

A303 Amesbury to Berwick Down

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Deadline 2

8.10.11 Flood risk, groundwater protection, geology and land contamination (Fg.1)

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A303 Amesbury to Berwick Down

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**Flood risk, groundwater protection, geology
and land contamination (Fig.1)**

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Flood risk, groundwater protection, geology and land contamination (Fig.1)

Question Fig.1.1

Geology and soils

- i. Notwithstanding the analyses undertaken on cores from specific locations ([APP-048] paragraph 10.6.74); being uranium bearing materials, would there still be a potential for the emission of radon from the chalk materials (which do not appear to have been directly assessed, ie through inherent variability)?
- ii. What mitigation would be necessary and how would this be secured through the DCO?

Response

1. The study area is not classified as being within a radon affected area by Public Health England as described in Environmental Statement, Chapter 10, Geology and Soils ([APP-048] paragraph 10.6.26. The potential for increased radon emissions relates specifically to uranium bearing materials within the Phosphatic Chalk that are present within the Stonehenge Bottom area of the study area. The radon potential screening undertaken in February 2018 on the Phosphatic Chalk cores, described in the Environmental Statement, Chapter 10, Geology and Soils [APP-048] paragraphs 10.6.80 and 10.6.81 is considered to be sufficiently representative of the Phosphatic Chalk within the study area. Other Chalk in the study area does not pose an increased risk of radon and therefore it has not been necessary to carry out radon potential screening beyond the area of the Phosphatic Chalk.
2. Excavated phosphatic chalk could give rise to emissions of radon gas, which in an outside environment would disperse rapidly, posing no risk to health. Within the enclosed environment of the tunnel boring, the health of construction personnel would be protected by the mitigation measures set out in the Outline Environmental Management Plan (OEMP) [APP-187], which include monitoring and the development of a ventilation strategy (MW-GEO5, MW-GEO10, MW-AIR3). The OEMP is secured through paragraph 4 of schedule 2 of the draft Development Consent Order [APP-020]. Further information on the phosphatic chalk and radon gas can be found in the ES Chapter 10, Geology and Soils [APP-048].
3. No additional mitigation, in addition to that already secured by the DCO as explained above, is considered necessary.

Question Fg.1.2

Geology and soils

- i. Would the operational tunnel need to be considered a more confined environment, where the risk posed by the potential accumulation of radon is a greater risk to human health (end users and maintenance workers)?
- ii. What mitigation would be necessary and how would this be secured through the DCO?

Response

- i. **Would the operational tunnel need to be considered a more confined environment, where the risk posed by the potential accumulation of radon is a greater risk to human health (end users and maintenance workers)?**
 1. As set out in the Environmental Statement (ES) Chapter 10, Geology and Soils [APP-048], paragraph 10.6.26, the study area is not classified as being within a radon affected area, as defined by Public Health England. The potential for increased radon emissions relates specifically to uranium bearing materials within the Phosphatic Chalk that is known to be present within the Stonehenge Bottom area of the study area. The radon impacts specific to the Phosphatic Chalk have been assessed by screening of core samples of the Phosphatic Chalk for naturally occurring radiation of materials (NORM). No significant levels of radon were detected, as set out in the ES, Chapter 10 [APP-048], paragraph 10.6.81.
 2. Confined spaces are identified as a potential human health exposure pathway in ES Chapter 10, Geology and Soils [APP-048] paragraph 10.6.85. Whilst it is correct that the operational tunnel is an example of a confined environment where there are specific risks to both end users and maintenance workers, these risks are assessed and controlled by various measures implemented within the tunnel, as explained below.
- ii. **What mitigation would be necessary and how would this be secured through the DCO?**
 3. The Outline Environmental Management Plan (OEMP) [APP-187] includes a Tunnel Ventilation Strategy (MW-AIR3) and the provision of appropriate ventilation and monitoring for confined space working during construction (MW-GEO5, MW-GEO10). If this monitoring identifies elevated levels of radon, the Tunnel Ventilation Strategy (as required by [APP-187] MW-AIR3) would be required to mitigate radon during the operation of the tunnel. Compliance with the OEMP is secured through paragraph 4 of schedule 2 to the DCO [APP-020].

Question Fg.1.3

Geology and soils

- i. Has consideration has been given to the provision of basic radon protection measures on a precautionary basis during construction and operation?
- ii. How would this be secured through the DCO?

Response

1. As set out in the Environmental Statement (ES) Chapter 10 Geology and Soils [APP-048] paragraph 10.6.26, the study area is not classified as being within a radon affected area, as defined by Public Health England. The potential for increased radon emissions relates specifically to uranium bearing materials within the Phosphatic Chalk that is known to be present within the Stonehenge Bottom area of the study area. The radon impacts specific to the Phosphatic have been assessed by screening of core samples of the Phosphatic Chalk for naturally occurring radiation of materials (NORM). No significant levels of radon were detected ([APP-048] paragraph 10.6.81). In accordance with BS 6164: 2011 'Code of Practice for health and safety in tunnelling in the construction industry', radon is considered as one of a suite of commonly encountered atmospheric contaminants to be assessed during construction. The presence of radon has accordingly been considered in the ES.
2. In terms of protection, appropriate protective measures during construction and operation have been considered and provided for within the ES and associated documentation. The Outline Environmental Management Plan (OEMP) [APP-187] provides for the implementation of a programme of radon monitoring during construction (MW GEO-05 and MW-GEO10). If this monitoring identifies elevated levels of radon, the Tunnel Ventilation Strategy (as required by OEMP [APP-187] MW-AIR3) would be required to mitigate radon during the operation of the tunnel. Compliance with the OEMP is secured through paragraph 4 of schedule 2 of DCO [APP-020].

Question Fg.1.4

Geology and soils

- i. Can the Applicant explain why there is no reference as part of PW-GEO1 or PWGEO2 in the OEMP to the conceptual site models (CSMs) which were developed for the specific spatial work areas within the scheme.
- ii. Should the subsequent GI works be based on the CSMs and specifically cited in the OEMP and or the DCO?

Response

1. Whilst not specifically referenced, the Outline Environmental Management Plan (OEMP) [APP-187] is integral to the conceptual site models (CSMs) as they are part of the same overall document. The information evaluated in the CSMs is inherent to and reflected in the OEMP, as such whilst the CSMs have not been explicitly referred to, their data is included as part of the OEMP.
2. The design of the future ground investigation works has been based on the CSMs. The ground investigation will provide information to refine the CSM which is in accordance with published guidance including Environment Agency Contaminated Land Report (CLR11) Model Procedures for the Management of Land Contamination (2004) as cited in the Environmental Statement land contamination assessment methodology ([APP-048] paragraph 10.3.5). The OEMP at item PW-GEO1 [APP-187] (secured through paragraph 4 of Schedule 2 to the DCO [APP-020]) includes commitments to complete appropriate ground investigation works in accordance with CLR11.

Question Fg.1.5

Geology and soils

ES Chapter 10: Geology and soils [APP-048] identifies that the risk of discovering further solution features is higher than previously anticipated.

- i. Notwithstanding the information in section 10.6.21, could the Applicant provide further detail regarding the approach and mitigation measures involved should 'open voids' in the phosphatic chalk be encountered during the construction phase of the scheme, particularly during the tunnelling process?
- ii. How would any mitigation measures be secured through the DCO?

Response

- i. **Notwithstanding the information in section 10.6.21, could the Applicant provide further detail regarding the approach and mitigation measures involved should 'open voids' in the phosphatic chalk be encountered during the construction phase of the scheme, particularly during the tunnelling process?**
 1. The approach to dealing with the risk of encountering open voids within the chalk during tunnelling requires detailed consideration of the most appropriate tunnel boring method to use based on an assessment and understanding of the expected geological and hydrogeological conditions. Industry guidelines, as published by the British Tunnelling Society¹ and a health and safety code of practice² have been referenced in the development of the Scheme in consideration of the most appropriate means of tunnelling. In addition, the Joint Code of Practice for Risk Management of Tunnel Works³ contains measures to ensure best practice in the minimisation and management of risks associated with the design and construction of tunnelling projects.
 2. A closed-face Tunnel Boring Machine (TBM) is considered to be the best option for tunnelling in the chalk geology found in this location as it provides greater control on settlement and removes the need for dewatering during the main tunnel construction; this is referenced in the Environmental Statement (ES) Chapter 2 The Scheme section 2.4.33 [APP-040]. Closed-face tunnelling also removes the exposure of workers to an unsupported ground interface; this interface is considered one of the highest safety risks in tunnelling.
 3. It will be the responsibility of the contractor to ensure risks are assessed and mitigated in their safe systems of work during construction. Their assessment of the risk will be based on the existing and supplementary ground investigation being undertaken for detailed design. As part of their safe working plan, the contractor will develop a suite of tool box items to allow further investigation and assessment during construction to identify the need for ground treatment ahead of the tunnel face. Where the need for ground treatment is identified this will be undertaken from inside the tunnel bore where it is safe and practicable to do so in preference to surface intervention.

4. The Preliminary Geotechnical Investigation Report, ES Appendix 10.1 [APP-273], has identified that the tunnel will be constructed through a zone of Phosphatic chalk. The sections of main TBM tunnel drives to be constructed within this zone are below the groundwater level and the presence of open voids will not present any problems for the closed-face tunnelling methodology. As part of the risk management process during the TBM operation, grouting behind the tail skin will ensure uniform contact between the lining and the ground by ensuring voids are filled. The safe construction of the cross passage tunnels located within this zone can be mitigated through various measures, including fissure grouting and local depressurisation, facilitated from the main TBM tunnels. Additional mitigation measures include enhanced ground support by the installation of pipe umbrellas or spiles. These techniques would mitigate against the risks posed by the presence of voids in both the Phosphatic and normal chalk. These methods have been successfully employed on the recent (2013) Crossrail C310 Thames Tunnel project through the chalk aquifer.

ii. How would any mitigation measures be secured through the DCO?

5. The construction of the main tunnel bore using a closed-face TBM is included in the Environmental Statement Chapter 2 The Scheme section 2.4.33 [APP-040]. Mitigation measures will be implemented by the contractor in their safe systems of work during construction and secured through item MW-WAT9 of the Outline Environmental Management Plan (OEMP) [APP-187] which specifies grouting for ground stabilisation of the chalk during cross-passage excavation. The OEMP is secured in the draft Development Consent Order (dDCO) [APP-020] through paragraph 4 of Schedule 2.

Technical References

- *1 BTS/ICE (2005) Closed-face Tunnelling Machines and Ground Stability, A Guideline for Best Practice.*
- *BS 6164:2011 Code of Practice for Health & Safety in Tunnelling in the Construction Industry.*
- *ABI/BTS (2003) The Joint Code of Practice for Risk Management of Tunnel Works in the UK.*

Question Fg.1.6

Geology and soils

In the Record of Environmental Actions and Commitments set out in the OEMP [APP-187] the sequence jumps from MW-GEO9 to MW-GEO10.

Please clarify whether MW-GEO9 is missing or if MW-GEO10 should be renumbered?

Response

1. In the Outline Environmental Management Plan (OEMP) [APP-187] the sequence jumps from MW-GEO8 to MW-GEO10. This is a numbering error and we confirm that there is no MW-GEO9. However due to the fact that reference to ME-GEO10 has already been made throughout the Scheme application documents, we do not propose to amend the numbering of the OEMP.

