

# A1 Birtley to Coal House

## Scheme Number TR010031

### 7.5C Statement of Common Ground: Environment Agency

Rule 8 (1) (e)

Planning Act 2008

The Infrastructure Planning (Examination Procedure  
Rules) 2010

Infrastructure Planning

Planning Act 2008

**The Infrastructure Planning  
(Examination Procedure  
Rules) 2010**

The A1 Birtley to Coal House  
Development Consent Order 20[ ]

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**STATEMENT OF COMMON GROUND: ENVIRONMENT  
AGENCY**

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<b>Regulation Number:</b>	Rule 8 (1) (e)
<b>Planning Inspectorate Scheme Reference</b>	TR010031
<b>Application Document Reference</b>	7.5C
<b>Author:</b>	A1 Birtley to Coal House Project Team, Highways England

<b>Version</b>	<b>Date</b>	<b>Status of Version</b>
Rev 0	February 2020	Deadline 1 Submission
Rev 1	April 2020	Deadline 4 Submission

**STATEMENT OF COMMON GROUND**

**This Statement of Common Ground has been prepared and agreed by (1) Highways England Company Limited and (2) Environment Agency.**

**Signed.....**  
**[NAME]**  
**Project Manager**  
**on behalf of Highways England**  
**Date: [DATE]**

**Signed.....**  
**[NAME]**  
**[POSITION]**  
**on behalf of [Environment Agency]**  
**Date: [DATE]**

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## 1 INTRODUCTION

### 1.1 Purpose of this Document

- 1.1.1 This Statement of Common Ground (SoCG) relates to an application made by Highways England (the Applicant) to the Planning Inspectorate (the Inspectorate) under the Planning Act 2008 (the 2008 Act) for a Development Consent Order (DCO). If made, the DCO would grant consent for the A1 Birtley to Coal House (the Scheme). A detailed description of the Scheme can be found in **Chapter 2: The Scheme** of the Environmental Statement (ES) [APP-023].
- 1.1.2 This SoCG does not seek to replicate information which is available elsewhere within the Application documents. All documents are available on the Inspectorate website (<https://infrastructure.planninginspectorate.gov.uk/projects/North%20East/A1-Birtley-to-Coal-House-Improvement-Scheme/>).
- 1.1.3 The SoCG has been produced to confirm to the Examining Authority where agreement has been reached between the parties to it, and where agreement has not (yet) been reached. SoCGs are an established means in the planning process of allowing all parties to identify and so focus on specific issues that may need to be addressed during the examination.

### 1.2 Parties to this Statement of Common Ground

- 1.2.1 This SoCG has been prepared by (1) **Highways England** as the Applicant and (2) the **Environment Agency**.
- 1.2.2 Highways England became the Government-owned Strategic Highways Company on 1 April 2015. It is the highway authority in England for the strategic road network and has the necessary powers and duties to operate, manage, maintain and enhance the network. Regulatory powers remain with the Secretary of State. The legislation establishing Highways England made provision for all legal rights and obligations of the Highways Agency, including in respect of the Application, to be conferred upon or assumed by Highways England.
- 1.2.3 The Environment Agency is an executive non-departmental public body, sponsored by the Department for Environment, Food and Rural Affairs with the stated purpose “*to protect or enhance the environment, taken as a whole*”. Within England it is responsible for, amongst other things: regulating major industry and waste; treatment of contaminated land; water quality and resources; fisheries; inland river, estuary and harbour navigations; conservation and ecology; and managing the risk of flooding from main rivers, reservoirs, estuaries and the sea.

### 1.3 Terminology


- 1.3.1 In the tables in the Issues chapter of this SoCG, “Not Agreed” indicates a final position, and “Under discussion” where these points will be the subject of on-going discussion wherever possible to resolve, or refine, the extent of disagreement between the parties. “Agreed” indicates where the issue has been resolved.

- 1.3.2 It can be taken that any matters not specifically referred to in the Issues chapter of this SoCG are not of material interest or relevance to the **Environment Agency**, and therefore have not been the subject of any discussions between the parties. As such, those matters can be read as agreed, only to the extent that they are either not of material interest or relevance to the **Environment Agency**.

## 2 RECORD OF ENGAGEMENT

2.1.1 A summary of the meetings and correspondence that has taken place between Highways England and the Environment Agency in relation to the Application is outlined in **Table 2-1**.

**Table 2-1- Record of Engagement**

Date	Form of correspondence	Key topics discussed and key outcomes
31/10/2017	<p>Meeting (Appendix A)</p>  <p>Environment Agency</p>	<p><b>Key Topic</b></p> <p>The Applicant discussed the potential for the Scheme to require sheet piling in relation to widening of the piers supporting the River Team crossing.</p> <p><b>Key Outcome</b></p> <p>The Environment Agency confirmed this would require a bespoke permit and method statement due to the close proximity of a gauging station. At this stage sheet piling has been discounted, however, the construction works at this location would require an Environmental Permit prior to construction. This agreement is covered in <b>Section 3, Table 3-1, Item 6</b>.</p>
		<p><b>Key Topic</b></p> <p>Discussion on the publication of a new National Planning Policy Framework (NPPF) policy in 2018/ 2019 with potential implications in relation to climate change and the design life of the Scheme for surface water modelling.</p> <p><b>Key Outcome</b></p> <p>An approach has since been agreed with the Environment Agency, as detailed within email correspondence email with Caroline Maarouf on 17/04/19. This agreement is covered in <b>Section 3, Table 3-1, Item 3</b>.</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p><b>Key Topic</b></p> <p>Discussed the Environment Agency’s proposal for the Lamesley Pastures Flood Alleviation Scheme, which is to be a 12 ha flood storage area near Coal House roundabout (Junction 67) which would generate 80,000 m<sup>3</sup> surplus of engineering fill, that the Environment Agency would need to dispose of.</p> <p><b>Key Outcome</b></p> <p>The Environment Agency confirmed that the engineering fill may be offered to the Scheme; however, the proposal is at pre-application stage and would require full planning permission. The Applicant issued engineering specifications to the Environment Agency for the fill required.</p> <p>Since this discussion, the timescales have diverged, and the Scheme is likely to be completed before the Environment Agency’s Lamesley Pastures Flood Alleviation Scheme.</p> <hr/> <p><b>Key Topic</b></p> <p>The Environment Agency outlined their desire to reduce rate and improve quality of surface water runoff through Lamesley Pastures to support integrated catchment management of River Team.</p> <p><b>Key Outcome</b></p> <p>As a result of the discussions the Scheme design includes water quality improvement measures (interceptors, sediment vortexes and ponds). This agreement is covered in <b>Section 3, Table 3-1, Items 3 and 7.</b></p>



Date	Form of correspondence	Key topics discussed and key outcomes
		<p><b>Key Topic</b></p> <p>Discussion on the outfalls (in terms of identification, location, Highways Agency (now Highways England) Water Risk Assessment Tool (HAWRAT) assessment required for all, not just any priority outfalls, discharge rates, water quality improvements) which form part of the drainage strategy for the Scheme. The Environment Agency would require sight of the drainage strategy.</p> <p><b>Key Outcome</b></p> <p>All outfalls have been identified through a CCTV survey of the whole scheme, a HAWRAT assessment has been undertaken for every outfall with discharge rates restricted and water quality improvements secured. The drainage strategy has been discussed with the Environment Agency. This agreement is covered in <b>Section 3, Table 3-1, Item 3</b>; the HAWRAT is covered in <b>Section 3, Table 3-1, Item 5</b>.</p>
06/12/17	<p>Letter (Appendix B)</p> <p>██████████, Environment Agency</p>	<p><b>Key Topic</b></p> <p>The Applicant requested comments and advice on the proposed approach to the Flood Risk Assessment (FRA).</p> <p>The Environment Agency confirmed that the FRA should consider/include:</p> <ul style="list-style-type: none"> <li>• Climate change allowances; which must be factored into the design of the road and drainage.</li> <li>• Floodplain compensation for any loss of the floodplain must be provided. This should include the provision of climate change.</li> </ul>

Date	Form of correspondence	Key topics discussed and key outcomes
		<ul style="list-style-type: none"> <li>• Collaborating with other flood risk management authorities to join the delivery of wider strategic flood alleviation schemes.</li> <li>• Opportunities for environmental betterment, particularly to reduce surface water flood risk.</li> </ul> <p><b>Key outcome</b></p> <ul style="list-style-type: none"> <li>• Climate change allowances have been agreed with the Highways England Safety Engineering and Standards (SES) team and discussed and agreed with EA - 17/04/2019, email with Caroline Maarouf. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></li> <li>• Flood plain compensation has been provided within the Coalhouse Roundabout, and agreed in principal with the Environment Agency. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></li> <li>• Discussions have been held with the risk management authorities regarding the delivery of flood risk schemes, it has been determined that the timescales will not allow this.</li> <li>• Opportunities for betterment have been sought where the design allows, this is achieved through the Allerdene Burn realignment and water quality discharge. This agreement is covered in <b>Section 3, Table 3-1, Items 4 and 7.</b></li> </ul>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p><b>Key Topic</b></p> <p>The Applicant requested comments and advice on the proposed approach to flood risk Modelling.</p> <p>The Environment Agency confirmed that the flood risk modelling should consider/include:</p> <ul style="list-style-type: none"> <li>• The Environment Agency’s 2016 Team Valley flood risk model should be used to inform the proposed development.</li> <li>• Hydraulic modelling will be required in support of the National Significant Infrastructure Project (NSIP) application.</li> <li>• Any hydraulic modelling is undertaken in accordance with Methods E and F of HD45/09.</li> </ul> <p><b>Key outcome</b></p> <ul style="list-style-type: none"> <li>• The Environment Agency’s model has been used.</li> <li>• Hydraulic modelling, for other areas of interest (Allerdene Burn and surface water flooding at Eighton Lodge Junction) has been undertaken in broad accordance with Methods E and F of HD45/09, although this does not cover surface water modelling, which has been undertaken in accordance with best practice.</li> <li>• This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></li> </ul>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p><b>Key Topic</b></p> <p>The Applicant requested comments and advice on flood risk permits required.</p> <p>The Environment Agency advised that within the Order Limits is a designated "main river" and under the Environmental Permitting Regulations 2010, an environmental permit may be required for flood risk activities in the following circumstances.</p> <p>This would be required for any work within 8 metres of a non-tidal sections, or 16 metres of the tidal section, instance where work is proposed:</p> <ul style="list-style-type: none"> <li>a) in, under or near a main river (including where the river is in a culvert);</li> <li>b) on or near a flood defence on a main river;</li> <li>c) in the floodplain of a main river; and</li> <li>d) on or near a sea defence.</li> </ul> <p><b>Key Outcome</b></p> <p>The need for Environmental Permits are documented in the Outline CEMP [REP2-050 and 051] (a revised version of which was submitted at <b>Deadline 4</b>). This agreement is covered in <b>Section 3, Table 3-1, Item 7</b>.</p> <hr/> <p><b>Key Topic</b></p> <p>The Applicant requested comments and advice on the proposed approach to the water framework directive assessment (WFDa).</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>Environment Agency advised that the WFD consider/include:</p> <ul style="list-style-type: none"> <li>• The Scheme will affect the River Team (Source to Tyne, GB103023075670). This waterbody is currently classified under the WFD as Moderate. This Heavily Modified Waterbody is impacted by urbanisation from the highway network. Sedimentation, hydrocarbons and road salt from highway infrastructure has affected the water quality of the River Team. Hydraulic modelling will be required in support of the DCO application.</li> <li>• The WFD seeks to improve the water quality in all our waterbodies (including lakes, rivers and estuaries). In particular, it seeks to ensure that all waterbodies achieve 'good status' or 'good ecological potential'.</li> <li>• The overall objectives of the Northumbria RBMP are to 1) prevent deterioration 2) deliver protected area objectives 3) deliver improvements that make progress towards 2027 objectives where the benefits are greatest. Highway England must have regard to these objectives when making decisions that could affect the water environment.</li> </ul> <p>It is considered that the Scheme provides a great opportunity to</p>

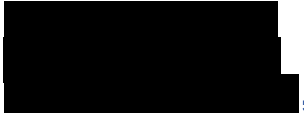
Date	Form of correspondence	Key topics discussed and key outcomes
		<p>implement WFD mitigation measures and river restoration. This could include de-culverting and enhancements to the river environment, such as fish and mammal passage and water quality improvements. The use of sustainable drainage systems combined with oil interceptors would be a recognised way to improve the water quality from the highway draining into the watercourses.</p> <p><b>Key Outcome</b></p> <p>A WFDa (<b>Appendix 13.2</b> of the ES) [<b>APP-164</b>] has been completed which demonstrates that the Scheme is compliant. Action points have been included on fish and mammal passage in the Scheme in the Outline CEMP [<b>REP2-050 and 051</b>] (<b>a revised version of which was submitted at Deadline 4</b>), as detailed in G6 of the Register of Environmental Actions and Commitments (REAC) and <b>Chapter 8: Biodiversity</b> of the ES [<b>APP-029</b>]. SuDS have been incorporated within the drainage design, where possible, and oil interceptors are included at every outfall, where SuDS measures are not able to be included.</p> <p>This agreement is covered in <b>Section 3, Table 3-1, Item 4.</b></p> <p><b>Key Topic</b></p> <p>The EA provided comments and advice on the proposed assessment on biodiversity and ecology.</p> <p>The EA advised that:</p> <ul style="list-style-type: none"> <li>Any works over the River Team must maintain or enhance the riparian corridor.</li> </ul>

Date	Form of correspondence	Key topics discussed and key outcomes
		<ul style="list-style-type: none"> <li>Opportunities should be sought for the development to contribute to improvement measures for the River Team. This could include local proposals to restore natural conditions in the river corridor and Lamesley Pastures conservation area and the wider vicinity.</li> </ul> <p>There may be operational and/or post construction impacts to invertebrates in the area. For example, artificial lighting could impact upon feeding, breeding and movement of insects. The EA requested that the number of lights and brightness should be assessed to avoid light spillage. This would be particularly important next to River Team. Risks should be minimised or eliminated where possible. The EA also requested that any planting schemes include native plants of local provenance.</p> <p><b>Key Outcome</b></p> <p>The River Team was included within the assessment detailed within the <b>Chapter 8: Biodiversity</b> of the ES [APP-029]. The River Team will be subject to temporary culverting during construction. Post-construction the river will be reinstated. Avoidance of artificial lighting of watercourses, particularly during the hours of darkness is included as mitigation within <b>Chapter 8: Biodiversity</b> of the ES [APP-029]. This is also detailed in in the Outline CEMP, in G6 of the REAC [REP2-050 and 051] (a revised version of which was submitted at Deadline 4).</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>Additionally, the River Team will be enhanced as a result of the predicted reduction in pollution road discharge and a reduced rate of surface water runoff due to the inclusion of oil interceptors, silt control, pollution control devices, and creation of attenuation ponds as detailed in the <b>Chapter 8: Biodiversity</b> of the ES [APP-029].</p> <p>All mitigation has been included and secured through the Outline CEMP [REP2-050 and 051] (a revised version of which was submitted at Deadline 4).</p> <p><b>Key Topic</b></p> <p>The Environment Agency advised that fish populations of the River Team should be considered, whilst these are known to be very poor, Brown Trout and Eels are present in the river and Atlantic Salmon have recently been recorded in the Eslington Area.</p> <p><b>Key Outcome</b></p> <p><b>Chapter 8: Biodiversity</b> of the ES [APP-029] includes an assessment of the Scheme's effects on fish populations based on the Environment Agency National Fisheries Populations Database records. Species included within the assessment detailed in <b>Chapter 8: Biodiversity</b> of the ES [APP-029] include: brown trout <i>Salmo trutta</i>, European eel <i>Anguilla anguilla</i> and Atlantic salmon <i>Salmo salar</i>. This is also detailed in in the Outline CEMP, in B8 of the REAC [REP2-050 and 051] (a revised version of which was submitted at Deadline 4).</p>



Date	Form of correspondence	Key topics discussed and key outcomes
		<p><b>Key Topic</b></p> <p>The assessment should consider geomorphological impacts where the scheme crosses the watercourses and the geomorphological processes in these areas.</p> <p><b>Key Outcome</b></p> <p>A WFDa (<b>Appendix 13.2</b> of the ES) [<b>APP-164</b>] has been completed which demonstrates that Scheme is compliant and that the detailed design will have input from a suitably qualified designer. This agreement is covered in <b>Section 3, Table 3-1, Item 4 and Item 7.</b></p> <hr/> <p><b>Key Topic</b></p> <p>The EA provided comments and advice on the proposed approach on protected species.</p> <p>The EA advised that:</p> <ul style="list-style-type: none"> <li>• The proposed development must ensure that protected species which could be directly or indirectly affected by the proposal are considered. European Otter records have been found in the vicinity.</li> <li>• Amphibians including Great Crested Newt may be present within the construction site.</li> <li>• The ecological report stated that desktop studies suggested that Water Vole may be present within 1km.</li> </ul> <p><b>Key Outcome</b></p> <p>European otter, water vole, amphibians, including great crested</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>newt were all included within the assessment detailed within <b>Chapter 8: Biodiversity</b> of the ES [APP-029]. Based on the assessment appropriate mitigation has been included within the Scheme. All mitigation has been included and secured through the Outline CEMP [REP2-050 and 051] (a revised version of which was submitted at Deadline 4).</p>
15/03/18	<p>Meeting (Appendix C)</p> <p> Environment Agency</p>	<p><b>Key Topic</b></p> <p>The Applicant requested comments and advice on the proposed approach to the sheet piling of the additional piers that support the Kingsway Viaduct</p> <p>Sheet piling would be contrary to the Environment Agency's desire to avoid further modification of the River Team (a 'failing water body' due to modification of its watercourse features).</p> <p>Potential for sheet piling into bedrock to create migratory pathways between shallow mine workings and groundwater.</p> <p>Alternative method of construction to be sought (sheet piling may be acceptable as a temporary measure, in which case temporary flood management would be required as sheet piling would entail a reduction in the river channel capacity).</p> <p><b>Key Outcome</b></p> <p>It was agreed that the approach to construction can only be agreed at detailed design and would include discussions with the EA in order to obtain the Environmental Permits</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>required. This agreement is covered in <b>Section 3, Table 3-1, Items 4 and 7.</b></p> <p>The need for compensatory mitigation for the works within Coalhouse Roundabout has been included within the Outline CEMP [REP2-050 and 051] <b>(a revised version of which was submitted at Deadline 4).</b> This agreement is covered in <b>Section 3, Table 3-1, Item 2 and Item 7.</b></p> <p><b>Key Topic</b></p> <p>Discussion on the proposed extension to Allerdene Culvert (sizing is due to increased embankment loading) is designed to replicate the existing flow capacity and velocity.</p> <p><b>Key Outcome</b></p> <p>The concept design of the Allerdene Burn has been undertaken to improve flow characteristics and includes a method of storage for the Viaduct Option, as space allows. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>Key Topic</b></p> <p>Discussion on the requirement for a balancing pond due to increase in impermeable hardstanding.</p> <p>Adaptions to outfalls &gt; 300mm would require a permit to construct from Environment Agency for those on the River Team and ordinary watercourse consent from the Gateshead Council.</p> <p><b>Key Outcome</b></p> <p>The balancing pond has been designed to accommodate the 1 in 100 year storm discharge (including an</p>

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		<p>allowance for climate change) plus a freeboard of 600mm.</p> <p>The Outline CEMP, B9 of the REAC [REP2-050 and 051] (a revised version of which was submitted at <b>Deadline 4</b>) details that Environmental Permits and Ordinary Watercourse Consent will be obtained. This agreement is covered in <b>Section 3, Table 3-1, Item 7.</b></p> <p><b>Key Topic</b></p> <p>Discussion on the publication of a new NPPF policy in 2018/2019 with potential implications in relation to climate change and the design life of the Scheme for surface water modelling.</p> <p><b>Key Outcome</b></p> <p>The Applicant confirmed that the surface water modelling accounts for 20% increase in rainfall intensity to take into account climate change. Climate Change allowances were agreed with the Environment Agency. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency's proposal for 12 ha flood storage area (the Lamesley Pastures Flood Alleviation Scheme) near Coal House Roundabout (Junction 67) which would generate 80,000 m<sup>3</sup> surplus of engineering fill.</p> <p><b>Key Outcome</b></p> <p>There is the opportunity to use this surplus material for this Scheme, if</p>

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		<p>programmes allow. It now appears that the Lamesely Flood Alleviation Scheme will be delivered after this Scheme, therefore, no further action required.</p> <p><b>Key Topic</b> The Environment Agency advised that they consider there is an opportunity to improve runoff water quality in accordance with objectives of WFD and National Policy Statements (NPS).</p> <p><b>Key Outcome</b> The drainage strategy includes SuDS measures, where the design constraints allow, for the other outfalls oil interceptors have been included and sediment vortices at the Longacre Dene outfalls to improve the water quality. This is documented in <b>Appendix 13.1: FRA</b> of the ES [APP-163]. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p>
21/03/18	<p><b>Letter (Appendix D)</b> <b>Lucy Mo,</b> <b>Environment Agency</b></p>	<p><b>Key Topic</b> The Environment Agency confirmed that a FRA should be completed to support the Scheme and that this should include an allowance for climate change. They also advised that their 2016 Team Valley Flood Risk Model should be used for the basis of any flood modelling.</p> <p><b>Key Outcome</b> The flood risk assessment has been prepared and agreed in principal with the Environment Agency, this agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p><b>Key Topic</b></p> <p>The Environment Agency advised that Environmental Permits would be required for any work within 8 metres of a non-tidal sections, or 16 metres of the tidal section, instance where work is proposed:</p> <ul style="list-style-type: none"> <li>• In, under or near a main river (including where the river is in a culvert);</li> <li>• On or near a flood defence on a main river;</li> <li>• In the floodplain of a main river; and</li> <li>• On or near a sea defence.</li> </ul> <p><b>Key Outcome</b></p> <p>The need for Environmental Permits are documented in the Outline CEMP [REP2-050 and 051] (a revised version of which was submitted at Deadline 4). This agreement is covered in <b>Section 3, Table 3-1, Item 7.</b></p> <hr/> <p><b>Key Topic</b></p> <p>The Applicant requested comments and advice on the proposed approach to the WFDa.</p> <p>EA advised that the WFD consider/include:</p> <ul style="list-style-type: none"> <li>• The Scheme will affect the River Team (Source to Tyne, GB103023075670). This waterbody is currently classified under the WFD as Moderate. This Heavily Modified Waterbody is impacted by urbanisation from the highway network.</li> </ul>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>Sedimentation, hydrocarbons and road salt from highway infrastructure has affected the water quality of the River Team. Hydraulic modelling will be required in support of the DCO application.</p> <ul style="list-style-type: none"> <li>• The WFD seeks to improve the water quality in all our waterbodies (including lakes, rivers and estuaries). In particular, it seeks to ensure that all waterbodies achieve 'good status' or 'good ecological potential'.</li> <li>• The overall objectives of the Northumbria RBMP are to 1) prevent deterioration 2) deliver protected area objectives 3) deliver improvements that make progress towards 2027 objectives where the benefits are greatest. Highways England must have regard to these objectives when making decisions that could affect the water environment.</li> </ul> <p>It is considered that the proposed development provides a great opportunity to implement WFD mitigation measures and river restoration. This could include de-culverting and enhancements to the river environment, such as fish and mammal passage and water quality improvements. The use of SuDS combined with oil interceptors would be a recognised way to improve the water quality from the highway draining into the watercourses.</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p><b>Key Outcome</b></p> <p>A WFDa has been completed which demonstrates that Scheme is compliant with regards to the WFD. Additionally fish and mammal passages have been included in the Scheme and documented within the Outline CEMP [REP2-050 and 051] (a revised version of which was submitted at Deadline 4), and Chapter 8: Biodiversity of the ES [APP-029], SUDS have been incorporated within the drainage design, where possible and oil interceptors are included at every outfall, where SuDS measures are able to be included.</p> <p>This agreement is covered in <b>Section 3, Table 3-1, Item 4.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency advised that the proposed works will affect the River Team (Source to Tyne, GB103023075670). This waterbody is currently classified under the WFD as Moderate. This Heavily Modified Waterbody is impacted by urbanisation from the highway network. In particular, sedimentation, hydrocarbons and road salt from highway infrastructure has affected the water quality of the River Team.</p> <p>Highways England must have regard to the environmental objectives as set in the Northumbria River Basin Management Plan and every organisation should seek to deliver WFD mitigation measures.</p>



Date	Form of correspondence	Key topics discussed and key outcomes
		<p><b>Key Outcome</b></p> <p>The WFDa (<b>Appendix 13.2</b> of the ES) [<b>APP-164</b>] has been prepared to demonstrate how the Scheme meets the requirements. This agreement is covered in <b>Section 3, Table 3-1, Item 4.</b></p> <hr/> <p><b>Key Topic</b></p> <p>The Environment Agency provided comments on the proposed Biodiversity assessment following the Applicant's request of 4<sup>th</sup> February 2018.</p> <p>The Environment Agency advised that:</p> <ul style="list-style-type: none"> <li>• Any works over the River Team must maintain or enhance the riparian corridor.</li> <li>• Natural networks are important.</li> <li>• The waterbodies which should be considered include the River Team and unnamed tributaries, Black Burn, Longacre Dean and Leyburnhold Gill.</li> <li>• Consideration must be given to protected and non-protected species that use the aquatic environment and riparian corridor.</li> <li>• Mitigation measures that involves managing/removing invasive species, where practical should be considered.</li> <li>• Impacts upon freshwater ecology should be undertaken and the Environment Agency would support monitoring.</li> </ul>

Date	Form of correspondence	Key topics discussed and key outcomes
		<ul style="list-style-type: none"> <li>Impacts of climate change should be considered.</li> </ul> <p><b>Key Outcome</b></p> <p>Watercourses, non-native invasive species, protected and notable species within the aquatic and riparian environments have been included within <b>Chapter 8: Biodiversity</b> of the ES [APP-029]. This includes mitigation to minimise impacts associated with invasive, non-native species, monitoring of the freshwater environment, and mitigation for protected and notable species and watercourses. All mitigation has been included and secured through the Outline CEMP [REP2-050 and 051] (a revised version of which was submitted at Deadline 4).</p> <p><b>Key Topic</b></p> <p>The Environment Agency would welcome consideration of alternatives to extending the culverted section of the watercourse which passes under Allerdene Bridge.</p> <p><b>Key Outcome</b></p> <p>The length of culvert on the Allerdene Burn has been minimised by only extending the section which is needed to facilitate the Scheme and daylighting the section which is under the current highway which will be disused. This agreement is covered in <b>Section 3, Table 3-1, Item 4.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency advised that a WFD will need to be undertaken to assess the impacts on all watercourses and the baseline</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>condition will need to be assessed to demonstrate how the temporary works will be undertaken and mitigated against.</p> <p><b>Key Outcome</b></p> <p>As the temporary crossing approach is currently unknown this aspect will be undertaken as part of the detailed design stage. This agreement is covered in <b>Section 3, Table 3-1, Item 4 and 7.</b></p> <hr/> <p><b>Key Topic</b></p> <p>The Environment Agency advised that consideration should be given to the mortality of fish species and adverse effects on their routes of migration, as well as patterns of behaviour. Opportunities should be sought to enhance the River Team habitat for fish species and works undertaken outside of the spawning season.</p> <p><b>Key Outcome</b></p> <p><b>Chapter 8: Biodiversity</b> of the ES [APP-029] includes an assessment of the effects on fish populations based on the Environment Agency National Fisheries Populations Database records. Potential impacts described within <b>Chapter 8: Chapter 8: Biodiversity</b> of the ES [APP-029] details mitigation to reduce the impacts on fish populations</p> <p>Additionally, the River Team will be enhanced by virtue of the reduction in pollution road discharge and a reduced of rate of surface water runoff because of the inclusion of oil interceptors, silt control, pollution control devices, and creation of attenuation ponds as</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>detailed in the <b>Chapter 8: Biodiversity</b> of the ES [APP-029].</p> <p>All mitigation has been included and secured through the Outline CEMP [REP2-050 and 051] (a revised version of which was submitted at Deadline 4).</p>
		<p><b>Key Topic</b></p> <p>The Environment Agency advised that groundwater within the coal measures underlying the area is currently being managed by the Coal Authority to prevent mine water pollution. Water is currently being actively pumped at a site (Kibblesworth) near Birtley. There is a risk that shallow groundwater may be present, now or in future, along some parts of the proposed route.</p> <p>Suitable pollution prevention measures should be put in place to manage the risks associated with the storage and use of any chemicals used on site during the development works.</p> <p><b>Key Outcome</b></p> <p>Groundwater has been assessed within the <b>Appendix 13.1: FRA</b> of the ES [APP-163], <b>Chapter 13: Road Drainage and Water Environment</b> of the ES [APP-034] and the Outline CEMP [REP2-050 and 051] (a revised version of which was submitted at Deadline 4), W15 of the REAC includes measures to manage the risks of chemicals. This agreement is covered in <b>Section 3, Table 3-1, Items 1, 2 and 7.</b></p>
20/07/18	<p><b>Letter (Appendix E)</b></p> <p><b>Lucy Mo, Environment</b></p>	<p><b>Key Topic</b></p> <p>The Environment Agency advised that floodplain compensation will be</p>

