that the combining of the reduced proposed S1-OU11 catchment with the adjacent proposed S1-OU12 catchment will not require any alterations to the S1-OU12 catchment drainage edge collection proposals described in paragraphs 6.2.12 to 6.2.18 of the Surface Water Drainage Strategy [APP-174].

- 4.2.10 Further to the “Design Change 2” description in Table 4.1, Hydraulic modelling has been undertaken for the combined drainage catchments (i.e. the reduced proposed S1-OU11 catchment and the adjacent proposed S1-OU12 catchment). The highway drainage catchment portion associated with the previously proposed S1-OU11 catchment is diverted to the proposed S1-OU12 catchment attenuation pond. The hydraulic modelling results confirm an increase in the attenuation storage volume requirements for the proposed S1-OU12 catchment and its associated footprint.
- 4.2.11 The revised highway drainage design proposal reduces the extent of permanent acquisition of land take due to the removal of the previously proposed S1-OU11 catchment attenuation pond. Also, the constraint imposed by recently built water main and its design interfaces with the previously proposed S1-OU11 attenuation pond outfall can potentially be designed out. The proposed S1-OU12 catchment attenuation pond increased footprint has been adjusted locally to ensure that it will not have any impact on the adjacent proposed ecology measures submitted at DCO application in August 2022.

Updated proposed catchments areas summary, discharge rates and attenuation storage volume estimates

- 4.2.12 The existing and proposed paved catchment areas and any permeable catchment areas draining into the proposed highway drainage systems for the updated proposed highway drainage catchments S1-OU1, S1-OU1A and S1-OU12 are presented in Annex A. Refer to Sheet 2 of 21 of updated Drainage and Surface Water Plan provided in Map Book 1 [TR010060/EXAM/10.5], for the extent of existing and proposed highway drainage catchments associated with the updated highway drainage design in the vicinity of junction 19.
- 4.2.13 The proposed catchment discharge rates, the associated flow control devices used to achieve the proposed discharge rates, the attenuation storage type used, and the resulting modelled attenuation storage volume estimates for the updated proposed highway drainage catchments S1-OU1, S1-OU1A and S1-OU12 are presented in Annex B.
- 4.2.14 Regarding the proposed peak discharge rates, Annex B presents a summary table of the outfall locations for the proposed highway drainage systems for the updated highway drainage catchments S1-OU1, S1-OU1A and S1-OU12. The modelled proposed case peak discharge rates for the 1 in 1-year, 1 in 2-year, 1 in 5-year and 1 in 100-year return period storm events (plus an allowance for climate change) for the critical storm event are presented. The proposed highway drainage attenuation storage volumes have been determined for design events up to and including the 1 in 100-year return period storm event (plus an allowance for climate change) and the associated critical storm duration for the attenuation storage locations.

Updated natural catchment drainage

- 4.2.15 The majority of the proposed drainage ditches in the vicinity of junction 19, designed for the proposed highway drainage submitted at DCO application, are unaffected by the above-described design changes. However, some minor localised ditch alignment adjustments are required to suit the new on-slip road connection to the existing A12 mainline. These are illustrated in Sheet 2 of 21 of the updated Drainage and Surface Water Plans in Map Book 1 [TR010060/EXAM/10.5], submitted with the Change Application.

Exceedance flows assessment

- 4.2.16 The assessment of exceedance flows from the proposed highway drainage systems has been undertaken in line with the exceedance flows assessment criteria outlined in Section 9 of the Surface Water Drainage Strategy [APP-174] to ensure that there is no increased surface water drainage flood risk to road users and to the third-party land outside the proposed scheme permanent acquisition of land boundary. The hydraulic model simulations undertaken for the proposed scheme highway drainage design associated with the proposed S1-OU1, S1-OU1A and S1-OU12 catchments for the 1 in 100 year return period plus a climate change allowance design event indicate that the exceedance flows for the affected proposed catchments are similar to those determined for the 1 in 100 year return period plus a climate change allowance design event as part of the Surface Water Drainage Strategy [APP-174]. This is due to the localised intervention provided by the new Attenuation Pond, proposed S1-OU1A catchment attenuation pond, which has ensured that the proposed S1-OU1 catchment would remain largely unaffected from the design submitted at DCO application. Hence, there is no further impact on the land take beyond the proposed scheme Order Limits established as part of the design submitted at DCO application.

Infiltration potential assessment

- 4.2.17 Based on the findings of the preliminary ground investigation (GI), in-situ testing undertaken to date has found that ground conditions are generally not suitable across the majority of the proposed scheme for SuDS using infiltration techniques. With regards to the feasibility of using infiltration techniques for the disposal of collected highway surface water runoff for the proposed S1-OU1 and S1-OU12 catchments, the findings from the infiltration potential assessment undertaken at the DCO design stage remain unchanged. Refer to Section 8 and associated Annex E of the Surface Water Drainage Strategy [APP-174] which assesses the preliminary GI findings with respect to the feasibility of using infiltration techniques for the proposed scheme highway drainage catchments.
- 4.2.18 It should be noted that there is currently limited ground investigation information available in the vicinity of the newly proposed S1-OU1A catchment attenuation pond location. Supplementary GI will be undertaken prior to the detailed design stage and subsequently reviewed to further assess the feasibility of using SuDS infiltration techniques for highway surface water runoff disposal in the vicinity of the newly proposed S1-OU1A catchment attenuation pond.

Water quality assessment

- 4.2.19 An assessment of impacts to the water quality assessment as a result of the updated highway drainage design in the vicinity of junction 19 (i.e. updated proposed S1-OU1, S1-OU1A and S1-OU12 catchments) has been undertaken and presented in Section 14 of the ES Addendum [TR010060/EXAM/10.12], submitted with the Change Application. The Water Quality assessment concludes that there would be no change in significance of effects to the water quality receptors as a result of updated highway drainage design in the vicinity of junction 19 (i.e. updated proposed highway drainage catchments S1-OU1 and S1-OU12) from that reported in the Water Quality Assessment Report [APP-158].

Landscape and ecology

- 4.2.20 An assessment of impacts to the proposed landscape and ecology measures as a result of the updated highway drainage design in the vicinity of junction 19 (i.e. updated proposed S1-OU1, S1-OU1A and S1-OU12 catchments) has been undertaken and presented in Section 8 of the ES Addendum [TR010060/EXAM/10.12], submitted with the Change Application. As the proposed attenuation pond S1-OU11 would be removed, the area west of Boreham Brook would no longer be required for landscape mitigation with the exception of an area along the northern boundary that would be required to mitigate Paynes Lane Bridge and integrate it into the landscape. The proposed S1-OU12 catchment attenuation pond increased footprint has been adjusted locally to ensure that it will not have any impact on the adjacent proposed ecology measures submitted at DCO application in August 2022.

Maintenance access provision

- 4.2.21 The maintenance access track requirements for the proposed attenuation ponds have been reviewed and adjusted to accommodate the updated highway drainage design in the vicinity of junction 19. This includes a new maintenance access track for proposed S1-OU1A catchment attenuation pond and minor modifications to the previously proposed maintenance access track for the proposed S1-OU12 catchment attenuation pond. The updated maintenance access track proposals are shown on updated Sheet 2 of 21 of the Drainage and Surface Water Plan in Map Book 1 [TR010060/EXAM/10.5] submitted with the Change Application. It should be noted that there is no change to maintenance access track provision associated with the proposed S1-OU1 catchment attenuation pond from that submitted at DCO application.

5 Updated highway drainage design along B1023 Kelvedon Road at Inworth

5.1 Overview of highway drainage design changes

5.1.1 The proposed mitigation required for the highway drainage and flood risk infrastructure in the vicinity of the B1023 Kelvedon Road, near Inworth, has been rationalised to reduce the number of watercourse fluvial flood mitigation storage areas and proposed highway drainage attenuation storage ponds. As a result of this design change, the number of highway drainage attenuation ponds has been reduced from four to two. The number of watercourse flood mitigation areas has been reduced from seven to four, and of those four, two have also reduced in size. Refer to Section 2.5 of the ES Addendum [TR010060/EXAM/10.12] for further details on the proposed change, including the detailed reasons as to why this design change is being proposed. This updated design, shown on Plate 5.1 and Plate 5.2, presents a schematic comparison of the proposed change in the design along the B1023 Kelvedon Road at Inworth compared to the design submitted at DCO application. Table 5.1 and Table 5.2 describes the numbered design changes labelled on Plate 5.1 and Plate 5.2. The design changes related to the watercourse flood mitigation measures are further discussed in the FRA Addendum [TR010060/EXAM/10.16] submitted with the Change Application.

