Lower Thames Crossing

9.152 Responses to the Examining Authority's ExQ2 Appendix F – 10. Road Drainage, Water Environment & Flooding

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1 Introduction

1.1 Introduction

1.1.1 This document has been prepared by the Applicant to set out its responses to the ExQ2 - Examining Authority's (ExA's) written questions and requests for information (ExQ2) [**PD-040**].

1.1.2 These can be found in Tables set out under the following headings:

a. Climate Change and carbon emissions (Found in Appendix A)

b. Traffic and transportation (Found in Appendix B)

c. Air quality (Found in Appendix C)

d. Geology and soils (Found in Appendix D)

e. Tunnelling considerations (Found in Appendix D)

f. Waste and materials (Found in Appendix D)

g. Noise and vibration (Found in Appendix E)

h. Road Drainage, water environment and flooding (Found in Appendix F)

i. Biodiversity (Found in Appendix G)

j. Physical effects of development and operation (Found in Appendix H)

k. Social, economic and land-use considerations (Found in Appendix I)

l. The acquisition and temporary possession of land and rights (Found in Appendix J)

m. General overarching questions (Found in Appendix J)

2 Responses to the Examining Authority's ExQ2 10

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ExQ2_Q10.1.1	Applicant only	**Surface water flood risk** The Applicant's response to ExQ1 Q10.2.1 is noted, particularly the point that " …. mitigation measures will be developed during detailed design in conjunction with the highway drainage design ….": however Gravesham Borough Council, in their submission [**REP4-291**], suggests that there are significant issues to be dealt with at detailed design stage, particularly, as the Council notes, "….the Works Plan shows two new sub-stations to be built south of the Cobham roundabout in this location (Works Plan REP2-037 shown as SS4 + SS5 and Work MU13 in the dDCO REP3-077) which appear to conflict with the position of the existing drainage culvert under HS1 …". The Council suggests that the consequences could include a reduction in landscaping area opening the view from the south. This could also have biodiversity and flood risk consequences. Using the above as an example, can the Applicant provide sufficient detail to allow confidence that the conflict issue could be satisfactorily resolved at the detailed design stage, without compromising the design parameters, and within existing Order Limits? An outline design solution will suffice.
		Response: The Applicant is satisfied that the provisions and commitments contained within the Development Consent Order (DCO) application are robust and appropriate to ensure that at the detailed design stage the position of the two substations (SS4 and SS5) would not conflict with the existing High Speed 1 (HS1) drainage culvert, nor give rise to any biodiversity or flood risk. This shall be achieved via the following: • The detailed design of the works will accommodate HS1 infrastructure as per Item 2.1.15 of the Statement of Common Ground between HS1 and the Applicant [**REP4-108**]. This is secured via the Protective Provisions contained within Schedule 14, Part 4 of the draft DCO [**REP5-024**]. • The selection and construction of a UK Power Networks standard substation designed specifically for its proximity to a watercourse. • By adhering to the commitments regarding the inspection and maintenance of drainage infrastructure contained within the Register of Environmental Actions and Commitments (REAC) items RDWE012 and RDWE014 [**REP5-048**]. • Via the locating of the proposed substations near the boundary fence of HS1 to reduce any potential biodiversity effects in relation to the forming of a barrier for wildlife movements.