Date	Form of correspondence	Key topics discussed and key outcomes
	<p><b>Agency</b></p>	<p>required at the Allerdene Culvert and the River Team culverts at junction 67 (Coal House).</p> <p><b>Key Outcome</b></p> <p><i>Allerdene Burn</i></p> <p>The Applicant confirmed that the modelling undertaken shows that both the Viaduct and Embankment Options for the realigned watercourse downstream of Allerdene Culvert (for the embankment option) provides sufficient capacity to ensure the 1 in 1000-year flood plain continues to function in a similar manner. The 1 in 100 year and smaller events are already contained within the existing channel. Therefore, no flood plain compensation is required. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><i>River Team</i></p> <p>Floodplain storage is to be provided at the River Team/Kingsway Viaduct pier extension. This is in the form of a topsoil strip to offset the loss of floodplain (approximately 12m<sup>3</sup>) associated with the additional piers. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency confirmed that the FRA must take into account pluvial flood risk on the replacement Allerdene Bridge and demonstrate a betterment in terms of flood risk.</p> <p><b>Key Outcome</b></p> <p>The Applicant confirmed that there is currently no pluvial risk of flooding on the Kingsway Viaduct. The Environment Agency's risk of flooding</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>from surface water mapping incorrectly shows a flow path onto the A1 at this point. As the A1 is substantially elevated and the railway runs north-south beneath this, any surface water flows would preferentially run along this route before building up to a depth sufficient for flooding of the road. This is confirmed through the above hydraulic modelling and documented within <b>Appendix 13.1: FRA</b> of the ES [APP-163]. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency confirmed that they are generally opposed to the culverting of watercourses because of the adverse ecological, flood risk, human safety and aesthetic impacts. They will consider each application to culvert a watercourse on its own merits and in accordance with their risk-based approach to permitting. In all cases where appropriate to do so, the Applicant must provide adequate mitigation measures, accept sole ownership and responsibility for future maintenance.</p> <p><b>Key Outcome</b></p> <p>The Applicant confirmed that the Allerdene Burn is currently a piped arched culvert. For the embankment option, this watercourse would continue to be culverted. For the viaduct option, the culvert would be removed and replaced by an open channel in the form of a lined ditch. Suitable mitigation and maintenance proposals for both options will be provided as part of the Scheme. The Environment Agency agreed that this watercourse is already culverted and</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>dependent upon the final option the Scheme will require this to remain culverted. This agreement is covered in <b>Section 3, Table 3-1, Item 4.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency confirmed they welcome the addition of SuDS to improve water quality and increase water attenuation. It is strongly recommended that the design maximises the biodiversity potential of the Scheme as a whole. This includes the planting of native and non-native species of local provenance and a management strategy for their ongoing maintenance.</p> <p><b>Key Outcome</b></p> <p>The Applicant has incorporated SuDS and other water quality and attenuation measures as appropriate across the Scheme. This includes a pond, oversized pipes and attenuation tanks along with oil interceptors and a sediment vortex control at Longacre Dene. This agreement is covered in <b>Section 3, Table 3-1, Item 3.</b></p> <p>The planting scheme is subject to detailed design and appropriate native and non-native species will be selected. As this is refined during detailed design it will need to consider the Applicant's maintenance regime to ensure suitability. This agreement is covered in <b>Section 3, Table 3-1, Item 1 and 8.</b></p>
8/4/2019	<p><b>Letter (Appendix F)</b></p> <p><b>Lucy Mo, Environment Agency</b></p>	<p><b>Key Topic</b></p> <p>The Environment Agency provided comments on the FRA following the Applicant's request of 14<sup>th</sup> February 2019.</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p><b>Key Topic - Exception Test</b></p> <p>Section 2.17 states that <i>‘the FRA demonstrates that the scheme will remain safe throughout its design life and that flood risk will not be increased elsewhere’</i>. As it stands, the FRA does not demonstrate how both elements of the Exception Test as set out in the NPPF and Planning Practice Guidance have been addressed. Further information regarding the application of the Sequential and Exception Test must be included in the FRA. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>Key Outcome</b></p> <p>The FRA was updated to include the Sequential and Exceptions Tests (Paragraph 2.5.14 and 2.5.15 of <b>Appendix 13.1: FRA</b> of the ES [APP-163]).</p> <p><b>Key topic</b></p> <p>UKCP18 was published on 26 November 2018 and replaces the UKCP09 projections. The allowances in FRA: Climate Change Allowances (published February 2016) are still the best national representation of how climate change is likely to affect flood risk for peak river flow and peak rainfall intensity. Research that is due to be published in 2019 may result in changes to these allowances.</p> <p><b>Key Outcome</b></p> <p>The FRA and Hydraulic Modelling report detail the climate change allowances used in the FRA – these were agreed with the Environment Agency (email with Caroline Maarouf 17<sup>th</sup> April 2019) – Appendix H and is covered in <b>Section 3, Table 3-1, Item</b></p>



Date	Form of correspondence	Key topics discussed and key outcomes
		<p><b>2.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency confirmed that flood zones have not been updated with the latest hydraulic modelling. As a result, the flood outlines are incorrect.</p> <p><b>Key Outcome</b></p> <p>The FRA had already used the modelling for the assessment and has been updated to ensure that the latest flood risk maps are utilised in the figures. This agreement is covered in <b>Section 3, Table 3-1, Items 1 and 2.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency confirmed that flood events caused by blockages for the culvert located on Lady Park Burn have previously occurred for large events.</p> <p><b>Key Outcome</b></p> <p>Blockages to the culvert are considered within <b>Appendix 13.1: FRA of the ES [APP-163]</b> and the need for consideration of a joint inspection process (between the Environment Agency and Highways England at times of increased flood risk) have been outlined and will be taken forward at detailed design. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency state that there is no mention to piers being located in the floodplain and channel of the River Team.</p>

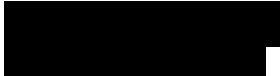
Date	Form of correspondence	Key topics discussed and key outcomes
		<p><b>Key Outcome</b></p> <p><b>Appendix 13.1: FRA</b> of the ES [APP-163] has assessed the impact of this on flood waters and details how compensation will be provided, this is also documented within the Outline CEMP [REP2-050 and 051] (a revised version of which was submitted at Deadline 4). This agreement is covered in <b>Section 3, Table 3-1, Items 2 and 7.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency stated that there is a reference to the option of betterment to the existing Allerdene Culvert, but no reasons why this option has now been discounted. In line with the 25 Year Environment Plan and NPPF, we strongly recommend that betterment is achieved.</p> <p><b>Key Outcome</b></p> <p>There are several constraints associated with providing betterment with the Allerdene Burn, these include the existing and proposed NGN infrastructure and the East Coast Main Line, along with the existing highway embankment. The Environment Agency have stated that they are satisfied with <b>Appendix 13.1: FRA</b> of the ES, [APP-163] subject to the approval of the hydraulic modeling. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency stated that references in the historical flooding section are out of date and need to be updated. For example, there was a flood event in 2012 in Lady Park.</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>Section 4.2.11: an area of floodplain compensation is to be located in an area that already floods. The FRA must demonstrate that this area of land is able to fully function as floodplain compensation, and that it floods at the right flood event.</p> <p>Section 4.2.14: we would welcome clarity regarding whether the culvert needs to be extended or can it be a channel alignment.</p> <p><b>Key Outcome</b></p> <p>The FRA has been refined to ensure sufficient consideration of these points. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency confirmed it should be noted that the bottom section of the River Team is tidal.</p> <p><b>Key Outcome</b></p> <p>It has been agreed that specific analysis of the tidal influence is not explicitly required within the FRA, as it is included within the Environment Agency's hydraulic model of the River Team. This is documented within the email with Caroline Maarouf 17<sup>th</sup> April 2019, <b>Appendix H</b> and in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency confirmed that the FRA does not adequately consider the risk of groundwater flooding. Groundwater within the coal measures underlying the area are currently being managed by the Coal Authority to prevent mine water pollution. Water is currently being actively pumped at a site</p>

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		<p>(Kibblesworth) near Birtley. There is a risk that shallow groundwater may be present, now or in future, along some parts of the proposed route.</p> <p><b>Key Outcome</b></p> <p>This is assessed within <b>Chapter 13: Road Drainage and Water Environment</b> of the ES [APP-034] which the Environment Agency have approved. This agreement is covered in <b>Section 3, Table 3-1, Item 1.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency state that the Hydraulic Modelling Report demonstrates that the impact on flood levels is within the model tolerance as the largest increase is 20mm. In addition, the flood difference should also be considered in terms of the impact on residential properties if there is any. This should be clarified/stated in the FRA.</p> <p><b>Key Outcome</b></p> <p>The flood difference as a result of the Scheme does not impact any residential properties. This is documented within Section 4.1.2 of <b>Appendix 13.1: FRA</b> of the ES [APP-163]. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>Environment Agency comments on the WFDa:</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency confirmed that WFD highlights the River Team and associated waterbodies in the catchment suffer from sedimentation. This is due to urban and transport run off.</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>Clarification to be made in relation to the silt control vortex separators; including why they are not being installed on all outfalls. Silt control vortex separators are only proposed at Longacre Dene and would be beneficial on all outfalls.</p> <p><b>Key Outcome</b></p> <p><b>Chapter 13: Road Drainage and the Water Environment</b> of the ES [APP-034] and <b>Appendix 13.2: WFDa</b> of the ES [APP-164] have been updated to provide a commitment to investigate the potential to include further silt control measures on all other outfalls at detailed design to minimise sediment issues. This agreement is covered in <b>Section 3, Table 3-1, Item 4.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency confirmed that they would welcome clarity regarding the drainage from Kingsway Viaduct. Will this receive any treatment for water quality and sediment?</p> <p><b>Key Outcome</b></p> <p>There is insufficient space within the Coalhouse Roundabout to include SuDS measures, however, the water quality will be enhanced over the baseline situation through the inclusion of hydrocarbon interceptors, with sediment vortices considered. This agreement is covered in <b>Section 3, Table 3-1, Item 4.</b></p> <p><b>Key Topic</b></p> <p>There are a large number of Highways England culverts and outfalls in the proposed works. Under the WFD, these modifications have to be</p>

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		<p>assessed and offer mitigation for their impact on habitat and biodiversity. The WFDa does not look at the options to mitigate for these.</p> <p>With respect to the Heavily Modified Designation (Urbanisation) a list of potential mitigation measures were provide and these should be considered and were possible enhancement measures implemented</p> <p><b>Key Outcome</b></p> <p>The WFDa was revised with the list of measures included within the WFDa. This agreement is covered in <b>Section 3, Table 3-1, Item 4.</b></p> <p><b>Key topic</b></p> <p>The Environment Agency confirmed Geomorphological impacts of the construction of the new piers should be considered and assessed in the WFDa. What are the geomorphological impacts of the construction of the new piers/abutment within the floodplain (before, during the construction and post development)?</p> <p>The Environment Agency confirmed that the WFDa should also demonstrate how the temporary works will be carried out and the impact they will have on the hydromorphology, including connectivity, sediment transport processes, the simplifying of channels and how this will be mitigated against.</p> <p>The impact upon the hydromorphology should then be used to directly assess the impact upon ecology including fish and their habitat, invertebrates and macrophytes. This could be</p>

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		<p>incorporated into the WFDa and mitigation included where appropriate.</p> <p><b>Key Outcome</b></p> <p><b>Appendix 13.1: FRA</b> of the ES [APP-163] demonstrates that the piers are only in the flood plain for extreme events, once climate change is included. The Outline CEMP [REP2-050 and 051] (a revised version was submitted at Deadline 4), W9 of the REAC outlines that the scour protection for the piers will be designed so as not to impact the morphology of the river. <b>Appendix 13.2: WFDa</b> of the ES [APP-164] outlines that a geomorphological assessment would be completed for the piers during detailed design once the construction process is known. This agreement is covered in <b>Section 3, Table 3-1, Item 2 and 7.</b></p>
10/4/2019	<p>Meeting (Appendix G)</p> <p> Environment Agency</p>	<p><b>Key Topic</b></p> <p>The Environment Agency outlined that they had concerns over the need to extend the Kingsway Viaduct Piers in the flood plain.</p> <p><b>Key Outcome</b></p> <p>The Applicant detailed that modelling was undertaken using the Environment Agency's Integrated Catchment Modelling (ICM) model. Five piers have been included in the modelling. The Applicant showed the results of the modelling that has been undertaken. This showed that none of the piers are in the baseline flood extents, they only fall into the flood extents when considering climate change allowances (+25% and +50%). The Applicant provided photographs showing the piers in relation to the</p>

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		<p>river. Additionally, <b>Appendix 13.1: FRA of the ES [APP-163]</b> demonstrates that floodplain compensation will be provided to offset the loss of floodplain. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>Key Topic</b> The Environment Agency highlighted that they would like to see the hydraulic modelling so that they can check that it is correct. They could then make their comments prior to submission of the DCO application. Confirmed that at detailed design stage of the Scheme, the Flood Risk Permit would be straightforward.</p> <p><b>Key Outcome</b> The Environment Agency have been provided with hydraulic models and have provided one round of comments, which have been addressed and submitted back as part of the Deadline 2 submission to enable the Environment Agency to completed their review. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>Key Topic</b> The Applicant highlighted that no comments had been provided on <b>Chapter 13: Road Drainage and Water</b> of the ES [APP-034].</p> <p><b>Key Outcome</b> The Environment Agency confirmed that they are happy with the content of <b>Chapter 13: Road Drainage and Water</b> of the ES [APP-034]. This agreement is covered in <b>Section 3,</b></p>



Date	Form of correspondence	Key topics discussed and key outcomes
		<p><b>Table 3-1, Item 1.</b></p> <p><b>Key Topic</b></p> <p>The Applicant discussed that climate change guidance (UK CP09) had been adopted for the modelling which was completed in December 2018. After the modelling had been completed the Environment Agency released an interim position on climate change in light of UK CP18. Due to the timing of this, the UK CP18 had therefore not been used.</p> <p>The Environment Agency is currently reviewing and assessing UK CP18. They suggested that in the case of something of importance like this – the interim position would be to use UK CP18 (not UK CP09).</p> <p><b>Key Outcome</b></p> <p>The Applicant undertook a review of the guidance that was discussed at a high level and agreed with the Environment Agency that further assessments in the model were not required, via email with Caroline Maarouf, 19<sup>th</sup> April 2019, Appendix H. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency identified that their Flood map for planning as currently published does not include the findings of the Environment Agency’s latest flood model and that they are working on updating this. The maps to be used within the assessment should not be the Flood Map for Planning and instead the outputs from the baseline ICM model are to be used.</p>


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		<p><b>Key Outcome</b></p> <p>The Applicant stated that the Environment Agency’s flood model has been used to inform the assessment. The figures [APP-092 to APP-100] within <b>Chapter 13: Road Drainage and Water</b> of the ES [APP-034] and associated appendices [APP-163 to APP-165] are based on the Environment Agency’s latest mapping from the flood modelling, and text has been included within <b>Appendix 13.1: FRA</b> of the ES [APP-163] and <b>Chapter 13: Road Drainage and Water Environment</b> of the ES [APP-034] provide clarity on the differences between the Flood Map for Planning and the mapping used. This agreement is covered in <b>Section 3, Table 3-1, Items 1 and 2.</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency identified that the Lady Park Burn blocks during heavy extreme rainfall (the screen blocks and the watercourse backs up). This overtopped onto the A1 in 2012. There would not be enough water for a 1:5 or 1:10 year event to block the screen and cause flooding of the A1.</p> <p><b>Key Outcome</b></p> <p>The Applicant confirmed that this is within the area where only signage changes were proposed and there are no other changes required as a result of the Scheme.</p> <p>The FRA has been updated to include an assessment of this risk, and identifies that the mechanisms for managing the residual risk will be agreed between the Environment Agency and Highways England during</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>detailed design, but are likely to include measures within the operating procedures for this section of the A1, with Highways England undertaking inspections of the trash screen adjacent to Coach Burn Road at pertinent times to assist the Environment Agency with understanding their maintenance requirements. In the most extreme circumstances part of the A1 may need to be closed. This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>Key Topic</b></p> <p>The Applicant described that flood plain compensation has been provided in the Scheme for the climate change scenarios only, and its location is constrained by the location of the surface water attenuation tanks. The Environment Agency outlined that further information is required to demonstrate that this area will flood at the same time as the lost floodplain.</p> <p><b>Key Outcome</b></p> <p>Additional information has been included within <b>Appendix 13.1: FRA</b> of the ES [APP-163] (paragraph 4.2.13). This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>WFDa</b></p> <p><b>Key Topic</b></p> <p>The Environment Agency discussed that from a WFD point of view – looking at objective year of 2027 - need to get it to “good” status by 2027. The Environment Agency stated that WFDa as it stands seems as though it is only looking to do the bare minimum</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>to match WFD objectives. Every structure, culvert and outfall should be assessed, and the Applicant should look at the suite of mitigation that the WFDa should provide. Mitigation should include consideration of oil interceptors, hydro-breaks and SuDS.</p> <p>The Environment Agency and the Applicant discussed additional measures that could be considered in the WFD included looking at naturalising the channel at Allerdene culvert (currently daylighting), consider culverts and outfalls for improvements, e.g. flow spreaders, location of outfall, impacts to habitat, naturalised/cobbly outfalls set back from channel.</p> <p>The Applicant discussed the restrictions on the Scheme boundary and need to prevent adverse impacts on other receptors.</p> <p><b>Key Outcome</b></p> <p><b>Appendix 13.2:</b> WFDa of the ES [APP-164], (paragraph 6.6.3) and <b>Chapter 13: Road Drainage and Water Environment</b> of the ES [APP-034] (paragraph 13.9.12) states where existing surface water outfalls fall within the Extent of Works, detailed design will consider modifications to the outlet structure to ensure that they are set back from the watercourse, to reduce the impacts to flow. This agreement is covered in <b>Section 3, Table 3-1, Item 4.</b></p> <p><b>Key Topic</b></p> <p>It was agreed that the Applicant would consider changing the significant effects to beneficial as the measures are “on the path” to betterment with regards to the WFD.</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p><b>Key Outcome</b></p> <p>The potential impacts on Water Quality for the operational phase of the Scheme have been changed to be Slight Beneficial for all watercourses bar Longacre Dene in <b>Chapter 13: Road Drainage and Water Environment</b> of the ES [APP-034]. This agreement is covered in <b>Section 3, Table 3-1, Item 1.</b></p> <p><b>Key Topic</b></p> <p>The Applicant discussed that a sediment vortex separator has been provided on Longacre Dene for woodland – identified as a sensitive receptor. The Applicant outlined that other watercourses are ephemeral and only flow at certain times.</p> <p>The Environment Agency stated that during flashy rainfall conditions, sediment would be flushed through these channels particularly around the viaduct and further sediment control measures should be included in the Scheme.</p> <p><b>Key Outcome</b></p> <p>The Applicant detailed that around the Allerdene viaduct there will be the settlement pond. At Kingsway viaduct – some water goes to the pond and some water will go through the tanks and there are also oversized pipes. <b>Chapter 13: Road Drainage and Water Environment</b> of the ES [APP-034] has been updated to detail that the potential to include further silt control measures on all other outfalls would be investigated at detailed design to minimise sediment issues. This agreement is covered in <b>Section 3, Table 3-1, Items 1, 3 and 4.</b></p>

Date	Form of correspondence	Key topics discussed and key outcomes
17/4/2019	<p><b>Emails (Appendix H),</b></p> <p><b>Caroline Maarouf, Environment Agency</b></p>	<p><b>Key Topic</b></p> <p>The Applicant provided further information to the Environment Agency in terms of the approach to including climate change within the assessment and the management of the residual risk associated with the Lady Park Burn.</p> <p><b>Key Outcome</b></p> <p>The Applicant and the Environment Agency reached an agreement on the approach to assessing climate change and Lady Park Burn.</p> <p><i>Climate Change</i> – No further assessment is required as there is no change to the peak rainfall or river flow allowances and there is significant difference in elevation and distance between the Scheme and the nearest tidally influenced reach of the River Team which is included within the Environment Agency’s flood model.</p> <p><i>Lady Park Burn</i> – There is no gauge so the Highways England officers would need to view the screen during heavy rainfall events at Coach Burn Road, subject to agreement during detailed design.</p> <p>This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p>
<p>23/7/2019</p> <p>And</p> <p>24/7/2019</p>	<p><b>Letter (Appendix I)</b></p> <p><b>Lucy Mo, Environment Agency</b></p> <p>And</p> <p><b>Meeting (Appendix J)</b></p>	<p>The Environment Agency submitted a letter to the Applicant to confirm that they had reviewed <b>Appendix 13.2: WFDa</b> of the ES [<b>APP-164</b>], <b>Chapter 8: Biodiversity of the ES [APP-029]</b> and <b>Chapter 13: Road Drainage and Water Environment</b> of the ES [<b>APP-034</b>] following the Applicant’s request of 10<sup>th</sup> July 2019. This letter was issued the day prior to an organised</p>

Date	Form of correspondence	Key topics discussed and key outcomes
	 <b>Environment Agency.</b>	<p>meeting to enable an informed discussion by both parties. The approach to the meeting was to discuss the points in the letter in turn, therefore these two aspects have been combined.</p> <p><b>Key Topic</b></p> <p><i>Flood Risk Model</i></p> <p>The Environment Agency stated that they accept the findings of the FRA subject to the additional works required to the flood risk model. The Environment Agency consider that the flood risk model requires further work before the Environment Agency can confirm the model and its findings, in particular the hydrology and the Allerdene surface water modelling.</p> <p><b>Key Outcomes</b></p> <p>The Environment Agency provided their approval for the hydraulic model on 20<sup>th</sup> March 2020.</p> <p>This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p> <p><b>Key topic</b></p> <p><b><i>Chapter 13: Road Drainage and Water Environment of the ES [APP 034].</i></b></p> <p>The Environment Agency confirmed:</p> <ul style="list-style-type: none"> <li>• That they are unable to accept mitigation measures until the modelling has been agreed/accepted.</li> <li>• Floodplain compensation of topsoil scrape needs details and calculations to be submitted with DCO application.</li> <li>• Temporary culvert will need</li> </ul>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>Flood Risk Activity Permit.</p> <ul style="list-style-type: none"> <li>The Scheme should seek opportunities for synergies with the Environment Agency proposed flood alleviation scheme for the Team Valley Trading Estate to broaden environmental enhancements.</li> </ul> <p><b>Key Outcomes</b></p> <p>As outlined above the updated modelling has been submitted to the Environment Agency, <b>Appendix 13.1: FRA</b> of the ES [<b>APP-163</b>] has been updated to include calculations on the flood plain compensation (paragraph 4.2.13), the Outline CEMP [<b>REP2-050 and 051</b>] (a revised version of which was submitted at Deadline 4) W12 of the REAC provides a commitment to obtain the required permits. It has also since been recognized that the proposed Flood Alleviation Scheme will be delivered after this Scheme. This agreement is covered in <b>Section 3, Table 3-1, Items 2 and 7.</b></p> <p><b>Key Topic</b></p> <p><i>WFDa</i></p> <p>The Environment Agency confirmed:</p> <ul style="list-style-type: none"> <li>Regarding the topsoil scrape mitigation for the piers in the floodplain, there is an opportunity to reconnect with sections of the floodplain to enhance the River Team.</li> <li>Allerdene viaduct option preferred as here is an opportunity to realign with natural processes.</li> <li>The Environment Agency would welcome proposals as to how</li> </ul>




Date	Form of correspondence	Key topics discussed and key outcomes
		<p>in-channel improvements to increase flow diversity of the modified channel could be achieved for both the Allerdene embankment and Allerdene Viaduct options.</p> <ul style="list-style-type: none"> <li>• The Geomorphological Assessment to be completed at the detailed design stage should include the comments made in this advice note.</li> <li>• Where bank protection measures are proposed, bioengineering should be provided first.</li> <li>• Recommended that drainage such as SuDS, oil interceptors, filter drains and vortex separators be installed on all outfalls.</li> <li>• Clarification sought in respect to outfalls and what the options are for the setting back and construction/alterations of these structures.</li> <li>• Any outfall structure/discharge that is required to be constructed near a Main River may require a flood risk activity permit.</li> </ul> <p>Design of outfalls should be sympathetic to the water environment with low impact design options that mimic greenfield runoff and not drain onto or impact Habitats of Principal Importance. Soakaways to rivers must prevent any hard engineering on the banks of watercourses and ensure no degradation to its WFD status/potential.</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>The Environment Agency confirmed that the temporary culvert would need to be as short as possible and ideally if over 7m wide then the Environment Agency would prefer a bridge. Location and design would need to be agreed with the Environment Agency as part of detailed design/preconstruction works.</p> <p>This agreement is covered in <b>Section 3, Table 3-1, Item 4.</b></p> <p><b>Key Outcomes</b></p> <p>Many of the points are advice for the completion of the detailed design at later stages of the Scheme. With <b>Chapter 13: Road Drainage and Water Environment</b> of the ES [APP-034] providing confirmation that opportunities for the inclusion of sediment vortex's at all outfalls would be investigated at detailed design along with the potential to modify outlet structures where they fall within the Scheme boundary (both in paragraph 13.9.12).</p> <p><b>Appendix 13.1: FRA</b> of the ES [APP-163] outlines that runoff from the new impermeable surfaces is restricted to greenfield runoff rates (paragraph 1.1.4 of Appendix C).</p> <p>The Outline CEMP [REP2-050 and 051] (a revised version of which was submitted at Deadline 4), (W12 of the REAC) details that the relevant permits will be obtained.</p> <p>This agreement is covered in <b>Section 3, Table 3-1, Items 1, 2, 3, 4 and 7.</b></p> <p><b>Key Topic</b></p> <p><i>River Gauge</i></p> <p>The Applicant confirmed they will</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p>provide information as to what works are taking place near the Environment Agency river gauge where this is included in the Scheme Footprint.</p> <p><b>Key Outcome</b></p> <p>Further information on the works proposed has been provided, to the Environment Agency on 14<sup>th</sup> April 2020 and the Environment Agency provided clarification as to the operating procedures for the gauging station on 15<sup>th</sup> April 2020.</p> <p>This agreement is covered in <b>Section 3, Table 3-1, Items 6 and 7.</b></p>
<p><b>25/7/19</b></p> <p><b>And</b></p> <p><b>29/10/19</b></p> <p><b>And</b></p> <p><b>11/02/20</b></p> <p><b>And</b></p> <p><b>20/03/20</b></p>	<p><b>Emails from Lucy Mo providing a Spreadsheet (Appendix K)</b></p> <p><b>Environment Agency’s model review with the Applicants responses</b></p> <p><b>And</b></p> <p><b>Emails between Andy Smith and Lucy Mo to discuss Technical Note (Appendix M and L)</b></p> <p><b>And</b></p> <p><b>The Applicant’s response to the Environment Agency’s comments (Appendix K)</b></p> <p><b>And</b></p>	<p><b>Key Topic</b></p> <p>The Environment Agency provided their comments on the flood models, the key areas for refinement were:</p> <ul style="list-style-type: none"> <li>• Hydrology</li> <li>• Hydraulics - River Team</li> <li>• Hydraulics – Allerdene Burn</li> </ul> <p><b>Key Outcome</b></p> <p>The Applicant and the Environment Agency agreed the approach addressing the comments (<b>Appendix L</b>). Following this the Applicant has refined the flood models in line with the comments from the Environment Agency and submitted these back to the Environment Agency for their review and approval, this was undertaken informally on the 11<sup>th</sup> February 2020 and submitted formally as part of the Written Representations 10 (Deadline 2) part of the DCO process for the Environment Agency to consider. The Environment Agency provided their approval on 20<sup>th</sup> March 2020.</p>

Date	Form of correspondence	Key topics discussed and key outcomes
	<p><b>The Applicants Final Response to the Environment Agency's comments (Appendix N)</b></p> <p><b>And</b></p> <p><b>The Environment Agency's Approval of the Flood Model (Appendix O)</b></p>	<p>This agreement is covered in <b>Section 3, Table 3-1, Item 2.</b></p>
<p><b>02/04/20</b></p>	<p><b>Meeting (Appendix P)</b></p> <p><b>[REDACTED],</b> <b>Environment Agency.</b></p>	<p><b>Key Topic</b> <i>Addendums to the ES</i></p> <p>The Applicant confirmed that they have submitted ES Addendum – additional land (<b>EXA/D4/009</b>) and ES Addendum- Allerdene three span (<b>EXA/D4/011</b>) to the ES as part of the DCO application. The Environment Agency requested a copy of these.</p> <p><b>Key Outcome</b></p> <p>The Applicant provided links to these to the Environment Agency for their review on 2<sup>nd</sup> April 2020.</p> <p><b>Key Topic</b> <i>Flood Risk Model</i></p> <p>The Environment Agency confirmed that they are satisfied with the flood risk model but would like a summary note detailing how the compensation area will work.</p> <p><b>Key Outcome</b></p> <p>The Applicant is to submit a Technical Note to the Environment Agency.</p>

Date	Form of correspondence	Key topics discussed and key outcomes
		<p><b>Key topic</b> <i>River Gauging Station</i></p> <p>The Environment Agency are currently reviewing the draft DCO and Protective Measures and outlined how important this gauging station is for providing flood warnings in this area.</p> <p><b>Key Outcome</b></p> <p>Information on the temporary works is to be provided to the Environment Agency and additional measures have been included in the Outline CEMP [REP2-050 and 051] (a revised version of which was submitted at <b>Deadline 4</b>) to ensure sufficient protection for gauging station. This agreement is covered in <b>Section 3, Table 3-1, Item 6 and 7.</b></p> <p><b>Key Topic</b> <i>Temporary Works</i></p> <p>The Environment Agency have requested hydraulic modelling of the temporary works to demonstrate what if any impact they will have on the gauging station.</p> <p><b>Key Outcome</b></p> <p>The Applicant is to submit a Technical Note to the Environment Agency.</p> <p><b>Key Topic</b> <i>Water Framework Directive Assessment</i></p> <p>The Environment Agency confirmed that they are satisfied with <b>Appendix 13.2: WFDa</b> of the ES [APP-164].</p> <p><b>Key Outcome</b></p> <p>This agreement is covered in <b>Section 3, Table 3-1, Item 4.</b></p>

Date	Form of correspondence	Key topics discussed and key outcomes
08/04/2020	<p>Meeting (Appendix Q)</p> <p> Environment Agency.</p>	<p><b>Key Topic</b></p> <p><i>Water Vole</i></p> <p>The Coal House Roundabout is partly culverted (so unsuitable for Water Voles), some natural sections which would be considered suitable but not optimal. The Environment Agency confirmed they are happy with this assessment. Water vole surveys would be done pre-construction. This is included in the Outline CEMP [REP2-050 and 051] (a revised version of which was submitted at Deadline 4).</p> <p><i>Fish</i></p> <p>To provide clarity on the bed material and fish passage the Outline CEMP [REP2-050 and 051] (a revised version of which was submitted at Deadline 4) requires updating.</p> <p><i>Design</i></p> <p>The Environment Agency require consultation on the detailed design.</p> <p><b>Key Outcome</b></p> <p>The Environment Agency were satisfied with <b>Chapter 8: Biodiversity</b> of the ES [APP-029] and approach, subject to reviewing the Outline CEMP [REP2-050 and 051]. The Outline CEMP [REP2-050 and 051] (a revised version has been submitted for Deadline 4) has been updated with additional measures to ensure sufficient protection for Water Voles.</p> <p>This agreement is covered in <b>Section 3, Table 3-1, Item 7 and 8.</b></p>

2.1.2 It is agreed that this is an accurate record of the key meetings and consultation undertaken between (1) the Applicant and (2) the **Environment Agency** in relation to the issues addressed in this SoCG.