Question Fg.1.7

Contaminated land

Please provide greater clarity as to the strategy for dealing with risk from contaminated land beyond what is set out in section 10.8 of [APP-048] and PW-GEO1, PW-GEO2 and MW-GEO1-MW-GEO10 of the OEMP [APP-187]. In responding, please take account of the comments raised by the Environment Agency in [RR-2060].

Response

1. In RR-2060 the Environment Agency raises concern about lack of ground investigation in key areas identified with a potential for contaminated land. The Environmental Statement (ES) [APP-048] at paragraph 10.6.90 and 10.6.91 and Appendix 10.2 [APP-274] indicates that the risk of contaminated land being present at these sites is likely to be low. The information provided in section 10.8 of [APP-048] and in the Outline Environmental Management Plan [APP-187] reflects this finding and provides appropriate strategies (PW-GEO1, PW-GEO2, MW-GEO1, MW-GEO8) for responding to this risk.
2. However, and as set out in the ES (paragraph 10.8.2), since the ES submission a package of ground investigation referred to as Phase 7 has been scoped by Highways England to provide geotechnical, hydrogeological and geo-environmental information in order to contribute to detailed design. This scope includes exploratory holes and geo-environmental testing along the route alignment specifically targeting key potentially contaminated sites including the former RAF Oatlands Hill, former RAF Stonehenge and current Countess filling station as well as providing more general spatial coverage. These investigations would precede construction and, in the event that contamination not identified in the ES was discovered, remediation options and strategies would be developed in liaison with the EA. This is pursuant to the process set out by the DCO requirement at Schedule 2 paragraph 7 of the DCO [APP-020].
3. The OEMP at item PW-GEO1 [APP-187] (secured through paragraph 4 of Schedule 2 to the DCO [APP-020]) includes commitments to undertake all ground investigation works in accordance with BS 5930:2015 Code of Practice for ground investigations and BS 10175:2011 + A2:2017 Investigation of potentially contaminated sites Code of Practice. In addition, the assessment of contaminated land will be risk-based and in accordance with the Environment Agency's Contaminated Land Report 11 'Model Procedures for the Management of Land Contamination' (2004). The approach established in these documents requires a phased approach to contaminated land assessment.

Question Fg.1.8

Contaminated land

Requirement 7 requires that the Local Planning Authority and the Environment Agency are informed in the event that any previously unidentified contaminated land (including ground water) is found during the construction of the development. Subsequently the Undertaker must assess what, if any, remediation is necessary, this must be approved by the Local Planning Authority and the Environment Agency and then implemented.

Is it necessary to amend the wording to provide a timescale in which the Local Planning Authority and the Environment Agency should be informed and/or to prevent further construction works being carried out in the area where the contamination has been found until the approval has been secured?

Response

1. Should Requirement 7 of the draft Development Consent Order (DCO) [APP-020] be amended to provide a timescale in which the Local Planning Authority and Environment Agency are informed in the event that any previously unidentified contaminated land is found during construction?
2. Requirement 7 obliges the Applicant to inform the Local Planning Authority and the Environment Agency "as soon as reasonably practicable" in the event that contaminated land is found at any time when constructing the authorised development. The Applicant considers this to be a sufficient timescale, without delay, and follows the precedents that have been set by other recent Development Consent Orders made in relation to transport (for instance, (i) the A14 Cambridge to Huntingdon Improvement Scheme DCO 2016, requirement 6 and (ii) the A19/ A184 Testos Junction Improvement DCO 2018, requirement 6). The Applicant therefore does not consider that Requirement 7 needs to be or should be amended.
3. (Should Requirement 7 of the draft Development Consent Order (DCO) [APP-020] be amended to prevent further construction works being carried out in the area until approval has been secured?
4. In addition to Requirement 7, the Applicant notes that it has a duty to ensure that potential environmental hazards from unexpected contamination found during construction are subject to further investigation, risk assessment and, where found to be necessary, remediation prior to construction work proceeding. This is in accordance with Environment Agency Contaminated Land Report (CLR11) Model Procedures for the Management of Land Contamination (2004) as cited in the Environmental Statement ([APP-048] paragraph 10.3.5), compliance with which is required under MW-GEO2 of the OEMP. Whilst the discovery of unexpected contamination can be conveyed to regulators promptly it is not usual to place a specific timescale on the process for assessing remediation requirements and/or a construction stand-down period for dealing with unexpected contamination. This is because the timescale required would vary

dependent on the nature and spatial extent of the contamination, the necessary scope of further investigations/risk assessments and the scope and duration of any necessary remediation. Furthermore, the Applicant notes that the procedure provided for in Requirement 7 of the Scheme draft DCO follows the precedent that has been set by other recent Development Consent Orders made in relation to transport (for instance, (i) the A14 Cambridge to Huntingdon Improvement Scheme DCO 2016, requirement 6 and (ii) the A19/ A184 Testos Junction Improvement DCO 2018, requirement 6)

Question Fg.1.9

Land and groundwater contamination

The Tunnel Arising's Mitigation Strategy in Appendix 12.1 of the ES [APP-285] sets out that additives are to be introduced at the cutting face in the tunnel boring process to provide lubrication. It states that migration of contaminants leached from materials placed at the surface may travel rapidly downwards into groundwater through fracture networks in the chalk providing little time for natural attenuation. The assessment of residual risk is acknowledged to be an ongoing process and discussions with the Environment Agency is planned.

Considering the comments and queries posed by the Environment Agency [RR-2060] what is the planned response/actions and how can the ExA have confidence that remediation strategies and risk assessments will ensure the risks are adequately mitigated against if the extent of the risks are not fully defined that this stage?

Response

1. The sensitivity and potential risks to groundwater have been identified in the ES Chapter 11 [APP-049] paragraph 11.7.2 and assessed in the Groundwater Risk Assessment [APP-282] Sections 5.3 to 5.8. As such they are well understood and adequate mitigation has been designed into the Scheme. For instance, the potential for risks associated with additives used in the tunnelling works are addressed in the OEMP [APP-187], which sets a requirement for the contractor to ensure that work operations do not affect the Chalk aquifer (MW-WAT6), and to avoid using materials in the permanent or temporary works that could result in direct or indirect discharge of hazardous substances or non-hazardous pollutants to groundwater (MW-WAT7).
2. Any additives introduced at the cutting face in the tunnel boring process will therefore be required to comply with these requirements of the OEMP and not result in discharge of pollutants to groundwater, either during tunnelling or following placement of tunnel arisings. Compliance with the provisions of the OEMP is secured by paragraph 4 of Schedule 2 of the draft DCO [APP-020].
3. The ExA can therefore have a high degree of confidence that the remediation strategies and risk assessments will ensure that the risks are adequately mitigated. Tunnelling additives which do not pose risks to the water environment are widely available and commonly used.

Question Fg.1.10

Combined effects

It is noted that there is no clear discussion or reference to the interaction between geology and soils (Chapter 10), groundwater (Chapter 11 – Road Drainage and the Water Environment) and material assets and waste (Chapter 12).

- i. Can the Applicant explain how the interaction between these closely aligned aspects has been considered as it does not appear to be given particular prominence in Chapter 15 of the ES where ‘combined effects’ are considered. For example, the consideration of groundwater levels within the scheme extents (within the differing geological facies) and the likely dewatering required during construction and operation of the proposed development.
- ii. In addition, what consideration has been given to the impedance of groundwater flow via the construction of the twin bore tunnel and potential seepage into the tunnel bores, once constructed?

Response

- i. **Can the Applicant explain how the interaction between these closely aligned aspects has been considered as it does not appear to be given particular prominence in Chapter 15 of the ES where ‘combined effects’ are considered. For example, the consideration of groundwater levels within the scheme extents (within the differing geological facies) and the likely dewatering required during construction and operation of the proposed development.**
 1. In Chapter 15 [APP-053] paragraph 15.2.15 states that the combined effects comprised a review of the assessments reported in Chapters 5 to 14 to identify new or different environmental effects, or those which may result in effects of greater significance than those arising from any one impact in isolation. Section 15.3 of Chapter 15 [APP-053] identifies no combined effects arising from geology and soils, road drainage and the water environment and material assets and waste.
 2. This follows on from the assessment of these individual aspects in the separate chapters. There are no significant construction or operation stage effects in relation to Geology and Soils [Chapter 10, APP-048 paragraph 10.9.15]; no significant adverse effects are identified for the Road Drainage and the Water Environment [Chapter 11, APP-048 paragraph 11.10.1]; and for Material Assets and Waste [Chapter 12, APP-050 paragraphs 12.9.1] the only significant effect would occur in relation to the use of secondary and recycled aggregate and not to any local effects in the immediate vicinity of the Scheme.
 3. The interactions between these aspects are taken into account in the relevant chapters, for example, Chapter 10 cross references Chapter 11 on twelve occasions and Chapters 11 and 12 refer back to Chapter 10. The geology baseline is common to two Chapters [APP-048 section 10.6 and APP-049

paragraph 11.6.27]. Drainage and contamination and the water environment are discussed in both the geology and soils and water chapters. The potential for impacts in the water chapter includes sources such as excavated material, contaminants and pollution [APP-049 section 11.7.2] which are referred to in the geology and soils chapter [APP-048 Table 10.9] and the material assets and waste chapter [APP-050 Table 12.11].

4. These aspects are also aligned with respect to design, mitigation and enhancement measures through the OEMP [APP-187], Code of Practice for Sustainable Use and Management of Soils on Construction Sites (Defra, 2009), Materials Management Plan developed in accordance with the CL:AIRE Code of Practice (Contaminated Land: Applications in Real Environments (CL:AIRE), 2011. The Definition of Waste: Development Industry Code of Practice, Version 2) and the Drainage Strategy [APP-281].
5. The presence of different geological facies has been considered in terms of the potential for preferential flow horizons. A precautionary approach to groundwater modelling has been adopted which assumes the tunnel impedes a larger proportion of flow than the ratio of its size compared to the thickness of aquifer through which it passes i.e. if the tunnel passes through zones of greater permeability its presence could impede more flow than if it passes through zones of lower permeability (Section 3.5 of Annex 1 to the Appendix 11.4 [APP-282]).
6. Groundwater levels are considered in Chapter 11 of the ES [APP-49], for the calculation of impedance that may be caused by the tunnel to groundwater flow (Annex 1 to the Appendix 11.4 [APP-282]). Groundwater levels have also been used in the drainage design [APP-281] and for informing the surface water flood model [APP-283].
7. Groundwater is below the soil zone in the Chalk aquifer, through which it has percolated to form recharge. This is considered in the groundwater model while potential contamination in the soil zone is considered in Chapter 10 of the ES [APP-49 paragraph 10.6.47].
8. With regard to dewatering, the principle of the design is to minimise dewatering. Based on the current design and construction methods it is assumed that no abstraction of groundwater or surface water will be required. Notwithstanding this, as stated in paragraph 2.4.34 of Chapter 2 of the Environmental Statement [APP-040] notes that the highly variable nature of the groundwater levels (see ES Chapter 11 Road drainage and the water environment) means that it is possible that temporary and localised groundwater control could be required for the construction of the tunnel portal slab to launch the TBM and also for some cross-passages for mechanical and electrical services at Stonehenge Bottom where groundwater levels are exceptionally high. If required, the extent and duration of groundwater control would be minimised. The Statement of Common Ground with the Environment Agency states under Matters Agreed with regard to any abstraction that the assessment of risk and identification of any required mitigation measures will be achieved through the OEMP [APP-187] and

whichever regulatory regime is ultimately agreed, i.e. either the Environment Agency's permitting regime or protective provisions within the DCO.