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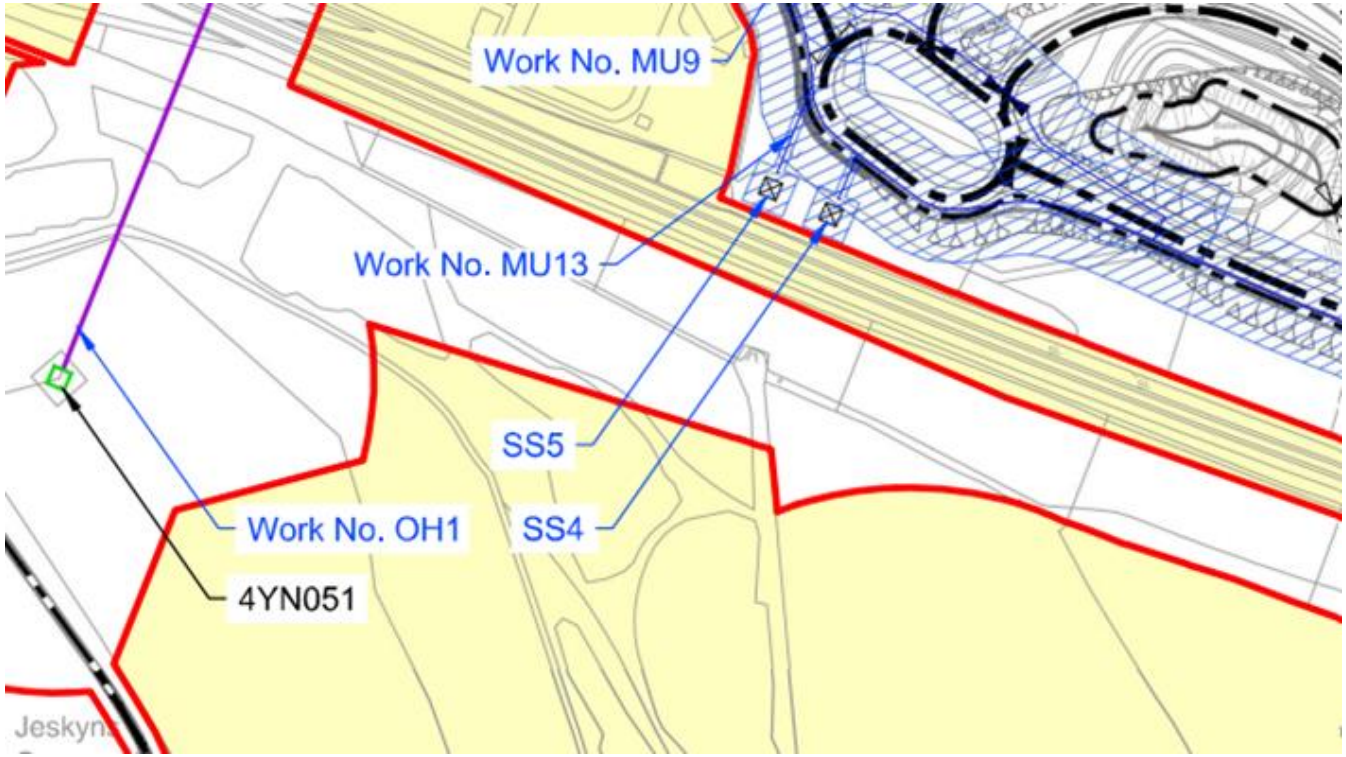
		The Applicant does not believe that the substation locations would give rise to a reduction in landscaping areas resulting in an opening of the view from the south for the following reasons: • The proposed location is against an existing railway embankment over 6m in height, which affords a natural reduction in view of the 2.4m high substations from the south. • Furthermore, the designed highway level and the existing railway level have an approximate 6m difference in elevation, with the highway being the lower of the two features. The Applicant believes with standard design details adhered to, the substation roof would still be approximately 3m below the railway, screening it from views from the south. • The existing site is vegetated, providing a screen of views from the south. REAC LV001 [**REP5-048**] and Design Principle LSP.01 [**REP4-146**] commit to the retention of existing vegetation as far as reasonably practicable in order to '*preserve its function as a natural screen to the works*'. • To ensure those views were not opened resulting in a detrimental effect, the detailed design would adhere to Design Principle STR.17 [**REP4-146**] and would '*Integrate any above-ground infrastructure required for the operation and maintenance of the utility networks into the setting of the area, or screen by landscaping, where practicable and compliant with the requirements of the utility owner.*' Further details regarding the two proposed substations (SS4 and SS5) are provided below to support this response. The two substations form part of the electricity distribution network and are to be consented as part of Work No MU13: '*Work No. MU13 comprises the diversion of multi-utilities, to include installation or diversion of underground utilities within a multi-utility corridor and the provision of two new substations (annotated as SS4 and SS5) in a 5m x 5m plot south of the new Cobham roundabout (Work No. 2U)*' (Schedule 1 of the draft DCO [**REP5-024**]). The two substations are afforded a limit of deviation, as per article 6 of the draft DCO [**REP5-024**], to be located within the hatched area shown on sheet 6 of the Works Plans [**REP4-040**], of which an extract is included in Plate 1 below.

Plate 1 Extract from the Works Plans Sheet 6 – Utilities [REP4-040] showing SS4 and SS5



The substation enclosures (as per UK Power Networks standard details) are 3m x 3m x 2.4m and are set within an area of 5m x 4m (as shown in Plate 2), though provision for an area of 5m x 5m has been included within the DCO application as the orientation of the substations is not known at this stage of design. The height of the surrounding enclosure would be 2.4m (as shown in Plate 3).