### 3 ISSUES

Table 3-1 - Issues related to the ES and Other Issues

Item	ES Chapter	Paragraph Reference	Sub-section	Environment Agency Comment	Highways England Response	Status
1.	<b>Chapter 13: Road Drainage and the Water Environment of the ES [APP-034]</b>	Whole Chapter	N/A	The Environment Agency confirm that they are happy with the content of Chapter 13: Road Drainage and Water Environment of the ES [APP-034] on Table in Section 2 – 10th April 2019 - Meeting ( <b>Appendix G</b> ).	Agreed	Agreed
2.	<b>Appendix 13.1: FRA of the ES [APP-163]</b>	Whole Document (excluding Surface Water Drainage Strategy - Section 5 and Appendix C)	N/A	The Environment Agency request additional information on the flood compensation approach	A supplementary Technical Note has been provided to the Environment Agency for their review.	Under Discussion

Item	ES Chapter	Paragraph Reference	Sub-section	Environment Agency Comment	Highways England Response	Status
3.	Surface Water Drainage Strategy [APP-163]	Section 5 and Appendix C of <b>Appendix 13.1: Flood Risk Assessment</b> of the ES [APP-163]	N/A	<p>The Environment Agency confirm that they are happy with the content Appendix C: Surface Water Drainage Strategy of <b>Appendix 13.1: FRA</b> of the ES [APP-163].</p> <p>Other aspects agreed including that the flood risk from ordinary watercourse and surface water falls under remit of LLFA (Gateshead Council).</p>	<p>Agreed.</p> <p>Noting that the location and number of oil interceptors and sediment control measures are being refined in accordance with an aspect of detailed design that has been brought forward and will be submitted at some point during the examination.</p>	Under discussion
4.	<b>Appendix 13.2 – WFDa</b> of the ES [APP-164]	Whole Document	N/A	<p>The Environment Agency confirm that they are happy with the content of the <b>Appendix 13.2: WFDa</b> of the ES [APP-164] and 2nd April 2020 - Meeting (<b>Appendix P</b>).</p>	Agreed	Agreed



Item	ES Chapter	Paragraph Reference	Sub-section	Environment Agency Comment	Highways England Response	Status
5.	<b>Appendix 13.3 – Highways Agency Water Risk Assessment Tool of the ES [APP-165]</b>	Appendix A	N/A	The findings of the HAWRAT assessment are agreed.	Agreed - A technical note on the updated methodology within the Design Manual for Roads and Bridges (DMRB) updates – LA 113 – Road Drainage and the Water Environment has been submitted within the Deadline 4 response (Water HEWRAT Assessment DMRB Updates ( <b>EXA/D4/018</b> )).	Under discussion
6.	Draft DCO			Concerns about the potential impact on the gauging station.	This is to be managed by protective provisions and the measures provided in W20 of the Outline CEMP [ <b>REP2-050</b> and <b>051</b> ].	Under discussion
7.	Construction Environmental Management Plan	Whole Report	N/A	A range of clarification comments were submitted.	The Outline CEMP [ <b>REP2-050</b> and <b>051</b> ] has been updated in line with the	Under discussion

Item	ES Chapter	Paragraph Reference	Sub-section	Environment Agency Comment	Highways England Response	Status
	(CEMP) [REP2-050 and 051]				Environment Agency's comments as part of the Written Representations for Deadline 2.	
8.	<b>Chapter 8: Biodiversity</b> of the ES [APP-029]	Whole Chapter	N/A	The Environment Agency confirm that they are happy with the content of <b>Chapter 8: Biodiversity</b> of the ES [APP-029], in Table in Section 2 and 7th April 2020 - Meeting ( <b>Appendix Q</b> ).	Agreed	Agreed

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## **APPENDICES**

**Appendix A – Meeting Minutes [REDACTED]  
[REDACTED], Environment Agency and [REDACTED]  
[REDACTED] Gateshead Council (31/10/2017)**



## AGENDA & MEETING NOTES

<b>PROJECT NUMBER</b>	70039571	<b>MEETING DATE</b>	31 October 2017
<b>PROJECT NAME</b>	A1 Birtley to Coal House	<b>VENUE</b>	Gateshead Civic Centre- Room S21.
<b>CLIENT</b>	Highways England	<b>RECORDED BY</b>	█
<b>MEETING SUBJECT</b>	A1 widening- Flood risk/drainage		

<b>PRESENT</b>	WSP- █ Environment Agency (EA) - █ Gateshead Council (GC)- █
<b>APOLOGIES</b>	█
<b>DISTRIBUTION</b>	As above.
<b>CONFIDENTIALITY</b>	<b>Confidential</b>

ITEM	SUBJECT	ACTION	DUE
1	Introductions		
2	The outline of proposed Highways England works that may impact the water environment provided by WSP were described as follows: <ul style="list-style-type: none"><li>• River Team crossing.</li><li>• Allerdene culvert</li><li>• Outfalls</li></ul>		
3	<p>Additional Information/Local Knowledge:</p> <p>Smithy Lane culvert: Gateshead Council █ to provide WSP with the historic records regarding the uncertainty of connections to this culvert.</p> <p>Surface water issues at Bowes Railway: GC highlighted there has been historical issues relating to flood damage and erosion issues at this location. GC █ stated the need for some form of improvement/protection measures. WSP █ confirmed the culvert will be lengthened as part of the works and there are no surface water outfalls at this location. █ stated that the problem may be due to overland flows upstream. EA █ asked WSP if there would be any opportunities to improve this by looking at the opportunities to the underpass.</p> <p>EA enquired about the operational storm event design standard of the highway.</p>	GC █  WSP █	

<p>4</p>	<p>Flood Risk Implications:</p> <p><b>River Team</b></p> <p>WSP [REDACTED] confirmed that two piers will be widened by approximately 8m at the base and sheet piling may be used. EA highlighted the gauging station is near the crossing and the works would require a bespoke permit and method statement. WSP [REDACTED] mentioned that the type of piling to extend the base is to be confirmed.</p> <p>Modelling: WSP [REDACTED] confirmed models undertaken to date show no impact to proposed works and no impact on the Lamesley Pastures scheme.</p> <p>The EA requested if WSP [REDACTED] can check the models to see if there are any updates. WSP will also confirm using they are using the latest version. WSP will produce a technical note detailing scheme proposals, model reports and flood maps for EA's review.</p> <p><b>Allerdene Culvert</b></p> <p>The proposed works would require an extension to the existing 78m culvert by an additional 87m. WSP [REDACTED] confirmed that they will be undertaking simple hydraulic monitoring of the area. WSP [REDACTED] requested GC [REDACTED] to provide any historical data relating to this structure and stated that the proposed design would be based on replicating the existing flow capacities and velocity.</p>	<p>WSP [REDACTED]</p> <p>WSP [REDACTED]</p>	
<p>5</p>	<p><b>Climate Change- Flood Risk and Drainage</b></p> <p>WSP to review new climate change guidance.</p> <p>The EA mentioned new NPPF policy to be published in 2018/19 which discusses a range of climate change scenarios on surface water modelling and should be updated to reflect the design life of the scheme. EA [REDACTED] highlighted that this could be added to the risk register.</p> <p>WSP [REDACTED] clarified the design principles as agreed with Highways England. The proposed drainage scheme will allow for a 20% increase to the rainfall intensities to account for climate change over the existing and proposed catchment Where it is proposed to increase the paved areas (e.g. nearside widening / hardening of the central reserve), the discharge rate can be increased above the existing by an amount equal to the greenfield runoff rate for the additional paved area. GC [REDACTED] requested for the modelling files to be submitted for their review.</p>	<p>WSP [REDACTED]</p> <p>WSP [REDACTED]</p> <p>WSP [REDACTED]</p>	
<p>6</p>	<p>Wider flood alleviation schemes - Team Valley Flood Alleviation Scheme (£8.5m)</p> <p>The EA [REDACTED] discussed that it is proposed to create 12ha of flood storage near to the Coal House Roundabout with construction commencing in 2018. It is anticipated that this will generate a surplus of 80,000 cubic meters of material for engineering fill. The excess material may be offered to the A1 or A19 Testos scheme. The scheme is at a pre-application stage and will require full planning permission, and has the potential to be completed before A1 scheme has started construction.</p> <p>WSP to issue MCHW Series 600 engineering specifications to the EA.</p> <p>The EA [REDACTED] to forward Lamesley Pastures Flood Alleviation details to WSP.</p> <p>GC [REDACTED] advised that the scheme should consider the new draft planning policy 'Making Spaces for Growing Places' which now includes the proposed Team Valley Flood Alleviation Scheme and a requirement for development to</p>	<p>WSP</p> <p>EA [REDACTED]</p> <p>WSP [REDACTED]</p>	

MEETING NOTES

	<p>consider the Team Valley Surface Water Management Plan, forthcoming coming Team Valley Flood Masterplan and forthcoming SPD on SuDS/water management. The Level 1 Strategic Risk Flood Risk Assessment is now available on the website and needs consideration.</p> <p>The EA and the Council expressed a desire for the Scheme to reduce surface water run off rates as betterment to aid works in Lamesley Pastures through mitigation options yet to be defined and support opportunities that contribute towards the integrated catchment management of the River Team. The EA and the Council would also like the scheme to consider opportunities to improve the water quality of the existing surface water runoff in line with the WDF objectives, reflecting the NPS. The EA requested WSP [REDACTED] will liaise with Highways England to confirm if this is possible.</p> <p>WSP [REDACTED] confirmed the relevant contacts at Highways England for the A1 scheme would be [REDACTED] acting as Assistant PM and [REDACTED] acting as PM.</p> <p>The EA asked if plots of land will be available for the Team Valley Flood Alleviation scheme and Highways England to initiate discussions on this opportunity.</p>	<p>[REDACTED]</p> <p>Highways England [REDACTED]</p>	
<p>7</p>	<p>Drainage Strategy</p> <ul style="list-style-type: none"> <li>• Outfalls – the EA [REDACTED] discussed that the outfalls need to be up to current (not just high priority outfalls) and future (changes expected before the DCO is submitted) standards with emphasis on climate change guidance to be followed.</li> <li>• CCTV Survey – WSP [REDACTED] stated that a CCTV survey of the existing highway drainage has been undertaken due to limited information and currently being modelled to establish the existing flow rates.</li> <li>• Discharge rates – WSP [REDACTED] confirmed that upon establishing the existing flow rates, the proposed flows will be restricted to this in order to mitigate any flooding due to discharge.</li> <li>• Attenuations – WSP [REDACTED] confirmed that attenuation will be provided as part of the scheme to retain the volume of surface water due to restricted discharge.</li> <li>• Water Quality – WSP [REDACTED] confirmed that WSP will be assessing the water quality and mitigating treatment where applicable.</li> </ul>		
<p>8</p>	<p>Other Schemes in the Area</p>		
<p>9</p>	<p><b>AOB</b></p> <p>EA requested if WSP could share ecology surveys and locations, ground investigations and topographical information undertaken to date. WSP [REDACTED] to discuss with [REDACTED] from Highways England regarding permission to send through this information.</p> <p>GC discussed that WSP could liaise with [REDACTED] at GC regarding ecology. [REDACTED] requested from GC [REDACTED] their current maintenance liabilities of the ditches covered in the scheme.</p> <p>The EA requested that the DCO programme for the scheme could be shared and Highways England would be able to send through this information.</p>	<p>WSP [REDACTED] / Highways England [REDACTED]</p> <p>GC [REDACTED] Highways England</p>	

## MEETING NOTES

	<p>Andrew Softley will be the EA case officer for the Scheme.</p> <p>WSP to issue a 'Statement of Ambitions' to EA/GC.</p> <p>EA requested that WSP prepare an Ecological Survey Scoping Report to allow comment as part of the full engagement process.</p>	<p>■</p> <p>WSP</p> <p>WSP</p>	
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### NEXT MEETING

An invitation will be issued if an additional meeting is required.



## **Appendix B – Letter Lucy Mo, Environment Agency (06/12/2017)**

Planning Inspectorate  
Temple Quay House Temple Quay  
Bristol  
Avon  
BS1 6PN

**Our ref:** NA/2017/113874/01-L01  
**Your ref:** TR010031-000007  
**Date:** 06 December 2017

Dear Sir/Madam

**PLANNING ACT 2008 (AS AMENDED) AND THE INFRASTRUCTURE  
PLANNING (ENVIRONMENTAL IMPACT ASSESSMENT) REGULATIONS  
2017(THE EIA REGULATIONS) – REGULATIONS 10 AND 11**

**APPLICATION BY HIGHWAYS ENGLAND (THE APPLICANT) FOR AN  
ORDER GRANTING DEVELOPMENT CONSENT FOR THE A1 BIRTLEY TO  
COAL HOUSE IMPROVEMENT SCHEME (THE PROPOSED DEVELOPMENT)  
A1 BIRTLEY TO COAL HOUSE IMPROVEMENT SCHEME**

Thank you for referring the above Scoping Opinion which we received on 8 November 2017. We have assessed the information submitted against matters within our remit and have the following comments/advice to offer:

**Flood Risk**

A Flood Risk Assessment should be undertaken to address the flood risks during the construction phase of the A1 widening and the permanent works. In particular, the Flood Risk Assessment should take into account the following matters:

Climate change allowance must be factored into the design of the road and drainage; and

Floodplain compensation for any loss of the floodplain must be provided. This should include the provision of climate change.

The scoping report makes reference to working with other flood risk management authorities to join the delivery of wider strategic flood alleviation schemes. We welcome and support this approach.

We would welcome opportunities for environmental betterment, in particular opportunities to reduce surface water flood risk. This issue was highlighted and discussed at a meeting on 31 October 2017 with the consultants managing the application and Gateshead Council.

Tyneside House, Skinnerburn Road, Newcastle Business Park, Newcastle upon Tyne, NE4 7AR.  
Customer services line: 03708 506 506  
Email: [enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk)  
[www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)



### **Flood Risk Modelling**

The Environment Agency's 2016 Team Valley flood risk model should be used to inform the proposed development. The existing Team Valley hydraulic model was constructed in 2011, and updated in 2016 by JBA on behalf of the Agency. The purpose of the update was to test the impact of all options proposed in the Project Appraisal Report (PAR) and to improve the understanding of the flood risk within the Team Valley area from the western tributaries. This information is available upon request. Any request for data should be sent to our Customer and Engagement Team at [northeast-newcastle@environment-agency.gov.uk](mailto:northeast-newcastle@environment-agency.gov.uk)

It is noted that section 15.7.7 states 'where hydraulic modelling is required this will be undertaken in accordance with Methods E and F of HD45/09'. It is considered that hydraulic modelling will be required in support of the National Significant Infrastructure Project (NSIP) application.

### **Flood Risk Permits**

Within your site boundary is a designated "main river" and under the Environmental Permitting Regulations 2010, you may require an environmental permit for flood risk activities. If you want to do work within 8 metres of a non-tidal sections, or 16 metres of the tidal section, instance where work is proposed:

- a) in, under or near a main river ( including where the river is in a culvert;
- b) on or near a flood defence on a main river
- c) in the floodplain of a main river
- d) on or near a sea defence.

You can find out more information on permit requirements using the following link: <https://www.gov.uk/guidance/flood-risk-activities-environmental-permits>. If a permit is required, it must be obtained prior to beginning the works. The applicant is advised to contact the Environment Agency to discuss the issues likely to be raised.

### **Water Framework Directive**

The proposed works will affect the River Team (Source to Tyne, GB103023075670). This waterbody is currently classified under the Water Framework Directive (WFD) as Moderate. This Heavily Modified Waterbody is impacted by urbanisation from the highway network. In particular, sedimentation, hydrocarbons and road salt from highway infrastructure has affected the water quality of the River Team.

The WFD seeks to improve the water quality in all our waterbodies (including lakes, rivers and estuaries). In particular, it seeks to ensure that all waterbodies achieve 'good status' or 'good ecological potential'. The environmental objectives of the WFD are:

Tyneside House, Skinnerburn Road, Newcastle Business Park, Newcastle upon Tyne, NE4 7AR.  
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to prevent deterioration of the status of surface waters and groundwater  
to achieve objectives and standards for protected areas

to aim to achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological potential and good surface water chemical status

to reverse any significant and sustained upward trends in pollutant concentrations in groundwater

the cessation of discharges, emissions and losses of priority hazardous substances into surface waters

progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants

The Northumbria River Basin Management Plan provides the overarching framework for all decisions that are relevant to water management to ensure the protection and improvement of the water environment.

The overall objectives of the Northumbria RBMP is to 1) prevent deterioration 2) deliver protected area objectives 3) deliver improvements that make progress towards 2027 objectives where the benefits are greatest. Environmental objectives have been set for each of the protected areas and waterbodies in the Northumbria river basin district. Highway England must have regard to these objectives when making decisions that could affect the water environment.

It is considered that the proposed development provides a great opportunity to implement WFD mitigation measures and river restoration. This could include deculverting and enhancements to the river environment, such as fish and mammal passage and water quality improvements. The use of sustainable drainage systems combined with oil interceptors would be a recognised way to improve the water quality from the highway draining into the watercourses.

### **Biodiversity and Ecology**

Any works over the River Team must maintain or enhance the riparian corridor. Article 10 of the Habitats Directive, stresses the importance of natural networks of linked corridors to allow movement of species between suitable habitats, and promote the expansion of biodiversity. Such networks may also help wildlife adapt to climate change.

We would welcome any opportunities for the development to contribute to improvement measures for the River Team. This could include local proposals to restore natural conditions in the river corridor and Lamesley Pastures conservation area and the wider vicinity.

There may be operational and/or post construction impacts to invertebrates in the

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area. For example, artificial lighting could impact upon feeding, breeding and movement of insects. We would request that number of lights and brightness should be assessed to avoid light spillage. This would be particularly important next to River Team. Risks should be minimised or eliminated where possible. We would also request that any planting schemes include native plants of local provenance.

### **Protected Species**

The proposed development must ensure that protected species which could be directly or indirectly affected by the proposal are considered. European Otter records have been found in the vicinity. They are protected under Habitat Directive Annex 4, Wildlife and Countryside Act Schedule 5 and Natural Environment and Rural Communities Section 41.

Amphibians including Great Crested Newt may be present within the construction site. They are protected under Habitat Directive Annex 2. The ecological report stated that desktop studies suggested that Water Vole may be present within 1km. Water Vole are protected under Schedule 5 of the Wildlife and Countryside Act.

### **Fisheries**

With respect to section 10.7.8 to 10.7.13, the evaluation of the ecological resources should extend to fish populations of the River Team. Whilst these are known to be very poor, due to water quality and other issues. Brown Trout and Eels, are present in the river and Atlantic salmon have recently been recorded in the Eslington area. All of these species are of high conservation value and as such carry protected species status. Data on fish populations of the Team can be found on open access here: <https://data.gov.uk/dataset/freshwater-fish-counts-for-all-species-all-areas-and-all-years>). Please refer to the Fisheries Classification Scheme output for the Kibbleworth. They are also sensitive receptors to any impacts from the scheme such as pollution and habitat degradation. Given their impoverished status, any opportunity the scheme provides to improve the habitat in the Team for fish should also be taken.

### **Geomorphology**

Morphology is a supporting element under WFD. The NSIP should assess any impact on the geomorphology of the watercourses that are crossed by the carriageway and the processes that determine the fluvial geomorphology. This would include (but is not limited to) any changes to crossings, alterations to piers, extension to culverts and alterations to the bed or banks (temporary or permanent). Where impacts are found, the Environmental Impact Assessment should outline how these can be mitigated e.g. deculverting of the existing converted watercourses.

### **Land contamination**

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The Environment Agency does not hold detailed information on the history, in terms of its previous use(s), or the current condition, of the land in the area under consideration. As such, we are unable to assess whether the land may be affected by contamination.

It is the responsibility of the landowner/developer to identify land affected by contamination and to ensure that remediation is undertaken to ensure a safe development. If there is a possibility of risks associated with land contamination to be present at the development site, we recommend that the applicant undertakes a risk assessment (RA) to quantify any risks and recommend remedial works. Further information can be found in 'Guiding Principles for Land Contamination (2010)' which provides guidance for applying a risk management process when dealing with land affected by contamination.

### **Groundwater**

The applicant should undertake a Hydrogeological Risk Assessment (HRA) if there are risks to groundwater from the proposed development.

Please do not hesitate to contact me if you have any questions regarding this letter.

Yours faithfully

**Lucy Mo**  
**Planning Technical Specialist - Sustainable Places**

Direct dial 020847 46524  
Direct e-mail [lucy.mo@environment-agency.gov.uk](mailto:lucy.mo@environment-agency.gov.uk)



**Appendix C – Meeting Minutes [REDACTED]  
[REDACTED] Environment Agency and [REDACTED]  
[REDACTED] Gateshead Council (15/03/2018)**



## AGENDA & MEETING NOTES

<b>PROJECT NUMBER</b>	70039571	<b>MEETING DATE</b>	15 March 2018
<b>PROJECT NAME</b>	A1 Birtley to Coal House	<b>VENUE</b>	Gateshead Civic Centre- Blaydon Room.
<b>CLIENT</b>	Highways England	<b>RECORDED BY</b>	█
<b>MEETING SUBJECT</b>	A1 widening- Flood risk/drainage		

<b>PRESENT</b>	WSP- █ Environment Agency (EA) - █ Gateshead Council (GC)- █
<b>APOLOGIES</b>	█
<b>DISTRIBUTION</b>	As above. █
<b>CONFIDENTIALITY</b>	Public

ITEM	SUBJECT	ACTION	DUE
1	Introductions		
2	The outline of proposed Highways England works that may impact the water environment provided by WSP were described as follows: <ul style="list-style-type: none"><li>• Kingsway Viaduct - River Team crossing</li><li>• Allerdene culvert</li><li>• Outfalls</li></ul>		
3	Minutes and actions from previous meeting:  Smithy Lane culvert: Gateshead Council █ provided WSP with the culvert and watercourse connection records regarding the uncertainty to this culvert.  Surface water issues at Bowes Railway: GC highlighted there has been historical issues relating to flood damage and erosion issues at this location. WSP █ requested if any further information was available to the source of the flood damage as a meeting with Highways England Asset Led suggested this could be due to the change in ploughing of the fields. GC █ to check if this information could be investigated further.	GC █	



<p>4</p>	<p><b>River Team</b></p> <p>WSP [REDACTED] confirmed that two piers will be widened by approximately 8m at the base and sheet piling has been proposed. EA highlighted the River Team as a failing water body due to the modified watercourse features. The aspiration of the EA is to divert from modification and sheet piling would be adverse to this requirement. EA [REDACTED] requested to seek alternative methods to the construction and provided an insight to WFD mitigation measures. EA [REDACTED] informed that sheet piling may be acceptable as a temporary measure based on factors which will not cause negative adjustment to the river. Temporary flood management measures should be set out given the reduction in channel capacity from sheet piling.</p> <p>EA [REDACTED] compensatory mitigation measures would be required for any additional heavily modified elements and opportunities for betterment should be considered in order to achieve the required WFD objective to 2027.</p> <p>EA [REDACTED] enquired about the depth of the sheet piling: piling into bedrock had potential to create minewater/groundwater pathway – shallow mineworkings in area needed to be considered which had implications in terms of water quality and quantity.</p> <p>WSP will produce a technical note detailing scheme proposals, model reports and flood maps for EA's review.</p> <p><b>Allerdene Culvert</b></p> <p>The proposed works would require an extension to the existing 78m culvert by an additional 87m. WSP [REDACTED] confirmed that the hydraulic capacity has been based on the existing and the replacement structure has been sized larger due to the increased embankment loading. WSP [REDACTED] stated the design has been based on replicating the existing flow capacities and velocity.</p> <p>WSP [REDACTED] described the proposal to expose the existing culvert section and form an open ditch. EA [REDACTED] promoted the concept as similar work was to be carried out with the culvert along Kingsway. EA [REDACTED] initiated further development for WSP to propose methods in reducing the energy of the flows at this location and storage and conveyance e.g. swales, pools, baffles. GW highlighted that this area was designated in Draft Local Plan 'Making Spaces for Growing Places' for green infrastructure and flood management. The Strategic Flood Risk Assessment had identified historic flooding downstream of the culvert, new development should consider betterment opportunities. [REDACTED] highlighted consideration should be given to opportunities upstream of the culvert to help reduce velocities within the culvert and flood risk downstream.</p> <p>EA [REDACTED] informed the presence of otters in the vicinity of the culvert along Kingsway.</p> <p>EA stated for WSP to evaluate the requirement for providing trash screen at the headwalls for the culvert. Reference shall be made to the CIRIA guidance. WSP to consult with GC further proposals. [REDACTED] suggested a larger scale drawing of the area around the culvert entrance should be supplied. This would allow assessment of whether a screen was required.</p> <p><b>Allerdene Pond</b></p> <p>Due to the addition of paved areas and restricted flows, WSP [REDACTED] explained</p>	<p>WSP [REDACTED]</p> <p>WSP [REDACTED]</p> <p>WSP [REDACTED]</p>	
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	<p>the requirement for a balancing pond and the location of the site identified for this. EA [REDACTED] informed that further ecological advice can be sought from Peter Shield – Council’s ecologist for SuDS and watercourses/culverts. A freeboard of minimum 600mm will be required over and above the water level for a 1 in 100 year storm plus climate change allowance. [REDACTED] confirmed that ecological design input was required for developing the pond shape, form and location.</p> <p>[REDACTED] stated that location of pond should consider flood risk constraints e.g. surface water flow routes.</p> <p><b>Outfalls</b></p> <p>EA [REDACTED] that a permit to construct will be required for any adaptations to outfalls greater than 300mm in diameter. [REDACTED] directed towards the advice from the River Restoration website for better outfall design. GC [REDACTED] informed that watercourse consent will be required from Gateshead Council.</p>	<p>WSP [REDACTED]</p> <p>WSP [REDACTED]</p>	
<p>5</p>	<p><b>Climate Change- Flood Risk and Drainage</b></p> <p>The EA mentioned new NPPF policy to be published in 2018/19 which discusses a range of climate change scenarios on surface water modelling and should be updated to reflect the design life of the scheme.</p> <p>WSP [REDACTED] clarified the design principles as agreed with Highways England. The proposed drainage scheme will allow for a 20% increase to the rainfall intensities to account for climate change over the existing and proposed catchment. Where it is proposed to increase the paved areas (e.g. nearside widening / hardening of the central reserve), the discharge rate has been restricted as the existing or marginally lower. This feature has been provided as an overall betterment from the scheme.</p> <p>WSP [REDACTED] provided GC [REDACTED] with the Microdrainage model files and drawings (on CD) which are to be reviewed for comments.</p>	<p>WSP [REDACTED]</p> <p>GC [REDACTED]</p>	
<p>6</p>	<p><b>Wider flood alleviation schemes - Team Valley Flood Alleviation Scheme</b></p> <p>EA [REDACTED] confirmed the surplus material as a result of the flood storage works will be stockpiled for the A19 Testos scheme. WSP action to issue MCHW Series 600 engineering specifications to the EA will be withdrawn.</p> <p>The EA [REDACTED] to forward Lamesley Pastures Flood Alleviation details to WSP.</p> <p>[REDACTED] it was important to ensure that the wetland habitat created at Lamesley would not be detrimentally affected by the A1 scheme either during construction or operation.</p> <p>The EA and the Council would also like the scheme to consider opportunities to improve the water quality of the existing surface water runoff in line with the WDF objectives, reflecting the NPS. The EA requested WSP [REDACTED] will liaise with Highways England to confirm if this is possible.</p> <p>Water treatment of runoff from existing or new part of highway would be important. Consideration should be given to EIA scoping opinion comments which flagged up the importance of considering sensitive environmental receptors. [REDACTED] to re-send EIA scoping comments.</p>	<p>EA [REDACTED]</p> <p>WSP [REDACTED]</p> <p>GC [REDACTED]</p>	
<p>7</p>	<p><b>Drainage Strategy</b></p> <ul style="list-style-type: none"> <li>Outfalls – the EA [REDACTED] discussed that the outfalls need to be up to current (not just high priority outfalls) and future (changes expected before the DCO is submitted) standards with emphasis on climate change guidance to be followed. WSP [REDACTED] informed that oil</li> </ul>	<p>WSP [REDACTED]</p>	

## MEETING NOTES

	<p>interceptors will be provided at all outfalls. Design standards should consider reducing hard engineering and sediment.</p> <ul style="list-style-type: none"> <li>• Discharge rates – WSP [REDACTED] confirmed that upon establishing the existing flow rates, the proposed flows have been restricted to this in order to mitigate any flooding due to discharge.</li> <li>• Attenuations – WSP [REDACTED] confirmed that attenuation in form of large pipes and geocellular storage will be provided to retain the volume of surface water due to restricted discharge. [REDACTED] (EA) groundwater /minewater considered in design. [REDACTED] (GC) opportunities to integrate SuDS should be considered in line with national and local policy taking account of multifunctional benefits e.g. ecology, amenity and water quality.</li> <li>• Water Quality – WSP [REDACTED] confirmed that WSP will be assessing the water quality and mitigating treatment where applicable.</li> <li>• Water Quality – EA [REDACTED] shared lessons learnt from the HAWRAT assessment based on the A19 Testos scheme that the 'Toolbox' was to be updated from the superseded version. There was also a risk factor which caused an error in the traffic flows.</li> </ul>	WSP [REDACTED]	
8	<p><b>AOB</b></p> <p>EA requested if WSP could share ecology surveys and locations, ground investigations and topographical information undertaken to date. WSP [REDACTED] to discuss with [REDACTED] from Highways England regarding permission to send through this information.</p> <p>GC discussed that WSP could liaise with [REDACTED] at GC regarding ecology. [REDACTED] requested from GC [REDACTED] their current maintenance liabilities of the ditches covered in the scheme. This specifically related to the section of ditch connecting to the north end of the Allerdene culvert.</p> <p>The EA requested that the DCO programme for the scheme could be shared and Highways England would be able to send through this information. [REDACTED] will be the EA case officer for the scheme and all future meeting correspondence shall be forwarded to him.</p> <p>WSP to issue a 'Statement of Ambitions' to EA/GC.</p> <p>EA requested that WSP prepare an Ecological Survey Scoping Report to allow comment as part of the full engagement process.</p> <p>EA RC River Team Catchment Partnership was forming to improve flood management, water quality/WFD and environment. It would be beneficial if Highways England joined partnership.</p>	<p>Highways England [REDACTED]</p> <p>GC [REDACTED]</p> <p>Highways England [REDACTED]</p> <p>WSP</p> <p>WSP</p> <p>Highways England [REDACTED]</p>	

### NEXT MEETING

An invitation will be issued if an additional meeting is required.