Plate 5.1 Revised highway drainage design proposals in the vicinity of the B1023 Kelvedon Road compared with the design submitted in August 2022 (Cluster Area 1)

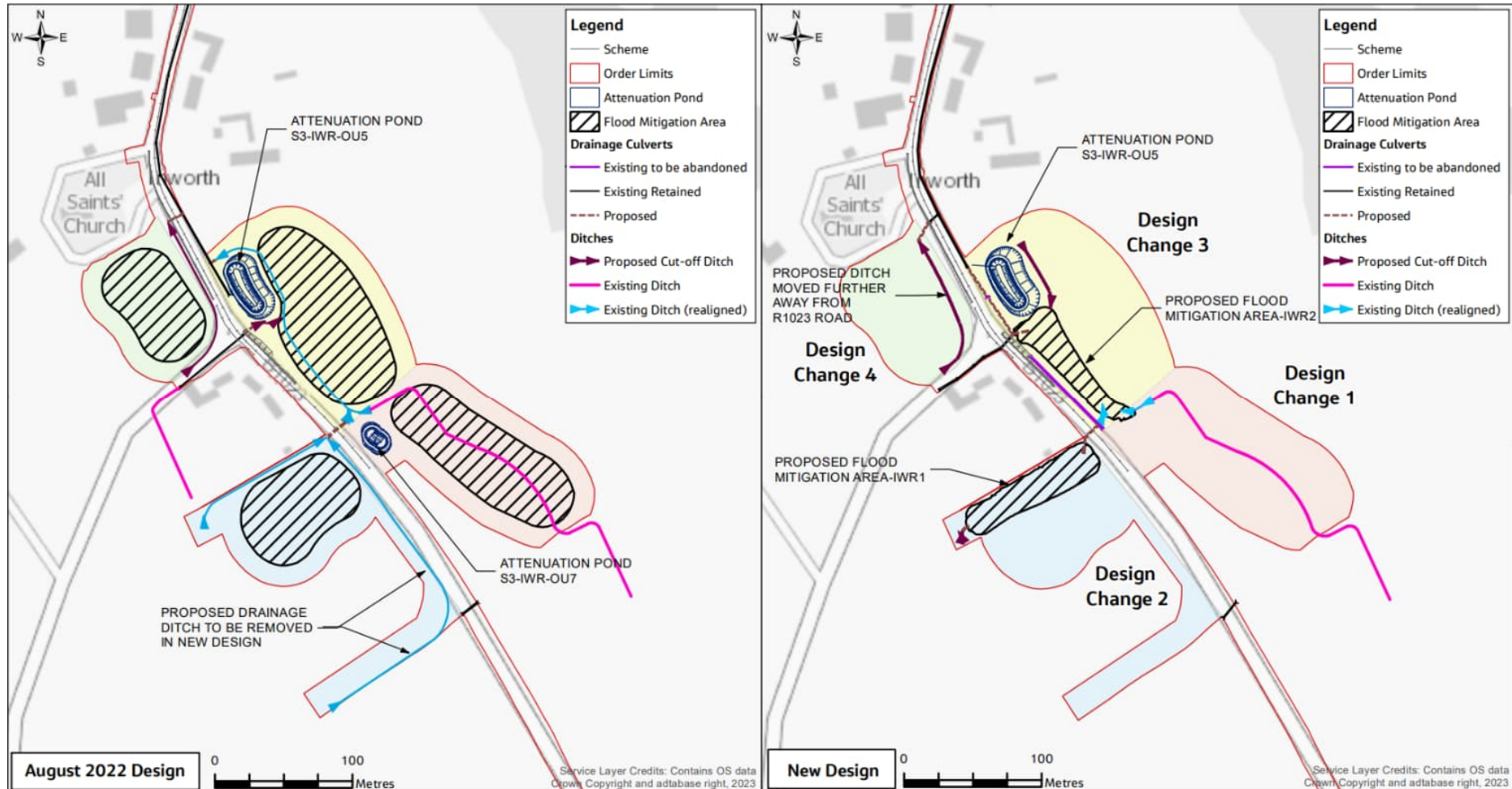


Plate 5.2 Revised highway drainage design proposals in the vicinity of the B1023 Road compared with the design submitted in August 2022 (Cluster Area 2)

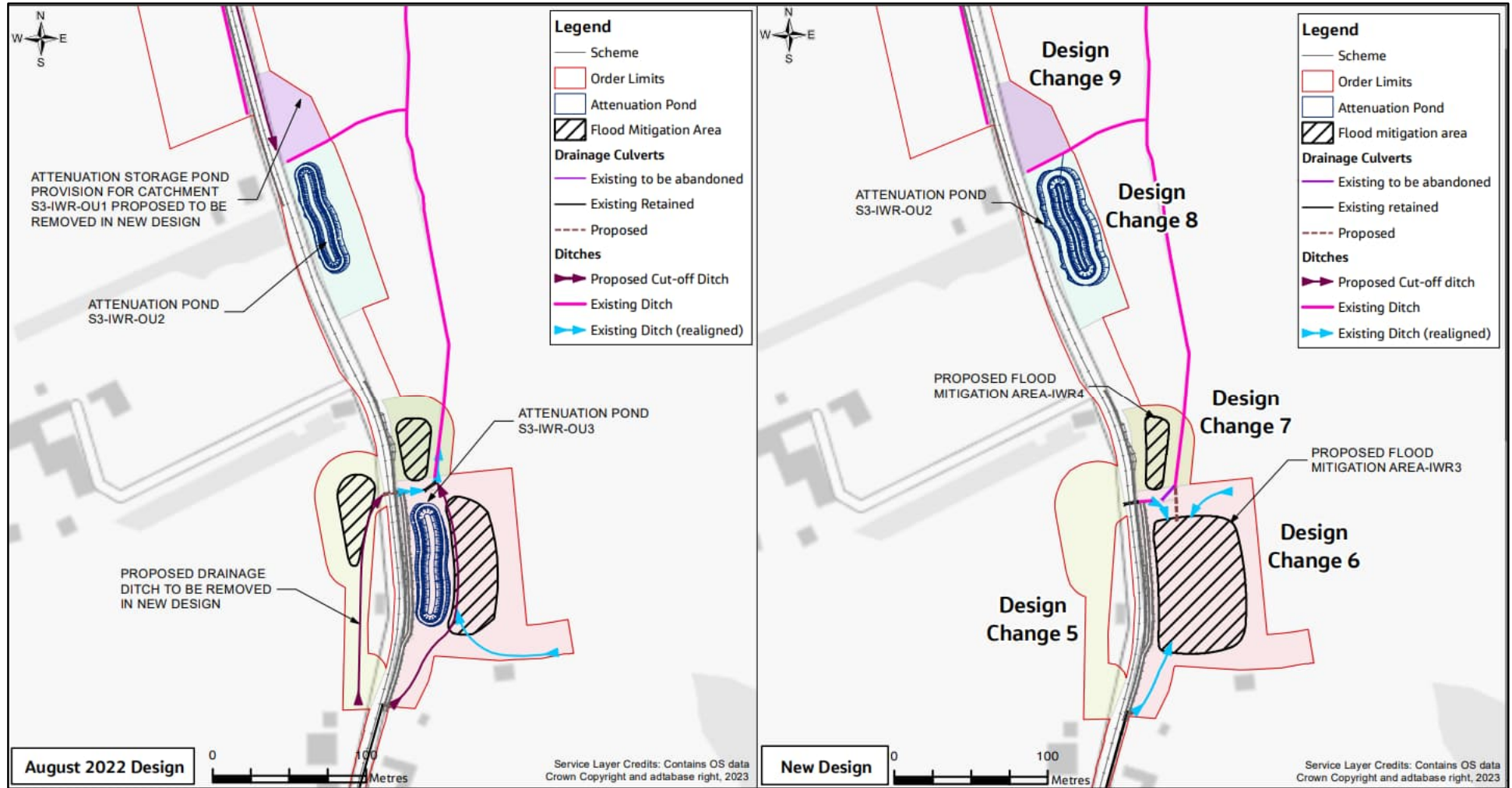


Table 5.1 Summary of highway drainage design changes in the vicinity of the B1023 Kelvedon Road at Inworth (Cluster Area 1)

Landtake area reference from Plate 5.1	New highway drainage design solution
Design Change 1	Proposed S3-IWR-OU7 catchment attenuation pond removal – This previously proposed attenuation pond has been removed as there are no highway widening works within the proposed S3-IWR-OU7 catchment boundary. The design development process that has enabled the removal of this previously proposed attenuation pond is discussed in paragraph 5.2.6.
Design Change 2	Proposed drainage ditches adjacent to the B1023 Kelvedon Road at Inworth removal – The proposed drainage ditches that were considered previously as part of flood risk mitigation are no longer required and are removed as the additional drainage survey identified existing field drains/ditches that will be retained.
Design Change 3	Proposed S3-IWR-OU5 catchment attenuation pond retention – In light of the additional drainage survey information this proposed attenuation pond has been retained. The mitigation measure updates associated with this retained proposed attenuation pond are discussed in paragraph 5.2.7.
Design Change 4	The proposed drainage ditch is retained – The proposed drainage ditch is required to move further away from the B1023 Kelvedon road and is increased in size to capture the overland runoff from the upstream catchment which forms part of the overall solution for the watercourse flood mitigation measures in this area.
Note: Refer to FRA Addendum [TR010060/EXAM/10.16] for the design changes related to the watercourse flood mitigation measures.	