- ii. **In addition, what consideration has been given to the impedance of groundwater flow via the construction of the twin bore tunnel and potential seepage into the tunnel bores, once constructed?**
9. Annex 1 to the Groundwater Risk Assessment, Appendix 11.4 [APP-282] sets out the assessment of the potential for the tunnel to cause impedance to groundwater flow. A groundwater model (based on the Environment Agency's Wessex basin regional groundwater model) has been used to simulate the effect of the tunnel. The assessment was based on development of a local conceptual model and calibration of the regional numerical model. The model predicted increases in groundwater level upstream (north) and decreases downstream (south) as a result of impedance. Details are provided in Section 4.1 of Annex 1 [within APP-49]. Small changes were predicted for all conditions with no resultant significant effects as follows:
- groundwater level changes at peak groundwater level periods [APP-282, Annex 1, Section 4.1.4 and Figure 4.1] which are relevant when considering flood risk;
 - groundwater level lows (APP-49, Annex 1, Section 4.1.25 and Figure 4.11), which are relevant when considering effects to baseflow in rivers (Section 4.1);
 - supply to private water users (Section 4.2); and
 - average conditions were also assessed (APP-49, Annex 1, Section 4.1.13 and Figure 4.6).
10. The tunnel construction method, using a tunnel boring machine, will prevent most ingress to the tunnel during and after construction. Such small volumes as may occur would not affect the catchment water balance that may affect river flows and other water users.

Question Fg.1.11

Geology and groundwater

Groundwater movement is (at least in part) a function of the underlying geology, therefore this matter is relevant to ES Chapter 10 (Geology and Soils) as well as ES Chapter 11 (Road Drainage and the Water Environment). The Bored Tunnel Limits of Deviation Plan [APP-019] depicts the Limits of Deviation for the bored tunnel and includes a longitudinal section of the proposed tunnel showing levels (metres above Ordnance Datum) of the upper limit of deviation for the finished road level and for the crown of the tunnel. The postulated groundwater levels would appear to be a potential issue with respect to the construction process.

Can the Applicant clarify the hydrogeological characteristics of the underlying chalk materials and any likely mitigation measures eg dewatering?

Response

1. As set out in the question, groundwater levels would be above the level of tunnel construction in some places. This is depicted graphically in the Figure on page 20 of Annex 1 to Appendix 11.4 of the Environmental Statement [APP-282].
2. The tunnel construction is intended to be by tunnel boring machine which provides mitigation as it allows minimal groundwater ingress and seals the tunnel as it is excavated. Therefore, during construction and operation there would be minimal groundwater ingress to the tunnel, even where the tunnel is being excavated below the water table. Based on the current design and construction methods it is assumed that no dewatering/abstraction of groundwater or surface water would be required. The draft Statement of Common Ground with the Environment Agency, submitted to the Examination at deadline 2, states under Matters Agreed that the EA will be consulted on the relevant aspects of detailed design, construction methods, CEMPs and any subsequent risk assessment and mitigation measures associated with abstraction, as set out in each case in the Requirements and protective provisions in the draft DCO and the Outline Environmental Management Plan [APP-187] in the application documents.
3. The geological and hydrogeological characteristics of the Chalk are described in Section 3.5 and 3.6 of Chapter 11, Appendix 11.4 [APP-282] and as part of the conceptual model [APP-282, Annex 1, Section 3.5.8]. The presence of different geological facies has been considered in terms of the potential for preferential flow horizons and a precautionary approach to modelling which means the tunnel impedes a larger proportion of flow (Section 3.5 of Annex 1 to the Appendix 11.4 [APP-282]) [APP-282]. Following ground investigations in 2018 more detail on geology was made available. Findings in relation to fractures and stratigraphy are provided in Section 3 of the Implications of 2018 Ground investigations to the groundwater risk assessment [AS-017 and AS-023]. The ground investigation data does not change the assessment or conclusions of the ES.

Question Fg.1.12

Geology

Section 10.8.3 of ES Chapter 10 (Geology and Soils) specifies that a protective structure would be installed to protect the Esso oil pipeline against construction impact and the effects of ground settlement of the new road.

It is acknowledged that targeted ground investigation works in this area have not been completed to inform the design, could the Applicant indicate what form this structure is likely to take and the construction of it (or what options would be considered)?

Response

1. Esso has indicated that the protective structure is likely to be a 200mm thick reinforced concrete slab, located below ground level at a height of 450mm to 1000mm above the top of diverted pipeline and a minimum of 250mm below finished road level. The extent and locations of the protective structures or potential alternative options will be determined by Esso through their detailed design and through agreement on construction traffic routes.

Question Fg.1.13

Road drainage strategy

Chapter 2 of the ES states (within 2.3.45) that drainage from the proposed tunnel would be conveyed by a carrier pipe to an 'impounding sump' which would then be removed from site by tanker. ES Appendix 11.3 Road Drainage Strategy [APP-281] provides a description and schematic of this feature. However, the location of this feature within the tunnel and the emptying point (potentially at surface in the WHS) are not currently shown on any plans.

Can the Applicant provide further detailed information on this feature, its associated infrastructure, the resilience measures for the pumped system and the likely approach to transferring drainage waters to tankage, and how these measures will be secured and delivered as part of the DCO (with reference to the Works Plans)?

Response

1. The schematic proposed layout of the tunnel drainage system as set out at Fig 4.1 of the Road Drainage Strategy [APP-281] demonstrates that the impounding sump will be located within the retained cut section close to the eastern portal entrance. The impounding sump will be accessed via the proposed A303 carriageway. A lay-by at the Tunnel Service Building has been proposed within the preliminary design to provide safe access to this feature, to tanker the waters away. This is shown indicatively on Sheet 8 of the General Arrangement Drawings [APP-012] and on the Structures Drawings, Eastern Tunnel Portal, Sheets 10 and 11 [APP-017].
2. The detailed design of the tunnel drainage system will be compliant with the Design Manual for Roads and Bridges (DMRB) Volume 2, Section 2, Part 9 BD 78/99 Design of Road Tunnels. Typical arrangements would include duty/assist/standby pumps so the risk of mechanical failure is addressed and power resilience in the form of a diesel generator.
3. The maintenance strategy for the tunnel drainage system will form part of the Handover Environmental Management Plan (HEMP) to be developed in the latter stages of the scheme as required by the Outline Environmental Management Plan (OEMP MW-G11). The OEMP is secured by Requirement 4 of the draft DCO [APP-020], which requires that the authorised development be carried out in accordance with it.
4. Requirement 10 of Schedule 2 of the DCO [APP-020] sets out that written details of surface water drainage proposals for each part of the Scheme must be approved by the Secretary of State, and that these details must be based on the mitigation measures included in the Environmental Statement (ES), which include the Drainage Strategy.

Question Fg.1.14

Road drainage strategy

The proposed drainage system from the proposed tunnel allows for water to be stored in an impounding sump but also allows for diversion to the highway network (depending on water quality) through the Operator using a control valve to switch flows.

Can the Applicant provide further details on the monitoring schedule, testing regime and thresholds to trigger the diversion of flows to each system?

Response

1. Section 4 of the Road Drainage Strategy [APP-281] describes the principles of the Tunnel Drainage Strategy. All water is initially held in the low point sump. During general use the strategy assumes only waters emanating from ingress through the tunnel lining and are carried in by vehicles and these would be diverted to the highway drainage network. These waters would contain only small concentrations of contaminants associated with the waters carried in by vehicles. These waters would outfall to a ditch. The ditch will act as a sustainable drainage system and treat any contaminants contained within the runoff prior to discharge.
2. In the event of spillage, planned wall washing or as a precaution during any stopped vehicle, accident or fire event, water would be assumed to be contaminated, and it would be diverted and contained in the impounding sump. This assumption negates the need for water quality monitoring schedule, testing regime and definition of thresholds to trigger diversion.
3. This Tunnel Drainage Strategy is compliant with the Design Manual for Roads and Bridges (DMRB) Volume 2, Section 2, Part 9 BD 78/99 Design of Road Tunnels.

Question Fg.1.15

Ground conditions

ES Appendix 10.1 Preliminary Ground Investigation Report [APP-273] references a 'Ground Investigation Gap Analysis Report', produced by AmW, in 2016.

Can the Applicant provide a copy of this report to assist in the decision-making process highlighting with more clarity areas of uncertainty with respect to ground conditions?

Response

1. The Ground Investigation Gap Analysis Report (the Gap Analysis Report) was produced in November 2017 to contribute to the development of the Scheme. As such its contents are historic and have been superseded by the position as set out in the Environmental Statement (ES) submitted in October 2018 [APP-048]. Accordingly, the information contained within the Gap Analysis Report is out of date and consequently is not considered to be of assistance in the current decision-making process.
2. The information presented in the Scheme documentation including ES Chapter 10 Geology and Soils [APP-048] therefore provides the pertinent information and assessment conclusions relating to the Scheme that will assist the ExA in the decision making process. Furthermore, and as has been provided for in ES Chapter 10, Geology and Soils [APP-048] (paragraph 10.8.2), since the ES submission a package of ground investigation has been scoped by Highways England to provide geotechnical, hydrogeological and geo-environmental information in order to contribute to detailed design. This scope includes exploratory holes and geo-environmental testing as well as providing more general spatial coverage. These investigations would precede construction and, in the event that contamination not identified in the ES was discovered, remediation options and strategies would be developed in liaison with the EA. This is pursuant to the process set out by the DCO requirement at Schedule 2 paragraph 7 of the DCO [APP-020].

Question Fg.1.16

Ground conditions

ES Chapter 10 (Geology and Soils) sets out the monitoring works relating to geology and soils at Paragraph 10.8.19. This includes an undertaking that any areas restored to an agricultural land use would be subject to a 5-year period of condition monitoring.

- i. What determines if land is considered agricultural and subject to monitoring?
- ii. Will other land areas subject to restoration/landscaping be subject to similar monitoring?
- iii. Is a plan depicting all areas to be covered by monitoring efforts available to determine the extents of the monitoring regime?
- iv. How will ground conditions be monitored, what would trigger any remedial works, and how would this be secured as part of the DCO?