## **Appendix D – Letter Lucy Mo, Environment Agency (21/03/2018)**

Ms Nicola Wilkes  
Highways England  
Lateral 8 City Walk  
LEEDS  
LS11 9AT

**Our ref:** NA/2018/113997/01-L01  
**Your ref:** A1B2CH  
**Date:** 21 March 2018

Dear Ms Wilkes

**SECTION 42 DUTY TO CONSULT ON A1 BIRTLEY TO COAL HOUSE SCHEME. A1 BIRTLEY TO COAL HOUSE IMPROVEMENT SCHEME**

Thank you for referring the above proposal which we received on 6 February 2018. We have reviewed the information submitted and have the following comments/advice to offer:

**Flood Risk**

A Flood Risk Assessment should be undertaken to address the flood risks during the construction phase of the A1 widening and the permanent works. In particular, the Flood Risk Assessment should take into account the following matters:

Climate change allowance must be factored into the design of the road and drainage. Further information regarding climate change allowances are available at <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>; and

Floodplain compensation for any loss of the floodplain must be provided. This should include the provision of climate change.

**Flood Risk Modelling**

The Environment Agency's 2016 Team Valley flood risk model should be used to inform the highway scheme. The existing Team Valley hydraulic model was constructed in 2011, and updated in 2016 by JBA on behalf of the Agency. The purpose of the update was to test the impact of all options proposed in the Project Appraisal Report (PAR) and to improve the understanding of the flood risk within the Team Valley area from the western tributaries. This information is available upon request. Any request for data should be sent to our Customer and

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Email: [enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk)  
[www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)



Engagement Team at [northeast-newcastle@environment-agency.gov.uk](mailto:northeast-newcastle@environment-agency.gov.uk)

### **Flood Risk Permits**

Within your site boundary is a designated "main river" and under the Environmental Permitting Regulations 2010, you may require an environmental permit for flood risk activities. If you want to do work within 8 metres of a non-tidal sections, or 16 metres of the tidal section, instance where work is proposed:

- a) in, under or near a main river ( including where the river is in a culvert;
- b) on or near a flood defence on a main river c)in the floodplain of a main river
- d) on or near a sea defence.

You can find out more information on permit requirements using the following link: <https://www.gov.uk/guidance/flood-risk-activities-environmental-permits>. If a permit is required, it must be obtained prior to beginning the works. The applicant is advised to contact the Agency to discuss the issues likely to be raised.

### **Water Framework Directive**

The proposed works will affect the River Team (Source to Tyne, GB103023075670). This waterbody is currently classified under the Water Framework Directive (WFD) as Moderate. This Heavily Modified Waterbody is impacted by urbanisation from the highway network. In particular, sedimentation, hydrocarbons and road salt from highway infrastructure has affected the water quality of the River Team.

The WFD seeks to improve the water quality in all our waterbodies (including lakes, rivers and estuaries). In particular, it seeks to ensure that all waterbodies achieve 'good status' or 'good ecological potential' by 2027.

The environmental objectives of the WFD are:

to prevent deterioration of the status of surface waters and groundwater to achieve objectives and standards for protected areas;

to aim to achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological potential and good surface water chemical status;

to reverse any significant and sustained upward trends in pollutant concentrations in groundwater;

the cessation of discharges, emissions and losses of priority hazardous substances into surface waters; and

progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants.

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The Northumbria River Basin Management Plan provides the overarching framework for all decisions that are relevant to water management to ensure the protection and improvement of the water environment. In particular, it seeks to 1) prevent deterioration 2) deliver protected area objectives, and 3) deliver improvements that make progress towards 2027 objectives where the benefits are greatest.

Environmental objectives have been set for each of the protected areas and waterbodies in the Northumbria river basin district. Highway England must have regard to these objectives when making decisions that could affect the water environment. For example, Highway England will need to consider the water quality and address the impacts on the affected waterbodies from structures such as outfalls, bridge supports, culverts etc. These structures may need to be reduced, modified and mitigated against in order to achieve the 2027 WFD objectives.

### **WFD mitigation**

It is considered that the proposed scheme provides a great opportunity to implement WFD mitigation measures and river restoration. This could include deculverting, daylighting of culverts and enhancements to the river environment, such as fish and mammal passage and water quality improvements. The use of sustainable drainage systems combined with oil interceptors would be a recognised way to improve the water quality from the highways draining into the watercourses.

The delivery and implementation of the measures outlined above, would be supported by the River Team Catchment Partnership and the Agency. The River Team is a focus area for improvement for the Catchment Partnership. The Catchment Partnership has several complementary projects in the catchment which seek to improve water quality, ecology, river restoration, habitat improvement and quantity, naturalisation for flood risk, woodland planting and improvements to land contamination. Several investigations and feasibilities such as Northumbrian Water's Chemical Investigations Programme for Rowletch Burn) and significant investment by Northumbrian Water for the removal of phosphate have been carried out for the catchment. In order for the catchment to achieve its 2027 WFD objectives, every organisation, especially those identified as contributing to the WFD failure of the waterbody, should seek to deliver WFD mitigation measures which go beyond the minimum. Opportunities to deliver and enhance the environment and WFD should be undertaken.

### **Biodiversity**

We welcome the aim to work with stakeholders to improve the water environment.

Any works over the River Team must maintain or enhance the riparian corridor.





Article 10 of the Habitats Directive, stresses the importance of natural networks of linked corridors to allow movement of species between suitable habitats, and promote the expansion of biodiversity. Such networks may also help wildlife adapt to climate change.

With respect to section 6.3.23, it is noted that waterbodies are not mentioned as a sensitive receptor. Waterbodies that are within the footprint of the scheme and may be impacted by the proposed development are: River Team and unnamed tributaries, Black Burn, Ladypark Burn, Longacre dene and Leyburnhold Gill (not exhaustive).

Section 6.4.10: we would welcome design and enhancement measures to consider the connectivity of the watercourses that the scheme impacts upon. Consideration must be given to protected and non-protected species that use the aquatic environment and riparian corridor.

Section 6.4.11: with respect to bullet point 'buffer zone around invasive species areas to avoid spreading', we would welcome mitigation that involves managing/removing invasive species where this is practical for the species.

Section 6.4.16 states that an updated Preliminary Ecological Appraisal will be undertaken in 2018. The Agency supports this approach. With respect to bullet point 'Consideration of the potential impacts to freshwater ecology, to be included within the ES, if appropriate', we advise that an assessment of the impacts upon freshwater ecology should be undertaken as part of the proposed scheme. We would support monitoring of the freshwater environment to assess the impacts of the scheme and mitigation/compensation put in place as a result.

Section 6.9.4: we welcome the production of a detailed survey to identify outfalls within the scheme footprint. With respect to water quality, given the moderate WFD status of the River Team, Highway England should seek to control drainage from these outfalls and implement mitigation measures to reduce/eliminate polluted run-off.

Section 6.9.6: we would welcome consideration of alternatives to extending the culverted section of the watercourse which passes under Allerdene Bridge. It is the Agency's policy that no watercourse should be culverted unless there is an overriding need to do so. This is due to the negative impacts on ecology, blockages/flood risk and maintenance issues.

We welcome the assessment of residual effects in terms of climate change within the next iteration of the Environmental Impact Assessment (EIA). As part of this process, we would welcome consideration of the impact on removal of maturing highway woodland and vegetation, and the potential impact to runoff and water quality.





## Geomorphology and WFD

We welcome the reference to assessing the geomorphological impacts associated with the River Team Culvert and watercourses associated with the Allerdene culvert. A WFD Assessment should be included to assess the impact upon all WFD qualifying elements of all affected watercourses, regardless of main river or ordinary watercourse.

The baseline hydromorphological condition of the watercourses will need to be assessed. All watercourse crossing surveys should demonstrate how the temporary works will be carried out and the impact they will have on the hydromorphology, including connectivity, sediment transport processes, the simplifying of channels and how this will be mitigated against. This impact upon the hydromorphology should then be used to directly assess the impact upon ecology including fish and their habitat, invertebrates and macrophytes. This could be incorporated into the WFD Assessment and mitigation included where appropriate.

The supporting documents do not provide any details regarding what assessment will be used to assess the current hydromorphological condition, and how the construction and permanent works will affect this. River Habitat Survey, watercourse crossing surveys, geomorphological surveys will be required. The EIA should identify how the scheme can help improve the condition of the River Team and its tributaries.

## Fish

Section 6.4.7: the list of protected species should also include Brown Trout, Eel and Atlantic salmon, all of which are present in the Team and sensitive receptors to any impacts arising from the scheme such as pollution and habitat degradation. Agency data on fish populations existing in the River Team can be found on open access here: <https://data.gov.uk/dataset/freshwater-fish-counts-for-all-species-all-areas-and-all-years>

Sections 6.4.8 & 6.4.9: consideration should be given to the mortality of fish species and adverse effects on their routes of migration, as well as patterns of behavior.

Section 6.4.10: we would welcome any opportunities the scheme provides to enhance the existing habitat of the River Team for fish, in the vicinity of Junction 67. In particular where the channel is relatively uniform and lacks diversity.

Section 6.4.11: any in river works should also be programmed out of the main migration and spawning season for salmonid fish species and eel (spring and autumn months). Monitoring of water quality should be undertaken, in order to assess impacts from construction activities on fish and other aquatic species in



the Team.

Section 6.4.12: we welcome the opportunity the scheme provides to reduce the impact of surface water drainage from the A1 on water quality in the Team. This will have a positive effects on fish and biodiversity.

Section 6.4.16: we welcome consideration of the impacts of fish populations of the River Team, especially in view of their recovering status and recent discovery of Salmon - a species of high conservation value in the lower reaches of the river.

### **Groundwater / Minewater**

Groundwater within the coal measures underlying the area are currently being managed by the Coal Authority to prevent mine water pollution. Water is currently being actively pumped at a site (Kibblesworth) near Birtley. There is a risk that shallow groundwater may be present, now or in future, along some parts of the proposed route. As such we recommend that the applicant consider whether this may pose a risk to any part of the proposed scheme. For example, infiltration is unlikely to be a suitable drainage option. It may be beneficial to contact the Coal Authority for further information.

Storage and use of any chemicals used on site during the development works should not pose a risk to controlled waters, suitable pollution prevention measures should be put in place e.g. storage of chemicals within appropriately sized bunds.

### **Land Contamination**

Highway England should consider whether any potentially contaminative current and previous land uses are located along the route of the development. If there is a possibility of encountering land contamination, then an assessment of the risk posed to controlled water receptors should be undertaken with remediation and/or mitigation undertaken as required to manage the risks identified.

Please do not hesitate to contact me if you have any questions regarding this letter.

Yours sincerely

**Lucy Mo**  
**Planning Technical Specialist- Sustainable Places**

Direct dial 020847 46524

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## **Appendix E – Letter Lucy Mo, Environment Agency (20/07/2018)**

Ms Nicola Wilkes  
Highways England  
Lateral 8 City Walk  
LEEDS  
LS11 9AT

**Our ref:** NA/2018/114158/01-L01  
**Your ref:** A1B2CH  
**Date:** 20 July 2018

Dear Ms Wilkes

**A1 BIRTLEY TO COAL HOUSE SCHEME 22 JUNE – 20 JULY 2018. SECTION 42 CONSULTATION**

Thank you for referring the above consultation, which we received on 22 June 2018. With respect to matters within our remit, we have reviewed the information submitted and have the following comments/advice to offer:

**Junction 67 sign gantries**

We have no comments to make regarding the location of signs and gantries at the northern end of the proposed development.

**Allerdene Bridge Compound and Access**

We have no comments to make regarding the proposed working compound or the access track.

**General Comments**

It should be noted that the comments outlined in our response dated 6 December 2017 (ref: NA/2017/113874/01-L01) and 21 March 2018 (ref: NA/2018/113997/01-L01) are still applicable. I have attached copies of these responses at the end of this letter.

Further to the comments outlined in our previous responses, we also have following comments to offer:

**Flood Risk**

A Flood Risk Assessment (FRA) must be submitted as part of the Development Consent Order application and climate change must be taken into account.



Floodplain compensation will be required at the Allerdene Culvert and the River Team culverts at junction 67. This could include alterations to the weir or culvert opening and/or changes to the highway embankment.

With respect to the pluvial flood risk on the replacement Allerdene Bridge, it is proposed that Allerdene Bridge will be reconstructed south of its current location. The supporting documents state that the road could be re-profiled, and changes to the drainage regime could be included as part of the design in such a way as to reduce the risk of surface water flooding through the replacement of the structure. This approach must be taken into account within the FRA and demonstrate a betterment in terms of flood risk.

### **No Net Loss / Net Gain**

The UK Government are committed to embedding an 'environmental net gain' principle for development, including housing and infrastructure, as part of their 25 Year Environment Plan. Highways England should seek to embed net gains in this scheme in addition to the no net loss as identified in the Preliminary Environmental Information Report.

There are several protected and priority habitats in the vicinity of these work. Therefore, it is recommended that where these sites are to sustain direct impacts, net gain enhancements should be made to expand these sites and increase their functionality and the links between them to enhance overall biodiversity in the area and wildlife corridors.

Consideration should also be given to the inclusion of wildlife crossings into the designs in and around the priority habitats identified with the Preliminary Environmental information Report. This will limit road traffic mortalities and further enhance connectivity between habitats.

### **Road Crossings**

The scheme involves extending existing road crossings and install new ones, including bridges and culverts. Where road crossings exist, we would welcome the opportunity to be involved in the design of these, in order to ensure passage for fish, mammals and amphibians are met, whilst also minimising sediment transport routes downstream of all watercourses.

We are generally opposed to the culverting of watercourses because of the adverse ecological, flood risk, human safety and aesthetic impacts. Watercourses are important linear features of the landscape and should be maintained as continuous corridors to maximise their benefits to society.

We will consider each application to culvert a watercourse on its own merits and in accordance with our risk-based approach to permitting. We will only approve a culvert if there is no reasonably practicable alternative, or if we think the



detrimental effects would be so minor that a more costly alternative would not be justified. In all cases where it is appropriate to do so, applicants must provide adequate mitigation measures, accept sole ownership and responsibility for future maintenance.

### **Sustainable Urban Drainage System (SuDS)**

We welcome the addition of SuDS to improve water quality and increase water attenuation. It is strongly recommended that the design of the road scheme maximises

the biodiversity potential of the scheme as a whole. This should include the planting of native and non-invasive species of local provenance and include a management strategy for their ongoing maintenance.

### **Invasive Non Native Species**

Where Schedule 9 species listed under the Wildlife and Countryside Act (1981) are found with or adjacent to the footprint of the works, section 14 of the WCA states that it is illegal to release or allow to escape into the wild any animal which is not ordinarily resident in Great Britain and is not a regular visitor to Great Britain in a wild state, or is listed in Schedule 9 of the Act.

It is also illegal to plant or otherwise cause to grow in the wild any plant listed in Schedule 9 of the Act. This includes through the distribution of seeds and rhizome fragments that may be present in organic matter being moved from site, i.e. soil. Further information is available from the Non-Native Species Secretariat (NNSS).

Vehicles are a known vector of environmental seeds and pathogens and actively spread these across road networks in the UK. We would therefore encourage Highways England to not only avoid INNS during the works, but to actively seek to control them to prevent their subsequent spread.

Please do not hesitate to contact me if you have any questions regarding this letter.

Yours sincerely

**Lucy Mo**  
**Planning Technical Specialist - Sustainable Places**

Direct dial 020847 46524

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## **Appendix F – Letter Lucy Mo, Environment Agency (08/04/2019)**



Mr Andy Smith  
WSP  
Kings Orchard 1 Queen Street  
St. Philips  
BRISTOL  
BS2 0HQ

**Our ref:** NA/2019/114476/01-L01  
**Your ref:** A1 Birtley Coal House  
Scheme  
**Date:** 08 April 2019

Dear Mr Smith

**CHARGED PLANNING ADVICE: REVIEW OF THE WFD ASSESSMENT, FRA AND THE ROAD DRAINAGE AND WATER ENVIRONMENT SECTION OF THE ENVIRONMENT STATEMENT. A1 BIRTLEY TO COAL HOUSE IMPROVEMENT SCHEME**

The following documents were reviewed:

- Appendix 13.1 Flood Risk Assessment – Draft GC and EA issue Copy
- Appendix 12.2 Water Framework Directive Assessment – Draft EA and GC issue
- Chapter 13 Road Drainage and the Water Environment – Draft EA and GC issue
- Figure 13.1 Scheme Extents and Extents of Works
- Figure 13.2. Water Feature Location Plan
- Figure 13.4 Outfall locations
- Figure 15.5a Fluvial Flood Zones
- Figure 13.5b Risk of Flooding from Surface Water
- Figure 13.6 Superficial Deposit Designations

**Flood Risk Assessment**

**Exception Test**

Section 2.17 states that ‘the FRA demonstrates that the scheme will remain safe throughout its design life and that flood risk will not be increased elsewhere’. As it stands, the Flood Risk Assessment (FRA) does not demonstrate how both elements of the Exception Test as set out in the National Planning Policy Framework (NPPF) and Planning Practice Guidance have been addressed. Further information regarding the application of the Sequential and Exception Test must be included in the FRA.





### **Climate change**

We would welcome clarity regarding which climate change allowances have been taken into account in the FRA. UKCP18 was published on 26 November 2018 and replaces the UKCP09 projections. The allowances in Flood Risk Assessment: Climate Change Allowances (published February 2016) are still the best national representation of how climate change is likely to affect flood risk for peak river flow and peak rainfall intensity. Research that is due to be published in 2019 may result in changes to these allowances.

### **Flood Risk Maps**

The flood zones have not been updated with the latest hydraulic modeling. As a result the flood outlines are incorrect. This was highlighted in our previous meeting with WSP in 2018. Data regarding flood risk maps and models can be obtained by emailing [northeast-newcastle@environment-agency.gov.uk](mailto:northeast-newcastle@environment-agency.gov.uk) Please note requests for information can take up to 20 working days.

### **National Policy**

We would welcome references to the Government's 25 Year Environment Plan within this section. The 25 Year Environment Plan seeks to ensure that new developments are flood resilient and do not increase flood risk, whilst achieving environmental net gains.

#### **3.1.8 Lady Park Burn**

Blockages to the culvert should be discussed and any risks to the A1 should be appraised.

#### **3.1.9 River Team**

There is no mention to piers being located in the floodplain and channel. The FRA will need to assess the impact of this on flood waters and provide compensation.

#### **Allerdene Burn**

There is a reference to the option of betterment to the existing culvert, but no reasons why this option has now been discounted. In line with the 25 Year Environment Plan and NPPF, we strongly recommend that betterment is achieved. Options for betterment were discussed in previous meeting with WSP/Highway England in 2018.

### **Chapter 4 Flood Risk - Historical Flooding**

References in this section are out of date and need to be updated. For example, there was a flood event in 2012 in Lady Park.

The text in figure 5 does not reflect that the flood modelling supersedes the flood map illustrated in figure 5.

Section 4.2.8: we support the use of sensors on the road.



Section 4.2.11: an area of floodplain compensation is to be located in an area that already floods. The FRA must demonstrate that this area of land is able to fully function as floodplain compensation, and that it floods at the right flood event.

Section 4.2.14: we would welcome clarity regarding whether the culvert needs to be extended or can it be a channel alignment.

Section 4.3 Tidal Flood Risk: it should be noted that the bottom section of the River Team is tidal. This should be taken into account in the FRA.

#### **Chapter 4.5 Groundwater Flood Risk**

The FRA does not adequately consider the risk of groundwater flooding. Groundwater within the coal measures underlying the area are currently being managed by the Coal Authority to prevent mine water pollution. In particular, water is currently being actively pumped at a site (Kibblesworth) near Birtley. There is a risk that shallow groundwater may be present, now or in future, along some parts of the proposed route. Therefore, it is vital that the FRA assesses and considers whether this may pose a risk to any part of the proposed scheme. For example, infiltration is unlikely to be a suitable drainage option. Further information is available from the Coal Authority for further information.

#### **Chapter 6. Conclusions**

Section 6.1.2: please see above comments regarding flood map accuracy and modelling.

Section 6.1.5: we would welcome clarity regarding the benefits of extending Allerdene culvert and realigning the existing drainage channel. What is the overall betterment on the Allerdene from the proposed works?

#### **A1 Birtley to Coal House Scheme Hydraulic Modelling Report**

Section 1.1.5: The 2016 River Team Model is available from the Environment Agency. Data regarding flood risk maps and models can be obtained by emailing [northeast-newcastle@environment-agency.gov.uk](mailto:northeast-newcastle@environment-agency.gov.uk) Please note requests for information can take up to 20 working days.

Section 1.3.4: the FRA and hydraulic modelling should reflect the latest flood risk modelling information.

Section 4.1.2: this paragraph states that table 7 demonstrates that the impact on flood levels is within the model tolerance as the largest increase is 20mm. What is the impact of this on residential properties, if any? This should be stated in the FRA.



### **Water Framework Directive (WFD) Assessment**

We welcome the application of the surface water drainage strategy including the use of Sustainable Drainage Systems (SuDS) and note the positive impact this can have on water quality and attenuation. It is also noted that the WFD assessment is based on the most up to date WFD information.

In order to achieve the objectives of the Government's 25 Year Environment Plan and the NPPF, the WFD assessment could be more ambitious and aspirational with respect to the achievement of environmental net gains for the environment. In particular, the WFD assessment does not take into account the 25 Year Environment Plan, which states that any development or infrastructure project should seek to demonstrate net gain for the environment. We would recommend that the WFD assessment takes into account the 25 Year Environment Plan, and identifies net gains for the environment especially in relation to the mitigation measures that should be addressed.

The WFD classified River Team and associated waterbodies in the catchment suffer from sedimentation. This is due to urban and transport run off. We would welcome clarity in relation to the silt control vortex separators, and why they are not being installed on all outfalls. Silt control vortex separators are only proposed at Long Acre Dene and would be beneficial on all outfalls.

We would also welcome clarity regarding the drainage from Kingsway Viaduct. Will this receive any treatment for water quality and sediment? There are a large number of Highways England culverts and outfalls in the proposed works. Under the WFD, these modifications have to be assessed and offer mitigation for their impact on habitat and biodiversity. The WFD assessment does not look at the options to mitigate for these.

With respect to the Heavily Modified Designation: Urbanisation, the following potential mitigation measures should be looked at and enhancement measures implemented:

- Align and attenuate flow to minimise impact on ecology
- Alter culvert channel bed to allow longitudinal connectivity
- Create habitat
- Educate landowners impacts to Hydromorphology and Hydromorphological harm
- Enhance existing structures to improve ecology
- Ensure maintenance minimises habitat impact
- Ensure maintenance prevents sediment transfer
- Implement bank rehabilitation
- Implement changes to locks etc.
- Implement channel maintenance strategy and/or technique
- Implement sediment management strategy



- Install fish passes
- Manage in-channel and riparian vegetation
- Manage realignment of flood defences
- Preserve or restore habitats
- Reduce fish entrainment
- Remove and prevent further dispersal of invasive non-native species
- Remove obsolete structure(s)
- Remove or enhance set-back embankments
- Remove or soften hard bank engineering
- Re-opening of culverts
- Restore or increase floodplain (lateral) connectivity
- Restore or Increase In-channel morphological diversity
- Retain habitats

### **Geomorphology**

What are the geomorphological impacts of the construction of the new piers/abutment within the floodplain (before, during the construction and post development)? This should be assessed as part of the WFD Assessment.

The WFD assessment should also demonstrate how the temporary works will be carried out and the impact they will have on the hydromorphology, including connectivity, sediment transport processes, the simplifying of channels and how this will be mitigated against. The impact upon the hydromorphology should then be used to directly assess the impact upon ecology including fish and their habitat, invertebrates and macrophytes. This could be incorporated into the WFD Assessment and mitigation included where appropriate.

Please do not hesitate to contact me if you have any questions regarding this letter.