Table 5.2 Summary of highway drainage design changes in the vicinity of the B1023 Kelvedon Road at Inworth (Cluster Area 2)

Landtake area reference from Plate 5.2	New highway drainage design solution
Design Change 5	Previously proposed drainage ditch removal – Located adjacent to the B1023 Road, at Inworth, this proposed drainage ditch was considered for the design submitted at DCO application and is no longer required. This previously proposed drainage ditch can be removed as the additional drainage survey identified existing field drains/ditches that will be retained.
Design Change 6	Proposed S3-IWR-OU3 catchment attenuation pond removal - A new design solution has been developed to enable the most efficient use of the available land take for the proposed scheme while integrating the design solutions for the proposed scheme required for both the proposed highway drainage attenuation storage (proposed S3-IWR-OU3 catchment attenuation pond) and the watercourse flood risk mitigation storage (proposed flood mitigation area – IWR3). This design solution comprises the removal of the previously proposed S3-IWR-OU3 catchment attenuation pond and diverting the highway drainage catchment to the downstream proposed S3-IWR-OU2 catchment attenuation pond. The design development process that has enabled the removal of this previously proposed attenuation pond is discussed in paragraph 5.2.8.
Design Change 7	Watercourse flood mitigation storage area (proposed flood mitigation area – IWR4) retained - Refer to FRA Addendum [TR010060/EXAM/10.16] for further details on the design requirements associated with this design change.
Design Change 8	Proposed S3-IWR-OU2 catchment attenuation pond retention and volume increase - This proposed highway drainage attenuation pond is retained. However, an increase in the proposed attenuation storage volume and associated footprint is required (i.e. in comparison to the DCO application design) as a result of the additional highway drainage catchment draining to this attenuation storage pond which was previously draining to the proposed S3-IWR-OU3 catchment attenuation pond (i.e. Design Change 6). The design development process for the proposed S3-IWR-OU2 catchment attenuation pond volume increase is discussed in paragraph 5.2.9.
Design Change 9	Potential location for highway drainage attenuation storage pond provision removal - This location was previously considered as a potential location for highway drainage attenuation storage provision for the proposed S3-IWR-OU1 catchment which now drains through the proposed S3-OU8B+OU8D catchment attenuation storage ponds. The design development process that has enabled this design change is discussed in paragraph 6.2.
Note: Refer to FRA Addendum [TR010060/EXAM/10.16] for the design changes related to the watercourse flood mitigation measures.	

5.2 B1023 Kelvedon Road at Inworth updated highway drainage measures

B1023 Kelvedon Road Post DCO design submission surveys and site investigations

- 5.2.1 Subsequent to the DCO submission, additional surveys and site investigations have been undertaken as part of the design development process. This additional information includes the following:
- Site surveys, in particular surveys of the existing highway drainage network (referred to as “post-submission drainage surveys” hereafter)
 - Existing underground utility surveys, specific to confirming the location of a high pressure (HP) gas main that crosses the B1023 Kelvedon Road
 - Topographic survey and the receipt of further as-built information, specific to confirming the location of the existing Anglian Water gravity foul sewer that runs along the B1023 Kelvedon Road
- 5.2.2 The above-described post-submission drainage surveys have confirmed that the highway drainage surface water runoff from the B1023 Kelvedon Road is primarily collected through traditional kerb inlet gullies and kerb/gully drainage arrangements, which generally appear to discharge to carrier drains and/or a number of highway drainage ditches which subsequently convey the collected surface water runoff to Ordinary Watercourses located adjacent to the B1023 Road. Some sections of the B1023 Road appear to have no formal highway drainage system and rely on ‘over-the-edge’ drainage into nearby field drainage ditches. It was also found that in some instances the existing highway drainage systems discharge directly into existing culverts that cross the B1023 Road. The post-submission drainage surveys have identified the presence of damaged and / or collapsed pipework and damaged manhole chambers. This is likely due to a lack of adequate highway drainage maintenance works being undertaken and results in a poorly functioning highway drainage system locally. It is noted that the presence of surface water attenuation features such as attenuation storage ponds, underground attenuation storage systems, flow control devices or pollution control measures were not found on the existing highway drainage systems that drain the B1023 Road at Inworth. Similarly, the presence of soakaways and/or other infiltration techniques could not be confirmed.
- 5.2.3 The post-submission drainage surveys were found to contain sufficient information to inform a general understanding of the existing highway drainage features, drainage catchments and outfall locations in and around the B1023 Road. The existing highway drainage catchment extents for the new design are illustrated on Sheet 14 of 21 and Sheet 20 of 21 of Drainage and Surface Water Plans provided in Map Book 4 [TR010060/EXAM/10.8], submitted with the Change Application.
- Design approach for the updated proposed highway drainage**
- 5.2.4 The design of the updated proposed highway drainage elements is based on the highway drainage design approach and design criteria as outlined in

Section 3 of this report, the highway improvement works and the subsequent receipt / assessment of further information on the existing highway drainage systems serving the B1023 Kelvedon Road at Inworth. The aforementioned further information on the existing highway drainage systems has helped to better understand existing drainage catchments and local outfall arrangements which has informed the proposed highway drainage design.

- 5.2.5 The proposed highway drainage design has been developed to enable the most efficient use of the available land take for the proposed scheme while integrating the design solutions required for both the proposed highway drainage attenuation storage mitigation measures and the proposed watercourse flood risk mitigation storage measures. For the new highway drainage design, the direct discharge of the proposed highway drainage outfalls to culverts is avoided, where possible, in favour of discharging to an open ditch/watercourse. In summary, the proposed highway drainage design results in a reduced number of proposed highway drainage attenuation ponds from those presented in the Surface Water Drainage Strategy [APP-174], while still adhering to the highway drainage design standards for the proposed scheme.

Removal of the proposed S3-IWR-OU7 catchment attenuation pond (Design Change 1, Table 5.2)

- 5.2.6 The DCO application design included the proposed S3-IWR-OU7 catchment attenuation storage pond which would have required excavation over an existing high pressure gas main, the location of which was unknown during the DCO application stage design. The updated proposed highway drainage design solution has taken this constraint into account and developed a solution that enables the removal of the previously proposed S3-IWR-OU7 catchment attenuation pond. It should be noted that the proposed scheme proposes no highway widening works within the proposed S3-IWR-OU7 catchment boundary. The hydraulic modelling checks undertaken to assess the potential increase in rainfall intensity due to climate change has confirmed a minor increase in the surface water flow rates from this proposed catchment compared to the existing site condition. This minor increase in surface water flow rates would be mitigated through localised upgrades to the highway drainage system and/or flow adjustments with the adjacent proposed S3-IWR-OU5 catchment which ultimately discharges to the same receptor, namely Ordinary Watercourse 34.

Proposed S3-IWR-OU5 catchment attenuation pond retention (Design Change 3, Table 5.2)

- 5.2.7 The proposed S3-IWR-OU5 catchment attenuation pond is required to mitigate the increase in surface water runoff rates from the proposed highway widening works within the catchment boundary. It should be noted that the proposed S3-IWR-OU5 catchment attenuation pond also provides attenuation storage mitigation for the adjacent proposed S3-IWR-OU5A, S3-IWR-OU6 and S3-IWR-OU7 catchments. Separate attenuation storage mitigation measures are not feasible within these catchments due to spatial constraints. The combined discharge rates from the proposed S3-IWR-OU5, S3-IWR-OU5A, S3-IWR-OU6 and S3-IWR-OU7 catchments are less than the combined existing S3-IWR-OU5, S3-IWR-OU6 and S3-IWR-OU7 catchments allowable discharge

rate estimates. This ensures that there is no adverse surface water drainage flood risk impact, considering that these catchments have a common ultimate receptor, namely culverted Ordinary Watercourse 34.

Proposed S3-IWR-OU3 catchment attenuation pond removal (Design Change 6, Table 5.3) and proposed S3-IWR-OU2 catchment attenuation pond storage volume increase (Design Change 8, Table 5.3)

5.2.8 The highway drainage design for the proposed S3-IWR-OU3 catchment (including the proposed S3-IWR-OU3 attenuation pond) is affected by the proposed flood mitigation measure requirements associated with the nearby watercourses. More detailed topographic surveys have been undertaken as part of the post-DCO surveys which have been used for the hydraulic modelling of the nearby watercourses. As a result it has been found that the most practicable location for the proposed realigned watercourse and associated proposed watercourse flood mitigation storage area is adjacent to the B1023 Road which coincides with the previously proposed S3-IWR-OU3 catchment attenuation pond. Therefore, the proposed S3-IWR-OU3 catchment highway drainage is proposed to be diverted to the adjacent proposed S3-IWR-OU2 catchment highway drainage system which was found to be feasible. This has enabled the removal of previously proposed S3-IWR-OU3 catchment attenuation pond.