Plate 2 Plan view of substation and enclosure

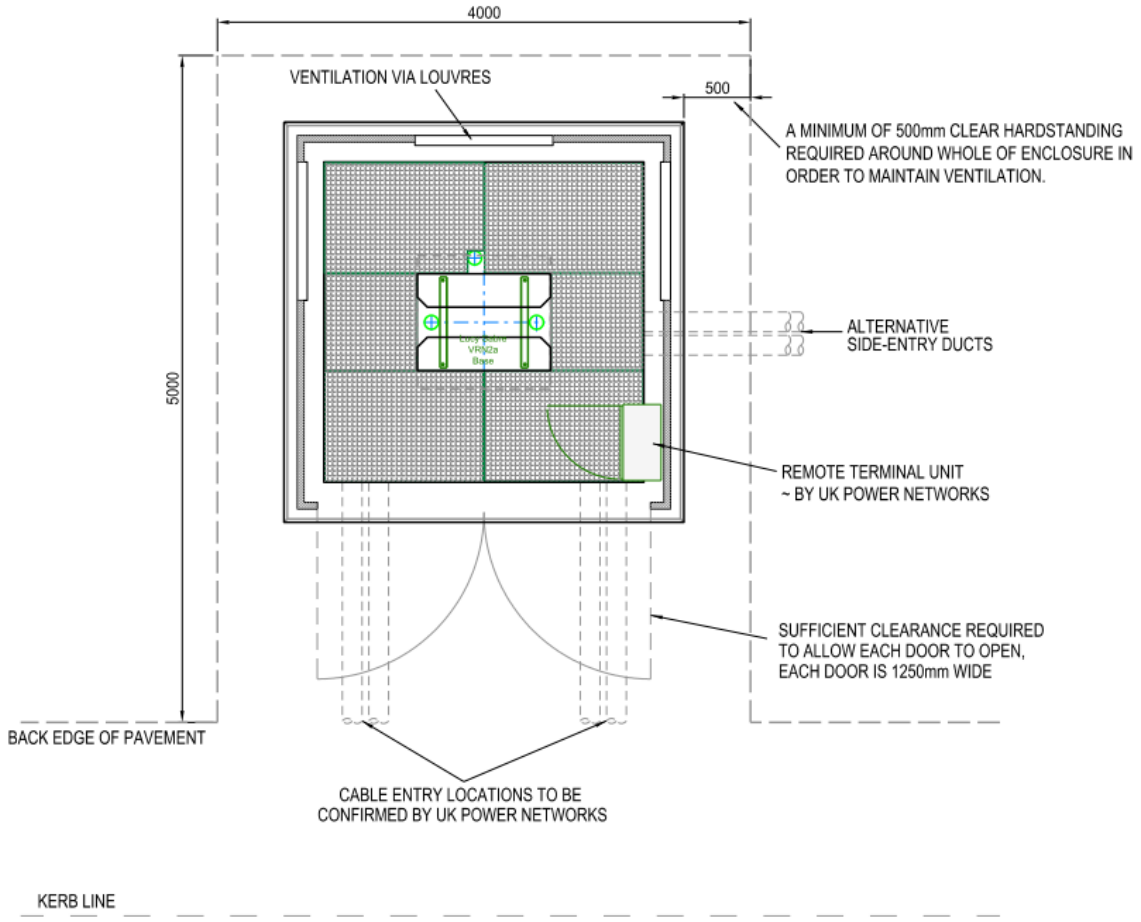
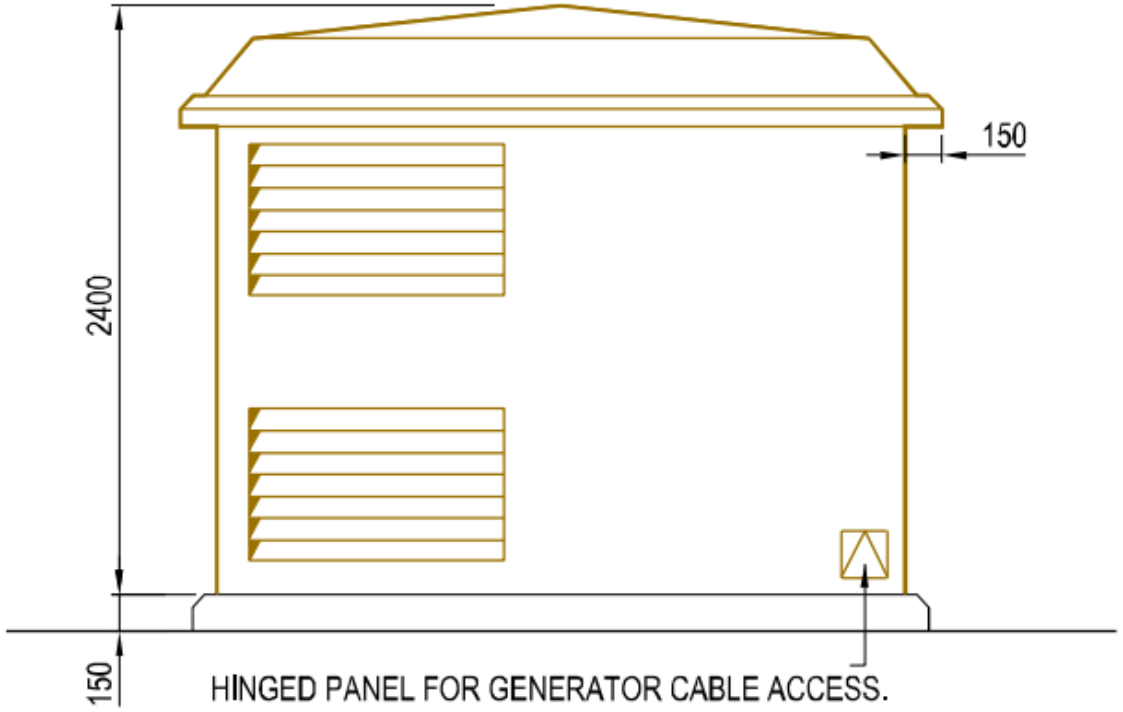