Yours sincerely

**Lucy Mo**  
**Planning Technical Specialist - Sustainable Places**

Direct dial 020847 46524  
Direct e-mail [lucy.mo@environment-agency.gov.uk](mailto:lucy.mo@environment-agency.gov.uk)



**Appendix G – Meeting Minutes Lucy Mo, Caroline Maarouf and Rob Carr,  
Environment Agency (10/04/2019)**



# AGENDA & MEETING NOTES

<b>PROJECT NUMBER</b>	70041947	<b>MEETING DATE</b>	10 April 2019
<b>PROJECT NAME</b>	A1 Birtley to Coalhouse upgrade	<b>VENUE</b>	Environment Agency, Tyneside House, Skinnerburn Road, Newcastle upon Tyne, NE4 7AR
<b>CLIENT</b>	Highways England	<b>RECORDED BY</b>	██████████
<b>MEETING SUBJECT</b>	Environment Agency Comments on the A1 BCH Road Drainage and the Water Environment		

<b>PRESENT</b>	██████████ - Planning Technical Specialist ██████████ - Flood and Coastal Erosion Risk Management Advisor ██████████ - Catchment Coordinator for the Tyne Catchment ██████████ - WSP Environmental Assessment Lead ██████████ - WSP Water Specialist
<b>APOLOGIES</b>	██████████, Gateshead Council
<b>DISTRIBUTION</b>	As above plus: ██████████ - Highways England PM, ██████████ - WSP PM
<b>CONFIDENTIALITY</b>	Restricted

ITEM	SUBJECT	ACTION	DUE
1.	<p>██████████ presented an overview of the Scheme and provided a progress update on the stage of the environmental assessments and DCO submission.</p> <p>In particular it was explained that the only changes north of the northern tie-ins at junction 67 (approximately level with the end of the existing noise barrier at Lady Park) are changes to signage.</p> <p>The current submission of the DCO to the inspectorate is mid-June.</p>		
2.	<p><u>Kingsway Viaduct Piers</u></p> <p>The Environment Agency (EA) outlined that they had concerns over the need to extend the piers in the flood plain.</p> <p>██████████ detailed that modelling was undertaken using the EA / ICM model. The piers have been included in the modelling (there are 5).</p> <p>AS showed the results of the modelling that has been undertaken. This showed that none of the piers are in the baseline flood</p>		

MEETING NOTES

ITEM	SUBJECT	ACTION	DUE
	<p>extents, they only fall in the flood extents when looking at the climate change allowances are taken into account (+25% and +50%).</p> <p>█ showed the results of the modelling that has been undertaken. This showed that none of the piers are in the baseline flood extents, they only fall in the flood extents when looking at the climate change allowances are taken into account (+25% and +50%).</p> <p>█ detailed that the photographs showing the piers in relation to the river.</p>		
<p>3.</p>	<p><u>Modelling:</u> EA █ highlighted that they would like to see the modelling so that they can check that it is correct. They could then make their comments prior to DCO submittal. Once at detailed design the Flood Risk Permit would be straightforward.</p> <p>█ to provide confirmation that the models were provided to the EA as part of the package of information.</p> <p>█ stated that the EA flood modelling team may not get their response back prior to the DCO being submitted, as a detailed model review would normally take 2 weeks to complete and that availability of resource to carry this out may not be immediately available. █ outlined that the PO may need to be increased – up to £2000 + VAT for review of the model. █ will send through costs.</p> <p>█ discussed that we would confirm or send the model today.</p>	<p>█</p>	<p>11/04/19 Completed (model already provided)</p>
<p>4.</p>	<p><u>ES Chapter:</u></p> <p>█ detailed that no comments had been provided on the ES chapter. EA (█ and █) confirmed that they are happy with the content of the ES chapter.</p>		
<p>5.</p>	<p><u>EA Comments:</u></p> <p>Inception / exception text – provide more information on this process and how have they been carried out? █ to provide additional information into the FRA.</p> <p>█ to send word version of the EA comments.</p>	<p>█</p>	<p>Completed 12/04/19</p>
<p>6.</p>	<p><u>Modelling and Climate Change Guidance:</u></p>		

ITEM	SUBJECT	ACTION	DUE
	<p>█ discussed that climate change guidance (UK CP09) had been adopted for the modelling which was completed in December 2018. After the modelling had been completed the EA released an interim position on climate change in light of UK CP18. Due to the timing of this, the UK CP18 had therefore not been used.</p> <p>█ detailed that the EA is currently reviewing and assessing UK CP18.</p> <p>█ outlined that in the case of something of importance like this – the interim position would be to use UK CP18 (not UK CP09).</p> <p>█ discussed that given that we are not in the flood plain it's likely there would not be any difference.</p> <p>EA █ asked if we could run the worst case scenario (8.5 scenario standard method) and that Highways England projects of this scale this should be followed. █ also noted that there could only be a minimal difference.</p>		
<p>7.</p>	<p><u>Flood Maps in the ES:</u></p> <p>█ detailed that the flood map for planning as currently published does not include the findings of the EA's version of the ICM model – this is currently being updated. The maps that should be used should therefore not be the flood map for planning but use the outputs from the baseline ICM model.</p> <p>█ stated that the figures used have got the current EA Flood maps but the ICM model has used to drive the assessment.</p> <p>█ outlined that WSP would add some text into the FRA and ES Chapter and figures as required.</p>	<p>█</p>	



MEETING NOTES

ITEM	SUBJECT	ACTION	DUE
8.	<p><u>Lady Park Burn:</u></p> <p>█ stated that the Lady Park Burn blocks during heavy extreme rainfall (the screen blocks and the watercourse backs up). This overtopped onto the A1 in 2012. CM also stated that there wouldn't be enough water for a 1:5 or 1:10 year event to block the screen. █ also outlined that HE can look on the EA website for levels on Lady Park Burn to inform risk assessment.</p> <p>█ stated that this is within the area where only signage changes were taking place – there are no other changes as a result of the Scheme.</p> <p>█ outlined that they would like the FRA to consider:</p> <ul style="list-style-type: none"> <li>• What do Highways England tolerate in this area?</li> <li>• What measures are put in place should it overtop?</li> <li>• Do Highways England put road closures in place?</li> <li>• Should maintenance be put in place from Highways England (however special rakes need to be used to clear the screen)?</li> <li>• Can asset maintainers go out and check if there is a storm event etc.?</li> </ul> <p>█ outlined that aspect may have been considered as part of the Coal House to Metro Centre scheme.</p> <p>█ to locate documents from that scheme, if possible and see if this aspect was considered.</p> <p>WSP to include text on this in the ES and that this would be investigated at detailed design (to close this issue out in the ES).</p>	<p>█</p> <p>█</p>	

ITEM	SUBJECT	ACTION	DUE
<p>9.</p>	<p><u>Flood Plain Compensation:</u></p> <p>█ described that flood plain compensation has been provided in the Scheme for the climate change scenarios only, and its location is constrained by the location of the surface water attenuation tanks. █ outlined that further information is required to demonstrate that this area will flood at the same time as the lost floodplain. This can be provided through a GIS cross section, as opposed to additional modelling.</p> <p>█ stated that from the slides she considered that WSP have done comprehensive modelling. Just need the finer points to demonstrate that the compensation area works – this can be done in a technical note.</p> <p>█ to produce technical note or ensure this is closed out in the ES.</p>	<p>█</p>	
<p>10.</p>	<p><u>Other:</u></p> <p>█ discussed Allerdene Burn – betterment varies depending on the option. We have optimised the floodplain. We can provide additional betterment for the viaduct option compared to the embankment option.</p> <p>█ - Tidal flood risk – this is embedded in the model. Include some information in the FRA to this effect.</p> <p>Groundwater Flood Risk - █ detailed that this is in the updated ES chapter and FRA.</p> <p>WSP need to consider the model tolerance (CM considers that approx. 20mm) is appropriate for the ICM model. █</p>	<p>█</p>	

<p>11.</p>	<p><u>WFD Assessment:</u></p> <p>█ discussed that from a WFD point of view – looking at objective year of 2027. Need to get it to “good” status by 2027.</p> <p>█ discussed that a sediment vortex separator has been provided on Longacre Dene for woodland – identified as a sensitive receptor. █ outlined that other watercourses are ephemeral and only flow at certain times.</p> <p>█ stated that during flashy conditions sediment would be flushed through these channels particularly around the viaduct.</p> <p>█ detailed that around the viaduct there will be the settlement pond. At Kingsway viaduct – some water goes to the pond and some water will go through the tanks. Also have oversized pipes.</p> <p>█ stated that it was hard to see what flows were going where and would like to understand better.</p> <p>█ to provide the surface water drainage sub catchment plan.</p> <p>█ to provide better referencing through to the FRA from the WFD.</p> <p>█ stated that it looked from the report that only the bare minimum had been done to achieve WFD objectives.</p> <p>█ stated that you would need to move it in the direction of moving it towards “good”. Oil interceptors, hydro-breaks and SuDS will help but it will be the bare minimum. Ideally every structure, culvert and outfall should be assessed and that WSP should look at the suite of mitigation that the WFD Assessment should provide.</p> <p>█ also noted that this issue had also been raised on the Testos scheme and Downhill Lane.</p> <p>Action to ensure that mitigation is linked back to other chapters – and bring in cross referencing into WFD.</p> <p>█ discussed that additional text could be considered in to the WFD included looking at naturalising the channel at Allerdene culvert (currently daylighting), look at the culverts and outfalls for improvements, e.g. flow spreaders, location of outfall, impacts to habitat, naturalised / cobbly outfalls set back from channel.</p>	<p>█</p> <p>█</p>	
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## MEETING NOTES

ITEM	SUBJECT	ACTION	DUE
	<p>█ to provide photographs of another scheme to ensure his desires are understood.</p> <p>It was agreed that WSP would consider changing the significant effects to beneficial as the measures are “on the path” to betterment with regards to the WFD.</p>	<p>█</p> <p>█</p>	

### NEXT MEETING

An invitation will be issued if an additional meeting is required.

## **Appendix H – Emails Caroline Maarouf, Environment Agency (17/04/2019)**

Smith, Andy

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From: Maarouf, Caroline <caroline.maarouf@environment-agency.gov.uk>  
Sent: 17 April 2019 08:29  
To: Smith, Andy  
Cc: Mo, Lucy  
Subject: RE: climate change guidance

Hi Andy,

Thanks for sending through the revised section of the water report.

Climate change  
This seems reasonable.

Lady's Park Burn

This sub catchment is not gauged and so nearest gauge is the River Team at Team Valley.  
The lady's park Burn is very flashy and it's a heavily wooded area, hence the risk of blinding to our screen.  
Maybe an appropriate action is for the Highway officers to view the screen on coach burn road?

Regards  
Caroline

Caroline Maarouf  
Flood and Coastal Erosion Risk Management Advisor  
Partnership and Strategic Overview Team –Durham & Tees Valley  
Email: caroline.maarouf@environment-agency.gov.uk  
Jabber: 46424 | External: 020 847 46424  
Environment Agency | Northumberland Durham and Tees  
Tyneside House, Newcastle Business Park, Skinnerburn Road, NE4 7AR

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From: Smith, Andy [mailto:Andy.Smith@wsp.com]  
Sent: 16 April 2019 17:17  
To: Maarouf, Caroline <caroline.maarouf@environment-agency.gov.uk>  
Cc: Mo, Lucy <lucy.mo@environment-agency.gov.uk>; Ashworth, Nicola <Nicola.Ashworth@wsp.com>  
Subject: RE: climate change guidance

Caroline,

I am currently making changes to the water reports for the A1 Birtley to Coalhouse scheme as we discussed last week and would like clarification on a couple of aspects:

**Climate Change**

Many thanks for sending over the climate change advice. I propose to include some additional text within the FRA to outline that no further assessment is required, as below, please can you confirm that my interpretation and suggested text is ok?

The hydraulic modelling that has been undertaken has been in accordance with the allowances in 'Flood risk assessments: climate change allowances' (published by the Environment Agency in February 2016). The Environment Agency in their document (*Using 'Flood risk assessments: climate change allowances' following publication of new climate projections in UKCP18*) consider that these are still the best national representation of how climate change is likely to affect flood risk for:

- peak river flow
- peak rainfall intensity

However, in the case of sea level rise then the guidance for this type of scheme (at the time of writing, again set out in *Using 'Flood risk assessments: climate change allowances' following publication of new climate projections in UKCP18*) is that

*"in exceptional cases where developments are very sensitive to flood risk and have a lifetime of at least 100 years<sup>2</sup>, we recommend you assess the impact of both the current allowance in 'Flood risk assessments: climate change allowances' and the 95th percentile of UKCP18 'RCP 8.5' scenario (high emissions scenario) standard method sea level rise projections of UKCP18, and plan according to this assessed risk. You will need to calculate sea level rise allowances beyond 2100 by extrapolating the UKCP18 dataset."*

As the beyond the Scheme the lower reaches of the River Team are tidally influenced due consideration needs to be given to the potential implications of future sea level rise. However, in this instance it was not felt appropriate to undertake further assessment within the hydraulic model given that:

1. The Normal Tide Level (NTL) is at a weir over 3km from the site
2. The OS mapping indicates a change in level of between 5 and 10m between the site and the NTL

Therefore, no further assessment was required within the hydraulic model, which as constructed by the Environment Agency includes an adequate representation of the tidal boundary.

### **Lady Park Burn**

We discussed the ability for HE to view the water levels on the trash screen to aid the mitigation of the residual risk and inform emergency management plans, however, I cant find the information on the Environment Agency's website, are you able to confirm that there is a guage here and if so how it can be accessed, so I can consider the appropriate approach?

# River and sea levels for: Newcastle upon Tyne, Tyne and Wear, England

4:43pm Tuesday 16 April 2019

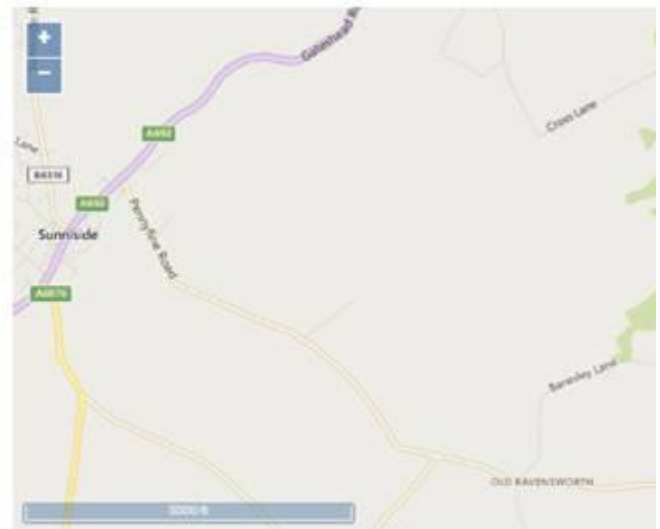
River and sea levels are regularly checked by a network of monitoring stations. These levels can help you understand your flood risk now and in the next few days. Enter a postcode or place to find your nearest station and select one from the map.

Location

## 5-day river level information for this area

You can get more information about local river and sea levels. Select a monitoring station from this list, or use the map.

- [Ouse Burn at Crag Hall](#)
- [Ouse Burn at Gosforth](#)
- [Ouse Burn at Woolsington](#)
- [River Team at Team Valley](#)



- [View the flood information service for England](#)
- [View your property's long term risk of flooding](#)
- ▶ [Flood information for Northern Ireland, Scotland and Wales](#)

Regards,  
Andy

**Andy Smith BSc MSc C.WEM CSci CEnv**  
Associate Director



T +44 (0) 117 9302082



[REDACTED]  
Kings Orchard, 1 Queen Street,  
Bristol, BS2 0HQ

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From: Maarouf, Caroline [<mailto:caroline.maarouf@environment-agency.gov.uk>]  
Sent: 16 April 2019 09:58  
To: Smith, Andy <[Andy.Smith@wsp.com](mailto:Andy.Smith@wsp.com)>  
Cc: Mo, Lucy <[lucy.mo@environment-agency.gov.uk](mailto:lucy.mo@environment-agency.gov.uk)>  
Subject: RE: climate change guidance

Hi Andy.

Attached is our guidance internally that we are working too.  
Second page first paragraph is what I have asked you to do.

Thanks  
Caroline

Caroline Maarouf  
Flood and Coastal Erosion Risk Management Advisor  
Partnership and Strategic Overview Team –Durham & Tees Valley  
Email: [caroline.maarouf@environment-agency.gov.uk](mailto:caroline.maarouf@environment-agency.gov.uk)  
Jabber: 46424 | External: 020 847 46424  
Environment Agency | Northumberland Durham and Tees  
Tyneside House, Newcastle Business Park, Skinnerburn Road, NE4 7AR

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From: Smith, Andy [<mailto:Andy.Smith@wsp.com>]  
Sent: 15 April 2019 17:48  
To: Maarouf, Caroline <[caroline.maarouf@environment-agency.gov.uk](mailto:caroline.maarouf@environment-agency.gov.uk)>  
Subject: climate change guidance

Caroline,

Many thanks for your time on Thursday, I'm just following up on a few of the points and it would be helpful to have a copy of the latest guidance on climate change as I want to ensure that the version I have is the latest.

Regards,  
Andy

**Andy Smith BSc MSc C.WEM CSci CEnv**  
Associate Director



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[REDACTED]

Kings Orchard, 1 Queen Street,

Bristol, BS2 0HQ

**wsp.com**

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## **Appendix I – Letter Lucy Mo, Environment Agency (23/07/2019)**

Mr Andy Smith  
WSP  
Kings Orchard 1 Queen Street  
St. Philips  
BRISTOL  
BS2 0HQ

**Our ref:** NA/2019/114620/01-L01  
**Your ref:** A1 Birtley Coal House  
Scheme  
**Date:** 23 July 2019

Dear Mr Smith

**CHARGED PLANNING ADVICE: REVIEW OF WFD ASSESSMENT,  
BIODIVERSITY ES CHAPTER AND ROAD DRAINAGE AND WATER  
ENVIRONMENT CHAPTER. A1 BIRTLEY TO COAL HOUSE IMPROVEMENT  
SCHEME**

We have reviewed the documents outlined below and have the following comments have the following comments to offer:

- Chapter 8 Biodiversity (May 2019)
- Appendix 13.2 Water Framework Directive
- Chapter 13 Road Drainage and the Water Environment
- Chapter 2 The Scheme (for info only)

**Flood Risk Model**

Overall the flood risk model requires further work before we accept the model and its findings. The hydrology in particular requires further clarification, and further details will need to be provided. In addition, there are number of issues in relation to Allerdene and the surface water modelling which need addressing. We will send you our model review assessment shortly, as we're currently seeking assurances from our modelling team on a number of matters.

**Chapter 13 Road Drainage and the Water Environment**

Within the report there is no reference to changes to the land where our river gauge is positioned. We currently lease this parcel of land from Gateshead Council, and are currently reviewing this lease.

We recognise the need for mitigation measures to be implemented in the overall scheme to reduce the increase in flood risks. However, we are unable to accept these mitigation measures until the modelling has been agreed.



The proposed floodplain compensation has been stated as being given as a top soil scrape near the coal house roundabout. Details of the scrape and calculations have not been submitted and will need to be submitted as part of Development Consent Order application.

It should be noted that the temporary culvert to aid crossing over the team will need a Flood Risk Activity Permit from the Environment Agency (EA), as the works are within 8m of the Main River Team.

### **Team Valley Flood Alleviation Scheme**

We are currently developing a flood alleviation scheme for the Team Valley Trading Estate, which incorporates a flood alleviation scheme element at Lamesley Pastures. There could be opportunities to work together with Highways England in relation to the proposed A1 bypass works to look for synergies, and project delivery efficiencies between the two projects. Furthermore, there may be opportunities to develop scheme elements collectively, in order to broaden the environmental enhancements that might be achieved separately and realise joint efficiencies through delivery.

### **Chapter 8 Biodiversity**

#### **Protected and Priority Species**

We are pleased to see that Biodiversity has been scoped into the Environmental Impact Assessment, and that a range of surveys for multiple species groups have been included to support the assessment of the Proposed Scheme.

#### *European Otter*

European otter are included in the Baseline Conditions and this summarises that otter could use the River Team, but then specifies that this is unlikely due to the impact of existing culverts in the area. Otter are known to be present at the Coal House Roundabout, Lamesley and the southern boundaries of the Team Valley Industrial Estate. There are also known resting places in the wider area, including records of juvenile otter.

Given the known presence of European otter and the likelihood that they do use the culverts, we feel that this assessment is unrepresentative of European otter on the River Team. Due to the outcome of this evaluation, it also prevents protective measures being included within the Design, Mitigation and Enhancement Measures section of the chapter.

We therefore recommend that European otter be re-evaluated, with appropriate mitigation included into the scheme. We are happy to liaise with the Applicant to provide information that would be pertinent to this. Mitigation measures would include (but not limited to) protective measures for the temporary River Team culvert and demolition activities in close proximity to the River. In addition, given that the assessment may change the outcome of the evaluation, separating



European water vole from European otter is recommended.

#### *European Water Vole*

The chapter states that “*The River Team has negligible potential to support water vole on this particular stretch*”. Were the smaller ditches and burns affected by the Proposed Scheme surveyed for water vole? For instance, Allerdene Burn or locations where outfalls are proposed to be built or upgraded? If not, this should be included in the assessment.

#### *Great Crested Newt*

We agree that while presence / absence surveys for great crested newt did not reveal any populations. The positive eDNA results may indicate that low populations are present, and that a Protective Method Statement is required for the Proposed Scheme.

#### *Red Squirrel*

While red squirrel are not a species led by the Environment Agency (EA), we note the report states that “*A Natural England licence must be in place for the removal of all active dreys*”. We are not aware of any licensable process in England that would allow the lawful removal of an active red squirrel drey, further advice from Natural England may be required.

#### *Invertebrates*

We note that invertebrates of Principal Importance (S41 Species) that have been recorded in the desk study have been described as not a constraint to the Scheme.

It would be beneficial to include a detailed habitats based assessment on each S41 invertebrate species recorded in the data search. This would allow for more targeted habitat improvements and specific planting regimes for each species the scheme could be impacting. This detailed approach could further demonstrate Biodiversity Net Gain for the Proposed Scheme as a whole.

#### *General biodiversity comments*

It is good to see that pre-construction surveys are included in the mitigation requirements for the scheme. We recommend that this extend to all protected and notable species that may be affected by the scheme. This will ensure that any mobile species which could be present during construction, be recorded and protected.

Regular monitoring by an Ecological Clerk of works throughout construction will be important in ensuring all mitigation in the chapter be effectively implemented. Where not mentioned in this response, mitigation measures that protect species and habitats during construction and operation are all acceptable.



### **Invasive Species**

We note that Japanese knotweed and potential giant hogweed have been recorded during surveys. We are pleased to see that an invasive species Management Plan will be written as part of the Proposed Scheme.

We also have records of Himalayan balsam and rhododendron in the area. Himalayan balsam is known to be extensive in areas of Team Valley. Provision for these species being present on site during construction should be made within the Method Statement.

### **Priority Habitats and Net Gain**

#### *Priority habitats*

There are a number of Habitats of Principal Importance within or adjacent to the site boundary, and it's good to see that these have been assessed as part of the development.

We do note that in Table 8-17 (page 48), there appears to be a loss of Running Water habitat. Further clarification on this loss is needed, and measures to prevent this loss included in any mitigation measures.

#### *Net Gain*

Biodiversity net gain requires developers to ensure habitats for wildlife are enhanced, and left in a measurably better state than they were pre-development. They must assess the type of habitat and its condition before submitting plans, and then demonstrate how they are improving biodiversity. The scheme must therefore deliver a measurable overall increase in biodiversity.

Biodiversity net gain is mentioned in the report and there are some calculations of loss and gain of some habitats. However, the chapter does not include any calculations on overall gain or loss of biodiversity. We therefore ask that biodiversity calculations for the scheme be produced, to demonstrate that Biodiversity Net Gain has been achieved.

#### *Habitat Improvements and Enhancements*

It is good to see enhancements will be included in the scheme such as bat and bird box creation. While these are positive measures, further measures should be included which provide varied, bespoke, and larger scale improvements to the area.

The River Team and Allerdene Burn provide opportunities for river restoration, realignment and wetland creation. Any improvements made will also help in achieving Biodiversity Net Gain for the Scheme.

We note that an attenuation pond will be included in the Scheme, could this include the creation multiple waterbodies to provide wider wetland creation and





habitat improvements in the area. We would welcome consideration of this.

The Allerdene viaduct option is preferred, as this allows for the removal of the culvert and the restoration of this watercourse at this location.

## **Fisheries**

### *Protected and Priority Species*

We are pleased to see a detailed assessment of fish species recorded in the vicinity of the proposed development, and that part of the Team is recognised as an important migratory route for Salmon, Sea Trout and Eel. In addition to the records mentioned in the report, surveys carried out by the Environment Agency in October 2018 confirmed the presence of protected species such as salmon, trout and eel just downstream of the scheme footprint and trout, upstream of it. A salmonid redd (nest), dug by adult salmon or sea trout potentially, and was also recorded in the Lamesley area in January of this year.

### *Water quality, fish passage and habitat improvements*

We welcome the proposed measures to improve the water quality of the road discharge and the knock-on beneficial effects this will have on fish populations in the watercourses concerned.

We also note that provision for fish passage and habitat will be included in the design criteria for any new culverts, and the commitment to render the existing ones passable to fish by installing baffles and other structures. This will not only complement improvements to fish passage and habitat expected to be delivered through the EA's Team Valley Flood Alleviation Scheme, which includes the removal of Eslington weir, a major barrier to migration. But is also critical for securing the wider recovery of fish populations in the Team.

The need to temporarily culvert the River Team where it runs through the centre of the Coal House roundabout, in order to facilitate the construction of the Kingsway Viaduct extension, is noted. Reinstating the river post-construction should however include measures to improve on the existing poor quality habitat available for fish within this straightened and uniform section of the Team. Any opportunity the scheme provides to improve both the in-river and marginal habitat for fish in the Allerdene Burn, which is similarly straightened and heavily modified throughout much of its' length, should also be taken.

## **Sedimentation and Biosecurity**

It is positive to see pollution prevention and sedimentation plans in the chapter. We recommend that a detailed specific Method Statement on pollution prevention and sedimentation be written and implemented during construction. This should also include biosecurity to prevent the spread of non-native invasive species, as well as pathogens harmful to biodiversity. This will be particularly relevant for the temporary culverting of the River Team, any outfall works and demolition activities





near the River.

## **Chapter 2 The Scheme**

It would be useful to include some details as to how the attenuation pond can be designed in such a manner as to provide some environmental benefits as well as any maintenance that will be required.

In terms of the Allerdene culvert option, it should be designed in order to maintain sediment transport through the culvert. Where Allerdene culvert is being diverted under one of the bridge spans as an open ditch, consideration should be given to the inclusion of measures to make this less of a ditch and a more of a restored section of channel, including the carrier drains.

## **Appendix 13.12 Water Framework Directive (WFD) Assessment**

With respect to geomorphology, the River Team is the main river which could be impacted by the scheme, as detailed in the WFD Assessment. The WFD Assessment describes mitigation for the piers in the floodplain in the form of a topsoil scrape. There is an opportunity here to reconnect with sections of the floodplain to enhance the River Team, as well as tying in with the EA's Team Valley Flood Alleviation Scheme.

In the Allerdene viaduct option, the Allerdene is noted to be realigned as part of The Scheme. There is an opportunity to realign this in such a manner as to work with natural processes, in order to gain a more diverse fluvial system than a uniform straight section of channel. The option for the Allerdene Burn viaduct gives substantially more day lighting, environmental enhancements and creation. We welcome and support this approach.

In the Allerdene embankment option, there would be a reengineered culvert. There are in-channel improvements which can be made to increase the flow diversity of the modified channel, which can in turn affect the morphology of the channel and therefore the biodiversity of the channel. We would welcome proposals as to how this may be achieved for both options.

The WFD Assessment states that a Geomorphological Assessment will be completed at the detailed design stage which is welcomed, and should include the comments made in this advice note.

Where bank protection measures have been proposed, a range of bioengineering options should be included first. These will provide stability to the bank, whilst providing the ability to trap fine sediment and improve the in channel morphology, flow diversity and natural functionality of the watercourse.

## **Net Gain and 25 Year Environment Plan**

We welcome and support references to the Governments 25 year Plan for the



Environment and the principle of Net Gains

### **Surface Water drainage and Outfalls**

It is recommended that surface water drainage such as SuDS, oil interceptors, filter drains and vortex separators are installed on all outfalls. This would give improvement to water quality within the catchment, and help to achieve WFD Good classification. This would also offer mitigation for the existing overall footprint of the A1 that is impacting the catchment.

With respect to outfalls, what are the options being considered for the setting back and construction/alterations of these structures? All outfalls linked to the scheme should be improved as this would give improvement to water quality within the catchment, and help to achieve the Good classification under the WFD. This would also offer mitigation for the existing overall footprint of the A1 that is impacting the catchment.

It should be noted that any outfall structure / discharge that is required to be constructed near a Main River may require a flood risk activity permit. As part of the application, the EA will assess the application in relation to its compliance with the Northumbria River Basin Management Plan (RBMP). The RBMP states that the water environment should be protected and enhanced to prevent deterioration and promote the recovery of water bodies. It is advised that the development incorporates a scheme which will help meet objectives and to promote the recovery of water bodies. The application should also take into account impacts to protected and notable species and habitats along these watercourses, with survey information informing these impacts within the permit.

The design of any outfall should be sympathetic to the water environment with low impact design options that mimics greenfield runoff, and not drain onto or impact Habitats of Principal Importance. Designs that feature soakaways to rivers must prevent any hard engineering on the banks of watercourses, and help to ensure there will be no degradation to its WFD Status / Potential. This should also apply to any upgrades or maintenance of current outfalls.

Please do not hesitate to contact me if you have any questions regarding this letter.