5.2.9 Further to the “Design Change 8” description in Table 5.1, hydraulic modelling has been undertaken for the combined highway drainage catchments (i.e. the proposed S3-IWR-OU2, S3-IWR-OU3 and S3-IWR-OU4 catchments) diverted to the proposed S3-IWR-OU2 attenuation pond. The hydraulic modelling results confirm an increase in the attenuation storage volume requirements for the proposed S3-IWR-OU2 catchment attenuation pond and its associated footprint. However, the increased attenuation pond footprint can be accommodated within the Order Limits submitted at DCO application. The proposed S3-IWR-OU2 catchment attenuation pond earthworks has been adjusted locally to minimise the impact on the nearby existing foul sewer located in this area.

Updated proposed catchments areas summary, discharge rates and attenuation storage volume estimates

5.2.10 The existing and proposed paved catchment areas and any permeable catchment areas draining into the proposed highway drainage systems for the updated proposed highway drainage catchments along B1023 Kelvedon Road at Inworth (i.e. proposed highway drainage catchments S3-IWR-OU2, S3-IWR-OU5, S3-IWR-OU5A, S3-IWR-OU6) are presented in Annex A. Refer to Sheet 20 of 21 of Drainage and Surface Water Plan provided in Map Book 4 [TR010060/EXAM/10.8], for the extent of existing and proposed highway drainage catchments associated with the updated highway drainage design at B1023 Kelvedon Road, at Inworth.

5.2.11 The proposed catchment discharge rates, the associated flow control devices used to achieve the proposed discharge rates, the attenuation storage type used, and the resulting modelled attenuation storage volume estimates for the updated proposed highway drainage catchments as described above are presented in Annex B.

- 5.2.12 Regarding the proposed peak discharge rates, Annex B presents a summary table of the outfall locations for the proposed highway drainage systems for the updated highway drainage catchments along B1023 Kelvedon Road. The modelled proposed case peak discharge rates for the 1 in 1-year, 1 in 2-year, 1 in 5-year and 1 in 100-year return period storm events (plus an allowance for climate change) for the critical storm event are presented. The proposed highway drainage attenuation storage volumes have been determined for design events up to and including the 1 in 100-year return period storm event (plus an allowance for climate change) and the associated critical storm duration for the attenuation storage locations.

Proposed natural catchment drainage

- 5.2.13 The proposed drainage ditches required for the updated highway drainage design proposals along the B1023 Kelvedon Road are described in Table 5.1 and Table 5.2 and are illustrated in Sheet 20 of 21 of the updated Drainage and Surface Water Plans provided in Map Book 4 [TR010060/EXAM/10.8], submitted with DCO application.

Infiltration potential assessment

- 5.2.14 Based on the findings of the preliminary GI, in-situ testing undertaken to date has found that ground conditions are generally not suitable across the majority of the proposed scheme for SuDS using infiltration techniques. Refer to Section 8 and associated Annex E of the Surface Water Drainage Strategy [APP-174] which assesses the preliminary GI findings with respect to the feasibility of using infiltration techniques for the proposed scheme highway drainage catchments. Annex C in this report summarises the preliminary GI findings for the retained proposed S3-IWR-OU2 and S3-IWR-OU5 catchment attenuation storage ponds that are part of the new highway drainage design proposal for the B1023 Kelvedon Road. The site-specific preliminary GI findings indicate that the ground conditions are not suitable for SuDS using infiltration techniques.
- 5.2.15 It should be noted that there is currently limited ground investigation information available in the vicinity of the retained proposed S3-IWR-OU2 and S3-IWR-OU5 catchment attenuation pond locations. Supplementary GI will be undertaken prior to the detailed design stage and subsequently reviewed to further assess the feasibility of using SuDS infiltration techniques for highway surface water runoff disposal in the vicinity of these retained proposed attenuation pond locations.

Exceedance flows assessment

- 5.2.16 The assessment of exceedance flows from the proposed highway drainage systems has been undertaken to ensure that there is no increased surface water drainage flood risk to road users and to the third-party land outside the proposed scheme permanent acquisition of land boundary. The exceedance flow assessment results satisfy the stated design standard requirements quoted in Section 2.3.8 and the exceedance flows assessment criteria outlined in Section 9 of the Surface Water Drainage Strategy [APP-174].

Water quality assessment

- 5.2.17 An assessment of impacts to the water quality assessment as a result of the updated highway drainage design for the B1023 near Inworth has been undertaken and presented in Section 14 of the ES Addendum [TR010060/EXAM/10.12], submitted with the DCO change application. The Water Quality assessment concludes that there would be no change in significance of effects to the water quality receptors as a result of updated highway drainage design for the B1023 Kelvedon Road at Inworth from that reported in the Water Quality Assessment Report [APP-158].

Landscape and ecology

- 5.2.18 An assessment of impacts to the proposed landscape and ecology measures as a result of the updated highway drainage design for the B1023 Kelvedon Road at Inworth has been undertaken and presented in Section 8 of the ES Addendum [TR010060/EXAM/10.12], submitted with the Change Application.

Maintenance access provision

- 5.2.19 The maintenance access track provision requirements for the retained proposed S3-IWR-OU2 and S3-IWR-OU5 catchment attenuation ponds have been reviewed and updated accordingly to accommodate the updated highway drainage design at B1023 Kelvedon Road at Inworth. This includes the provision of new maintenance access tracks for aforementioned proposed attenuation ponds as shown on updated Sheet 20 of 21 of Drainage and Surface Water Plan in Map Book 4 [TR010060/EXAM/10.8] submitted with the DCO change application.

6 Updated highway drainage design for the Junction 24/B1023 Road at Inworth

6.1 Overview of highway design change

6.1.1 The proposed highway design change involves the removal of a previously proposed segregated left turn lane (SLTL) from the proposed B1023 roundabout general arrangement. Refer to Section 2.6 of the ES Addendum [TR010060/EXAM/10.12] for further details on the proposed design change, including the reasons as to why this change is being proposed. Plate 6.1 presents a schematic comparison of the proposed highway design change for the B1023 roundabout to the design submitted at DCO.

6.2 Junction 24/ B1023 at Inworth updated highway drainage design measures

6.2.1 The removal of the SLTL at the proposed B1023 roundabout, will result in a small reduction in paved area associated with the proposed S3-OU8B + OU8D catchments. The reduction in the paved area catchment associated with the SLTL will be adjusted against the existing S3-IWR-OU1 catchment, which is now proposed to be drained through the proposed S3-OU8B + OU8D catchment (i.e. Design Change 9 described in Table 5.2 provided for the B1023 Kelvedon Road design).

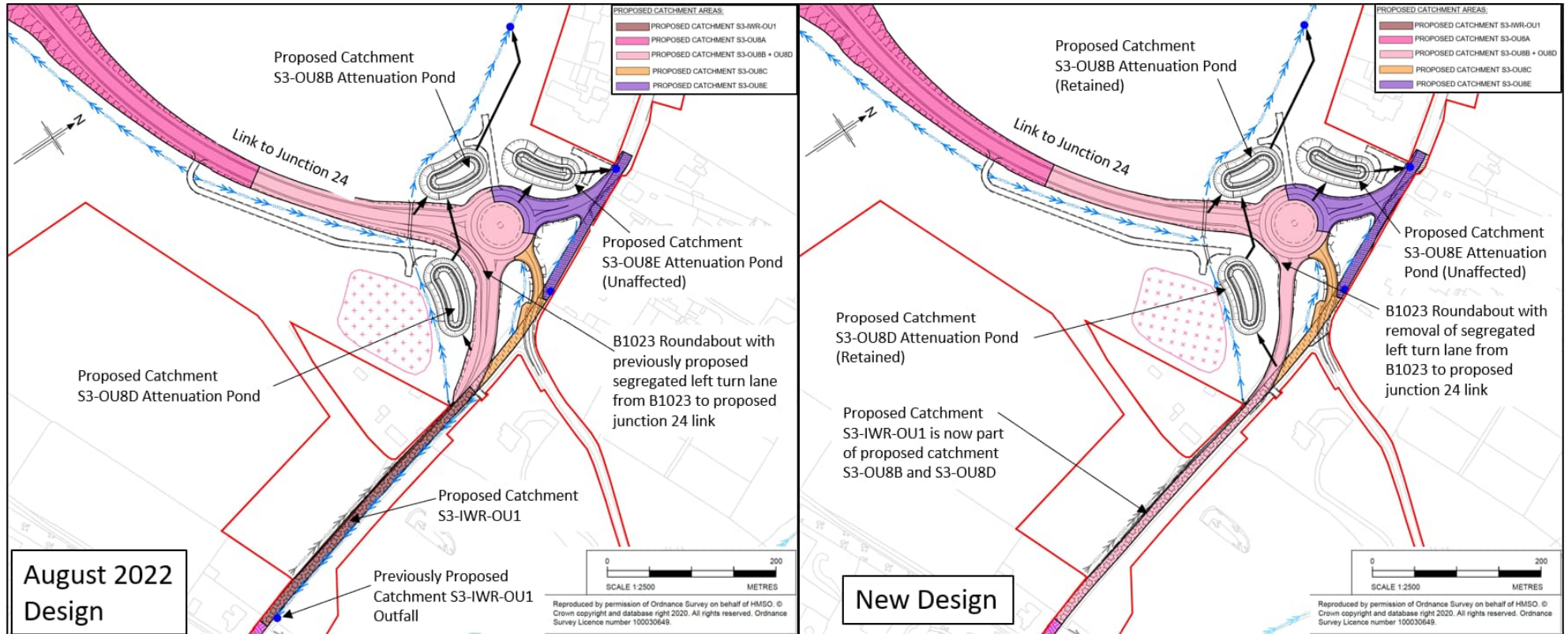
Proposed S3-OU8B+OU8D catchment attenuation ponds retention and Proposed S3-IWR-OU1 catchment attenuation provision removal (Design Change 9, Table 5.2)