Plate 3 Proposed substation enclosure side elevation



As shown in Plate 4 below, the substations are currently proposed to straddle the existing culvert and watercourse alignment, not impede or obstruct it. At the detailed design stage, the interface with the HS1 fence line boundary shall be considered and then agreed with HS1. It is expected that the fence line would pass around the substations with the substations remaining within the highway boundary.

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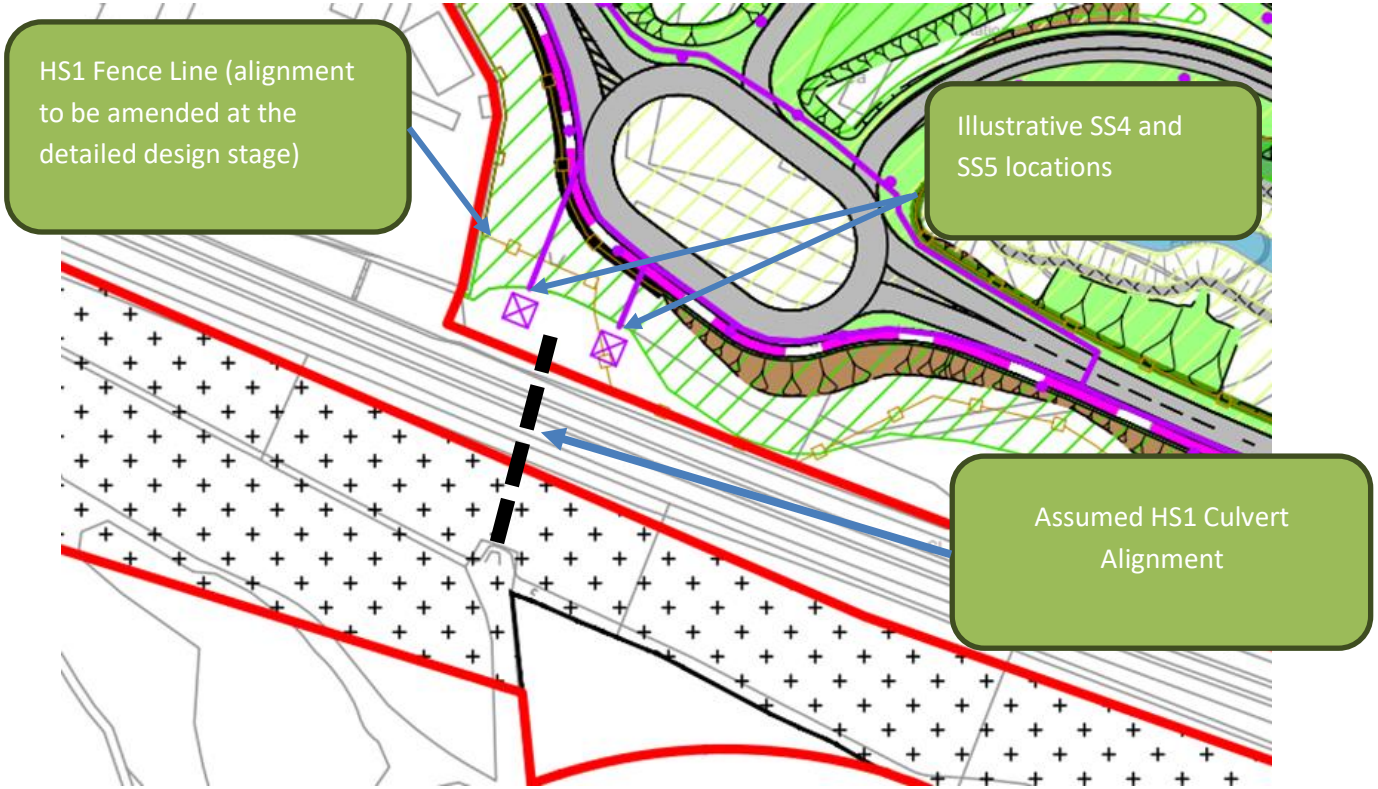
		Plate 4 Illustrative arrangement of substations SS4 and SS5 in relation to the HS1 culvert 
ExQ2_Q10.1.2	Applicant, Lead Local Flood Authorities (LLFAs)	**Infiltration ponds** In the Applicant's response to ExQ1 Q10.2.3, it is suggested that "the overtopped flows would be guided towards existing (pre-development) exceedance flow paths. Any civil works required to establish the flow paths would be within the Order Limits but overtopped flows would eventually be discharged to areas where existing exceedance flows naturally gather which may be beyond the Order Limits." Can the Applicant provide further information to demonstrate that the situation 'outside the Order Limits' is no worse after implementation of the scheme than is currently the case?