Response

1. The reference to 'a 5-year period of condition monitoring' in ES Chapter 10, Geology and Soils [APP-048], paragraph 10.8.19, has been superseded by the Outline Environmental Management Plan (OEMP) [APP-187]. As set out in MW-COM4 of the OEMP, restoration of agricultural land will proceed with full consultation between the landowner/tenant and the main works contractor. Subsequent to restoration, the main works contractor shall undertake further inspections of restored agricultural land with the landowner/tenant and Highways England's soils experts to assess the progress of the restoration (MW-COM5). These will be carried out with timing appropriate to any perceived issues or concerns. The OEMP is secured through paragraph 4 of Schedule 2 to the draft Development Consent Order [APP-020].
 - i. **What determines if land is considered agricultural and subject to monitoring?**
2. In response to (i), where not required permanently for the operation of the Scheme or as part of the Scheme's environmental mitigation provision (as set out in the OEMP and the Environmental Mitigation Schedule [APP-186]), land that was used for agricultural purposes immediately prior to the commencement of construction works for the Scheme and taken temporarily for the construction of the Scheme would be restored to agricultural use. All land restored to agricultural use following construction would be restored to its pre-construction condition, as set out in ES Chapter 13, People and Communities [APP-051], Section 13.4, and would be subject to monitoring, as set out in the OEMP [APP-187], item MW-COM5. The OEMP is secured through paragraph 4 of Schedule 2 to the draft Development Consent Order (DCO) [APP-020].
 - ii. **Will other land areas subject to restoration/landscaping be subject to similar monitoring?**

3. Yes - all planting and landscaping will be subject to monitoring by the main works contractor. The principles of creation, management, and monitoring of landscaping are set out in the Outline Landscape and Ecology Management Plan (OLEMP) [APP-267]. Under requirement 8 in Schedule 2 to the DCO, the Applicant will be required to submit a detailed landscaping scheme, which is required to be on the basis of the mitigation measures set out in the ES, which includes the OLEMP. The landscaping proposals are shown indicatively on the Environmental Masterplan, ES Figure 2.5 [APP-059]. As set out in the OEMP [APP-187], item MW-LAN1, the main works contractor will be required to prepare a Scheme-wide Landscape and Ecology Management Plan (LEMP), which will be developed in accordance with industry good practice (MW-LAN1), and will be required to ensure that landscaping works are carried out in accordance with Highways England's approved landscaping scheme (MW-LAN2), as referred to above.

iii. Is a plan depicting all areas to be covered by monitoring efforts available to determine the extents of the monitoring regime?

4. Yes - the full extent of the proposals for agricultural restoration and landscaping are shown indicatively on the Environmental Masterplan, ES Figure 2.5 [APP-059].

iv. How will ground conditions be monitored, what would trigger any remedial works, and how would this be secured as part of the DCO?

5. It is assumed, based on the context set by the preceding questions, that the question is seeking to investigate ground condition monitoring and associated remedial work in the context of agricultural land. As set out in the OEMP [APP-187], where land is to be restored to agriculture, the main works contractor shall liaise with the landowner/tenant and set out the detail for restoration on each specific area of farmland. The land restoration will proceed with full consultation between the landowner/tenant and the main works contractor including inspection of works where applicable and in accordance with requisite site health and safety procedures (MW-COM4). The main works contractor will assess the progress of agricultural restoration by inspections of restored land with the landowner/tenant and Highway England's soils experts (and valuer if required) (MW-COM5). Concerns regarding restored agricultural land will be assessed by all parties against the detail of restoration for each specific area of farmland agreed between the main works contractor and the landowner/tenant, and appropriate remedial actions or compensation agreed within the parameters of the compensation code and/or any previous agreements made at the time of acceptance of the initial restoration works and handover to the landowner/tenant (MW-COM5). The OEMP is secured through paragraph 4 of Schedule 2 to the draft Development Consent Order [APP-020].

Question Fg.1.17

Additional water reports (referred to at the Preliminary Meeting)

If not fully addressed in the relevant Statements of Common Ground, could the relevant parties provide an update on progress with the provision, and initial assessment of, each of the additional reports which have been provided? Please set out areas of common and uncommon ground with reasons.

Response

1. The following groundwater reports have been provided to the Environment Agency and Wiltshire Council:
 - Stonehenge Area Pumping Test 2018 Interpretative Report
 - Stage 4 – Implications of 2018 Ground Investigations to the Groundwater Risk Assessment
 - Stage 4 – Supplementary Groundwater Model Runs to Annex 1 Numerical Model Report
 - Stage 4 – Groundwater Monitoring 2018-19 Conceptual Model Review
2. The Environment Agency has provided final comments on the groundwater reports in a letter dated 17 April 2019. These changes have been made and the reports are now agreed with the Environment Agency and will be submitted for Deadline 3.
3. Wiltshire Council did not highlight any areas of uncommon ground beyond those in the Statement of Common Ground submitted to the Examination at deadline 2. Wiltshire Council commissioned a peer review of the Scheme's approach to flood risk. The peer review's findings and recommendations were provided to Highways England and the comments have been addressed by means of the reports listed above. The Applicant has been advised that the Council sent the reports for external peer review regarding matters for which they are responsible (groundwater flood risk). The Applicant understands that comments will be returned by Wiltshire Council by 10 May 2019.

Question Fg.1.18

Flood risk

Please set out your assessment of the Proposed Development in respect of the flood risk policy, including the application of the Sequential and Exception Tests, in the NPSNN. In responding to this question, please refer to the Applicant's evidence highlighting in particular any areas of disagreement.

Response

1. In order to appropriately respond to this question, the following have been extracted from the supporting Flood Risk Assessment (FRA) [APP-283].
2. The FRA, in paragraph 4.1.1 to 4.1.7 details how the work undertaken meets the criteria of the National Policy Statement for National Networks (NPSNN), paragraphs 5.92 to 5.98.

Paragraphs 5.99 to 5.104, from the NPSNN, are discussed here:

- NPSNN 5.99 – Due to positioning of reprofiled landscape and location of road drainage systems, there is a minor increase in flood depth. However, the change in flood depth does not cause a change in flood risk or flood risk hazard, nor does this occur in an area where vulnerable receptors are located. All development is appropriately flood resilient, sustainable, and is elevated above river crossings and overland flowpaths which would present the greatest flood risk to infrastructure.
 - NPSNN 5.100 – Appendix 11.3 of the updated Road Drainage Strategy and the Statement of Common Ground with Wiltshire County Council submitted at Deadline 2 demonstrates how the drainage strategy has been developed in consultation with Wiltshire Council, as lead local Flood Authority, in line with the principles of sustainable drainage including the Flood and Water Management Act.
 - NPSNN 5.101 – The Environment Agency have not objected on the grounds of flood risk.
 - NPSNN 5.102 – Significant measures have been taken through design to ensure that reasonable steps have been taken to avoid, limit and reduce the risk of flooding, as demonstrated within the FRA (Section 8.2.6 and 8.2.14). There is no risk of flooding to proposed infrastructure and there is no increase in flood risk or flood hazard to vulnerable receptors. Please see response above to NPSNN 5.99.
 - NPSNN 5.103 – In relation to net reduction of flood risk, there are many areas which receive a small benefit from the Scheme. The differences in flood risk are demonstrated within Figure 8-1 of the FRA.
 - NPSNN 5.104 – The infrastructure is not at risk from flooding and therefore remains functional during a forecasted event.
3. The FRA, in Paragraph 4.1.16 explains that the National Planning Policy Framework (NPPF), and paragraph 5.105 of the NPSNN, give preference to locating new development in Flood Zone 1 and that the Sequential Test should

be applied to demonstrate that there are no reasonably available sites in the areas with a lower probability of flooding that would be appropriate to the type of development proposed.

4. The FRA [APP-283] in paragraph 4.1.17 explains that as part of the option selection stage, an appraisal of over 60 different route options was undertaken to inform the selection of the route for the proposed scheme. The route appraisal and selection process involved multi-criteria assessment of the merits of each route against different environmental aspects including consideration of flood risk issues as part of the water environment/water quality and resources appraisal. The relative flood risk of each route, using the Environment Agency fluvial flood zones, was reported in the A303 Amesbury to Berwick Down Scheme Assessment Report (SAR)(REP1-023) and the Technical Appraisal Report (TAR)(REP1-031), which were submitted to the Examination at Deadline 1.
5. The FRA [APP-283] in paragraph 4.1.18 further explained that the Amesbury to Berwick Down Scheme Assessment Report (SAR) and the Technical Appraisal Report (TAR) were subject to statutory and public consultation to communicate the wider sustainability benefits of the project beyond flood risk and informed the decision on selection of the final route for the proposed scheme. The application of the Sequential Test was therefore undertaken through this process.
6. The FRA [APP-283] in Paragraph 7.2.3, confirms that the Exception Test is only required for elements of the proposed development (Essential Infrastructure) in Flood Zone 3, and the appraisal of the proposed scheme has shown that the only elements within Flood Zone 3 are the existing River Avon Bridge crossing (which is remaining as per its existing construction) and minor encroachment of highways drainage systems. Within the FRA [APP-283], Annex 1 (Part A - Fluvial Hydraulic Modelling Report, and Part B Fluvial Hydraulic Modelling Report), it is also demonstrated that the proposed scenario does not have a detrimental impact on flood risk and as such meets the requirements of the Exception Test.
7. The FRA [APP-283] in paragraph 7.2.8, explains in relation to the River Till, the Exception Test is only required for elements of proposed development (Essential Infrastructure) in Flood Zone 3. The appraisal of the proposed Scheme has shown that elements positioned within Flood Zone 3 include the River Till viaduct piers and slight encroachment of landscape profiling of embankment to the east of the River Till. The temporary work located within Flood Zone 3 is the River Till Haul Route. Within Annex 1 (Part A and Part B) of the FRA, it is demonstrated that under both proposed and temporary scenarios, neither have a detrimental impact on flooding to the satisfaction of the Exception Test.

Question Fg.1.19

Flood risk

The OEMP [APP-187] sets out specific measures for hoarding and fencing in areas at risk of flooding, explicitly referring to the River Till floodplain.

Should this be expanded to specifically also apply to the River Avon floodplain and if not, why?

Response

1. Section MWG28 of the OEMP [APP-187] explicitly refers to River Till floodplain due to the greater work taking place in this area. However we have also added specific reference to the River Avon floodplain in the updated OEMP that will be provided at deadline 3.

Question Fg.1.20

Flood risk

The RR from Wiltshire Council [RR-2365] raises a concern that the infiltration systems are to be designed for 100yrs + 30% climate change increase, but the pluvial modelling of general surface water runoff allows for a 40% increase. The Ground Water Risk Assessment [APP-282] allows for an increase in recharge of 20%. There are interdependencies between these in terms of flood risk and the design approach for drainage.

Please provide an explanation for the apparent inconsistencies and evidence to reassure the ExA that this has not resulted in any under or over estimates in the other studies.

Response

1. The National Policy Statement for National Networks (NPSNN) requires that the potential impacts of climate change using the latest UK Climate Projections available should be taken into account and appropriate mitigation or adaptation measures identified which cover the estimated lifetime of the new infrastructure. Highways England has complied with this requirement in the following manner.
2. Rainfall affects the likelihood of flooding and its speed of onset differently over land (e.g. a road or surface water flow) and in a groundwater aquifer. Unlike on the surface where a single rainfall event can trigger flooding within one or several hours, groundwater responds to rainfall events that take place over a period of weeks or months. Additionally, only a proportion of any rainfall percolates into a groundwater aquifer as some will run off over land into drains or watercourses. These different flooding mechanisms are therefore reflected in different climate change allowances, as set out in the question above.
3. In accordance with the Design Manual for Roads and Bridges (DMRB), separate systems are used to a) manage rainfall runoff from the road and to b) manage rainfall runoff from the surrounding land.
4. For the road drainage design, DMRB guidance in document HD33 on taking account of climate change was applied to manage the predicted rainfall that would be experienced by the road catchment. HD33 guidance requires the design solution to incorporate a 20% uplift in peak rainfall intensity and a sensitivity test with a 40% uplift in peak rainfall intensity, to enable an understanding of the range of impact between climate change risk scenarios. For this Scheme, it was determined that a more conservative approach was appropriate, due to the stage of design and the need to ensure sufficient land was included within the Red Line Boundary to accommodate the necessary road drainage features. Therefore, it was decided to adopt a precautionary approach and apply a 30% uplift in peak rainfall intensity as the design value, along with the 40% sensitivity test. The sensitivity testing showed that there would be no flooding from the Scheme with 40% uplift in climate change applied, as outlined

in the results of the ES (Appendix 11.5, Flood Risk Assessment sections 7-9, [APP-284]).