6.2.2 The DCO design submitted for the proposed S3-IWR-OU1 catchment included the proposed highway drainage would discharge to an existing ditch located adjacent to the B1023 Road. Spatial provision (i.e. Design change 9 as described previously in Table 5.2) was made accordingly as part of the DCO highway drainage design to attenuate the surface water runoff from the proposed S3-IWR-OU1 catchment. However, the post-DCO drainage surveys revealed that the existing highway drainage for the S3-IWR-OU1 catchment extends further north along Inworth Road and eventually drains into an existing highway drainage system that discharges to Domsey Brook. As a result, the previously planned attenuation pond provision and outfall arrangement could not be retained for the proposed S3-IWR-OU1 catchment. Therefore, an updated highway drainage design solution is required for the attenuation of surface water runoff from the proposed S3-IWR-OU1 catchment.

6.2.3 The previously described reduction in the proposed S3-OU8B + S3-OU8D catchment area (i.e. paragraph 6.2.1), which is located adjacent to the proposed S3-IWR-OU1 catchment, provided an opportunity to assess the feasibility of combining these adjacent catchments. The updated combined proposed S3-OU8B + S3-OU8D catchment results in a small increase to the paved area compared the highway drainage design submitted at DCO application. The hydraulic modelling of the updated combined proposed S3-OU8B + OU8D catchment has been undertaken which has confirmed a

small increase in the associated attenuation storage volumes for the proposed S3-OU8B + S3-OU8D catchments. However, this small increase in the attenuation storage volume will not have an impact on the proposed attenuation storage ponds footprint reported for the highway drainage design at DCO application. This is because the proposed S3-OU8B + S3-OU8D catchment attenuation storage ponds were found to have adequate attenuation storage capacity following the optimisation of the attenuation pond base invert level / side slopes geometry relative to the surrounding natural terrain (i.e. steep terrain and / or high ground). Therefore, there is no impact to the proposed S3-OU8B + S3-OU8D attenuation pond design to that submitted at DCO (with the exception of the previously proposed S3-IWR-OU1 catchment attenuation pond provision removal).

Plate 6.1 Revised highway drainage design proposals for the segregated left turn removal at the Junction 24/B1023 Road at Inworth compared with the design submitted in August 2022



Updated proposed catchments – area summary, discharge rates and attenuation storage volume estimates

- 6.2.4 The existing and proposed paved catchment areas and any permeable catchment areas draining into the proposed highway drainage systems for the updated proposed S3-OU8B + S3-OU8D catchments are presented in Annex A. Refer to Sheet 14 of 21 of updated Drainage and Surface Water Plan provided in Map Book 5 [TR010060/EXAM/10.9], for the existing and proposed catchment extents associated with the updated highway drainage design in the vicinity of the B1023 roundabout.

Discharge rates and attenuation storage volume estimates

- 6.2.5 The proposed catchment discharge rates, the associated flow control devices used to achieve the proposed discharge rates, the attenuation storage type used, and the resulting modelled attenuation storage volume estimates for the updated proposed highway drainage catchments S3-OU8B + S3-OU8D are presented in Annex B.
- 6.2.6 Regarding the proposed peak discharge rates, Annex B presents a summary table of the outfall locations for the proposed highway drainage systems for updated proposed highway drainage catchments S3-OU8B + S3-OU8D. The modelled proposed case peak discharge rates for the 1 in 1-year, 1 in 2-year, 1 in 5-year and 1 in 100-year return period storm events (plus an allowance for climate change) for the critical storm event are presented. The proposed highway drainage attenuation storage volumes have been determined for design events up to and including the 1 in 100-year return period storm event (plus an allowance for climate change) and the associated critical storm duration for the attenuation storage locations.

Proposed natural catchment drainage

- 6.2.7 The proposed drainage ditches required for the updated highway drainage design proposals along the B1023 roundabout will remain unaffected from the design submitted with DCO application.

Infiltration potential assessment

- 6.2.8 Refer to Section 8 and associated Annex E of the Surface Water Drainage Strategy [APP-174] which assesses the preliminary GI findings with respect to the feasibility of using infiltration techniques for the proposed scheme highway drainage catchments. The site-specific preliminary GI findings indicate that the ground conditions are not suitable for SuDS using infiltration techniques.
- 6.2.9 It should be noted that there is currently limited ground investigation information available in the vicinity of the retained proposed S3-OU8B + OU8D catchment attenuation pond locations. Supplementary GI will be undertaken prior to the detailed design stage and subsequently reviewed to further assess the feasibility of using SuDS infiltration techniques for highway surface water runoff disposal in the vicinity of these retained proposed attenuation pond locations.

Exceedance flows assessment

- 6.2.10 The assessment of exceedance flows from the proposed highway drainage systems has been undertaken to ensure that there is no increased surface

water drainage flood risk to road users and to the third-party land outside the proposed scheme permanent acquisition of land boundary. The exceedance flow assessment results satisfy the stated design standard requirements quoted in Section 2.3.8 and the exceedance flows assessment criteria outlined in Section 9 of the Surface Water Drainage Strategy [APP-174].

Water quality assessment

- 6.2.11 An assessment of impacts to the water quality assessment as a result of the updated highway drainage design has been undertaken and presented in Section 14 of the ES Addendum [TR010060/EXAM/10.12], submitted with the Change Application. The Water Quality assessment concludes that there would be no change in significance of effects to the water quality receptors as a result of updated highway drainage design for the B1023 roundabout catchments at Inworth from that reported in the Water Quality Assessment Report [APP-158].

Landscape and ecology

- 6.2.12 An assessment of impacts to the proposed landscape and ecology measures as a result of the updated highway drainage design for the B1023 roundabout catchments S3-OU8B+S3-OU8D has been undertaken and presented in Section 8 of the ES Addendum [TR010060/EXAM/10.12], submitted with the Change Application.

Maintenance access provision

- 6.2.13 There is no change to the maintenance access provision for the proposed S3-OU8B + S3-OU8D catchment attenuation ponds to the design submitted at DCO application. The maintenance access provision is shown on Sheet 14 of 21 of the Drainage and Surface Water Plans in Map Book 5 [TR010060/EXAM/10.9] submitted with the Change Application.

Annex A Updated Paved and Permeable Catchment Areas Summary Table

Proposed catchment	Existing paved area ¹	New paved area	Total proposed paved area ²	Total proposed permeable area ³	Catchment-specific comments
	(ha)	(ha)	(ha)	(ha)	
Proposed catchments in the vicinity of junction 19⁵					
S1-OU1	7.356 (6.726)	1.137	7.863	5.731	<p>Proposed highway improvement works in the vicinity of junction 19. The total proposed catchment area associated with the proposed S1-OU1 catchment has increased in comparison to the design submitted at DCO. This is because the proposed S1-OU1 catchment now includes new slip road connection to the existing A12 mainline (i.e. junction 19 northbound on-slip road portion and the realigned Beaulieu Park Radial Distributor Road portion (associated with the contributing proposed S1-OU1A catchment)). The new proposed S1-OU1A catchment was previously associated with the proposed S1-OU11 catchment as described in paragraphs 4.2.4 to 4.2.8 of the Surface Water Drainage Strategy Addendum (See the related catchment specific comments for the proposed S1-OU1A catchment also).</p> <p>The existing paved area (7.356ha) is associated with the existing S1-OU1 catchment that has been divided up between the proposed S1-OU1 catchment and the proposed S1-OU7A catchment (i.e. 6.726ha will be retained within the proposed S1-OU1 catchment boundary while 0.63ha will be drained to the proposed S1-OU7A catchment). There is no change in the highway drainage design proposal for the proposed S1-OU7A catchment from that submitted at DCO application</p>