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		Where is this secured in the dDCO and do the LLFAs agree that sufficient provision is secured within the DCO?
		Response: Due to the design standard of the basins (secured within the DCO through commitment RDWE034 in the Environmental Statement Appendix 2.2: Code of Construction Practice, First iteration of Environmental Management Plan v5.0 [**REP5-048**]), the generation of exceedance flows from the Project's infiltration ponds is a low residual risk. Overtopping would take the form of weiring of flows over the basin edges (rather than a sudden release of a head of water such as in a dam break scenario). During the extreme events that would trigger exceedance flows, the soils and geology of the catchments that drain the Order Limits would effectively be saturated and the capacity for the land to store and attenuate rainfall would be significantly reduced. Rainfall runoff from land within the Order Limits would therefore be generated at similar rates and volumes without the Project in place, to runoff from any impermeable land cover introduced by the Project. Without the Project, in these extreme events overland flow would be generated, with flow paths following topographical valleys and flows naturally gathering in topographical depressions. As a consequence of this hydrological response, and the attenuation provided by the Project, the Applicant considers that the situation outside the Order Limits with the Project in place would be no worse than without the Project in place. The detailed design of flow exceedance routes is secured within the DCO by commitments RDWE034, RDWE035 and RDWE048 within the Code of Construction Practice, First iteration of Environmental Management Plan v5.0 [**REP5-048**]. As documented in the Statements of Common Ground between the Applicant and Kent County Council [**REP1-103**], which has all road drainage and water environment matters agreed, and the North Kent Drainage Internal Drainage Board [**REP5-068**, item 2.1.5], the LLFAs agree that sufficient provision is secured within the DCO.
ExQ2_Q10.1.3	Applicant	**Whitecroft Care Home: drainage** In Document 9.123, Whitecroft Care Home Cross-sections [**REP5-092**], the Applicant provides an indication of the locations and sizing of drainage ditches. Section A indicates a ditch approximately 5 metres wide on both sides of the landscaped mound, one immediately adjacent to the Care Home boundary and one adjacent to woodland edge planting. Section B suggests the ditch is some 25 metres wide with the A1013 on one side and vegetation on the other. • Can the Applicant confirm if these representations have been determined utilising hydraulic analysis of the expected design flows as a result of the proposed scheme and potential discharge along interrupted overland flow routes?