5. For the land drainage design that would manage surface water flooding, the rainfall catchment of the Scheme's surrounding land was considered. The current UK Government guidance on climate change allowances for surface water flood risk [<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>] (2016, which remains unchanged in the 2019 guidance) was applied, including a 40% uplift in peak rainfall intensity. The ES concluded that the land drainage design ensured no flooding would be caused from the Scheme up to and including the 40% rainfall intensity scenario (Environmental Statement (ES) Appendix 11.5, Flood Risk Assessment sections 7-9, [APP-284]).
6. There is no published guidance specifying the way that climate change should be considered in a groundwater risk assessment. The methodology for this Scheme's groundwater risk assessment was agreed with the Environment Agency, as documented in the Statement of Common Ground. The groundwater model was modified to take account of climate change predictions by increasing the recharge into the aquifer by 20% (ES Appendix 11.4 [APP-282]).
7. The design of the road and land drainage systems took into consideration the maximum predicted groundwater levels from the groundwater risk assessment. All the basins' invert levels are placed a minimum 1m above predicted maximum groundwater levels and there is no potential for groundwater to flow into them or impede infiltration. For locations where, predicted maximum groundwater levels are high enough to potentially impede infiltration, conveyance of water via ditches into the River Till was the chosen drainage strategy.
8. Therefore, this methodology has not resulted in any under or over estimates in any of the other studies.

Question Fg.1.21

Flood risk and drainage

Please identify where any increases in runoff compared to the existing road drainage design is anticipated and set out how this would be managed/mitigated.

Response

1. The majority of the existing A303 carriageway to the west of the tunnel would be retained as local access routes. The proposed highway catchments shown within Figure 2.2 of the Road Drainage Strategy [APP-281] have therefore been assumed to be new impermeable areas which would increase runoff. The plan area of these preliminary catchments has been quantified in the table within the figure (see Figure Fg1.21).
2. Although the new impermeable areas would increase runoff, the proposals described in the Road Drainage Strategy, paragraphs 3.2 to 3.28 [APP-281] would mitigate this increase. The runoff would be conveyed to the Drainage Treatment Areas (DTA's) and then discharged directly to ground via infiltration. By utilising full infiltration to discharge the runoff the risk of increasing runoff from the site would be eliminated, as there would be no discharge to a surface water body or overland.
3. The runoff would be retained within the DTA's for up to 24 hours as it would discharge to ground via a filtration treatment system ensuring compliance with water quality requirements.
4. Throughout the length of the tunnel the existing A303 carriageway and therefore impermeable area would be removed and returned to grass. With the reduction in impermeable area there would be a decrease in runoff.
5. The existing A303 road drainage system in the vicinity of Countess Roundabout currently discharges the runoff un-attenuated directly to the river Avon. Further information is provided in the Environmental Statement Chapter 11 - Road Drainage and the Water Environment, paragraph 11.6.24 [APP-049]. The proposed road drainage catchments east of the tunnel are shown within Figure 2.2 of the Road Drainage Strategy [APP-281]. Further details on the proposals to reduce runoff rates and the commitment to provide 20% betterment over the existing situation at Countess Roundabout can be found in Section 5 of the Road Drainage Strategy [APP 281].

Question Fg.1.22

Flood risk and drainage

You have raised a number of matters in respect of the proposed use of a culvert in the drainage modelling, including that it would be contrary to the Council's policy on culverting.

Please provide a copy of this policy and indicate its status in planning decision making?

Response

1. Wiltshire Council's comments have been addressed and a new proposal has been developed which removes the 539m long culvert. This refined road drainage proposal has been verbally agreed with Wiltshire Council pending their review of the revised pluvial modelling. Discussions between the parties are ongoing on this issue and have been captured in the draft Statement of Common Ground (SoCG) being prepared between the two parties, which will be made available to the Examination at Deadline 2. The new proposals represent a minor change to the Road Drainage Strategy [APP-281], also to be issued at Deadline 2 and do not impact on the findings or conclusions of the Environmental Statement

Question Fg.1.23

Flood risk and drainage

The RR from Wiltshire Council [RR-2365] raises specific concerns in respect of the use of a proposed culvert. Please provide:

- i. Details of this part of the proposed drainage infrastructure.
- ii. Evidence as to why this option was considered to be the best/most appropriate.
- iii. Details of what other options were considered and why these were discounted.
- iv. A commentary as to how, if at all, Wiltshire Council's policy on culverting was taken into account.
- v. Details of what consideration has been given to the risk of blockages, and how could this be mitigated and secured in the DCO.
- vi. Details of what arrangements would be put in place for monitoring and maintenance of this feature.

Response

1. Subsequent to review of Wiltshire Councils Relevant Representation, a new proposal to convey and discharge the flood waters has been developed. The long culvert in question has been replaced with a shorter culvert which diverts the flood flows beneath the proposed A303 from north to south. This refined road drainage proposal has been verbally agreed with Wiltshire Council pending their review of the revised pluvial modelling. Discussions between the parties are ongoing on this issue and have been captured in the draft Statement of Common Ground (SoCG) being prepared between the two parties, which will be made available to the Examination at deadline 2.
2. These measures remain consistent with the design outlined in Chapter 2 of the Environmental Statement [APP-040] and the mitigation measures described in the Environmental Statement. The new proposals do not impact on the findings or conclusions of the ES. However, the Drainage Strategy submitted with the application, Environmental Statement Appendix 11.3 - Road Drainage Strategy [APP-281], has been updated to reflect this change and will be submitted to the Examination at at Deadline 2.

Question Fg.1.24

Water quality

With reference to the applicant's Water Framework Compliance assessment [APP-280], please expand on your concerns that the proposed use of a culvert may be against 'many' of the requirements of the Water Framework Directive.

Response

1. The 539m culvert highlighted by Wiltshire Council no longer forms part of the proposed Scheme and alternative road drainage measures have been verbally agreed with them, pending their review of the revised pluvial modelling. The refined proposal includes a culvert to divert the flood flows beneath the proposed A303 from north to south. From here the runoff would be conveyed in a ditch before out-falling into a culvert which would convey the water from the west of the B3083 to the east into the dry valley. The refined proposal would maintain the existing path of the overland flood flows.
2. These measures are consistent with the design outlined in Chapter 2 of the Environmental Statement [APP-040] and the mitigation measures described in the Environmental Statement. The new proposals do not impact on the findings or conclusions of the ES. However, the Drainage Strategy submitted with the application, Environmental Statement Appendix 11.3 - Road Drainage Strategy [APP-281], will be updated to reflect this change and will be submitted to the Examination by Deadline 2.

Question Fg.1.25

Flood risk

Please provide a response to the specific concerns/requests for clarification set out in paragraphs 66-69 of the RR from Wiltshire Council [RR-2365].

Response

1. Responses to the specific concerns raised by Wiltshire Council have been provided in the reply to the relevant representations [AS-026] and are repeated below for ease of reference.
 - i. **The current model results for the Scheme show that the modelled water levels are still rising at the end of the model run. The model results therefore do not capture flood risk accurately.**
 2. Highways England have discussed this detailed point with Wiltshire Council and, as such, updated and additional hydraulic modelling has been produced to provide Wiltshire Council with more detail regarding the modelling undertaken in response to this query. The updated FRA [APP-283], Section 4.2.3 of Annex 1 Part B (Pluvial Hydraulic Modelling Report) to be submitted to the Examination at Deadline 3 demonstrates that this no longer occurs and meets the requirements of the peer review comment.
 - ii. **There is an increase in flood risk due to the proposed Scheme.**
 3. Overall, the FRA [APP-283] concludes that there is low flood risk arising to or from the Scheme for all forms of flooding. The FRA demonstrates that there is a small and localised increase in flood depth. However, there is no increase in flood risk to vulnerable receptors as the increase is contained within the confines of the existing floodplain.
 - iii. **In order to generate confidence in the approach and outputs, the following points should be addressed:**
 - a. Sensibility / verification check of Depth-Duration-Frequency (DDF) modelling from Flood Estimation Handbook (FEH) with local rainfall data (15-minute data should be available) which could affect design inputs to the model.
 - b. Further discussion and sensitivity testing of the initial soil moisture content (Cini) value to be utilised in the project is required as the value is based on baseline catchment descriptors only.
 4. Highways England have discussed this detailed point with Wiltshire Council and, as such, updated and additional hydraulic modelling has been produced to provide Wiltshire Council with more detail regarding the modelling undertaken in response to this query.
 5. Regarding the points at (a), FEH Vol 2, Section 12.2 states that local rainfall data should not be used in comparison with DDF rainfall model outputs. Specifically,

this states that 'where users have access to rainfall records of a more realistic length (even 50-100 years), it is recommended in most cases that local data analyses should not be used to adjust FEH rainfall frequency results'. A similar recommendation was made by the FSR (Volume II, Section 1.13). The reason that this advice differs for that given in flood frequency estimation is that rainfall is a much more spatially consistent variable than river flow, affected less by local features. The addition of local rainfall records is therefore much less likely to be significantly improve an estimate than the addition of local flow records. Highways England has advised Wiltshire Council of this guidance.

6. With reference to (b) above, the updated FRA [APP-283], Section 2.4 of Appendix 11.5 (Annex 1 Part B) to be submitted to the Examination at Deadline 3 demonstrates that the peer review comments have been addressed.
- iv. **Furthermore, there are several queries and items that are required to be answered or addressed from the hydraulics study:**
 - a. The Triangular Irregular Networks (TINS) utilised to define the option topography should be better integrated with the underlying Light Detection and Ranging (LIDAR). There appears to be a 1m difference / step at the interface of the baseline Digital Terrain Model (DTM) and the proposed scheme.
 - b. There is conflicting information as to the design of the proposed culvert dimension which requires clarification / changes. There is no justification as to the dimension of the pipe required and no sensitivity testing of results of different sizes of culvert.
 - c. The model should be run for a longer simulation time as water levels are still rising at the current end-time of 10 hours. It will be important to test other storm durations, culvert sizes, (and model simulation length) to optimise the scheme.
 - d. The study does not consider the risk of blockage of the proposed culvert. Culverting of watercourse is often opposed by councils and the Environment Agency as it is against many of the legal requirements set out in the Water Framework Directive (2003) that the quality of the watercourse should not be reduced. At 539m long and buried to up to 5m deep, the maintenance of such an asset would be extremely difficult and expensive should a repair be required.
 - e. The proposals need to confirm who will own the culvert, who will be responsible for maintenance, and what the maintenance regime will be.
 - f. The proposals need to evaluate the resulting depth of flooding and flood hazard adjacent / across / downstream of the B3083 post scheme.
7. With respect to the previous 539m long culvert, the design has now been removed from the design in line with Wiltshire Councils comments.
8. The refined proposal includes a culvert to divert the flood flows beneath the proposed A303 from north to south. From here the runoff would be conveyed in a ditch before out-falling into a culvert which would convey the water from the west

of the B3083 to the east into the dry valley. The refined proposal would maintain the existing path of the overland flood flows. The culvert beneath the A303 will be owned and maintained by Highways England and the significantly shorter culvert beneath the B3083 will be owned and maintained by Wiltshire Council.