Yours sincerely



creating a better place



**Lucy Mo**  
**Planning Technical Specialist - Sustainable Places**

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[www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)



**Appendix J – Meeting Minutes [REDACTED]**  
**[REDACTED], Environment Agency (24/07/2019)**



# AGENDA & MEETING NOTES

<b>PROJECT NUMBER</b>	70041947	<b>MEETING DATE</b>	24 July 2019
<b>PROJECT NAME</b>	A1 Birtley to Coal House Scheme	<b>VENUE</b>	Environment Agency   Tyneside House, Skinnerburn Road, Newcastle upon Tyne NE4 7AR
<b>CLIENT</b>	Highways England	<b>RECORDED BY</b>	█
<b>MEETING SUBJECT</b>	Meeting to discuss road drainage and the water environment assessments and EA comments		

<b>PRESENT</b>	█ (WSP), █ (WSP), █ (EA), █ (EA), █ (EA), █ (EA)
<b>APOLOGIES</b>	None
<b>DISTRIBUTION</b>	As above plus: █ (Highways England), █ (Highways England), █ (WSP)
<b>CONFIDENTIALITY</b>	Restricted

ITEM	SUBJECT	ACTION	DUE
1.1	█ discussed that the DCO will be submitted in the middle of August. The final ES will be submitted to Highways England on 30/07/19.		
2	<b>Flood Risk Model</b>		
2.1	Flood risk model comments not yet received. <u>Hydrology:</u> Currently some issues identified. EA is currently discussing with reviewer as to what comments are appropriate and which should be updated. The EA will provide comments within a spreadsheet and WSP can respond on the spreadsheet as to the approach that we are intending to take, for agreement prior to the amendments being made. Following this, a technical note could be provided by WSP to outline changes to the model / FRA, if required. If the model is fit for purpose then the EA will accept the Flood Risk Assessment.	█	25/07/19
2.2	█ discussed that she couldn't see the drawing with the top soil scrape on or the calculations to inform it.	█	25/07/19

## MEETING NOTES

ITEM	SUBJECT	ACTION	DUE
	<p>█ showed █ drawing ES Figure 13.7 and the calculations that have informed it.</p> <p>█ will issue the FRA to the EA so that they can look at the flood compensation areas / updates from the previous issue.</p>		
<b>3</b>	<b>Chapter 13 Road Drainage and the Water Environment</b>		
<b>3.1</b>	EA river gauge. WSP to provide information as to what works are taking place in the area of the EA river gauge where this is included in the Scheme Footprint.	█	25/07/19
<b>3.2</b>	<p>The temporary culvert would need to be as short as possible and ideally if over 7m wide then the EA would prefer a bridge.</p> <p>The location and design would need to be agreed with the EA as part of detailed design / preconstruction works and environmental impacts would need to be minimised.</p>		
<b>4</b>	<b>Team Valley Flood Alleviation Scheme</b>		
<b>4.1</b>	<p>Update from █:</p> <p>Application in for EDF funding for Phase 1 (Lobley Hill) phase.</p> <p>Phase 2 (upstream of Coal House roundabout) – an outline business case is being submitted soon.</p> <p>█ requested for his details to be passed on to NGN to discuss the works at the PRS which is to be replaced by the AGI to the south for the A1.</p> <p>█ noted that there a is a potential weir structure within Coal House roundabout and any changes to this may impact the EA's gauging station.</p>		
<b>5</b>	<b>Chapter 8 Biodiversity</b>		
<b>5.1</b>	<p><u>Otter</u></p> <p>█ discussed that █ at Gateshead Council has recent records of otter observations within Coal House roundabout. WSP to request details from █.</p> <p><i>Post meeting note:</i> █ has requested information from █ (24/07/19).</p>	█	25/07/19
<b>5.2</b>	<p><u>Wolverole</u></p> <p>█ discussed that a habitat assessment was completed as part of the extended Phase 1 habitat survey and that habitats within the Scheme Footprint were considered unsuitable and were therefore scoped out of the further survey and assessment.</p>		

## MEETING NOTES

ITEM	SUBJECT	ACTION	DUE
	<p>■ discussed that it would be useful to add that the text in the chapter would benefit to extend to other associated watercourses (in addition to the River Team).</p> <p><i>Post meeting note:</i> Sentence added to chapter (25/07/19).</p>	■	25/07/19
5.3	<p><u>Invertebrates</u></p> <p>■ discussed that it would be useful to detail in the chapter if any of the habitats within the landscape design plan would support invertebrate species.</p> <p>■ to confirm if this has been / can be done.</p> <p><i>Post meeting note:</i> Given that impacts on invertebrates have been scoped out of the assessment there is not a suitable place to add this text. However WSP's ecologist confirmed that woodland retention would minimise impacts, and woodland and hedgerow creation and improving water quality overall would benefit invertebrates.</p>	■	25/07/19
5.4	<p><u>Invasive Species</u></p> <p>■ discussed that there is Himalayan balsam in extensive areas of Team Valley and it might be beneficial to mention this in the ES chapter.</p> <p><i>Post meeting note:</i> Sentence added to chapter (25/07/19).</p>	■	25/07/19
5.5	<p><u>Priority Habitats and Net Gain</u></p> <p><i>Net Gain</i></p> <p>■ discussed that there is no requirement for NSIPs to achieve Biodiversity Net Gain. Whilst biodiversity has not been achieved, the Scheme has sought to minimise loss as far as possible and has sought to improve the quality of planting and enhance green corridors across the Scheme. The Scheme is constrained due to it being a widening of the existing A1, and the design has sought to minimise impacts as far as possible, within the Scheme Footprint, this has included ensuring there is no permanent land take of Longacre Wood LWS.</p> <p>■ discussed that it might be useful to add this explanation into the chapter text in relation to Biodiversity Net Gain.</p> <p><i>Habitat Improvements and Enhancements</i></p> <p>■ discussed whether the attenuation pond and whether there would be the possibility to create multiple waterbodies (either within or adjacent to the proposed pond) to provide wider wetland creation and habitat improvements in the area. ■ and ■ discussed that the design of the attenuation pond would be done at detailed design but that it would be possible to include a requirement within the ES chapters (water and biodiversity) to consider this at detailed design.</p>	■	25/07/19
		■	25/07/19

## MEETING NOTES

ITEM	SUBJECT	ACTION	DUE
	<i>Post meeting note:</i> Sentence added to ES that consideration to ecological benefits with regards to the attenuation pond would be considered at detailed design (25/07/19).		
5.6	<p><u>Protected and Priority Species</u></p> <p>█ welcomed the additional information provided on salmon, sea trout and eel and discussed that this would be included in the ES Biodiversity chapter.</p> <p>█ discussed whether any measures to aid fish passage have been included in the design for Allerdene culvert (Allerdene Embankment option).</p> <p><i>Post meeting note:</i> The following text is currently included in the Biodiversity Chapter in relation to this:</p> <p><i>Culverts will be designed, where possible, to include natural beds (between 100mm and 250mm) to maintain and assist fish passage.</i></p> <p><i>To mitigate for potential downstream impacts and maintain passage along watercourses, baffles or similar structures will be installed within existing culverts.</i></p>	█	25/07/19
6	<b>WFDa</b>		
6.1	<p>Coal House Roundabout Flood Compensation</p> <p>Can improvements be made to the River Team channel to improve its current connectivity to the floodplain, it was recognised that this is what the flood plain compensation aims to do.</p> <p>The EA outlined that they would also like improvements to the banks of the channel to be made across Coalhouse Roundabout, as this section is highly modified and installation of the temporary river crossing and construction works would impact the river, remedial works should be considered as part of detailed design to aid the reduction in the river being considered as a HMWB.</p>		
6.2	The realignment of Allerdene burn was discussed. █ detailed that para 8.9.9 in Chapter 8 Biodiversity discusses that the realignment of the Allerdene culvert would create a naturalised line and to include an associated wet grassland.		
7	<b>Net Gain and 25 Year Environment Plan</b>		
7.1	It was discussed that NSIPs are not required to meet biodiversity net gain.		
8	<b>Surface water drainage and outfalls</b>		



## MEETING NOTES

ITEM	SUBJECT	ACTION	DUE																		
8.1	<p>Vortex separators will be considered for all outfalls at detailed design and this is stated in the ES (Paragraph 13.9.12.c).</p> <p>Improvements to the outfalls e.g. setting back, will also be considered at detailed design and this is included in the ES. (Paragraph 13.9.12.e).</p> <p>A quick high level review of the scheme Red Line Boundary against the OS Mastermap has been undertaken (note that the proposed scheme or drainage design has not yet been assessed) this indicates that during detailed design it may be possible to improve some of the outfalls as part of the scheme, these are summarised below:</p> <table border="1"> <thead> <tr> <th>Outfall Number (ES Figure 13.4)</th> <th>Summary</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Discharges to Gateshead as highway authority drainage infrastructure</td> </tr> <tr> <td>2 and 4</td> <td>Land may be available within the RLB</td> </tr> <tr> <td>3</td> <td>Likely to discharge to a culverted ordinary watercourse</td> </tr> <tr> <td>5</td> <td>Probbaly outside of the RLB</td> </tr> <tr> <td>6 and 7</td> <td>Land may be available within the RLB for the upstream outfalls, but unlikely for the downstream outfalls</td> </tr> <tr> <td>7A</td> <td>Land may be available within the RLB</td> </tr> <tr> <td>8</td> <td>Land may be available within the RLB</td> </tr> <tr> <td>9 to 13</td> <td>Land may be available within the RLB as these are within the Coalhouse Roundabout</td> </tr> </tbody> </table>	Outfall Number (ES Figure 13.4)	Summary	1	Discharges to Gateshead as highway authority drainage infrastructure	2 and 4	Land may be available within the RLB	3	Likely to discharge to a culverted ordinary watercourse	5	Probbaly outside of the RLB	6 and 7	Land may be available within the RLB for the upstream outfalls, but unlikely for the downstream outfalls	7A	Land may be available within the RLB	8	Land may be available within the RLB	9 to 13	Land may be available within the RLB as these are within the Coalhouse Roundabout		
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8	Land may be available within the RLB																				
9 to 13	Land may be available within the RLB as these are within the Coalhouse Roundabout																				
8.2	<p>█ detailed that it was great to see that the various mitigation measures discussed in the last meeting included in the WFDa.</p>																				

### NEXT MEETING

An invitation will be issued if an additional meeting is required.

## **Appendix K – Spreadsheet Environment Agency (25/07/2019)**



Technical Model Review Report		
Client	Environment Agency	
Single project or WEM package?	WEM Package	
Package name (if applicable)	2018-19 National Modelling and Forecasting Technical Support Contract	
Project name	Review No. 57 - A1 Birtley to Coal House	
JBA Project Number (or overarching project)	2018s0387	
JBA Sub-Project Number (if applicable)	57	
Review requirements	A) Previous project - hydrology	
	B) Previous project - hydraulic	
	C) New project - hydrology	Yes
	D) New project - hydraulics	Yes
	E) Survey data	
	F) Reporting	

"RAG" key	
Major issue	Omission that could make the findings subject to challenge and which requires correction/further work.
Minor issue	Non-standard method or method not following guidance but unlikely to have impacted on results
Clarification required	The approach used is unclear and requires further clarification before it can be reviewed
Recommendations	Suggestion for improved / good practice but which is unlikely to change the project outcomes.
Acceptable (but does not meet best practice)	The approach is acceptable, however it is not in line with standard industry best practice
Acceptable	Suggestion for improved / good practice but which is unlikely to change the project outcomes.

Summary of 1st hydrology review findings
<p><b>Hydrology review</b></p> <p>A few suggestions have been given below, which may give more conservative results. The reporting in Appendix A regarding the inflow calculations would benefit from additional detail, but is generally well written. The maps provided are excellent and are very helpful. There are a few omissions that should be addressed, see individual comments below.</p>
Summary of 1st hydraulics review findings
<p><b>Allerdene Burn model:</b></p> <p>Minor issues have been identified. Generally the baseline model and option 1 are well constructed. There were some issues identified in Option 2 that could be impacting the results. Therefore it is recommended that this model is revised.</p> <p>As for all modelling studies, results of the sensitivity testing and model proving, should be provided for review.</p>
<p><b>Kingsway Viaduct model:</b></p> <p>As the baseline model was constructed by JBA, only the described changes at the viaduct have been reviewed to avoid a conflict of interest. The representation of the existing and proposed viaduct has been done well. However, the stability of out of bank flows in the area of interest is a concern in the 0.1% AEP event, proposed scenario examined.</p>



A Hydrology Review	
Date of hydrology analysis	Dec-18
Name of reviewer	James Molloy BE(Hons) MEngSc
Date of review	08/07/2019
Revision	V1
Applicable standards or guidance	Flood Estimation Handbook (IH, 1999) updates including Kjeldsen (DEFRA, 2008), and recent outputs from the FEH Local project ReFH1 and/or ReFH2 guidance documents EA Flood Estimation Guidelines (Operational instruction 197_08, V6)
Nature of study watercourse(s)/constraints	The study looks at various sources of flood risk along a reach of the A1 road, to the south of Allerdene near Newcastle. Various proposed engineering works along the road require an assessment of (a) fluvial flood risk from Allerdene Burn, a small tributary of the River Team and (b) surface water flood risk around Longacre Dean a short distance to the south-east. <b>The report also looks at flood risk from the River Team, however as no changes have been applied to the hydrology used in the underlying model for this watercourse (previously signed off by the Environment Agency), this aspect is not reviewed in this document.</b>
Study objectives	The aim of the analysis is to determine if the proposed changes to the road layout have any effect on local flood risk. Information provided in Appendix A of the provided modelling report is used as the basis of this review.
Summary of 1st review	A few suggestions have been given below, which may give more conservative results. The reporting in Appendix A regarding the inflow calculations would benefit from additional detail, but is generally well written. The maps provided are excellent and are very helpful. There are a few omissions that should be addressed, see individual comments below.

Category	Detail	ID	1st review			
			Comment	Suitability	Suggested actions	Consultants Response (if required)
<b>General comments</b>						
General comments	Method statement	A-1	Quite detailed in places, as various sources of flood risk need to be considered in the analysis. The maps provided alongside the report are very useful and clear.  Some of the details regarding the hydrological inflows are quite sparse however, see individual comments below.	Clarification required	Reasoning is given in the main report text (Chapter 3) for the study requirements at each watercourse crossing of the A1 road. It seems an unusual decision why fluvial modelling was carried out on Allerdene Burn, but only pluvial modelling around Longacre Dean (why not carry out fluvial modelling at the latter site also?)	
	Previous studies	A-2	It is understood that there are no previous studies looking at flood risk for Allerdene Burn, and that only broad-scale pluvial mapping has been carried out in the region surrounding Longacre Dean, which the authors correctly point out does not account for local drainage features that would affect local flood risk.	Acceptable		
	Catchment description (any unusual features such as pumps, reservoirs, heavy urbanisation?)	A-3	Small catchments, some of which drain densely urbanised areas.	Recommendations	Has the Urban ReFH2 method been considered adequately? Checked in further detail below.	
<b>Method statement</b>						
Flow estimation points and descriptors	Location of FEPs / catchment descriptors provided?	A-4	Yes in Section 3.3.	Acceptable		
	Unusual catchment features (which may influence choice of approach)	A-5	The Allerdene catchment is heavily urbanised, and also has a moderately high BFIHOST, noted by the authors.	Recommendations	It may also be useful to obtain sewer drainage information for the area around the Allerdene Burn catchment, in case there are sewered areas outside the topographic catchment draining into this watercourse. However, this is unlikely given the steep slope in the urban area, but still would be a useful to check.	
	Checks on catchment descriptors	A-6	The catchment area has been correctly checked using LIDAR data, noted that this gives a larger area compared to the "default" FEH catchment.	Major issue	No further reporting given on how the change in catchment area influences other key catchment descriptors. DPLBAR should increase, and there could be significant changes to URBEXT2000 from the change in catchment boundary. Both of these need to be altered, and could have a big effect on calculated flows.	
Data review	Hiflows-UK version	A-7	NRFA V7 is the latest version	Recommendations	Should be used in FEH statistical as an independent check on ReFH2, see below.	
	Review of hydrometric data	A-8	No local hydrometric data available to calibrate hydrological methods unfortunately.	Acceptable		
	Rating reviews	A-9	n/a, no local gauges in the area apart from on the River Team, not reviewed here.	Acceptable		
	Flood history	A-10	Yes, the authors have queried data held by the Environment Agency and briefly reported this in Chapter 4 of the main report, giving some details of recent floods. This shows that the region assessed here is vulnerable to a range of flood mechanisms.	Acceptable - but does not meet best practice	There are other useful sources of flood history as well. I would recommend having a look on the CBHE website ( <a href="http://www.cbhe.hydrology.org.uk/index.php">http://www.cbhe.hydrology.org.uk/index.php</a> ), and a general internet search also.	
Initial choice of methods	Approaches suggested	A-11	Only the ReFH2 method is proposed for use for the Allerdene modelling. Depending on the software implementation used, urbanisation adjustments may/may not have been automatically applied given the very high URBEXT200 values.	Major issue	Confirm whether or not the ICM implementation of ReFH2 automatically applies the urban adjustment, giving faster response times and peak flows on highly urbanised catchments.  There is no mention anywhere in the document of the FEH statistical method, which should also be applied here, given the uncertainty from catchment-descriptor methods. This at least would be useful as ball-park check on the peak flow produced from ReFH2.	
	Justification of approach	A-12	A sensible argument is given for using FEH99 rainfalls over FEH13 (although it's hidden in a footnote!), given that the former is reported to give higher rainfall totals in this case. For the purposes of construction options modelling this is a good idea. Some data needs to be presented in the Appendix however to back this up, perhaps a table comparing rainfall totals across multiple storm durations.  However using FEH99 rainfall in the ReFH2 model may have an unforeseen drawback. In this situation with FEH99 rainfall, ReFH2 applies the "alpha" factor when calculating runoff (essentially a fudge factor that reduces runoff for increasing return periods - introduced to try to match FEH statistical peaks, but conceptually does not make a lot of sense!). So even though FEH99 might give more rainfall, the "alpha" factor may cancel out the effect. This factor is not used with FEH13 rainfall in the model.	Major issue	Add a table comparing FEH99 and FEH13 rainfalls to back up the argument given in Chapter 2 of Appendix A.  Run the ReFH2 model for the 100 and 1,000yr events with the FEH13 rainfall also, to test if this gives larger peak flows, due to the "alpha" issue discussed to the left.	
	Lumped / distributed	A-13	n/a, as a single inflow to the model is sufficient for this case for the Allerdene model.	Acceptable		
		A-14				

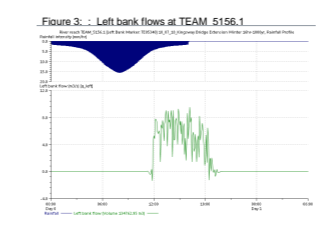
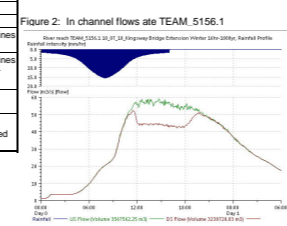
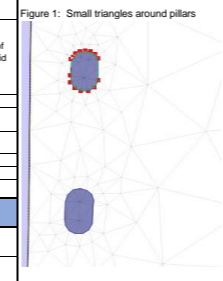
Flow estimation							
FEH Statistical	Suitable for statistical?	A-15	Yes, as a check on ReFH2 results, but not used, see above.	Major issue	See above		
	QMED estimation - CDs	A-16					
	QMED estimation - AMAX / POT	A-17					
	Choice of donors	A-18					
	Growth curve methodology	A-19					
	Hydrology shape	A-20					
ReFH method	Suitable for ReFH?	A-21	Yes with caution given the heavy urbanisation	Acceptable			
	Calibration	A-22	n/a, the small catchment assessed here is ungauged.	Acceptable			
		Choice of design storm	A-23	Summer rainstorm profile is suitable in this case. However only very little discussion given for the choice of design storm duration, choosing the value used in the existing River Team model, simply assuming this will also be critical for Allerdale Burn.	Major issue	Run the ReFH2 model for a range of storm durations to see which gives the largest peak flows for Allerdale Burn. Assuming the same critical storm duration as the downstream River Team model could under-estimate peak flows on this small and fast-responding stream, especially important when testing models needed to size culverts, bridges, etc (in this case I think it's OK to mix and match durations from the main Team model and the Allerdale model, to give conservative results). Give a table of peak flows from ReFH2 versus storm duration in the text.	
		Suitable for urban ReFH?	A-24	Yes, see previous comments	Major issue	Clarify in the text if the ICM implementation applies the urban adjustments from ReFH2.	
Urban ReFH variant	Catchment delineation	A-25	n/a, a lumped approach is OK here.	Acceptable			
	Calibration	A-26	n/a, no gauges available to calibrate the ReFH2 model on these small streams.				
	Choice of URBEXT values	A-27	See comments above	Major issue	See adjustments for URBEXT200 required above.		
		Choice of percentage runoff	A-28	ReFH2 defaults are presumably applied for the Allerdale Burn model, this should be OK (but should be reported, e.g. was urbanised %runoff left at the default 70%?)	Acceptable		
Final choice of method	Final flows	A-29	N/A as only one method used. Given reliance on (uncertain) catchment descriptor methods, it is important to look at both FEH statistical and ReFH2.	Recommendations			
Miscellaneous							
	Direct rainfall modelling - 2D domain extent	A-30	The model domain for the direct-rainfall modelling around Longacre Dene looks sensible, based on LIDAR. The plot in Table 6 in Appendix A is very useful to demonstrate this.	Acceptable			
	Direct rainfall modelling - 2D downstream boundary condition	A-31	The authors state that there was no need to apply a 2D downstream boundary condition to remove excess ponding at the southern edge of the model.	Minor issue	It is usually best practice to place a downstream boundary on a direct rainfall model, to stop any glasswaling affecting results. This might be more important if longer rainstorms are being tested.		
	Direct rainfall modelling - range of storm durations tested	A-32	There is no information given on the range of storm durations used in this direct rainfall modelling in the report. The EA national-scale pluvial mapping runs separate models for storm durations of 1hr, 3hrs and 6hrs, then merges the modelled maximum depths in a final grid. This allows for runoff rates on regions with different topography to influence the results. A similar method needs to be adopted for this more detailed assessment.	Major issue	Run the direct rainfall model for a range of storm durations, then merge the results taking the maximum from each individual model grid.		
	Direct rainfall modelling - Percentage runoff	A-33	Not much detail given on this, other than use of the ReFH rainfall. Not clear from the text if this is before or after application of the ReFH2 loss model (i.e., is gross or net rainfall used)? Another issue is the use of different percentage runoff on different parts of the model. Has base mapping been used to inform where percentage runoff should be increased on urban surfaces? This is typically set at 70% but can be altered in some cases, with the ReFH model used to inform %runoff on other surfaces.	Major issue	See list of issues to the left.		
Climate change	Consistent with latest guidance?	A-34	The text in Section 3.3.4 of Appendix A suggests an unusual method was used to apply climate change allowances, altering the rainfall applied to ReFH2. As the Allerdale part of the study is a fluvial analysis, it is standard practice to simply multiply the final fluvial hydrographs by the percentage increase.	Minor issue	(Minor issue) For climate change runs on the Allerdale catchment, recommend instead simply multiplying the initial flow hydrographs using the fluvial uplift factors, instead of altering the input rainfall to ReFH2. As the results of this unusual method are not too far off the required percentages, this is a minor issue only. However this complicated method is needed for applying climate change uplifts for the pluvial analysis (the ReFH loss model is non-linear).  (comment for EA) The EA also had a query on use of UKCP18 outputs instead of UKCP09 for climate change analysis. While some UKCP18 outputs are now available, research is ongoing to convert these large datasets to simple uplift factors for fluvial / rainfall inputs, due to be released later this year by CEH. Data from UKCP18 can be used manually to inform updated uplift factors, but current guidance recommends this is only needed on very high-risk areas (e.g. power stations). Therefore the use of uplift factors from the current EA guidance (2016 document) using UKCP09 is suitable in this case. ( <a href="https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances">https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances</a> )		
Reporting and follow up actions							
Reporting and Results.	Suitability of reporting	A-35	Quite detailed in places, but lacking detail in others, see the list above. The maps given alongside the report are very well put together and are very helpful.	Minor issue			
	Results	A-36	Some issues and omissions spotted, as listed above.	Major issue	See above		
	Recommendations	A-37	Key recommendations as follows: - Consider if fluvial modelling on Longacre Dene is needed as well as general pluvial modelling? - Carry out FEH statistical method as an independent ball-park check on the ReFH2 fluvial calculations - Consider sensitivity of using FEH13 rainfall due the "alpha" issue discussed above - Look at sensitivity of results to storm duration, for both fluvial and pluvial analysis.	Major issue	See above		



<b>B</b>	<b>Review of River Team Viaduct</b>			
Date of model	August 2016			
Name of reviewer	Jenny Hill			
Date of review	24/07/2019			
Revision	v2			
Applicable standards or guidance				
Nature of study watercourse(s)/constraints	Allerden Burn			
Study objectives	<p>The reporting states:</p> <p>Flood Risk Assessment (FRA) to support the Environmental Impact Assessment (EIA) and DCO Application for the A1 Birtley to Coal House Scheme. These areas were identified for further modelling:</p> <ul style="list-style-type: none"> <li>- Hydraulic modelling to the River Team at Junction 67 to assess the impact of the extension of the Kingsway Viaduct. This modelling utilises an existing Environment Agency hydraulic model of the River Team constructed by JBA in 2014.</li> <li>- Hydraulic modelling of the Allerden Burn to understand the impact of the A1 realignment which will require either:             <ul style="list-style-type: none"> <li>a. the extension of the existing Allerden culvert and replacement of the existing section of the Burn;</li> <li>b. or daylighting of the existing culvert and replacement and realignment of the existing burn to accommodate a new viaduct over the existing railway line.</li> </ul> </li> <li>- Hydraulic modelling of the surface water flood risk at Junction 66.</li> </ul> <p><b>This review focusses on the River Team at Junction 67</b></p>			
Summary of 1st review	As the baseline model was constructed by JBA, only the described changes at the viaduct have been reviewed to avoid a conflict of interest. The representation of the existing and proposed viaduct has been done well. However, the stability of out of bank flows in the area of interest is a concern in the 0.1% AEP event, proposed scenario examined.			

Category	Detail	Prompts	ID	Comment	Suitability	Suggested actions
<b>Data to be reviewed</b>						
Data to be reviewed	Software	- Versions	B-1	InfoWorks ICM v6	Acceptable	
			B-2	Updated to v6 for the purpose of this review	Acceptable	
	AEPs provided / reviewed		B-3	1% AEP + 20 or 40% and 0.1% AEP.	Acceptable	
			B-4	1% AEP event reviewed.	Acceptable	
	Scenarios provided / reviewed		B-5	Base and 'Kingsway Bridge Extension'. The Kingsway Bridge Extension scenario has been the focus of this review.	Acceptable	
Reports	- Reference versions - Technical reporting - General reporting	B-6	FRA report with technical appendices	Acceptable		
<b>Reporting</b>						
Reporting	Reporting	- Objectives - Constraints - Approach Justification (both model scale and structure scale) - Clarity - Automation	B-8	The report states that Modelling changes are confined to the A1 junction 67 roundabout 424950, 558550 and included the modelling of the existing Kingsway Viaduct and the proposed widening of the viaduct to include an additional pillar.	Acceptable	
			B-9	Reporting generally clear and thorough.	Acceptable	
			B-10	Results discussed	Acceptable	
<b>General comments</b>						
General comments	File organisation / naming convention	- Scenarios - Naming - Flags	B-12	Flags ED and AD have been used at the changed structure, although flags have not been included in the model describe what this means.	Clarification required	In future include a CSV report of flags or a table of flags in the report
			B-13	The viaduct option has been created as a scenario from the base model, which follows best practice.	Acceptable	
			B-14	The scenario is clearly named which is helpful for future users.	Acceptable	
	Survey / topographic data	- Age - Quality	B-15	Source of data is unknown as flag not included, although it is assumed that ED refers to Engineering Drawings.	Clarification required	
Other	- Any significant missing data	B-16	DTM was not provided although the commit history suggests a custom DTM which included topographic survey was used.	Clarification required	In future, provide the DTM used	
<b>General modelling approach</b>						
General modelling approach	Model extents	- Domain representation - Location of watercourse	B-18	Domain is unchanged from the base model.	Acceptable	
	Modelling approach	- 1D / 2D / Linked - georeferenced (xy/gz/2d links)	B-19	A 1D-2D approach has been used for the watercourse and a 2D representation of the viaduct pillars has been used.	Acceptable	
			B-20	The model is fully geo-referenced.	Acceptable	
	Application of hydrological estimates	- sampler / sensor - model / structure	B-21	The application of the hydrology is unchanged from the base model.	Acceptable	
<b>InfoWorks ICM</b>						
InfoWorks ICM	Model build	- Hard bed / soft bed - Accuracy of modelled channel length	B-23	The model is an adapted version of the JBA built, Environment Agency approved model. The changes made to the existing model have been documented in the commit history. Changes listed are all in relation to Kingsway Viaduct. The 'compare network' tool has been run on the WSP and existing EA model. This concluded that WSP's description of the changes was accurate.	Acceptable	
			B-24	The modelling report does not comment on whether hard or soft bed have been modelled. However, as this is a proposed design, it is assumed a hard bed level was implemented.	Acceptable	
			B-25	The modelled length has been calculated from the centre line and the centre line matches the mapped watercourse well.	Acceptable	
			B-26	1D river reaches have been voided from the 2D zone to avoid double counting	Acceptable	
			B-27	Based on the cross section naming convention, it is not thought that any interpolates have been applied. The resolution of cross sections in the study area mean no interpolates were necessary.	Acceptable	
	Watercourses	- Disactivation - Interpolates - Bank level and DTM matchup - Bank coefficients - Baseflow	B-28	Discharge coefficient of 1 and modular limit of 0.9 consistently used.	Acceptable	
			B-29	The 1D river banks generally track the DTM level well. However, at chainage 50m on river reach TEAM_5156.1 the 1D bank is 1m higher than the 2D level. The 0.1% AEP water level predicted to exceed bank tops so this has potential to impact the results.	Minor issue	Modify 1D or 2D water levels to allow a better match of levels in area of interest
			B-30	River sections look sensible but few panel markers have been used.	Acceptable	
			B-31	Conveyance plots for TE05365 and TE05340 are linked at higher depths.	Minor issue	Update panel markers and channel roughness to smooth conveyance plots at deeper flows.
	Watercourse structures	- Bridges - Culverts - Screens - Weirs - Flap valves - Sluices	B-32	25 mesh zones have been used to represent viaduct pillars in the flood plain	Acceptable	
			B-33	In the proposed scenario, all the pillars use a level of 20m AOD. This is 7.5m above ground level which seems appropriate. In the base scenario, the proposed pillars are included but with a level change of 0m.	Acceptable	
			B-34	Notes have been used to describe which pillars are existing and which are proposed, which is helpful.	Acceptable	
	Mesh	- Mesh optimisation - Infiltration surfaces - Initial conditions - Raster applied to the mesh. Use of sub catchments - 1D/2D linking: bank lines, manhole flood types, inline banks	B-35	The use of mesh zones with small footprints is causing the generation of small triangles (Figure 1) around the area of interest which could slow model run times.	Minor issue	In future models, simplify the geometry of 2D features (while retaining area) to avoid small triangles.
	Mesh modifications	- Representation of roads and buildings	B-36	See watercourse structures above	Acceptable	
Scenarios	- Do minimum (baseline) - Do nothing - Do something	B-38	As the baseline model was constructed by JBA, only the described changes at the viaduct have been reviewed to avoid a conflict of interest.	Acceptable		
		B-39	Only Kingsway Bridge Extension scenario has been reviewed.	Acceptable		
Run parameters and output data	- Results generated - Temporal resolution of results - Run parameters	B-40	Results are saved every 5 minutes.	Acceptable		
		B-41	Timestep used was 4 seconds	Acceptable		
		B-42	Simulation was run for 30-hours which allows the full storm to pass in the area of interest.	Acceptable		
<b>Runs</b>						
Model simulations	Model simulation runs - Existing (baseline) - Climate change - Sensitivity	B-136	Sims provided for the base and scenario for the 1, 1 +20 or 40% and 0.1% AEP events.	Acceptable		
		B-137	No sensitivity tests were provided.	Minor issue	Run sensitivity tests	
<b>Model results, interpretation, verification and stability</b>						
Model results, interpretation, verification and stability	Model stability	- zed, eol, fl - Model warnings and errors - Non-convergence - Mass balance - unrealistic oscillations (water level / flow / boundaries / dVol).	B-139	The base 0.1% AEP event ended incomplete.	Minor issue	
			B-140	Total mass error = 9.9 m3	Acceptable	
			B-141	Volume balance error = 0.9 %	Acceptable	
			B-142	There is some oscillation in the peak flows in the area of interest during a 0.1% AEP event (Figure 2)	Minor issue	Make updates to conveyance and bank lines to improve stability
	B-143	There is some significant oscillations in the out of bank flows in the area of interest during the 0.1% AEP event (Figure 3)	Major issue	Make updates to conveyance and bank lines to improve stability. If appropriate, lower bank co-efficient		
	Sensitivity testing	- Suitability of sensitivity testing undertaken - Results & interpretation of sensitivity testing	B-144	Sensitivity tests not provided for review	Minor issue	Run sensitivity tests
Calibration / performance		B-145	No model performance testing was provided for review.	Minor issue	Use the model report to provide commentary on the sensibility of predicted flooding.	