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		• Using these cross sections as an example, could the Applicant confirm which ditches they will be retaining maintenance responsibility for and those that are being gifted/returned to adjacent landowners? Where is this secured? • Using the ditches shown in the two sections as an example, can the Applicant provide an indication of the future maintenance operation on the ditches, particularly the one adjacent to the Care Home? • Is the methodology described above consistent across the whole project, or could other approaches be described with their locations being highlighted?
		Response: The sections shown in Whitecroft Care Home Cross-sections [**REP5-092**] show the outline design in the vicinity of Whitecroft Care Home. The drainage features shown in these sections have been designed to Design Manual for Roads and Bridges (DMRB) requirements, taking into account the catchment areas and expected design flows of each feature. The swale shown on Section B-B receives runoff from the realigned A1013 and is not designed to act as a longitudinal conveyance channel but will primarily hold run-off until it, more slowly, infiltrates into the ground. In this way, minimal maintenance will be required. The ditches and swales will be designed using the same strategy as the ponds and basins, i.e. they will accommodate the worst 1 in 100 year storm event with a 40% climate change uplift (within the freeboard) in order to prevent overtopping and flooding outside the highway boundary. In Section A-A the ditch shown provides drainage for the raised earthworks form; this will be a National Highways asset being maintained by the Applicant. Maintenance of National Highways' drainage assets will be undertaken in accordance with the DMRB standards GM 701[1] and GS 801[2]. GM 701 states that ditches would be cleared by removing all material that could impair operation every five years, and drainage channels, if V-channels, would be swept every two years, filter drains would be edge scraped and cut back every five years and weed sprayed every two years, although these would be risk assessed as part of the drainage asset management strategy during operation and could be more or less than the frequencies specified.

[1] Highways England (2020). DMRB GM 701 – Asset delivery asset maintenance requirements. https://www.standardsforhighways.co.uk/search/e0a134c8-f5e2-4f30-9cda-9e43d047f46e
[2] Highways England (2020). DMRB GS 801 – Asset delivery asset inspection requirements. https://www.standardsforhighways.co.uk/search/6b558352-5c85-4725-b5f2-f796f53d63a8

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		In Section B-B the drainage swale identified forms part of the drainage system for the A1013 Stanford Road. Drainage assets that form part of the local highway network drainage system will be adopted by the local authority and maintenance carried out in line with their standard maintenance regime. The examples above from these cross-sections are representative of the wider scheme.
ExQ2_Q10.2.1	Applicant	**Foul water systems** In its D4 submission, Anglian Water Services [**REP4-360**] has suggested that previous potential capacity may not be available. The Applicant has acknowledged in its answer to Q10.3.1 [**REP4-193**], that further discussions may be required with the Sewage Undertakers to provide suitable discharge arrangements. However, should alternative arrangements be required, these are normally administered by the Environment Agency through its permitting system. Can the Applicant confirm that such discharges into a watercourse or infiltration receptor within/adjacent to the Order Limits have been included in the EIA and other supporting information as to the potential effects on both biodiversity and flood risk?
		Response: The assessments presented in Environmental Statement Chapter 14: Road Drainage and the Water Environment [**APP-152**], with regard to the effects of disposal of foul water drainage on flood risk and the quality of the water environment, are based on the assumption detailed in Register of Environmental Actions and Commitments commitment RDWE005 [**REP5-048**]. This states that wastewater generated from the compound welfare facilities would be discharged to sewer, or in locations where a sewer connection is not reasonably practicable, collected and taken offsite by tanker for disposal at a licensed treatment facility. The assessment is also based on the assumption that foul drainage from the North Portal and South Portal Tunnel Services Buildings would be made to foul sewer during operation of the Project. If further consultation with Anglian Water Services, or Southern Water Services, confirms that capacity is not available, alternative arrangements would be sought by the appointed Contractors, who would lead on engagement with relevant Environment Agency permitting teams as outlined in Appendix A of the Consents and Agreements Position Statement [**REP5-026**]. Any subsequent permitting applications would be supported by relevant assessments. The discharges would comply with conditions set by the permits to ensure no significant adverse impacts to water quality and associated biodiversity, or an increase in flood risk.