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Proposed catchment	Existing paved area ¹	New paved area	Total proposed paved area ²	Total proposed permeable area ³	Catchment-specific comments
	(ha)	(ha)	(ha)	(ha)	
S1-OU1A	0	0.586	0.586	1.007	<p>New proposed offline slip road connection to the existing A12 mainline (i.e. junction 19 northbound on-slip road). The new paved area is comprised of the on-slip road portion (0.022 ha) and the proposed realigned Beaulieu Park Radial Distribution Road portion (0.564ha). There is no existing paved area within the proposed S1-OU1A catchment as the existing site condition is currently greenfield.</p> <p>The new proposed S1-OU1A catchment is a sub-catchment of the proposed S1-OU1 catchment and forms part of the new design solution required for the proposed highway drainage in the vicinity of Junction 19 as described in paragraphs 4.2.4 to 4.2.8 of the Surface Water Drainage Strategy Addendum (See the related catchment specific comments for the proposed S1-OU1 and S1-OU12 catchments also)</p>
S1-OU11	<p>The proposed highway drainage associated with the previously proposed S1-OU11 catchment is now merged with the proposed S1-OU12 catchment as described in paragraphs 4.2.9 to 4.2.14 of the Surface Water Drainage Strategy Addendum (See the related catchment specific comments for the proposed S1-OU1A and S1-OU12 catchments)</p>				

DEVELOPMENT CONSENT ORDER CHANGE APPLICATION CONSULTATION

Proposed catchment	Existing paved area ¹	New paved area	Total proposed paved area ²	Total proposed permeable area ³	Catchment-specific comments
	(ha)	(ha)	(ha)	(ha)	
S1-OU12	3.409	0.197	3.606	5.163	Proposed A12 mainline online highway widening works. The existing paved area is associated with the existing S1-OU12 catchment. The total proposed catchment area associated with the proposed S1-OU12 catchment has increased compared to the design submitted at DCO application. This is because the proposed S1-OU12 catchment now includes a portion of the previously proposed S1-OU11 catchment as described in paragraphs 4.2.9 to 4.2.14 of the Surface Water Drainage Strategy Addendum (See the related catchment specific comments for the proposed S1-OU11 and S1-OU1A catchments)
Proposed Catchments for the B1023 Kelvedon Road at Inworth⁶					
S3-IWR-OU1	The proposed highway drainage associated with previously proposed S3-IWR-OU1 catchment is now merged with the proposed S3-OU8B + S3-OU8D catchment as described in paragraphs 6.2.2 to 6.2.3 of the Surface Water Drainage Strategy Addendum (See the related catchment specific comments for the proposed S3-OU8B + S3-OU8D catchment also)				

DEVELOPMENT CONSENT ORDER CHANGE APPLICATION CONSULTATION

Proposed catchment	Existing paved area ¹	New paved area	Total proposed paved area ²	Total proposed permeable area ³	Catchment-specific comments
	(ha)	(ha)	(ha)	(ha)	
S3-IWR-OU2	0.414 (0.157)	0.055	0.469	0.028	<p>Minor highway improvement works to the existing B1023 Road in addition to the proposed offline walking, cycling and horse-riding (WCH) route access provision.</p> <p>The total existing paved area (0.414ha) associated with the existing the B1023 Road portion contained within the proposed S3-IWR-OU2 catchment boundary, includes the existing retained paved area of 0.157ha contained within the existing S3-IWR-OU2 catchment, the existing paved area (0.088ha) associated with existing S3-IWR-OU3 catchment and the existing paved area (0.169ha) associated with the existing S3-IWR-OU4 catchment</p>
S3-IWR-OU5	0.092 (0.046)	0.002	0.048	0	<p>Minor highway improvement works to the existing B1023</p> <p>The total existing paved area (0.092ha) is associated with the existing S3-IWR-OU5 catchment that has been divided up between the proposed S3-IWR-OU5 catchment and the proposed S3-IWR-OU5A catchment (i.e. 0.046ha will be retained within the proposed S3-IWR-OU5 catchment boundary while 0.046ha will be drained to the proposed S3-IWR-OU5A catchment)</p>
S3-IWR-OU5A	0 (0.082)	0.005	0.087	0.092	<p>Minor highway improvement works to the existing B1023</p> <p>The total existing paved area is associated with the existing S3-IWR-OU5 catchment portion (0.046ha) and the existing S3-IWR-OU6 catchment portion (0.036ha) contained within the proposed S3-IWR-OU5A catchment boundary</p>

DEVELOPMENT CONSENT ORDER CHANGE APPLICATION CONSULTATION

Proposed catchment	Existing paved area ¹	New paved area	Total proposed paved area ²	Total proposed permeable area ³	Catchment-specific comments
	(ha)	(ha)	(ha)	(ha)	
S3-IWR-OU6	0.129 (0.093)	0	0.093	0	<p>No online highway widening works proposed within the proposed S3-IWR-OU6 catchment boundary</p> <p>The total existing paved area (0.129ha) is associated with the existing S3-IWR-OU6 catchment that has been divided up between the proposed S3-IWR-OU5A catchment and the proposed S3-IWR-OU6 catchment (i.e. 0.093ha will be retained within the proposed S3-IWR-OU6 catchment boundary while 0.036ha will be drained to the proposed S3-IWR-OU5A catchment)</p>
S3-IWR-OU7	0.089	0	0.089	0	<p>No online highway widening works are proposed within the proposed S3-IWR-OU7 catchment boundary</p>
Proposed Catchments for Junction 24/B1023 at Inworth Road^{4,7}					
S3-OU8B+8D	0 (0.127)	0.393	0.520	0.238	<p>The proposed catchment includes the new Inworth Link Road portion and the new B1023 Roundabout connecting the link road to the existing B1023. The proposed paved area has been reduced from the design submitted at DCO due to a change in the highway design which removes the segregated left turn from the B1023 Kelvedon Road approaching the new B1023 Roundabout</p> <p>The existing paved area (0.127ha) is associated with the existing B1023 portion located within the existing S3-IWR-OU1 catchment that will now be drained to the proposed S3-OU8B+S3-OU8D catchment. The total proposed paved area associated with the proposed S3-OU8B+S3-OU8D catchment has increased by 0.114ha compared to that which was submitted at DCO application (See Note 4)</p>

Proposed catchment	Existing paved area ¹	New paved area	Total proposed paved area ²	Total proposed permeable area ³	Catchment-specific comments
	(ha)	(ha)	(ha)	(ha)	
Notes:					
<ol style="list-style-type: none"> For some proposed catchments the retained existing paved area contained within the proposed catchment boundary differs to that in the existing site condition. This is due to the retained existing paved area's adjustment to neighbouring catchments where required due to site constraints. The retained existing paved area within the proposed catchment boundary is presented in brackets in the 'Existing paved area' column where applicable and is included in the total proposed paved area summation. The total proposed paved area is the sum of the existing paved area (adjusted existing paved area where applicable) to be retained and the additional new paved area which will form the proposed highway drainage catchment areas across the proposed scheme. The existing and additional new paved areas are illustrated on the Drainage and Surface Water Plan provided in Map Book 1 (Sheet 2 of 21), Map Book 4 (Sheet 14 of 21 and Sheet 20 of 21), submitted with the Change Application. Permeable catchment areas include grassed verges, grassed roundabout centre islands, cut slopes, embankment slopes, etc. that drain into the proposed highway drainage systems. The increase in the total proposed paved area (0.114ha) will not have an impact on the proposed S3-OU8B and S3-OU8D catchment attenuation pond volumes or the associated footprint reported at DCO. This is because these attenuation ponds were found to have adequate attenuation storage capacity following the optimisation of the attenuation pond base invert level / side slopes geometry and the surrounding natural terrain (i.e. steep terrain and / or high ground). The junction 19 updated proposed catchment area information is to be read in conjunction with Table B.1 in Annex B of the Surface Water Drainage Strategy [APP-174] submitted at DCO application. The B1023 Kelvedon Road at Inworth catchment area information is to be read in conjunction with Table B.3 in Annex B within the Surface Water Drainage Strategy [APP-174] submitted at DCO application. The Junction 24/B1023 at Inworth proposed catchment area information is to be read in conjunction with Table B.3 in Annex B within the Surface Water Drainage Strategy [APP-174] submitted at DCO application. 					