9. These measures are consistent with the design outlined in Chapter 2 of the Environmental Statement [APP-040] and the mitigation measures described in that chapter of the Environmental Statement. The new proposals do not impact on the findings or conclusions of the ES. However, the Drainage Strategy submitted with the application, Environmental Statement Appendix 11.3 - Road Drainage Strategy [APP-281], will be updated to reflect this change and will be submitted to the Examination at Deadline 2.
10. Highways England have discussed this detailed point with Wiltshire Council and, as such, updated and additional hydraulic modelling has been undertaken to provide Wiltshire Council with more detail regarding the modelling undertaken in response to this query. The peer review comments have been addressed and are scheduled to be submitted to Wiltshire Council for confirmation and peer review sign off in May 2019.

Question Fg.1.26

Blick Mead – hydrology

- i. Please provide an update on the hydrological monitoring at Blick Mead and what additional investigation and monitoring has been undertaken to date.
- ii. Please provide an update on the discussion about how this data is to be used and the implications for the tiered assessment.

Response

- i. Please provide an update on the hydrological monitoring at Blick Mead and what additional investigation and monitoring has been undertaken to date.**
 1. Details of hydrological monitoring are provided in the report on groundwater monitoring at Blick Mead (Blick Mead monitoring to March 2019 HE51506-AMW-EWE-SW_GN_000_ZZ-TN-WR-0015, April 2019) [AS-022]).
 2. In summary, Highways England commenced monitoring at two stilling wells at Blick Mead in August 2018. Five boreholes, one stilling well and two staff gauges were added in November 2018. Monitoring of groundwater levels and surface water levels is ongoing.
- ii. Please provide an update on the discussion about how this data is to be used and the implications for the tiered assessment.**
 3. The monitoring results have been used to confirm the conceptual model set out in the tiered assessment (Annex 1 of [APP-282]). The tiered assessment concluded that the Mesolithic deposits at Blick Mead currently remain wetted by the underlying Chalk / sands and gravel aquifer under normal conditions but water levels can drop below the upper level of the Mesolithic deposits when groundwater levels are seasonally low or there is a natural drought. By confirming the conceptual model, the monitoring also confirms the conclusions of the ES that the Scheme will have a negligible effect on the hydrogeology of Blick Mead. A note on the proposals for additional monitoring (HE51506-AMW-EWE-SW_GN_000_ZZ-TN-WR-0127) [REP1-007] was submitted for Deadline 1 and summarises how the ES assessed effects at Blick Mead and concluded that they are not significant, the development of the tiered assessment, the installation of the monitoring locations, ongoing monitoring and why additional monitoring installations are not required.

Question Fg.1.27

Blick Mead – hydrology

- i. Please provide an update on the provision of water meters at Blick Mead and the related data.
- ii. What timescales are necessary to secure an appropriate baseline and, if this has not been completed, what are the implications and how could any mitigation be secured through the DCO?

Response

- i. **Please provide an update on the provision of water meters at Blick Mead and the related data.**
 1. Details of ‘water meters’ (i.e. water level monitoring installations including staff gauges, stilling wells and boreholes with piezometers and data loggers) and the related data are provided in the report on groundwater monitoring at Blick Mead (Blick Mead monitoring to March 2019 HE51506-AMW-EWE-SW_GN_000_ZZ-TN-WR-0015, April 2019 [AS-022]). In summary, monitoring is ongoing. As explained in that report, these water meters were provided as part of the Applicant's commitment to ongoing monitoring at this location (as noted at paragraph 11.3.14 of the ES [APP-049]). This data is not required to inform the EIA. The monitoring results confirm the conceptual model set out in the tiered assessment and confirm the conclusions of the ES that the Scheme will have a negligible effect on the hydrogeology of Blick Mead.
- ii. **What timescales are necessary to secure an appropriate baseline and, if this has not been completed, what are the implications and how could any mitigation be secured through the DCO?**
 2. A twelve-month period is commonly used to define a hydrological baseline because it covers the seasonal lows and highs. A low water level and high-water level period have already been recorded (autumn 2018 and spring 2019) at Blick Mead [AS-022] and span the extremes of a typical twelve-month period. This is sufficient as a baseline and for correlation with long term records. There is no guarantee that conditions recorded over a typical twelve months will be representative of extremes. Therefore, the effects of the Scheme were assessed under a wider range of conditions than those likely to be experienced in a single year and include data from the drought of 1976 and floods of 2014. There is no prediction of significant effects of the assessed Scheme on the hydrology at Blick Mead and therefore mitigation is not necessary [Chapter 11, APP-049 paragraphs 11.9.6 and 11.9.7].

Question Fg.1.28

Blick Mead – hydrology

- i. What consideration has been given to hydrological monitoring (and any associated remediation, if required) at Blick Mead during the construction and operational phases of the proposed development.
- ii. How would this be secured through the DCO?

Response

- i. What consideration has been given to hydrological monitoring (and any associated remediation, if required) at Blick Mead during the construction and operational phases of the proposed development.**
 1. Monitoring of water levels in ponds, the River Avon, and groundwater monitoring boreholes in the River Avon valley around the Blick Mead archaeological area is ongoing and will continue, subject to access. This is being undertaken as part of the Applicant's commitment to ongoing monitoring at this location (as noted at paragraph 11.3.14 of the ES [APP-049] and described in the response to Question Fg1.26).
- ii. How would this be secured through the DCO?**
 2. No significant effects are predicted on the hydrology at Blick Mead [APP-49 paragraphs 11.9.6 and 11.9.7]. As such there is no requirement for additional monitoring of significant effects throughout the construction or operational phases and no need for it to be secured in the DCO.

Question Fg.1.29

Blick Mead – hydrology

- i. What consideration has been given to hydrological monitoring (and any associated remediation, if required) at Blick Mead during the construction and operational phases of the proposed development.
- ii. How would this be secured through the DCO?

Response

1. RR Para 71 - Highways England acknowledges Wiltshire Council's recognition that the groundwater study approach and methods are sound and appropriate. Highways England has continued to engage with Wiltshire Council to understand and address the inconsistencies and omissions referred to. This engagement focussed on the matters of groundwater flood risk, for which Wiltshire Council is the relevant statutory body. Meetings with Wiltshire Council have also been attended by the Environment Agency (the statutory body responsible for other groundwater matters). Further detail has been reported and modelling undertaken to address concerns as reported in the following:
 - Supplementary Groundwater Model runs to Annex 1 numerical model report [AS-021]
 - Implications of 2018 Ground investigations to the groundwater risk assessment [AS-023]
 - Stonehenge Area Pumping Test 2018 Interpretative Report [AS-024]
 - Groundwater Monitoring 2018-19 Conceptual model review [AS-025]
2. Ongoing discussion and agreement on this matter will be captured through the Statement of Common Ground being prepared between the two parties, a draft of which will be made available to the Examination at deadline 2.
3. RR Para 72 - The water assessment, as set out in ES Appendix 11.6, Non-Significant Effects [APP-284], identifies non-significant effects on the water environment, including groundwater. The potential for in-combination effects is considered through the assessment of cumulative effects, as reported in ES Chapter 15 [APP-053]. The assessment of cumulative effects does not identify any significant effects on groundwater as a result of in-combination non-significant effects (para 15.3.2).
4. RR Para 73 - Groundwater modelling was undertaken in close consultation with the road drainage and pluvial modelling teams and has informed both the pluvial study and the Road Drainage Strategy. The general approach to the road drainage and water environment assessment, which includes cross-referencing between the groundwater and pluvial studies, is set out in ES Chapter 11 [APP-049]. The Road Drainage Strategy [APP-281] makes multiple references to groundwater monitoring and modelling in the context of road drainage, including, but not limited to, in Section 2.4 Hydrology and Geology.

Question Fg.1.30

Drainage and groundwater

Please provide details of the maintenance regime for the drainage treatments areas and how this would be secured as part of the DCO.

Response

1. The infiltration basins will be owned and maintained by Highways England. Information regarding the maintenance for the sustainable drainage systems (SuDS) features is provided in section 8 of the Road Drainage Strategy [APP-281]. They will require quarterly inspections and regular maintenance including an annual assessment of the requirement for sediment removal.
2. The maintenance proposals in the Drainage Strategy are secured at requirement 10 of Schedule 2 of the draft DCO [APP-020], which provides that written details of surface water drainage proposals for each part of the Scheme must be approved by the Secretary of State prior to commencement of development for that part. These details must be based on the mitigation measures included in the Environmental Statement (ES), which includes the Drainage Strategy, which is Appendix 11.3 to the ES [APP-281].

Question Fg.1.31

Drainage

Please provide details of the proposal for the conveyance of the drainage water to the drainage treatment areas.

Response

1. The runoff will be conveyed to the treatment areas via carrier pipes, as stated in paras 3.2.1 and 5.2.2 of Environmental Statement Appendix 11.3 - Road Drainage Strategy [APP-281]. As explained in para 3.2.1, the use of carrier pipes would ensure that spillages are contained within the drainage system and do not infiltrate to ground close to source.
2. The carrier pipe routes to the Drainage Treatment Areas (DTAs) are within the proposed order limits.

Question Fg.1.32

Drainage and the Outline Environmental Management Plan

In [RR-2060] the Environment Agency set out a number of concerns in respect of the drainage strategy and the OEMP.

Can the Applicant provide comments on these concerns and can both parties set out any further agreement which has been reached on these matters and indicate what, if any, updates to the specified components of the OEMP (MW-WAT1, MW-WAT2, MW-WAT7, and MW-WAT9) have been made as a result of further discussions?

Response

1. Discussions on the issues raised by the Environment Agency (EA) on the Road Drainage Strategy [APP-281] are ongoing and these issues have been captured in the draft Statement of Common Ground (SoCG) being prepared between the two parties, which will be made available to the Examination at deadline 2. The issues raised by the EA related to the level of detail provided within the submission of the filtration treatment systems and the provision of spillage control within the drainage design. It has been agreed that the level of detail provided within the strategy is satisfactory and reassurance has been provided that consultation with the EA will continue during the detailed design of the infiltration drainage systems. Further details are also provided in section 20 of the Relevant Representation Report submitted to the Examination at Deadline 1 [AS-026], which provides a response to the points made by the EA in its relevant representation.
2. As required by the Outline Environmental Management Plan (OEMP item MW-G5) [APP-187], the EA will also be consulted as the Construction Environmental Management Plan (CEMP) is developed by the contractor, including the contents of the Water Management Plan and in relation to pollution control. Additionally, requirement 10 of the draft DCO [APP-020] requires details of the proposed drainage system for the respective part of the scheme to be submitted to and approved by the Secretary of State prior to commencement of construction of that part. This will be when the detail on these matters is able to be provided; however, the Applicant notes that items MW-WAT 3, 4, 5 and 7 in the OEMP also provide more information in relation to pollution control issues. Compliance with the OEMP is secured through paragraph 4 of Schedule 2 to the draft DCO.
3. There are no areas designated as Source Protection Zone 1 within the scheme's boundary, so the suggestion in relation to MW-WAT 7 in the representation [RR-2060] is not necessary.
4. The Applicant continues to engage with the Environment Agency on these matters, which will be reflected in the draft SOCG between the parties to be submitted to the Examination at deadline 2.