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ExQ2_Q10.3.1	Applicant	**Water supply** The Applicant's response to ExQ1 Q10.4.1 is noted; however, could it be extended to make comment upon the proposed two-year rephasing of the start of the construction alongside the possible use of a single TBM as opposed to two? • What effects does this have on the analysis contained within documentation? • Does this have consequential effects on the Value for Money considerations or the ability of the project to be delivered, particularly if the alternative has a consequential cost increase? The Applicant should provide sufficient information to justify the answer.
		Response: *'The Applicant's response to ExQ1 Q10.4.1 is noted; however, could it be extended to make comment upon the proposed two-year rephasing of the start of the construction alongside the possible use of a single TBM as opposed to two?'* The two-year re-phasing is not considered material as the tunnel boring machine (TBM) drives are envisaged to still finish within the proposed agreement (water supply agreement) period or, if necessary, due to unforeseen prolongation, the Applicant would either seek extension to that agreement or replace it for the remaining duration only with Gun Hill Supply. A single TBM generally reduces the intensity of the water demand; however, this does not materially alter the proposal to use water from the Linford Well nor discount the benefits of using this supply ("Work No MU29".) In terms of timing, although two drives using one TBM would become a sequential event, the earlier start envisaged (due to less launch works being required) results in a broadly similar end date. In any event, the supply agreement would be triggered by commencement of the relevant works and hence would move in parallel with any movement in the commencement date thus leaving the supply agreement period unaltered. *'What effects does this have on the analysis contained within documentation?'* Owing to the factors explained above there is no change to the analysis with the Development Consent Order (DCO) application reporting a reasonable worse case. Further, whilst the single TBM strategy would generally reduce the intensity of demand it should be noted that the demand is based on the maximum requirement on charging of the system. During operation the system is (primarily) a closed circuit with notionally little additional water demand. In practice, the suspended solids quantity in the slurry circuit can build up such that on occasion some circuit water is discharged and cleaned through the treatment process and discharged to waste and therefore needs to be replenished. This is always at flows less than the assumed peak demand but the system is, of course, sized on anticipated peak.

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		'Does this have consequential effects on the Value for Money considerations or the ability of the project to be delivered, particularly if the alternative has a consequential cost increase? The Applicant should provide sufficient information to justify the answer.' The supply of water for the TBM(s) are subject to commercial agreements by the Applicant on the open market, which are yet to be concluded. It is estimated by the Applicant, following discussions with relevant water providers, that the provision of raw water, per megalitre, is expected to be up to 50% cheaper than the same provision using potable water owing to the lack of additional costs associated with treating the raw water to make it potable. The charging of the system for the use of the TBM(s) could reasonably be assumed as double in comparative costs if a potable water supply was used; however, this would not be true with regards to the ongoing use of the water owing to the demand being reliant on other factors, including the fact that the operational system is a closed circuit. There is no significant change to value for money consideration and any change would be marginal in the context of the overall Project, which would not materially impact the affordability or benefit cost ratio of the Project, in which an allowance has been made for the provision of water at an assumed higher cost, for a greater demand from which the Applicant and their Contractors would seek to better.
ExQ2_Q10.3.2	Applicant	**Calculation of flows and volumes** The Applicant's response to ExQ1 Q10.4.3 is noted. There are a number of watercourses shown within the Order Limits that simply 'disappear'. They do not seem to have an upstream nor downstream catchment. The defining of catchment boundaries appears to have been a 'desktop' exercise, utilising various techniques; however, during the recent Accompanied Site Inspections (ASI), it was suggested that some watercourses disappeared to resurface at other locations. • Can the underground element of these watercourses be determined through a 'desktop' exercise? • How are any and all changes noted following subsequent 'detailed design' review being accommodated within the structure of the submitted documentation?
		Response: *'Can the underground element of these watercourses be determined through a 'desktop' exercise?'* Catchments have been defined, using all available sources of information and in accordance with good practice and published guidance (EA, 2022[3]). These catchments form the basis of the flood flow calculations that have been undertaken to inform the Flood Risk Assessment for the Project. For a catchment, flow estimates are made based on the total area draining to the point of interest, and (in the absence of recorded