Annex B Updated Discharge Rate and Attenuation Storage Volume Summary Table

Proposed catchment	Receiving watercourse	Modelled peak discharge rates (l/s) ¹ Allowable discharge rates (A) ^{2,4} Proposed discharge rates (P) ²					Flow control type (diameter)	Attenuation storage type	Modelled attenuation storage volume ³ (m ³)	Catchment specific comments
		A / P	1yr	2yr	5yr	100yr				
Proposed catchments in the vicinity of junction 19										
S1-OU1A	Proposed highway drainage system S1-OU1 (Ultimately to River Chelmer)	A	See Comments				Hydrobrake (107mm)	Attenuation pond	623	<p>The new proposed S1-OU1A catchment is a sub-catchment to the proposed S1-OU1 catchment. Greenfield discharge rates are applicable given that the proposed junction 19 northbound slip road and the Beulieu Park Distributor Road to be drained by the proposed S1-OU1A highway drainage system is located on a currently greenfield site.</p> <p>The proposed S1-OU1A catchment attenuation pond attenuates the additional surface water runoff (i.e. as a result of the design change to the on-slip road connection to the existing A12 mainline) that would have otherwise impacted the retained existing highway drainage system associated to proposed S1-OU1 catchment as described in paragraphs 4.2.4 to 4.2.8 of the Surface Water Drainage Strategy Addendum</p>
		P	5.0	5.0	5.0	5.0				

Proposed catchment	Receiving watercourse	Modelled peak discharge rates (l/s) ¹ Allowable discharge rates (A) ^{2,4} Proposed discharge rates (P) ²					Flow control type (diameter)	Attenuation storage type	Modelled attenuation storage volume ³ (m ³)	Catchment specific comments
		A / P	1yr	2yr	5yr	100yr				
S1-OU1	River Chelmer	A	510.4	533.3	605.0	925.9	Orifice plate (243mm)	Underground geocellular attenuation storage No. 1	151	Refer to the catchment specific comments provided in Table C.1, Annex C, of the Surface Water Drainage Strategy [APP-174] with regards to the existing allowable discharge rates, proposed discharge rates and the proposed attenuation storage mitigation measures associated with the proposed S1-OU1 catchment. There is no change to the existing allowable discharge rates, proposed discharge rates and attenuation storage mitigation measures from that submitted at DCO. This is because the increase in the proposed catchment area and the associated surface water runoff rates from the proposed design change for the junction 19 proposed northbound on-slip road, have been mitigated through the provision of the new proposed S1-OU1A catchment attenuation pond and online attenuation storage (i.e. through oversized pipes) within the footprint of new on-slip road.
							Geocellular system outlet pipe (300mm)	Underground geocellular attenuation storage No. 2	176	
		P	254.5	338.2	439.9	597.9	Existing hydrobrake to be retained	Existing underground attenuation storage	289	
							Orifice plate (238mm)	Underground geocellular attenuation storage No. 3	63	
						Pond outlet pipe (750mm)	Attenuation Pond	2069		

Proposed catchment	Receiving watercourse	Modelled peak discharge rates (l/s) ¹ Allowable discharge rates (A) ^{2,4} Proposed discharge rates (P) ²					Flow control type (diameter)	Attenuation storage type	Modelled attenuation storage volume ³ (m ³)	Catchment specific comments
		A / P	1yr	2yr	5yr	100yr				
S1-OU11	The proposed highway drainage associated with the previously proposed S1-OU11 catchment is now merged with the proposed S1-OU12 catchment as described in paragraphs 4.2.9 to 4.2.14 of the Surface Water Drainage Strategy Addendum (See the related catchment specific comments for the proposed S1-OU1A and S1-OU12 catchments also).									
S1-OU12	Boreham Brook	A	402.8	390.5	536.4	909.0	Pond outlet pipe (675mm)	Attenuation pond	1,667	<p>Brownfield discharge rates are applicable due to the online highway widening works. The existing outfall in the vicinity of the proposed S1-OU12 catchment needs to be repositioned on Boreham Brook</p> <p>The attenuation storage volume for proposed S1-OU12 attenuation pond has increased compared to the design submitted at DCO application. This is because the updated design combines the proposed S1-OU11 and S1-OU12 catchments (i.e. removal of the previously proposed S1-OU11 catchment). The surface water runoff from the combined catchment is to be attenuated and discharge via the increased proposed S1-OU12 catchment attenuation pond.</p>

Proposed catchment	Receiving watercourse	Modelled peak discharge rates (l/s) ¹ Allowable discharge rates (A) ^{2,4} Proposed discharge rates (P) ²					Flow control type (diameter)	Attenuation storage type	Modelled attenuation storage volume ³ (m ³)	Catchment specific comments
		A / P	1yr	2yr	5yr	100yr				
		P	138.4	194.4	261.5	648.9				<p>The proposed discharge rates for the S1-OU12 catchment retains the combined proposed discharge rates for the proposed S1-OU11 and OU12 catchment determined at the DCO stage.</p> <p>Refer to the related catchment specific comments in Table C.1, Annex C, of the Surface Water Drainage Strategy [APP-174] regarding the existing allowable discharge rates and proposed discharge rates associated with the proposed S1-OU11 and S1-OU12 catchments</p>
Proposed Catchments for B1023 Kelvedon Road at Inworth⁷										
S3-IWR-OU1	The proposed highway drainage associated with previously proposed S3-IWR-OU1 catchment is now merged with the proposed S3-OU8B+S3-OU8D catchment as described in paragraphs 6.2.2 to 6.2.3 of the Surface Water Drainage Strategy Addendum (See the related catchment specific comments for the proposed S3-OU8B+S3-OU8D catchment also).									

Proposed catchment	Receiving watercourse	Modelled peak discharge rates (l/s) ¹ Allowable discharge rates (A) ^{2,4} Proposed discharge rates (P) ²					Flow control type (diameter)	Attenuation storage type	Modelled attenuation storage volume ³ (m ³)	Catchment specific comments
		A / P	1yr	2yr	5yr	100yr				
S3-IWR-OU2	Existing drainage ditch (Ultimately Ordinary Watercourse 34)	A	31.0	29.5	38.8	78.8	Orifice plate (175mm) & Orifice Plate (300mm)	Attenuation pond	201	<p>Minor highway improvement works on the B1023 Road which currently discharges to an existing drainage ditch. Therefore, brownfield discharge rates are applicable. A new outfall is required to an existing drainage ditch located adjacent to the B1023 Road.</p> <p>The proposed S3-IWR-OU2 catchment also intercepts flows from existing S3-IWR-OU3 and S3-IWR-OU4 catchments. This is because attenuation pond provision is not feasible due to spatial constraints adjacent to these existing catchments. See Note 4 and 5.</p> <p>Two orifice plate flow control devices are required and are to be set at different levels to ensure the proposed discharge rates meet the existing case allowable discharge rates</p>
		P	24.0	27.2	31.6	67.6				

Proposed catchment	Receiving watercourse	Modelled peak discharge rates (l/s) ¹ Allowable discharge rates (A) ^{2,4} Proposed discharge rates (P) ²					Flow control type (diameter)	Attenuation storage type	Modelled attenuation storage volume ³ (m ³)	Catchment specific comments
		A / P	1yr	2yr	5yr	100yr				
S3-IWR-OU5	Culverted Watercourse CL-IWR-4 (Ultimately Ordinary Watercourse 34)	A	18.4	17.6	23.6	53.7	Hydrobrake (107mm)	Attenuation pond	82	<p>Highway improvement works on the B1023 Road which currently discharges to an existing drainage ditch. Therefore, brownfield discharge rates are applicable.</p> <p>A new outfall is required to a culverted watercourse (i.e. Culvert CL-IWR-CL4) located adjacent to the B1023 Road</p> <p>Spatial constraints prevent attenuation pond provision for the adjacent proposed S3-IWR-OU5A catchment. Hence the attenuation storage mitigation measures are provided within the proposed S3-IWR-OU5 catchment attenuation pond.</p> <p>A minimum practicable discharge rate of 5 l/s has been used (See the related catchment specific comment for the proposed S3-IWR-OU5A catchment)</p>
		P	5.0	5.0	5.0	5.0				

Proposed catchment	Receiving watercourse	Modelled peak discharge rates (l/s) ¹ Allowable discharge rates (A) ^{2,4} Proposed discharge rates (P) ²					Flow control type (diameter)	Attenuation storage type	Modelled attenuation storage volume ³ (m ³)	Catchment specific comments	
		A / P	1yr	2yr	5yr	100yr					
S3-IWR-OU5A	Culverted Watercourse CL-IWR_4 (Ultimately Ordinary Watercourse 34)	A	See Comments					None. Unattenuated	None	-	<p>Brownfield discharge rates are applicable due to the proposed online highway widening works.</p> <p>The existing S3-IWR-OU5 catchment has been divided into the proposed S3-IWR-OU5 and S3-IWR-OU5A catchments.</p> <p>The existing S3-IWR-OU6 catchment allowable discharge rates are apportioned between the proposed S3-IWR-OU5 and S3-IWR-OU5A catchments. A new outfall to the culverted watercourse (Culvert CL-IWR-4) will be required</p>
		P	11	10.0	16.0	43.8					