Question Fg.1.33

Drainage

Wiltshire Council [RR-2365] raise a concern that crate storage systems are proposed as part of the road drainage strategy. Please provide:

- i. Details of the locations and extents to which this infrastructure is likely to be utilised.
- ii. Details of what access, monitoring and maintenance arrangements would be put in place and how would these be secured.
- iii. Details of what arrangements would be put in place to mitigate a scenario where the system was not functioning as designed.
- iv. Details of what alternatives were considered and why have these been discounted.

Response

- i. **Details of the locations and extents to which this infrastructure is likely to be utilised.**
 1. The crate storage systems would be located under the central reserve of the proposed A303 and are proposed within the retained cut sections within the WHS, represented by catchments 8 and 11 in Figure 2.2 of Environmental Statement Appendix 11.3 - Road Drainage Strategy [APP-281]). Paragraphs 3.2.6, 5.2.4 of the Road Drainage Strategy provide further information on the systems. The crate system will be utilised to infiltrate the highway runoff, through a filtration system directly to ground.
 2. Crate storage was chosen in this locality to provide a sustainable drainage system which removes any negative impacts upon the WHS in terms of landtake or visual intrusion. The system complies with sustainable drainage principles by discharging the runoff at source and doesn't require continuous pumping. The proposed crate system also matches the existing highway by discharging at source but provides betterment in terms of attenuation and the quality of the runoff entering the ground.
- ii. **Details of what access, monitoring and maintenance arrangements would be put in place and how would these be secured.**
 3. The inspection and maintenance requirements of the system will be captured within the Handover Environmental Management Plan (HEMP, as referenced in item MW-G11 of the Outline Environmental Management Plan (OEMP) [APP-187], issued post construction of the Scheme. With regard to the issues raised by Wiltshire Council regarding maintenance of the systems, it should be noted that this section of the A303 will be owned and maintained by Highways England so Wiltshire Council will have no maintenance liability for this.

iii. Details of what arrangements would be put in place to mitigate a scenario where the system was not functioning as designed.

4. The drainage strategy includes a tank, sump and pump solution to operate when the groundwater is at its maximum level limiting or preventing infiltration (see Environmental Statement Appendix 11.3 - Road Drainage Strategy, [APP-281] paragraph 3.2.7, 3.2.8). If the grate system becomes blocked then a similar scenario would apply with water prevented from infiltrating to ground. In both situations the emergency system would begin operation to pump the water to a point where infiltration can occur.

iv. Details of what alternatives were considered and why have these been discounted.

5. Alternative solutions considered during preliminary design included:
 - Capturing all runoff from all rainfall events at the tunnel entrance in a sump and pumping vertically to either a pond or larger tank within the WHS. This option was discounted because of the need to operate the pumps during every rainfall event.
 - Capturing runoff at the tunnel entrance in a sump and pumping back to the Drainage Treatment Areas (DTA) at Longbarrow junction. This option was discounted because of the need to pump all rainfall events and the length of rising main required to convey the flow to the DTA.
 - Taking runoff into a tunnel drainage system. This was discounted because of the volume of flows from the roads external to the tunnel. This would adversely impact the size of the tunnel drainage infrastructure and also require pumping from the tunnel low point during every rainfall event.

Question Fg.1.34

Drainage, groundwater and contamination

- i. What capacity would there be within the road drainage system to accommodate pollution spills?
- ii. What consideration has been given to designing the drainage treatment areas to be capable of holding any contaminated discharges before entering the infiltration zone?
- iii. Why are such parameters not set out in the drainage strategy [APP-281]?

Response

i. What capacity would there be within the road drainage system to accommodate pollution spills?

1. The road drainage for the scheme will be designed, constructed and maintained to Design Manual for Roads and Bridges (DMRB) standards. Spillage containment will be provided within the detailed design of the systems and the containment volume confirmed following consultation with the Environment Agency in line with requirements of design standard DMRB Volume 4 Section 2 Part 1 HA103 "Vegetative Treatment Systems for Highway Runoff" Clause 4.15. Paragraph 2.2 of the Road Drainage Strategy [APP-281] outlines the key drainage design standards.

ii. What consideration has been given to designing the drainage treatment areas to be capable of holding any contaminated discharges before entering the infiltration zone?

2. The holding of contaminated discharges has been considered and incorporated into the design proposals. The infiltration basins will be lined with filtration material designed to retain the majority of contaminants, as set out at paragraph 3.2.3 of the Road Drainage Strategy [APP-281]. Any contaminants that do pass through this layer will be attenuated in the unsaturated layer, which is the layer of ground between the bottom of the basin and the top of the groundwater table. This is designed to be at least 1m deep. The choice of material to meet the requirements will be determined at the detailed design stage.
3. Requirement 10 of Schedule 2 of the draft Development Consent Order (DCO) [APP-020] stipulates that written details of surface water drainage proposals for each part of the Scheme must be approved by the Secretary of State, and that these details must be based on the mitigation measures included in the Environmental Statement (ES). The Road Drainage Strategy is appended to the ES and as such, the drainage system to be submitted for approval must be based on the mitigation measures included within it.

iii. Why are such parameters not set out in the drainage strategy [APP-281]?

4. The concept to provide a filtration system to treat the runoff is described in the Road Drainage Strategy ([APP-281] paragraph 3.2.3). The specification of the

filtration treatment system type will be determined during detailed design, with the EA consulted on the proposals.

Question Fg.1.35

Drainage, groundwater and contamination

- i. What risk assessment has been carried out as to the propensity for the infiltration within the drainage treatment areas to be restricted by a build-up of sediment?
- ii. How could this be mitigated and how could such mitigation be secured through the DCO?

Response

- i. **What risk assessment has been carried out as to the propensity for the infiltration within the drainage treatment areas to be restricted by a build-up of sediment?**
 1. The risk of sedimentation and blinding of the base has been considered within the preliminary design for the basins. Because of this and other risk issues, design guidance (The SuDS Manual 2015 (CIRIA C753)), recommends applying a factor of safety (level of resilience in the design) of 10 to the discharge infiltration rate when undertaking detailed design. At this preliminary design stage a factor of safety of 20 was applied, thus ensuring suitable resilience within the preliminary design. Further information on design infiltration rates is outlined in the Road Drainage Strategy paragraph 2.4.3 [APP-281].
- ii. **How could this be mitigated and how could such mitigation be secured through the DCO?**
 2. The road drainage for the scheme will be designed, constructed and maintained to Design Manual for Roads and Bridges standards. The risk of sedimentation of the base is one of the key considerations when undertaking the detailed design. Information regarding the inspection and maintenance regime for a range of SuDS features is provided in section 8 of the Road Drainage Strategy [APP-281]. Requirement 10 of Schedule 2 of the draft Development Consent Order (DCO) [APP-020] stipulates that written details of surface water drainage proposals for each part of the Scheme must be approved by the Secretary of State, and that these details must be based on the mitigation measures included in the Environmental Statement (ES). The Road Drainage Strategy is appended to the ES and as such, the drainage system to be submitted for approval must be based on the mitigation measures included within it.

Question Fg.1.36

Drainage, groundwater and contamination

A proprietary treatment system is proposed as part of the drainage treatment areas.

- i. Please provide details of this system including how particulates and chemical contaminants will be treated.
- ii. Please also set out the monitoring and maintenance arrangements for the system.

Response

- i. **Please provide details of this system including how particulates and chemical contaminants will be treated.**
 1. The Road Drainage Strategy [APP-281] paragraph 3.2.3 describes a filtration treatment system to treat the highway runoff. The filtration material will be designed to retain the majority of contaminants. Any contaminants that do pass through this layer will be attenuated in the unsaturated layer, which is the layer of ground between the bottom of the basin and the top of the groundwater table. This is designed to be at least 1m depth. The materials chosen to achieve the required water quality objectives will be determined during detailed design following consultation with the Environment Agency.
- ii. **Please also set out the monitoring and maintenance arrangements for the system**
 2. Information regarding the maintenance and inspection regime for the sustainable drainage systems (SuDS) features is provided in section 8 of the Road Drainage Strategy [APP-281]. The infiltration basins will require quarterly inspections and regular maintenance including an annual assessment of the requirement for sediment removal. The monitoring and testing requirements for the filtration treatment system will be determined following the determination of material type

Question Fg.1.37

Flood risk and drainage

- i. What consideration has been given to the effect of the road drainage (including, but not limited to the drainage treatment areas) on the surrounding land in terms of the impact on existing overland flows?
- ii. Is any mitigation necessary and how would this be secured through the DCO?

Response

- i. **What consideration has been given to the effect of the road drainage (including, but not limited to the drainage treatment areas) on the surrounding land in terms of the impact on existing overland flows?**
 1. The Road Drainage Strategy [APP-281] para 3.2.4 describes the Drainage Treatment Areas (DTA) and the consideration of risk of exceedance flows from the DTA's. Paragraph 3.2.9 to 3.2.13 and 5.2.7 to 5.2.9 [APP-281] describe the proposals to manage and mitigate overland flow intercepted by the new highway.
 2. The new land drainage systems, which are completely independent of the road drainage systems will take the form of ditches or filter drains. These land drainage systems will divert the overland or piped flows from the fields to either a watercourse or a location suitable for infiltration.
 3. The detailed design of the land drainage systems will be in accordance with the Design Manual for Roads and Bridges (DMRB) HA 106.
 4. Requirement 10 of Schedule 2 of the draft Development Consent Order (dDCO) [APP-020] sets out that written details of surface water drainage proposals for each part of the Scheme must be approved by the Secretary of State, prior to commencement, and that these must be based on the mitigation measures included in the Environmental Statement, which includes the Road Drainage Strategy [APP-281], which is Appendix 11.3 to the ES.
- ii. **Is any mitigation necessary and how would this be secured through the DCO?**
 5. The Flood Risk Assessment [APP-283] considers locations where road drainage features coincide with overland flow of water. These have been identified at Parsonage Down (paragraph 8.3.1). At these locations the effect of road drainage features has been assessed through hydraulic modelling and no mitigation is required. For example, in the area east of Parsonage Down a road drainage pond will be located within close proximity to a surface water flow pathway through the valley. This drainage pond is included within the hydraulic model and the assessment is detailed within the Pluvial Hydraulic Modelling Report- Annex 1 Part B of the FRA [APP-283]. Results presented within Section 4 of this Annex do not demonstrate an adverse impact upon existing overland flow, and there is no need for mitigation in relation to the impact the road drainage feature has on overland flows at this location.

Question Fg.1.38

Flood risk and drainage

The NPSNN requires that the DCO (or any associated planning obligations) need to make provision for the adoption and maintenance of any SuDS. Row 5.100 in Table A1 [APP-294] indicates that the dDCO includes a draft Requirement (10) relating to drainage. As currently drafted the Requirement does not make any reference to adoption or maintenance.

How will future maintenance be secured, for example should the Requirement be expanded to incorporate this?

Response

1. The Drainage Treatment Areas will be owned and maintained by Highways England. Information regarding the maintenance regime for the Sustainable Drainage Systems (SuDS) features is provided in Section 8 of the Drainage Strategy [APP-281], which itself is secured by requirement 10 of the draft DCO [APP-020].
2. Future maintenance procedures for the drainage systems are set out within the Outline Environmental Management Plan (OEMP) [APP-187] (See table 3.2b Ref. MW-G11). This provides that a Handover Environmental Management Plan must be drawn up at the end of the construction phase, specifying maintenance obligations. The provisions of the OEMP are secured within requirement 4 of the draft DCO [APP-020] which requires works to be undertaken in accordance with the OEMP.
3. As Highways England will retain the ownership of the SuDS, there is no need for any provisions regarding adoption in the draft DCO.