[3] Environment Agency (2022). Flood Estimation Guidelines LIT 11832

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		flow data series) a suite of Flood Estimation Handbook descriptors that define physical characteristics e.g. slopes, as well as land use, soils and geology. Therefore, based on the methodologies applied for flood flow estimation, while there is some uncertainty on the flow paths of any 'underground' elements of watercourses, this uncertainty does not have a bearing on the outcome of the calculations (e.g. on the magnitude of the flood flows generated for the catchment). *'How are any and all changes noted following subsequent 'detailed design' review being accommodated within the structure of the submitted documentation.'* The detailed design would be the subject of consultation with and review by the relevant risk management authorities, for example the Environment Agency and the Lead Local Flood Authorities. The consultations would be informed by any updates to assessments where necessary to reflect the detailed design. This is secured by several RDWE commitments within Environmental Statement Appendix 2.2: Code of Construction Practice [**REP5-048**], for example RDWE025, RDWE034 and RDWE035. Through this route, detailed designs would be suitably audited, such that detailed designs would provide for, as a minimum, the same level of protections to the water environment and flood risk receptors.
ExQ2_Q10.3.3	Applicant	**Site information** The Applicant's answer to ExQ1 Q10.4.5 is noted. There have been comments from a number of IPs with regard to the current uncertainty of watercourse connectivity and concern has been raised on the ability to protect the watercourses, ground water and the associated biodiversity without a full understanding of connectivity with the associated cause and effect relationships. In ES Appendix 2.2: Code of Construction Practice [**REP5-049**] there are a number of instances where the Commitment states that '…. during detailed design ….' '…. would be assessed and, if confirmed to be necessary, the detail of such measures would be agreed by the Secretary of State following consultation with …'. What measures are in place to audit the various assessments that are suggested may be necessary, who is to act as the auditor, and how is the audit mechanism and the subsequent detailed measures secured?
		Response:. Key elements of the design where watercourse connectivity has a bearing, and which would be subject to refinement during detailed design, are the operational drainage design, the design of culverts and watercourse diversions and the design of flood protection measures. Each of these elements has an associated commitment secured within Environmental Statement Appendix 2.2: Code of Construction Practice [**REP5-048**]: RDWE011, RDWE013 and RDWE029 respectively.

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		Each of these commitments has achievement criteria that require approval of designs by the Secretary of State following consultation with the relevant risk management authority. This is the Environment Agency in several cases, or the applicable Lead Local Flood Authority. Through this route, detailed designs would be suitably audited, such that detailed designs would provide for, as a minimum, the same level of protections to the water environment and flood risk receptors. Further to this, during the detailed design phase there would be a requirement under the Protective Provisions (draft Development Consent Order [**REP5-024**]) for the Environment Agency (Schedule 14, Part 9) and Drainage Authorities (Schedule 14, Part 3), for appointed Contractors to consult with regard to aspects of the design relevant to their responsibilities.
ExQ2_Q10.4.1	Applicant, LLFAs, Internal Drainage Board (IDB)	**Operational surface water drainage pollution risk assessment** The Applicant's response is noted for question ExQ1 Q10.6.2; however, in relation to the proposed locations of outfalls it is stated that they are "subject to confirmation during the detailed design of operational drainage networks". • How is this flexibility secured within the DCO in order that any changes during the detailed design stage can be accommodated in flood risk terms in addition to the pollution risk on which has been commented? • Are the appropriate Drainage Authorities content with the arrangements?
		Response: *'How is this flexibility secured within the DCO in order that any changes during the detailed design stage can be accommodated in flood risk terms in addition to the pollution risk on which has been commented?'* The operational drainage systems described within the Application would be subject to refinement during the detailed design stage of the Project; a typical approach for large infrastructure projects. Any changes to the drainage networks that resulted from this phase of design would be subject to re-assessment by the Contractor, both with regard to pollution risks to the receiving water environment, and in flood risk terms. Commitment RDWE025 within Environmental Statement (ES) Appendix 2.2: Code of Construction Practice, First iteration of Environmental Management Plan v5.0 [**REP5-048**] secures that further survey and sampling would be undertaken to define the flow regime and water quality of receiving watercourses at proposed points of discharge to inform the detailed design of treatment measures. It also secures that the final design of treatment measures should provide for, as a minimum, the level of treatment achieved by the DCO application drainage design, on which the conclusions of ES Chapter 14 [**APP-152**] are based. RDWE034, RDWE035 and RDWE048 within the Code of Construction Practice [**REP5-048**] commit to sizing drainage attenuation features to ensure no increase in flood risk outside of the highway boundary by providing

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		for discharge that is attenuated to the 1 in 1-year greenfield runoff rate for all events up to and including the 1 in 100-year rainfall event with climate change. Requirement 8(1) of the Draft Development Consent Oder [**REP5-024**] secures these commitments at the detailed design stage of the project, by requiring approval of a surface and foul water drainage system which must reflect the mitigation measures set out in the REAC, including means of pollution control. Requirement 8(2) confirms that any amendments to the approved details must not give rise to any materially new or materially different environmental effects in comparison with those reported in the Environmental Statement. Under requirement 8, the Secretary of State has a role in approving details of drainage systems, following consultation with the relevant planning authorities, represented by the Lead Local Flood Authorities and the North Kent Marshes Internal Drainage Board. The Applicant has engaged with all of the appropriate Drainage Authorities with regard to their role in auditing the detailed drainage design. Agreements with the flood authorities are tracked within the relevant Statements of Common Ground.

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