Proposed catchment	Receiving watercourse	Modelled peak discharge rates (l/s) ¹ Allowable discharge rates (A) ^{2,4} Proposed discharge rates (P) ²					Flow control type (diameter)	Attenuation storage type	Modelled attenuation storage volume ³ (m ³)	Catchment specific comments
		A / P	1yr	2yr	5yr	100yr				
S3-IWR-OU6	Culverted Watercourse CL-IWR-9 (Ultimately Ordinary Watercourse 34)	A	24	22.8	30.7	64.9	None. Unattenuated	None	-	<p>Highway improvement works are proposed on the existing B1023 Road which currently discharges to an existing culvert, CL-IWR-9. Therefore, brownfield discharge rates are applicable.</p> <p>A new outfall to existing culvert CL-IWR-CL9 will be required</p> <p>The proposed S3-IWR-OU6 catchment requires no attenuation storage mitigation measures given that the proposed catchment has been adjusted with the nearby proposed S3-IWR-OU5 catchment and results in proposed discharge rates that are less than the existing case allowable discharge rates</p>
		P	21.8	20.7	27.8	59.3				

Proposed catchment	Receiving watercourse	Modelled peak discharge rates (l/s) ¹ Allowable discharge rates (A) ^{2,4} Proposed discharge rates (P) ²					Flow control type (diameter)	Attenuation storage type	Modelled attenuation storage volume ³ (m ³)	Catchment specific comments
		A / P	1yr	2yr	5yr	100yr				
S3-IWR-OU7	Ordinary Watercourse 34C	A	16.3	15.5	20.8	42.7	None. Unattenuated	None	-	<p>Existing catchment on the B1023 Road which currently discharges to an existing drainage ditch. Brownfield discharge rates are applicable.</p> <p>The existing outfall may need to be repositioned locally. Minor increase in the proposed case discharge rates has been adjusted by a reduction in the discharge rates for the proposed S3-IWR-OU5 catchment which ultimately discharges to the same receptor (Ordinary Watercourse 34)</p>
		P	20.4	19.3	25.7	45.6				
Combined S3-IWR-OU5, OU5A, OU6 and OU7	Ordinary Watercourse 34	A	58.7	55.9	75.1	161.3	N/A	N/A	N/A	<p>The combined proposed discharge rates from the proposed S3-IWR-OU5, S3-IWR-OU5A, S3-IWR-OU6 and S3-IWR-OU7 catchments are less than the combined existing S3-IWR-OU5, S3-IWR-OU6 and S3-IWR-OU7 catchments allowable discharge rates.</p> <p>This ensures there is no adverse flood risk impact, considering that these catchments have a common ultimate receptor in culverted Ordinary Watercourse 34</p>
		P	58.2	55.0	74.5	153.7				

Proposed catchment	Receiving watercourse	Modelled peak discharge rates (l/s) ¹ Allowable discharge rates (A) ^{2,4} Proposed discharge rates (P) ²					Flow control type (diameter)	Attenuation storage type	Modelled attenuation storage volume ³ (m ³)	Catchment specific comments
		A / P	1yr	2yr	5yr	100yr				
Proposed Catchments for Junction 24/B1023 at Inworth Road⁸										
S3-OU8B+ S3-OU8D	Proposed drainage ditch (ultimately Domsey Brook)	A	Greenfield (QMED) = 1.0				Hydrobrake (107mm) for S3-OU8B	Attenuation ponds	226 (S3-OU8B Attenuation Pond)	Refer to the catchment specific comments provided in Table C.1, Annex C, of the Surface Water Drainage Strategy [APP-174] with regards to existing, allowable discharge rates, proposed discharge rates and the proposed attenuation storage measures associated with the proposed S3-OU8B and S3-OU8D. There is no change in the existing and proposed discharge rates and attenuation storage measures from that submitted at DCO application. As described in Section 6.2, a small increase in the attenuation storage volume will not impact the proposed attenuation storage ponds footprint reported for the highway drainage design at DCO. Therefore, there is no impact to the proposed S3-OU8B + S3-OU8D attenuation ponds design to that submitted at DCO application (with the exception of the previously proposed S3-IWR-OU1 catchment attenuation pond removal)
		P	5.0	5.0	5.0	5.0	Hydrobrake (107mm) for S3-OU8D		258 (S3-OU8D Attenuation Pond)	

Proposed catchment	Receiving watercourse	Modelled peak discharge rates (l/s) ¹ Allowable discharge rates (A) ^{2,4} Proposed discharge rates (P) ²					Flow control type (diameter)	Attenuation storage type	Modelled attenuation storage volume ³ (m ³)	Catchment specific comments
		A / P	1yr	2yr	5yr	100yr				
Notes:										
<ol style="list-style-type: none"> FEH2013 rainfall data has been used in the hydraulic calculations for the modelled peak discharge rates. FEH2013 rainfall cannot be used for the assessment of the 1 in 1-year return period storm event. Therefore, FEH1999 rainfall data have been used for the assessment of the 1 in 1-year return period storm event. Section 4.6 of the Surface Water Drainage Strategy [APP-174] provides further details on the rainfall data inputs. The existing case allowable discharge rates do not include a climate change allowance given that current climatic conditions are required to inform the discharge rates for the proposed highway drainage systems. The proposed case discharge rates include a climate change allowance as described in Section 4.4 of the Surface Water Drainage Strategy [APP-174]. The modelled proposed case attenuation storage volumes are determined for the 1 in 100-year return period storm event plus a climate change allowance. The modelled proposed case attenuation storage volumes for attenuation pond S3-IWR-OU2 is based on existing case allowable discharge rates associated with the existing S3-IWR-OU2 catchment only. This does not take into account the existing case discharge rates associated with the existing S3-IWR-OU3 and S3-IWR-OU4 catchments which are part of the proposed S3-IWR-OU2 catchment and is considered as a conservative design approach for the estimation of the attenuation storage volumes and the associated landtake. With regards to the proposed S3-IWR-OU2 catchment which includes the existing S3-IWR-OU3 and S3-IWR-OU4 catchments, it is currently assumed that a separate highway drainage system (i.e. the existing highway drainage network has connections to the existing culverted watercourse which are proposed to be abandoned) will be feasible to install within the road corridor for the section of road associated with the existing S3-IWR-OU3 and S3-IWR-OU4 catchments. This highway drainage proposal would need to be reviewed at the detailed design stage. The junction 19 updated discharge rate and attenuation storage volume information is to be read in conjunction with Table C.1 in Annex C of the Surface Water Drainage Strategy [APP-174] submitted at DCO application. The B1023 Kelvedon Road at Inworth updated discharge rate and attenuation storage volume information is to be read in conjunction with Table C.3 in Annex C within the Surface Water Drainage Strategy [APP-174] submitted at DCO application. The Junction 24/B1023 at Inworth updated discharge rate and attenuation storage volume information is to be read in conjunction with Table C.3 in Annex C within the Surface Water Drainage Strategy [APP-174] submitted at DCO application. 										

Annex C Preliminary Ground Investigation Data in the Vicinity of the Proposed Attenuation Ponds for B1023 Kelvedon Road at Inworth

Proposed Catchment	Pond Elevation from LIDAR (mAOD)	Geology at Pond Location in Accordance to BGS GeoIndex Map	Exploratory Hole	Exploratory Hole Elevation (mAOD)	Exploratory Hole Depth (mbgl)	Exploratory Hole Distance from the Pond (m)	Geology of Exploratory Hole Within Anticipated Pond Depth	Soil Infiltration Rate from Soakaway Test (ms ⁻¹)	Groundwater Strike / Level (mbgl)	Highest Recorded GW Monitoring Level (mbgl)	Comments, Provisional Assessment of Drainage Conditions and Engineering Assessment of Infiltration Drainage Feasibility
S3-IWR-OU2	38.0/39.0	LOFT	TP6509	38.48	4.0	On	0.30 – 4.0mbgl HEAD (slightly gravelly sandy CLAY)	N/A	Not encountered	N/A	Soakaway drainage unlikely to be feasible Limited groundwater data The design of a lined pond solution may need to be considered as mitigation measures (e.g. clay and or concrete) to reduce the effects of potential uplift
			BH6132	38.06	5.0	On	0.30 – 2.70mbgl HEAD (slightly sandy slightly gravelly silty CLAY) 2.70 – 5.00mbgl LC (slightly sandy CLAY)	N/A	Not encountered	4.36 (limited readings)	
S3-IWR-OU5	44.0/45.0	LC	TP6511	47.36	3.30	On	0.30 - 1.70 HEAD (slightly sandy CLAY with rootlets) 1.70 - 3.30 LOFT (slightly gravelly CLAY with frequent sandy clay layers)	N/A	Not encountered	N/A	
			WS6417	47.88	5.45	70m to the SE	0.30 - 1.20 HEAD (slightly sandy gravelly CLAY) 1.20 - 5.45 LC (CLAY)	N/A	Not encountered	5 (limited readings)	