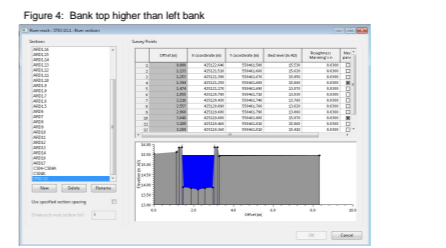
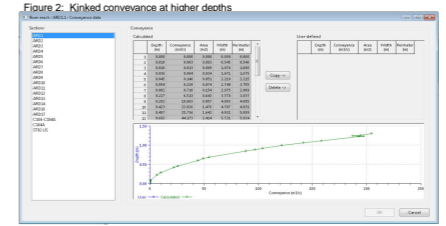
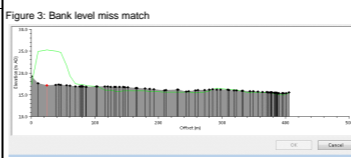
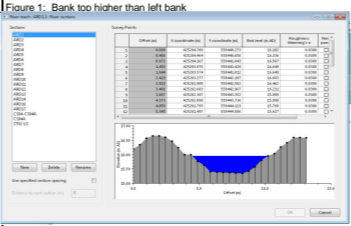
Acceptable
Acceptable - but does not meet best practice
Clarification required
Minor issue
Major issue
Recommendations





<b>B</b>	<b>Review of Alledene Burn</b>				
Date of model	August 2016				
Name of reviewer	Jenny Hill				
Date of review	19/07/2019				
Revision	v1				
Applicable standards or guidance					
Nature of study watercourse(s)/constraints	Alledene Burn				
Study objectives	<p>The reporting states:</p> <p>Flood Risk Assessment (FRA) to support the Environmental Impact Assessment (EIA) and DCO Application for the A1 Birtley to Coal House Scheme. These areas were identified for further modelling:</p> <ul style="list-style-type: none"> <li>- Hydraulic modelling to the River Team at Junction 67 to assess the impact of the extension of the Kingsway Viaduct. This modelling utilises an existing Environment Agency hydraulic model of the River Team constructed by JBA in 2014.</li> <li>- Hydraulic modelling of the Alledene Burn to understand the impact of the A1 realignment which will require either: <ul style="list-style-type: none"> <li>a. the extension of the existing Alledene culvert and replacement of the existing section of the Burn;</li> <li>b. or daylighting of the existing culvert and replacement and realignment of the existing burn to accommodate a new viaduct over the existing railway line.</li> </ul> </li> <li>- Hydraulic modelling of the surface water flood risk at Junction 66.</li> </ul> <p><b>This review focusses on the Alledene Burn options</b></p>				
Summary of 1st review	Minor issues have been identified. Generally the baseline model and option 1 are well constructed. There were some issues identified in Option 2 that could be impacting the results. Therefore it is recommended that this model is revised. As for all modelling studies, results of the sensitivity testing and model proving, should be provided for review.				

Category	Detail	Prompts	ID	Comment	Suitability	Suggested actions
<b>Data to be reviewed</b>						
Data to be reviewed	Software	- Versions	B-1	InfoWorks ICM v6	Acceptable	
	AEPA provided / reviewed		B-2	0.1% AEP model files and results	Acceptable	
	Scenarios provided / reviewed		B-3	Base, Option 1 ditch realignment, Option 1 realignment flow control, Option 2 and Option 3	Acceptable	
	Reports	- Reference versions - Technical reporting - General reporting	B-4	FRA report with technical appendices	Acceptable	
<b>Reporting</b>						
Reporting	Reporting	- Objectives - Constraints - Approach Justification (both model scale and structure scale) - Clarity - Assumptions	B-6	Objectives clearly stated in the reporting	Acceptable	
		B-7	Reporting generally clear and thorough	Acceptable		
		B-8	The scenarios are a bit unclear - more models provided than options discussed.	Clarification required	Check consistency between model and reporting provided for review.	
		B-9	Results discussed	Acceptable		
<b>General comments</b>						
General comments	File organisation / naming convention	- Scenarios - Naming - Flags	B-11	Scenarios and files well labelled although it was a bit confusing to establish what is the base scenario. One model network with all options as scenarios could have been a neater way to organise the options.	Acceptable - but does not meet best practice	In future, use one model network with a series of scenarios to represent options
		B-12	Flags have not been included although data has been flagged.	Acceptable - but does not meet best practice	In future include a CSV export of flags or a table of flags in the report	
		B-13	Naming conventions are clear and descriptive	Acceptable		
		B-14	The DTM has not been provided which makes comparisons more difficult. A lidar clip has been made but it is understood that the model DTM was a composite of three sources	Clarification required	In future, provide the DTM used	
	Survey / topographic data	- Age - Quality - Suitability	B-15	According to the report, Channel survey for Alledene Culvert was undertaken by Longdin and Browning in March 2016	Acceptable	
		B-16	Lidar data was supplemented by topo survey in the study area.	Acceptable		
	Other	- Any significant reasons data	B-17	NextMap 5m has been used to north east of the A1 which has partial or no Lidar coverage.	Acceptable	
<b>General modelling approach</b>						
General modelling approach	Model extents	- Domain boundaries - Upstream/downstream boundaries - Potential downstream influences on water levels - Glass walling	B-19	The Alledene Burn is not mapped. However, a check against 1m Lidar suggests that the full length of the watercourse has been modelled in 1D with 2D linking.	Acceptable	
		B-20	A check on the maximum flood extent for the 0.1% AEP event showed no glass walling. Therefore the extent of the 2D model is considered appropriate.	Acceptable		
		B-21	1D river reaches are linked to the 2D domain at banks.	Acceptable		
	Modelling approach	- 1D / 2D / Linked - georeferenced (x/y/gz/2d links)	B-22	Model is fully georeferenced	Acceptable	
		B-23	Inflows have been applied at the upstream extent of the model	Acceptable		
	Application of hydrological estimates	- Lumped / distributed - Applied to 1D or 2D domain - Lateral or point inflows - Consistency with reporting	B-24	No lateral inflows are made, but it is not anticipated that these would be required for a watercourse of this size.	Acceptable	
B-25		A downstream water level from the River Team for the same AEP has been applied.	Acceptable			
<b>InfoWorks ICM</b>						
InfoWorks ICM	Model build	- Hard bed / soft bed - Accuracy of modelled channel length	B-27	Hard bed / soft bed not specified in the reporting.	Clarification required	Specify if hard or soft bed levels were used.
		B-28	All river reach lengths have been calculated based on the length of the centre line and the centreline follows the channel indicated in the DTM well.	Acceptable		
		B-29	1D river reaches have been voided from the 2D zone to avoid double counting	Acceptable		
	Watercourses	- Deactivation - Interpolates - Bank level and DTM match - Bank coefficients - Baseflow	B-30	Interpolates have been used excessively, with an interpolate every 10m. The interpolates have not caused any kinks in the conveyance plots so it is concluded that this is unlikely to impact results.	Acceptable - but does not meet best practice	
		B-31	Bank levels are interpolated between survey points rather than updated from the DTM. In some cases this can make the 1D bank 2m above the 2D level	Minor issue	In future, update bank levels from DTM in between surveyed cross sections if there is good confidence in the DTM levels.	
		B-32	Discharge coefficient of 1 and modular limit of 0.8 consistently used.	Acceptable		
		B-33	No inflow applied to the river reach link as inflow hydrograph has been used.	Acceptable		
	Watercourse structures	- Bridges - Culverts - Screens - Weirs - Flap valves - Sluices	B-34	7 culverts have been modelled. The data flags suggested 6 of these 7 have been modelled from survey data and 1 from As Bath drawings. The size and roughness looks sensible although I would recommend that Manning's n is used for fluvial culverts over Colebrook White.	Acceptable	
		B-35	Culvert inlets and outlets consistently used with appropriate coefficients applied.	Acceptable		
		B-36	1 bridge has been modelled. The bridge opening (flagged as survey data) and deck look sensible compared to the river cross section. Bank coefficient and discharge coefficient have been left as default.	Acceptable		
B-37		Summary on none modelled: flap valve, orifice, pump, screen, weirs	Acceptable			
Mesh	- Mesh optimisation - Infiltration surfaces - Initial conditions - Rainfall applied to the mesh. Use of sub catchments - 1D/2D linking: bank lines, manhole flood types, inline banks	B-38	Max triangle area was 20m <sup>2</sup> and minimum element was 10m <sup>2</sup> which is appropriate for a model of this scale. The general roughness was 0.035 which is within typical range.	Acceptable		
	B-39	No mesh warnings have been produced.	Acceptable			
	B-40	No rainfall was applied to the mesh, despite rainfall being applied in the run set up. It is understood that this was a fluvial model, and therefore the rainfall was not required. However, clarification on why rainfall files have been included is required.	Clarification required	Clarify if rainfall was an intended inflow to this model.		
Mesh modifications	- Representation of roads and buildings - Roughness	B-41	1D-2D linking happens at bank lines which has been successfully achieved.	Acceptable		
	B-42	There is no representation of the conveyance in highways or the resistance caused by buildings.	Minor issue	Represent buildings, road, woodland, scrub as roughness zones in the 2D model.		
B-43	However, the raised highway embankment are represented in the DTM and therefore the mesh.	Acceptable				
Scenarios	- Do minimum (baseline) - Do nothing - Do something	B-44	<p>Option 1a: Ditch re-alignment</p> <p>A Mesh Level Zone has been added over the existing watercourse. This adjusts the DTM elevation to give a minimum elevation of 16 mAOD and maximum elevation of 17.5 mAOD. A 3D view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground levels to tie in with the proposed bank heights. In some locations this can cause a 1m discrepancy between 1D and 2D bank level. This is not shown to impact 0.1% AEP results.</p> <p>The extended culvert has been connected to the proposed culvert with a break node. I would think it more likely that a manhole chamber would be installed to connect these. A manhole would have the potential to flood whereas a break node does not. However, the pipe is not surcharged at the peak of the 0.1% AEP event so this is not thought to impact results.</p> <p>The roughness of the proposed culvert has not been updated from default. The new cross sections mainly look sensible but ARD1 - ARD4 all have left bank lower than the highest point, allowing for premature flooding (Figure 1). However, the max water level doesn't exceed left bank level in the 0.1% AEP event so this is not thought to impact results.</p> <p>The conveyance of the new cross sections is kinked at higher depths (Figure 2). However, the max water depth doesn't reach this level in the 0.1% AEP event so this is not thought to impact results.</p>	Acceptable - but does not meet best practice		
		B-45	<p>Option 1b: Ditch realignment + flow control</p> <p>A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option 1a).</p> <p>Pipe size of SA02USC.1 has been reduced from 1.35 to 1.2m in diameter. No other apparent changes made from Option 1a so same comments stand.</p>	Acceptable - but does not meet best practice		
		B-46	<p>Option 2: Viaduct</p> <p>A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option 1a).</p> <p>There is no apparent level change in the model to account for lowering the highway embankment which is present in the DTM (JBA imposed) (no DTM provided). As a result, in some places there is a 9m miss match between the 1D and 2D bank levels modelled. In channel water levels do not exceed bank top during the 0.1% AEP so this is not impacting results.</p> <p>The open channel has been extended to replace the culvert.</p> <p>As per Option 1a, sections ARD1-ARD4 have lower left bank to the bank top (Figure 1). The same is true for ARD4-7 and STD2 US. Here channel flow does exceed bank top in the 0.1% AEP event (Figure 4) so this is impacting results.</p> <p>As per Option 1a, conveyance plots are kinked at greater depths, which in this instance could impact the results as in channel depths exceed 1m.</p>	Minor issue	Trim 1D cross sections to the highest point on the left bank. Update panel markers and channel roughness to smooth conveyance plots at deeper flows.	
		B-47	<p>Option 3: Viaduct</p> <p>There are no apparent changes between Options 2 and 3 so the same comments stand unless clarification of changes is provided.</p>	Minor issue	Trim 1D cross sections to the highest point on the left bank. Update panel markers and channel roughness to smooth conveyance plots at deeper flows.	
Run parameters and output data	- Results generated - Temporal resolution of results - Run parameters	B-48	Results saved at a 1 minute interval which is high but acceptable.	Acceptable		
	B-49	Model is run for 12 hours which allows the full storm to pass	Acceptable			
	B-50	Run use a GPU card but don't link 1D and 2D calculations at minor timesteps.	Acceptable			





Runs						
	Model simulations	Model simulation runs - Existing (baseline) - Climate change - Sensitivity	B-144	The model has been run and reviewed for the baseline and options. All results use the 0.1% AEP event.	Acceptable	
			B-145	There were no sensitivity tests provided.	Minor issue	Run sensitivity tests
Model results, interpretation, verification and stability						
Model results, interpretation, verification and stability	Model stability	- ztd, eol, tff - Model warnings and errors - Non-convergence - Mass balance - unrealistic oscillations (water level / flow / boundaries / dV0)	B-147	Total mass error = 0.0 m3	Acceptable	
			B-148	Volume balance error = 0.0 %	Acceptable	
			B-149	In channel flows rise and fall in a smooth hydrograph	Acceptable	
			B-150	Out of bank flows are generally stable	Acceptable	
			B-151	There is some instability at the downstream boundary due to the backing up of the River Team 0.1% AEP level but this is not impacting the results in the area of interest.	Acceptable	
	Sensitivity testing	- Suitability of sensitivity testing undertaken - Results & interpretation of sensitivity testing	B-152	Sensitivity tests not provided for review	Minor issue	Run sensitivity tests
Calibration / performance		B-153	No model performance testing was provided for review.	Minor issue	Use the model report to provide commentary on the sensibility of predicted flooding.	

Acceptable
Acceptable - but does not meet best practice
Clarification required
Minor issue
Major issue
Recommendations



**Appendix L Technical Note (Flood Modelling Response) to EA comments  
(29/10/2019)**

# TECHNICAL NOTE 1

<b>DATE:</b>	29 October 2019	<b>CONFIDENTIALITY:</b>	Public
<b>SUBJECT:</b>	Flood Modelling Response to EA Comments		
<b>PROJECT:</b>	A1 BCH	<b>AUTHOR:</b>	Chris Parker
<b>CHECKED:</b>		<b>APPROVED:</b>	Andy Smith

## INTRODUCTION

This note has been prepared to provide a high level summary of the approach we propose to adopt to provide the clarifications requested by JBA on behalf of the Environment Agency to enable the approval of the hydraulic models that support the FRA for the A1 Birtley to Coal House scheme. This note is intended to be read in conjunction with the JBA review sheet that provides the comments in line, however this provides a high level summary.

## Hydrology

- **Method Statement** - Fluvial modelling was not required at Longacre Dean due to the proposals not impacting the main channel. At Long acre dean the culvert is substantially lower than the road, with no flow route on to the A1 and no changes are proposed but the surface flow routes to the channel are of interest.
- **Flow estimation points and descriptors** - We will review the catchment descriptors used and adjust if required.
- **Flow estimation points and descriptors** - We will use NRFA V8 to cross check ReFH2 hydrology using the FEH statistical method.
- **Initial choice of methods** - The ReFH2 analysis was undertaken outside of ICM within the ReFH2 software. We will undertake a confirmatory check to ensure that the flows between the two approaches are similar.
- **Initial choice of methods, Justification of approach** - We will include the table and explanatory text showing the differences in FEH99 and FEH13 rainfall for the study area.
- **Direct rainfall modelling - 2D domain extent** - We will undertake a further run as a as a sensitivity check/analysis on the model downstream boundary condition
- **Direct rainfall modelling - Percentage runoff** – We will provide clarification on the approach adopted

## Hydraulics River Team

- **General comments** – Modelling flags and DTM will be provided
- **Model stability - oscillations in the out of bank flow during a 0.1% AEP event** - we will update in the area of the scheme and rerun the model for the 1% AEP event, but nowhere else as the issue is likely to be related to instabilities in the wider model.

## Hydraulics Allerdene Burn

- **Reporting** – Model scenarios will be clarified.
- **General Comments** – DTM will be provided.
- **Watercourse** – River cross sections trimmed to the highest elevation, panel markers added and bank levels updated from the DTM.
- **Sensitivity testing** – This will be undertaken and description of the tests and results added to the report.
- **Mesh modification – Roads and buildings, roughness** - This model covers a small area and this level of detail is not required in this instance.



# TECHNICAL NOTE 1

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<b>DATE:</b>	29 October 2019	<b>CONFIDENTIALITY:</b>	Public
<b>SUBJECT:</b>	Flood Modelling Response to EA Comments		
<b>PROJECT:</b>	A1 BCH	<b>AUTHOR:</b>	Chris Parker
<b>CHECKED:</b>		<b>APPROVED:</b>	Andy Smith

---

## CONCLUSIONS

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Please let myself know if you agree with our proposed approach to address the comments at your earliest convenience.

Andy Smith

Associate Director

0117 930 2082

## **Appendix M – Email Lucy Mo, Environment Agency (14/11/2019)**

Smith, Andy

---

From: Mo, Lucy <lucy.mo@environment-agency.gov.uk>  
Sent: 14 November 2019 10:26  
To: Smith, Andy  
Subject: RE: A1 BCH FRA Model Comments

Hi Andy,

Please accept my apologies for the delay in getting back to you.

We have reviewed the technical note 'Flood Modelling Response to EA Comments, dated 29 October 2019, and we consider the proposed approach is acceptable in principle. However, the EA would need to either review the flood risk model prior to the DCO submission, or as part of the formal DCO submission to verify the model and to confirm that it is fit for purpose, and that there is no increase in flood risk. The comments outlined in previous model review are still applicable and will need to be addressed/reflected into your modelling work. For clarity, the EA have not yet signed off the proposed flood risk model for the A1 Birtley Coalhouse scheme.

Please give me a call if you have any questions.

Many thanks

Lucy

---

From: Smith, Andy [mailto:Andy.Smith@wsp.com]  
Sent: 31 October 2019 15:47  
To: Mo, Lucy <lucy.mo@environment-agency.gov.uk>  
Subject: RE: A1 BCH FRA Model Comments

Lucy

Perfect, many thanks

Regards,  
Andy

**Andy Smith BSc MSc C.WEM CSci CEnv**  
Associate Director



T +44 (0) 117 9302082  
[REDACTED]

Kings Orchard, 1 Queen Street,  
Bristol, BS2 0HQ

---

From: Mo, Lucy [mailto:lucy.mo@environment-agency.gov.uk]  
Sent: 31 October 2019 15:45  
To: Smith, Andy <Andy.Smith@wsp.com>  
Subject: RE: A1 BCH FRA Model Comments

Hi Andy,  
I've spoken to Caroline, we should be able to review and send you our comments by Wed 13 November at the latest.

Many thanks  
Lucy

---

From: Smith, Andy [<mailto:Andy.Smith@wsp.com>]  
Sent: 29 October 2019 11:46  
To: Mo, Lucy <[lucy.mo@environment-agency.gov.uk](mailto:lucy.mo@environment-agency.gov.uk)>  
Cc: Rothwell, Jodie <[Jodie.Rothwell@wsp.com](mailto:Jodie.Rothwell@wsp.com)>; Parker, Chris <[Chris.Parker@wsp.com](mailto:Chris.Parker@wsp.com)>  
Subject: RE: A1 BCH FRA Model Comments

Lucy,

As we discussed please find attached a high level summary of the approach that we propose to undertake in addressing the comments from JBA on the A1 BCH hydraulic models, this is only a page long so hopefully short enough for a quick review.

Regards,  
Andy

**Andy Smith BSc MSc C.WEM CSci CEnv**  
Associate Director



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[REDACTED]

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Bristol, BS2 0HQ

---

From: Mo, Lucy [<mailto:lucy.mo@environment-agency.gov.uk>]  
Sent: 22 October 2019 11:58  
To: Smith, Andy <[Andy.Smith@wsp.com](mailto:Andy.Smith@wsp.com)>  
Subject: RE: A1 BCH FRA Model Comments

Hi Andy,

I've just heard back from our modelling team. It is estimated that the review of the spreadsheet will cost approximately £1400 (14 hours) plus VAT, and will be completed by Friday 22 November at the latest (the completion date is based on receiving confirmation from yourself to proceed with this work no later than Thursday 24 October).

Therefore, please let me know if you would like to proceed with work. We currently have a contract of 75 hours in place. This work could be completed under the current contract and invoicing details.

Please do not hesitate to contact me if you have any questions.

Many thanks

Lucy

---

From: Smith, Andy [<mailto:Andy.Smith@wsp.com>]  
Sent: 21 October 2019 13:20  
To: Mo, Lucy <[lucy.mo@environment-agency.gov.uk](mailto:lucy.mo@environment-agency.gov.uk)>

Cc: Rothwell, Jodie <[Jodie.Rothwell@wsp.com](mailto:Jodie.Rothwell@wsp.com)>  
Subject: Re: A1 BCH FRA Model Comments

Lucy

It was submitted in August to the inspector and ideally needs to be resolved by December.

Does a dco not work in the same manner as a planning application in that there are no costs to recover in this period?

Regards  
Andy

0117 930 2082  
[REDACTED]

---

From: Mo, Lucy <[lucy.mo@environment-agency.gov.uk](mailto:lucy.mo@environment-agency.gov.uk)>  
Sent: Monday, October 21, 2019 10:19:12 AM  
To: Smith, Andy <[Andy.Smith@wsp.com](mailto:Andy.Smith@wsp.com)>  
Subject: RE: A1 BCH FRA Model Comments

Hi Andy,

It's great to hear from you. I hope you weren't working too much over the weekend.

We'll need to recover our costs on this work. So I've forwarded the spreadsheet onto our modelling team to get an idea of estimated costs and timescales. I'll confirm the costs and timescales once I hear back from them.

In terms of the NSIP, do you by any chance know when the application was/is submitted to the Planning Inspector?

Many thanks

Lucy

---

From: Smith, Andy [<mailto:Andy.Smith@wsp.com>]  
Sent: 20 October 2019 21:04  
To: Mo, Lucy <[lucy.mo@environment-agency.gov.uk](mailto:lucy.mo@environment-agency.gov.uk)>  
Cc: Ashworth, Nicola <[Nicola.Ashworth@wsp.com](mailto:Nicola.Ashworth@wsp.com)>; Rothwell, Jodie <[Jodie.Rothwell@wsp.com](mailto:Jodie.Rothwell@wsp.com)>  
Subject: A1 BCH FRA Model Comments

Lucy,

I hope that you had a great weekend, apologies for the delay in getting our responses on the JBA review of our hydraulic modelling back to you, if you could arrange for Caroline to review and let me know whether you all agree with our proposed approach that would be great.

Regards,  
Andy

**Andy Smith BSc MSc C.WEM CSci CEnv**  
Associate Director  
Please note Monday is my non working day



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**Appendix N – WSP Technical Note and Spreadsheet Response to Environment Agency Model Queries (11/02/2020)**



# TECHNICAL NOTE

<b>DATE:</b>	28 January 2020	<b>CONFIDENTIALITY:</b>	Public
<b>SUBJECT:</b>	Flood Modelling Response to EA Comments		
<b>PROJECT:</b>	A1 BCH	<b>AUTHOR:</b>	Chris Parker
<b>CHECKED:</b>		<b>APPROVED:</b>	Andy Smith

## INTRODUCTION

This note has been prepared to provide responses to the clarifications requested by JBA on behalf of the Environment Agency, to enable the approval of the hydraulic models that support the FRA for the Highways England A1 Birtley to Coal House scheme. This note is intended to be read in conjunction with the JBA review sheet that provides the comments in line. The ID from the JBA comment sheet has been used in the section headings in this technical memo to identify where a comment has been addressed. Only points identified in our Technical Note 1 dated 29<sup>th</sup> October and agreed with the Environment Agency (email from Lucy Mo, 14<sup>th</sup> November 2019) have been covered, in this Technical Note.

Each of the three topics in the Environment Agency review have been addressed in turn these are Hydrology, Hydraulics - River Team and Hydraulics – Allerdene Burn. This review has been supported by the provision of the following documents information have been provided to support this note:

- 1 JBA review sheet (2018s0387-57\_A1\_BCH\_Review\_v2
- 2 Updated ICM model files
- 3 River Team DTM
- 4 Allerdene Burn DTM

## HYDROLOGY

**ID: A-6: NO FURTHER REPORTING GIVEN ON HOW THE CHANGE IN CATCHMENT AREA INFLUENCES OTHER KEY CATCHMENT DESCRIPTORS. DPLBAR SHOULD INCREASE, AND THERE COULD BE SIGNIFICANT CHANGES TO URBEXT2000 FROM THE CHANGE IN CATCHMENT BOUNDARY. BOTH OF THESE NEED TO BE ALTERED, AND COULD HAVE A BIG EFFECT ON CALCULATED FLOWS.**

The catchment area has been delineated in GIS and has been compared to the URBEXT coverage, both of which are shown in Figure 1. The catchment descriptors have been updated in line with the identified change in catchment area, these are documented in Table 1

# TECHNICAL NOTE

<b>DATE:</b>	28 January 2020	<b>CONFIDENTIALITY:</b>	Public
<b>SUBJECT:</b>	Flood Modelling Response to EA Comments		
<b>PROJECT:</b>	A1 BCH	<b>AUTHOR:</b>	Chris Parker
<b>CHECKED:</b>		<b>APPROVED:</b>	Andy Smith

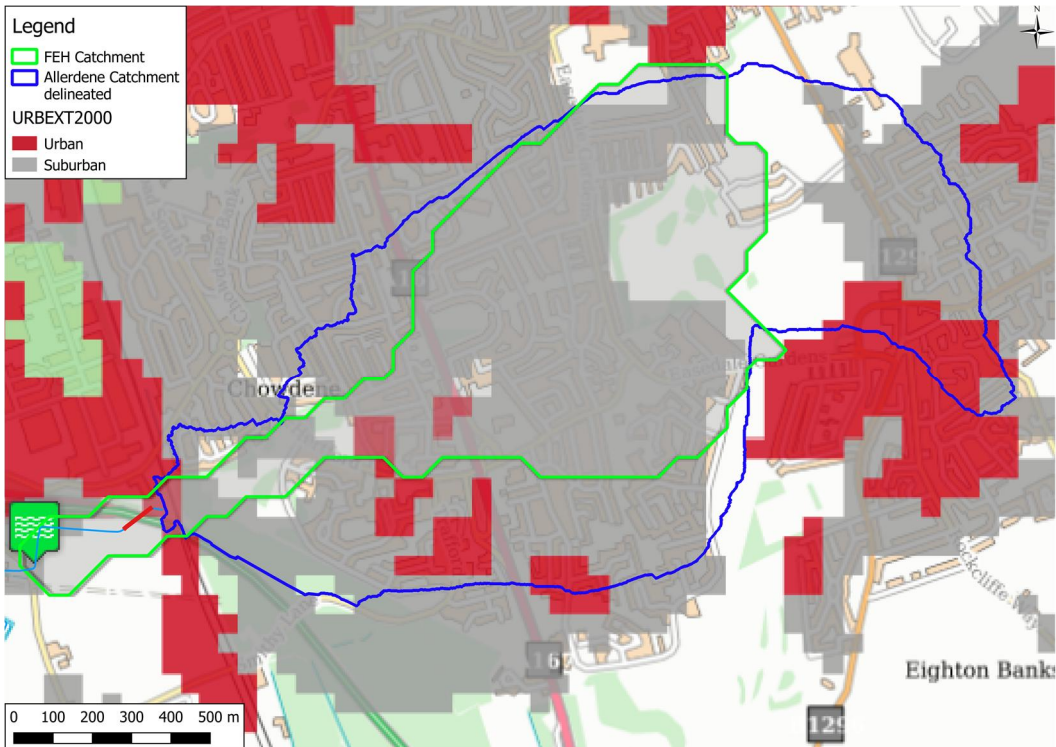


Figure 1: URBEXT Map

Table 1: Updated catchment descriptors (refined descriptors shown in red)

Descriptor	FEH Catchment	Adopted Catchment
AREA	0.9075	1.688
BFIHOST	0.682	0.682
DPLBAR	1.65	<b>2.31</b>
DPSBAR	82	82
FARL	1	1.000
SPRHOST	12.12	12.12
URBEXT <sub>1990</sub>	0.2948	<b>0.4600</b>
URBEXT <sub>2000</sub>	0.3747	<b>0.5620</b>

The approach and reasons for the updates to the catchment descriptors are detailed below:

§ **DPLBAR** updated based on formula within FEH calc-sheet (new DPLBAR = New Area<sup>0.548</sup>).  
 $0.9075^{0.548} = 0.948$ .  $1.65 / 0.948 = 1.741$ .  $1.688^{0.548} = 1.33$ .  $1.33 \times 1.741 = 2.31$ .