Question Fg.1.39

In the dDCO, Requirement 10 requires consultation with the planning authority in respect of the details of the drainage system.

Should this be expanded to include consultation with the Environment Agency?

Response

1. The Applicant does not consider that it is necessary to name the Environment Agency (EA) as a consultee on the face of the order, as the EA will be consulted anyway during the development of the drainage detailed design, as this is a requirement of the Design Manual for Roads and Bridges (DMRB) HA103 Vegetative Treatment Systems for Highway Runoff Clause 4.15.

Question Fg.1.40

Drainage

Please provide assurance to the ExA that appropriate drainage arrangements during the construction phase will be secured, including details of phasing and how this would be secured through the DCO?

Response

1. Requirement 10 of the draft DCO [APP-020] requires details of the proposed drainage system for the respective part of the Scheme to be submitted to and approved by the Secretary of State prior to commencement of construction of that part. In addition to this, the Construction Environmental Management Plan (CEMP) will be developed by the contractor, including the contents of the Water Management Plan which includes mitigation in relation to pollution control and control of surface waters during construction. This will be secured through paragraph 4 of Schedule 2 of the draft DCO [APP-020], which requires that the authorised development must be carried out in accordance with the Outline Environmental Management Plan (OEMP). The requirements for the Water Management Plan are defined within the OEMP at Table 3.2b: REAC tables for the main works, MW-WAT2

Question Fg.1.41

Dewatering and abstraction

- i. Please provide an update on any proposals which would require dewatering and consumptive abstraction.
- ii. Please respond to the Environment Agency's concerns on these matters and the proposed disapplication of abstraction licencing set out in [RR-2060].

Response

1. Based on the current design and construction methods it is expected that no abstraction of groundwater or surface water will be required. Notwithstanding this, as noted in paragraph 2.4.34 of Chapter 2 of the Environmental Statement [APP-040], the highly variable nature of the groundwater levels means that it is possible that temporary and localised groundwater control could be required for the construction of the tunnel portal slab to launch the tunnel boring machine and also for some cross-passages for mechanical and electrical services at Stonehenge Bottom when groundwater levels are exceptionally high.
2. If required, the extent and duration of groundwater control would be minimised. Should the final design or construction methods require abstraction of groundwater or surface water, the Statement of Common Ground with the Environment Agency states under Matters Agreed that the assessment of risk and identification of any required mitigation measures will be achieved through the Outline Environmental Management Plan (OEMP) [APP-187] (MW-WAT8) and whichever regulatory regime is ultimately agreed i.e. either the Environment Agency's permitting regime or protective provisions within the DCO.

Question Fg.1.42

Protective Provisions – drainage authorities

Please provide an update as to any progress in agreeing the relevant Protective Provisions?

Response

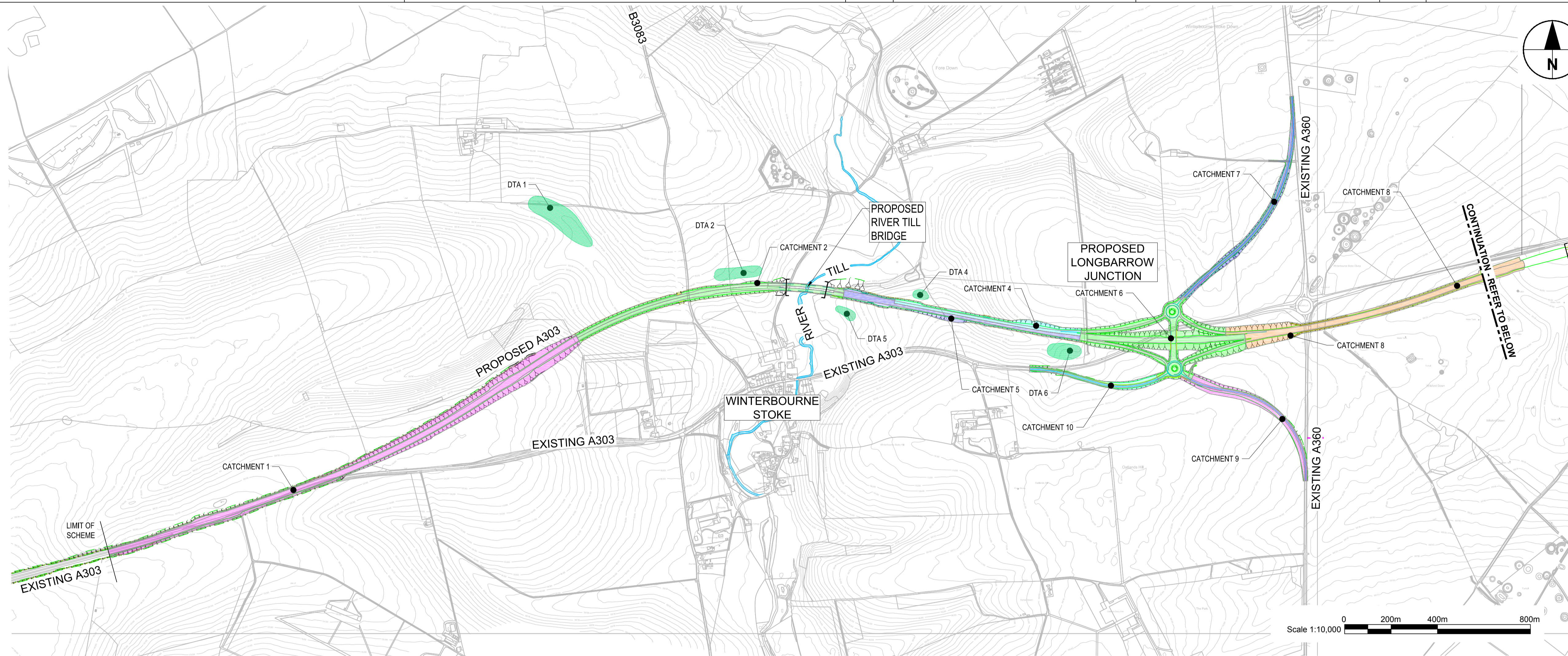
1. The Applicant acknowledges that this question is directed to the Environment Agency. The Applicant notes that since the submission of its application for development consent the Environment Agency has updated its standard form of protective provisions. These were provided to the Applicant on 11 April 2019. Negotiations are ongoing.

Appendices Fg.1

Appendices Fg.1

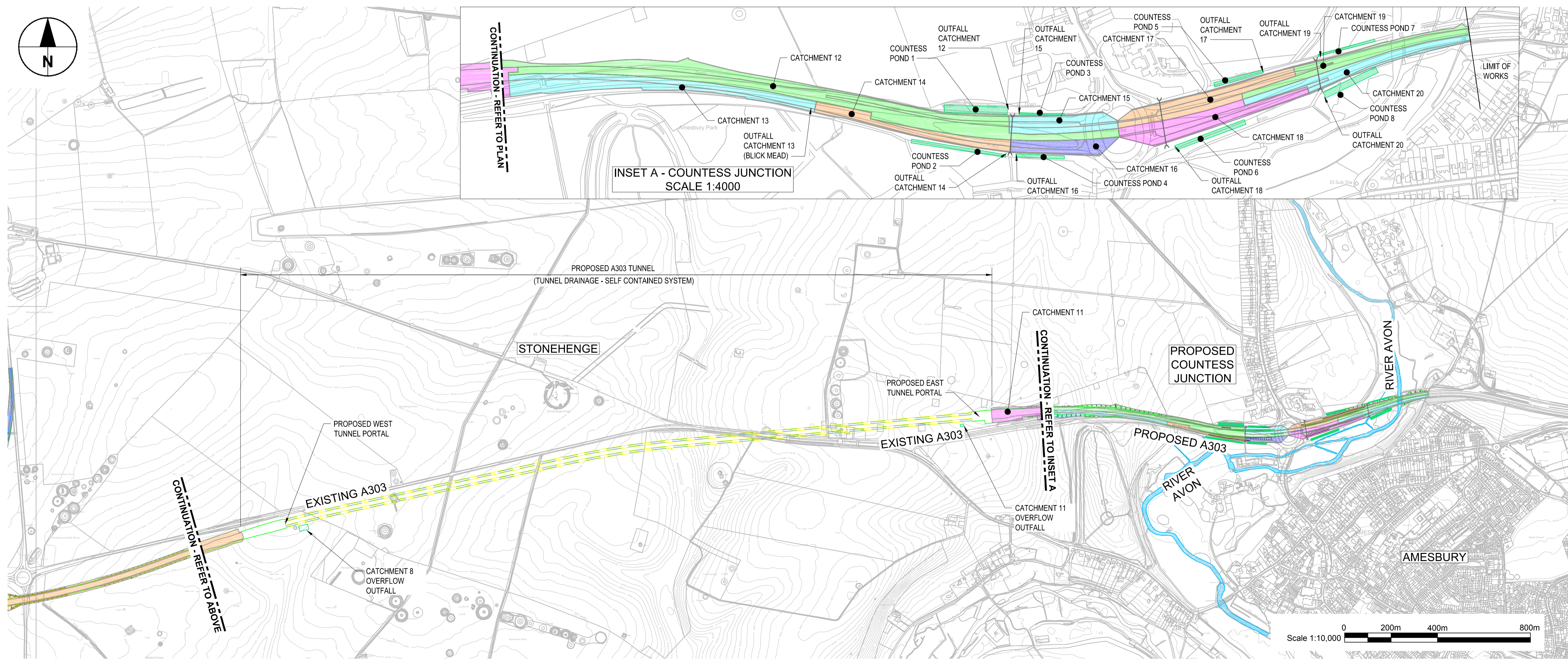
Question Fg.1.21

Figure 2-2 Preliminary Design Drainage Catchments



NOTES:
1. CATCHMENT COLOURS DEFINE EACH AREA EXTENT

CATCHMENT	ROAD AREA (ha)	PERMEABLE AREA (ha)	OUTFALL TO
1	4.854	7.853	DTA1
2	2.969	1.982	DTA2
4	0.949	1.086	DTA4
5	1.479	1.402	DTA5
6	3.915	6.387	DTA6
7	1.013	2.048	SOAKAWAYS
8	3.014	3.635	INFILTRATION CRATES
9	0.687	2.009	SOAKAWAYS
10	0.528	0.976	SOAKAWAYS
11	0.702	0.602	INFILTRATION CRATES
12	2.016	0.868	COUNTLESS POND 1
13	0.523	1.300	EXISTING DITCH
14	0.505	0.069	COUNTLESS POND 2
15	0.543	0.036	COUNTLESS POND 3
16	0.392	0.031	COUNTLESS POND 4
17	0.799	0.032	COUNTLESS POND 5
18	0.834	0.058	COUNTLESS POND 6
19	0.581	0.098	COUNTLESS POND 7
20	0.579	0.089	COUNTLESS POND 8



FIRST ISSUE	DC	08/08/18	P01.1
Revision Details	By	Check	Date
Purpose of issue	FINAL		

Client: **highways england**

Project Title: **A303 Amesbury to Berwick Down**

Drawing Title: **FIGURE 2-2**

Designed DC	Drawn DC	Checked AT	Approved TE	Date 08/08/18
Internal Project No. 60541439	Scale @ A1	Suitability S0	Zone	Scheme Wide

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