# TECHNICAL NOTE

<b>DATE:</b>	28 January 2020	<b>CONFIDENTIALITY:</b>	Public
<b>SUBJECT:</b>	Flood Modelling Response to EA Comments		
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<b>CHECKED:</b>		<b>APPROVED:</b>	Andy Smith

- § **URBEXT** updated based on determining the extent of urban / suburban areas are in the additional part of the catchment, using the URBEXT map from the FEH Webservice. Work out total percentage of urban/suburban area  $URBAN_{50K}$ .
- §  $URBEXT_{2000} = 0.629 \times URBAN_{50K}$ .
- §  $URBEXT_{2000}$  then multiplied by  $UEF_{2000}$  for 2019 (1.04).
- § **FARL** checked against online mapping and no changes are needed as there are no lakes in the additional area.
- § **BFIHOST** and **SPRHOST** checked against online BGS Geology mapping and online soil mapping (soil scape). The geology and soils in the larger catchment area is still the same. Sandstone with bands of Coal measures, overlain by slowly permeable loamy and clayey soils.

The potential impact of these changes on the calculated flows is considered in response to comment A-12 which presents the latest ReFH2 flow estimates.

**A-12: ADD A TABLE COMPARING FEH99 AND FEH13 RAINFALLS TO BACK UP THE ARGUMENT GIVEN IN CHAPTER 2 OF APPENDIX A. RUN THE REFH2 MODEL FOR THE 100 AND 1,000YR EVENTS WITH THE FEH13 RAINFALL ALSO, TO TEST IF THIS GIVES LARGER PEAK FLOWS, DUE TO THE "ALPHA" ISSUE.**

The ReFH2 derived flows have been recalculated (within the ReFH2 software v2.2 and not within ICM) with the refined catchment descriptors as detailed in A-6, the revised flows are detailed in Table 2 and the growth curves in Figure 2, both are below, the key aspects / findings are:

- § A comparison of 2013 and 1999 rainfall models along with the winter and summer storms was undertaken.
- § The use of summer rainfall substantially increases flows – this has been adopted given the urban nature of the catchment.
- § Flows estimated using the 1999 rainfall are marginally higher than the 2013 rainfall, as shown in Table 2.

*Table 2 ReFH Flow Estimates*

Peak Flow (m <sup>3</sup> /s) at given Return Period	FEH 1999 Rainfall			FEH 2013 Rainfall		
	2.5hr	3.5hr	8.5hr	2.5hr	3.5hr	8.5hr
2	0.86	0.943	0.944	0.755	0.839	0.84
20	1.67	1.795	1.725	1.527	1.627	1.52
100	2.53	2.691	2.521	2.221	2.357	2.2
1000	4.57	4.786	4.333	4.005	4.193	3.77
Growth factor at given Return Period						
2	1	1	1	1	1	1
20	1.93	1.9	1.83	2.02	1.94	1.8
100	2.93	2.85	2.67	2.94	2.81	2.61
1000	5.29	5.08	4.59	5.3	5	4.46

# TECHNICAL NOTE

<b>DATE:</b>	28 January 2020	<b>CONFIDENTIALITY:</b>	Public
<b>SUBJECT:</b>	Flood Modelling Response to EA Comments		
<b>PROJECT:</b>	A1 BCH	<b>AUTHOR:</b>	Chris Parker
<b>CHECKED:</b>		<b>APPROVED:</b>	Andy Smith

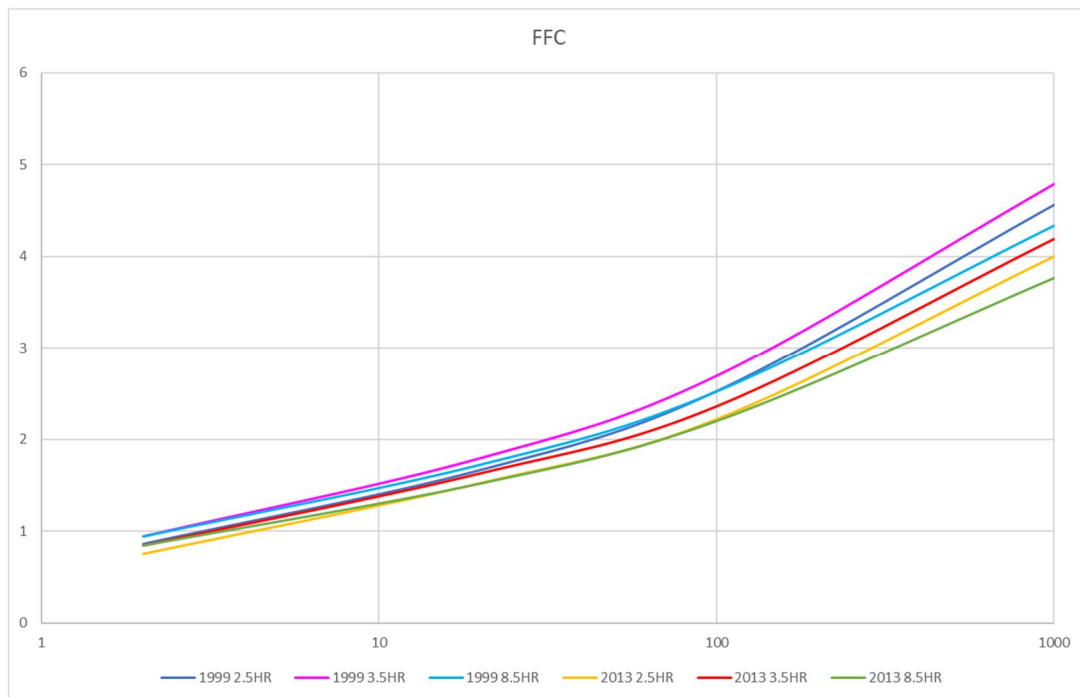


Figure 2 ReFH2 Growth Curves

## A-23 (CHOICE OF DESIGN STORM): RUN THE REFH2 MODEL FOR A RANGE OF STORM DURATIONS TO SEE WHICH GIVES THE LARGEST PEAK FLOWS FOR ALLERDENE BURN.



As shown in Table 2 the ReFH2 model was run with a range of storm durations, the design duration is 3.5 hrs, as the highest flows are observed here. The impacts of different durations have been tested using 2.5-hour and 8.5-hour storms.

## A-15-A-20: RUN THE FEH STATISTICAL METHOD AS A CHECK IN REFH2 RESULTS.

The FEH Statistical method has been undertaken as a check against the ReFH2 results the approach to this is outlined below:

### FEH STATISTICAL

This has been undertaken using:

-  Winap v4.1
-  NRFA Peak Flow Dataset V8

# TECHNICAL NOTE

<b>DATE:</b>	28 January 2020	<b>CONFIDENTIALITY:</b>	Public
<b>SUBJECT:</b>	Flood Modelling Response to EA Comments		
<b>PROJECT:</b>	A1 BCH	<b>AUTHOR:</b>	Chris Parker
<b>CHECKED:</b>		<b>APPROVED:</b>	Andy Smith

## QMED

- § The Team Valley gauge is located just downstream of the catchment; however, the catchment area of this gauge is 61.9 km<sup>2</sup> (approximately 36x larger than the subject catchment), so it is not considered to be a suitable donor.
- § The Ouse Burn at Woosington is located approximately 13km northwest of the subject catchment, and has an area of 9km<sup>2</sup>, however BFIHOST at this catchment is 0.312, which is significantly lower than the subject site, so it is not considered to be an appropriate donor.
- § Other nearby catchments: 23007, 24009, &, 23001 are all significantly larger than the subject catchment so are not suitable donors.
- § Stations 23016 and 22081 are marked as not suitable for QMED on the NRFA website.
- § Therefore, QMED for the Allerdene Burn catchment has been calculated through the catchment descriptors approach, which gives 0.184 m<sup>3</sup>/s and 0.418 m<sup>3</sup>/s once urbanised.

## POOLING GROUP

- § Table 3, below, sets out the initial pooling group from WINFAP and the adjustments made to the pooling group (PG1 is the adopted group).

Table 3: Pooling group composition

Station	Distance	Years of data	QMED AM	AREA	SAAR	FPEXT	FARL	URBEXT 2000	BFIHOST	SPRHOST	PG0	PG1	Notes
76011	1.063	41	1.84	1.63	1096	0.074	1	0	0.196	58.93	Yes	No	BFI Too Low
27051	2.266	46	4.539	8.17	855	0.013	1	0.006	0.309	40.77	Yes	Yes	
45816	2.275	25	3.456	6.81	1210	0.011	1	0.005	0.59	31.27	Yes	Yes	
28033	2.564	43	4.205	7.92	1346	0.007	1	0	0.403	42.5	Yes	Yes	
25019	3.093	40	5.384	15.09	830	0.019	1	0.004	0.524	38.58	Yes	Yes	
26802	3.139	19	0.109	15.85	757	0.03	1	0	0.959	5.67	Yes	Yes	Permeable adjustment applied
27073	3.163	37	0.82	8.06	721	0.237	1	0.008	0.887	17.77	Yes	Yes	Permeable adjustment applied
91802	3.215	34	6.35	6.54	2554	0.003	0.992	0	0.397	53.31	Yes	Yes	
25011	3.216	32	15.533	12.79	1463	0.012	1	0.001	0.237	58.21	Yes	No	BFI Too Low
47022	3.254	25	6.18	13.43	1403	0.023	0.942	0.014	0.431	44.18	Yes	Yes	
71003	3.266	37	10.9	10.71	1882	0.016	1	0	0.276	54.51	Yes	No	BFI Too Low
49005	3.268	8	6.511	16.08	1044	0.023	0.991	0.006	0.627	31.92	Yes	No	Record Length too short
25003	3.346	45	15.12	11.4	1905	0.041	1	0	0.227	59.86	Yes	No	BFI Too Low
54022	3.422	38	14.988	8.75	2481	0.01	1	0	0.323	52.68	Yes	Yes	
27010	3.463	41	9.42	18.82	987	0.009	1	0.001	0.341	50.58	Yes	Yes	
206006	3.503	48	15.33	14.44	1704	0.023	0.981	0	0.336	51.72	No	Yes	
44008	3.565	39	0.448	20.18	1012	0.015	1	0.004	0.811	19.53	No	Yes	Permeable adjustment applied
27032	3.894	52	3.923	22.25	1433	0.021	0.997	0	0.252	57.36	No	No	BFI Too Low
36010	3.911	51	7.5	27.58	588	0.045	0.999	0.007	0.387	44.57	No	Yes	
49003	3.968	52	13.985	21.61	1628	0.064	0.998	0	0.379	47.75	No	Yes	

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## PERMEABLE ADJUSTMENTS

As the subject catchment has an SPRHOST of 12.12%, permeable adjustments are necessary (based on guidance detailed in FEH Volume 3, which states this is required for catchments with an SPRHOST less than 20%). In the adopted pooling group (PG1), three catchments were identified as needing permeable adjustments (26802, 27073 & 44008). The final growth and flood frequency curves are detailed in Table 4.

*Table 4: PG1 Permeable Adjustment Results*

Return Period	2	10	20	30	50	100	200	500	1000
Growth Curve	1.00	1.744	2.088	2.308	2.610	3.072	3.604	4.437	5.183
Flood Frequency Curve	0.418	0.729	0.873	0.965	1.091	1.284	1.506	1.855	2.166

## REFH1

As a further check the ReFH1 method has also been used the findings are below:

### PARAMETERS FOR REFH MODEL – FEH1999 RAINFALL

Site code	Method: OPT: Optimisation BR: Baseflow recession fitting CD: Catchment descriptors DT: Data transfer (give details)	T <sub>p</sub> (hours) Time to peak	C <sub>max</sub> (mm) Maximum storage capacity	BL (hours) Baseflow lag	BR Baseflow recharge
Allerdene_001	CD	0.736	545.275	14.854	1.646

### DESIGN EVENTS FOR REFH METHOD

Site code	Urban or rural	Season of design event (summer or winter)	Storm duration (hours)	Storm area for ARF (if not catchment area)
Allerdene_001	Urban	Summer	1.25	-

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## FLOOD ESTIMATES FROM THE REFH METHOD

Site code	Flood peak (m <sup>3</sup> /s) for the following return periods (in years)			
	2	20	100	1000
Allerdene_001	0.491	0.941	1.342	2.718
Growth curve_001	1	1.916	2.733	5.536

## COMPARISON OF METHODS

To ensure that the most appropriate flows are used within the hydraulic model to understand the potential impacts of the Scheme on the flood regime a comparison of the methods, as refined, in light of the discussion in the previous sections, is presented below:

*Table 5: Flood Frequency Curve comparison*

Peak Flow (m <sup>3</sup> /s) at given Return Period	ReFH2		ReFH1	FEH Statistical Method	Results from previous study
	FEH 1999	FEH 2013			
<b>2</b>	0.943	0.839	0.491	0.418	-
<b>20</b>	1.795	1.627	0.941	0.729	-
<b>100</b>	2.691	2.357	1.342	1.204	1.996
<b>1000</b>	4.786	4.193	2.718	2.166	3.576

*Table 6: Comparison of the effect of FEH 1999 and 2013 winter and summer rainfall on Growth factors of ReFH2 flows*

Growth Factor at given Return Period	ReFH2		ReFH1	FEH Statistical Method
	FEH 1999	FEH 2013		
2	1.000	1.000	1.000	1.000
20	1.904	1.940	1.916	2.088
100	2.854	2.810	2.733	3.072
1000	5.076	4.998	5.536	5.183



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The tables outline the differences between the results from the different ReFH2 runs and the FEH statistical method, this demonstrates that:

- § The flows from the FEH statistical method are significantly lower.
- § Whilst the growth curves for ReFH2 and FEH Statistical are similar, the QMED (derived from the statistical method) is significantly lower hence the lower flows at the higher return periods.

In light of this assessment we have adopted the ReFH2 flows with FEH 2013 rainfall for use within the assessment because:

- § Given the permeable nature of the catchment, ReFH flows are unreliable.
- § The FEH Statistical method is often preferred for permeable catchments and a permeable adjustment was undertaken, however the flows from this method are substantially lower than the ReFH2 flows, therefore the ReFH2 flows are preferred as a more conservative approach.
- § Although using the FEH1999 rainfall within ReFH2 does give slightly larger flows than FEH2013 rainfall, the FEH1999 rainfall uses the alpha factor which is not reliable in permeable catchments. Given that the subject site is permeable, using the FEH2013 rainfall is deemed more appropriate.

As part of the addressing the hydraulics comments the models have been re-run with the adopted flows. Any significant changes / implications are discussed in the relevant sections below.

### **ID: A-1 WHY WAS FLUVIAL MODELLING NOT UNDERTAKEN AT LONGACRE DEAN; AND**

### **ID: A-32 THERE IS NO INFORMATION GIVEN ON THE RANGE OF STORM DURATIONS USED IN THIS DIRECT RAINFALL MODELLING IN THE REPORT.**

The Scheme has the potential for significant impacts on the Allerdene Burn as the culvert will be replaced (Allerdene Embankment Option) or a new channel will be constructed (Allerdene Viaduct Option), greater certainty in the flows and associated impacts were required.

In the Longacre Dean catchment a direct rainfall model was utilised, a separate fluvial model was not deemed necessary as:

- § The risks to the scheme as a result of fluvial flooding were not considered to be significant
- § The proposals do not impact the main channel.

This is because at Longacre Dean the culvert is substantially lower than the road, with no flow route on to the A1. The surface flow routes to the channel are of interest and the main risk to the Scheme in this area was identified as being surface water related associated with the slip road for which the potential flow routes and depths were assessed.

The ReFH2 software was used to develop the net hyetographs for use within the model, as part of this the 1, 3, 6 & critical duration (hr) storms were assessed for both the 1999 and 2013 rainfall. The model has been run with the 1, 3 and 6 hour durations, which confirm that the 1 hour produces the most flooding, in

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the area of interest. However, as requested all the durations have been run and the results merged to obtain the greatest flood depths. The resultant 1 in 100 year flood map is shown on Figure 3.

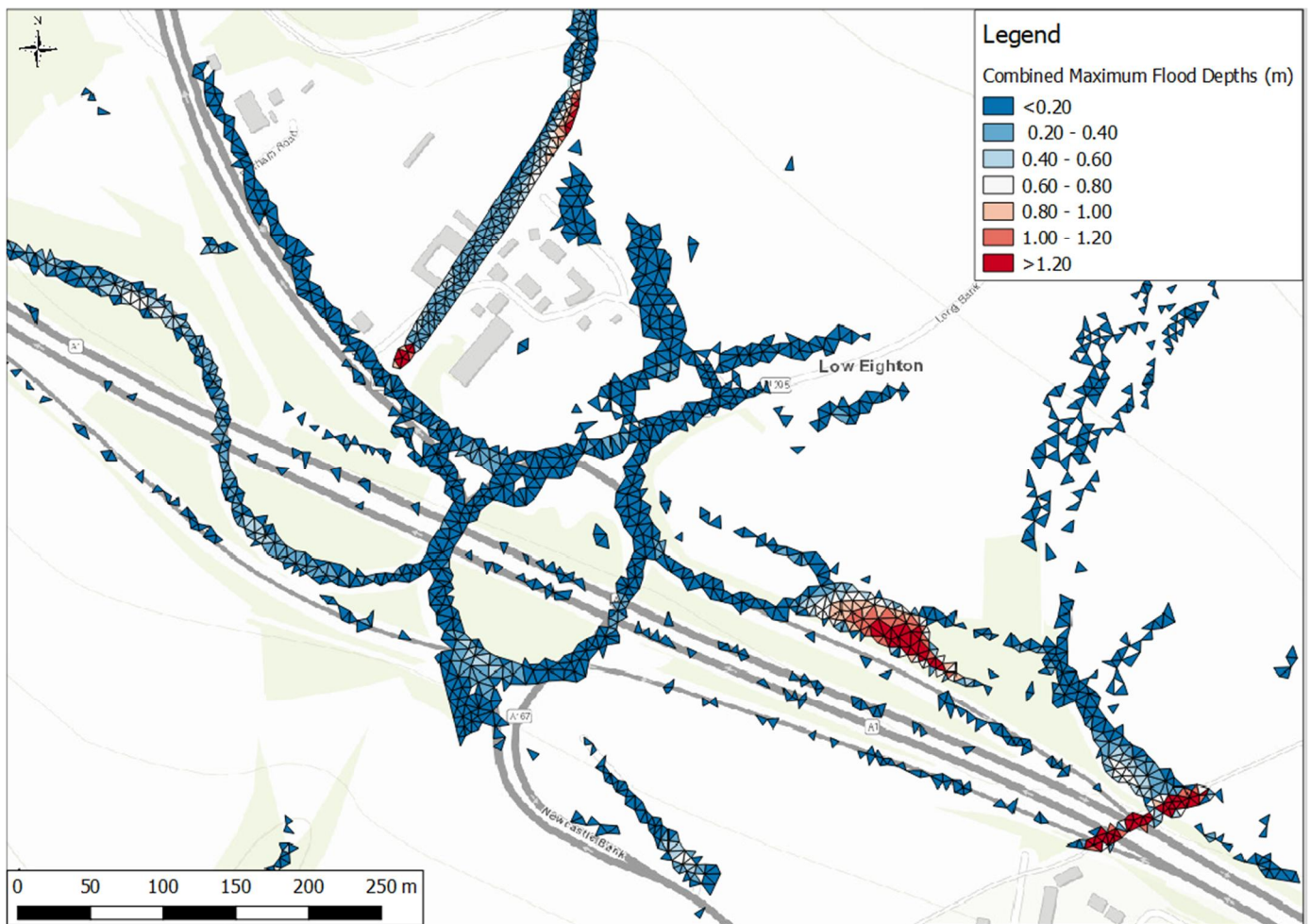


Figure 3: J66 Flood Depths for the 1 in 100 year (1%) event

The hyetograph's were developed using the catchment descriptors for the Allerdene Burn FEH catchment (after undertaking checks against the available online mapping, which identified that the values for BHIHOST, SPRHOST and FARL were deemed appropriate ) with AREA, DPLBAR & URBEXT adjusted as described below, with the resultant descriptors contained in Table 7.

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Table 7 Junction 66 Catchment Descriptors

Descriptor	Allerdene FEH Catchment	LiDAR J66 catchment
AREA	0.9075	0.817
BFIHOST	0.682	0.682
DPLBAR	1.65	<b>1.56</b>
DPSBAR	82	82
FARL	1	1.000
SPRHOST	12.12	12.12
URBEXT2000	0.3747	<b>0.236</b>

- § **DPLBAR** updated based on formula within FEH calc-sheet (new DPLBAR = New Area<sup>0.548</sup>).  
 $0.9075^{0.548} = 0.948$ .  $1.65 / 0.948 = 1.741$ .  $0.817^{0.548} = 0.895$ .  $0.895 \times 1.741 = 1.558$ .
- § **URBEXT** updated based on determining the extent of urban / suburban areas are in the additional part of the catchment, using the URBEXT map from the FEH Webservice. Work out total percentage of urban/suburban area  $URBAN_{50k}$   
 $URBEXT_{2000} = 0.629 \times URBAN_{50k}$ .  
**URBEXT<sub>2000</sub>** then multiplied by UEF2000 for 2019 (1.04).
- § **FARL** checked against online mapping and no changes are needed as there are no lakes in the additional area.
- § **BFIHOST** and **SPRHOST** checked against online BGS Geology mapping and online soil mapping (soil scape). The geology and soils in the larger catchment area is still the same. Sandstone with bands of Coal measures, overlain by slowly permeable loamy and clayey soils.
- § For **URBEXT** there are 0.295km<sup>2</sup> of urban / suburban area as measured from the georeferenced URBEXT map in QGIS.  
 $URBAN_{50k} = 0.295 / 0.817 \times 100 = 36.11\%$   
**URBEXT** = 0.227 pre UEF adjustment and 0.236 post UEF adjustment

## HYDRAULICS - RIVER TEAM

### ID: B-16 PROVISION OF DIGITAL TERRAIN MODELS

A digital terrain model that incorporate topographic survey has been provided.

### ID: B-29 MODEL STABILITY AND B-143 OUT OF BANK OSCILLATIONS

Lowering the bank line modular limit to 0.6 for the TEAM\_5156.1 river reach improved left bank flow for the option model, as shown in Figure 4, but caused the original basemodel provided by the EA to fail. The change in modular limit had no impact on in channel flows. The stability problem seems to be a wider issue with the model for example, river reach TE05820.1 directly upstream of the Kingsway Viaduct, shown in Figure 5, shows significant oscillations to in channel and left bank flows. Resolving stability issues with the wider approved and provided Environment Agency model (as developed by JBA) is not required as part of

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the evidence base for the Scheme. This is because the A1 is significantly elevated above the River Team and its associated floodplain at this point on a viaduct and the only impacts occur in the future climate change scenarios when the additional bridge piers require a small amount of floodplain compensation (12m<sup>3</sup>). The model is therefore considered suitable to assess the scale and nature of the proposed impacts.

An attempt was made to improve channel conveyance of river reach TEAM\_5156.1 however, this resulted in the model failing to run.

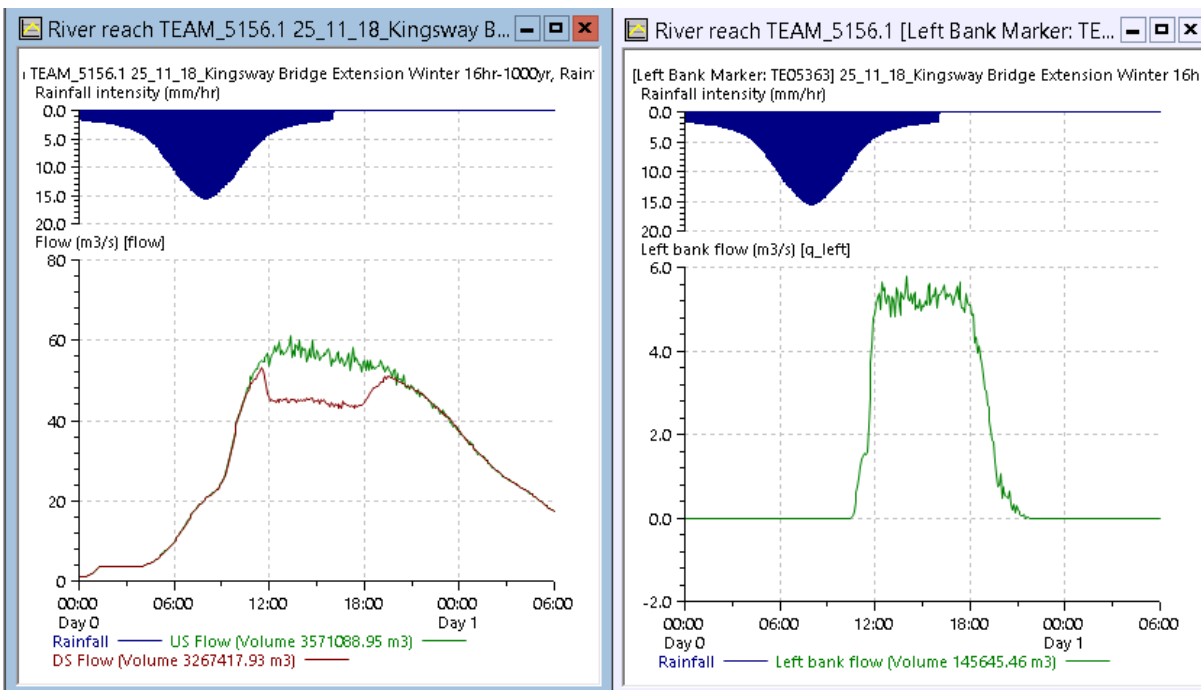


Figure 4: Improvements to channel and left bank flows for the Kingsway Viaduct river reach (TEAM\_5156.1) because of lowering the bank modular limits to 0.6 (option model)

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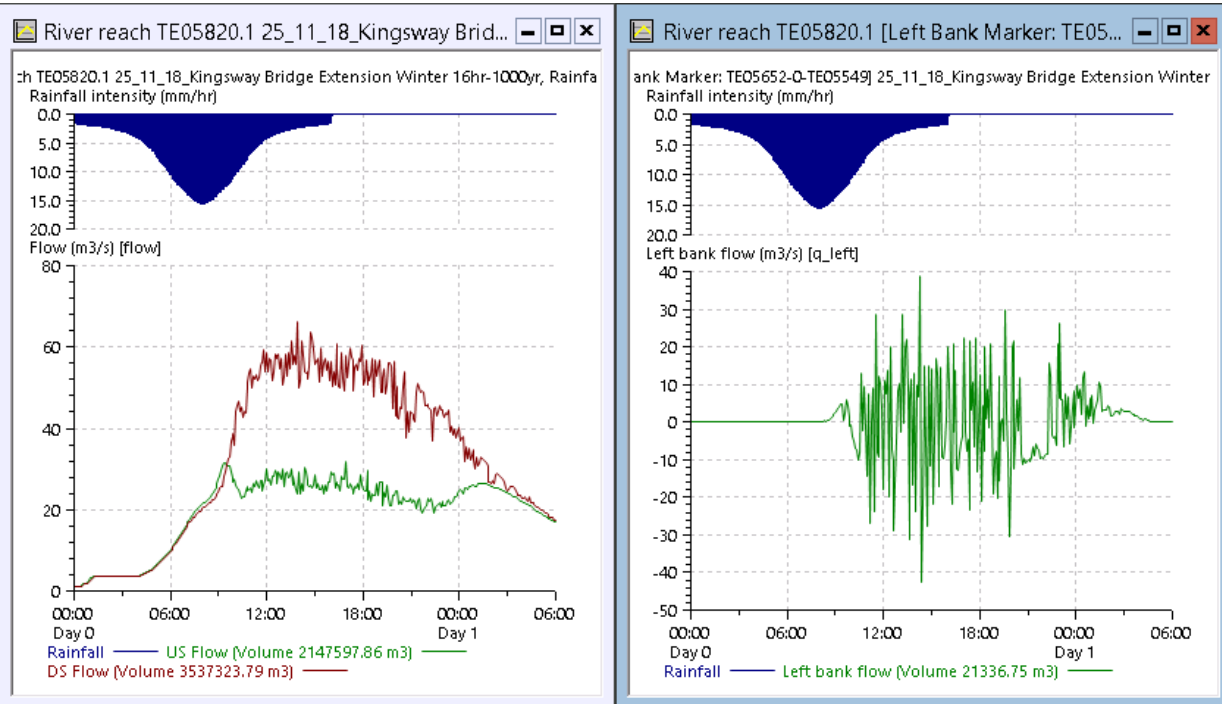


Figure 5: Channel and left bank flows for the river reach TE05820.1, directly upstream of the Kingsway Viaduct, showing stability issues for the 1 in 1000 year flow event highlighting the stability issue with the wider model (option model)

## ID: B-137 SENSITIVITY TESTS

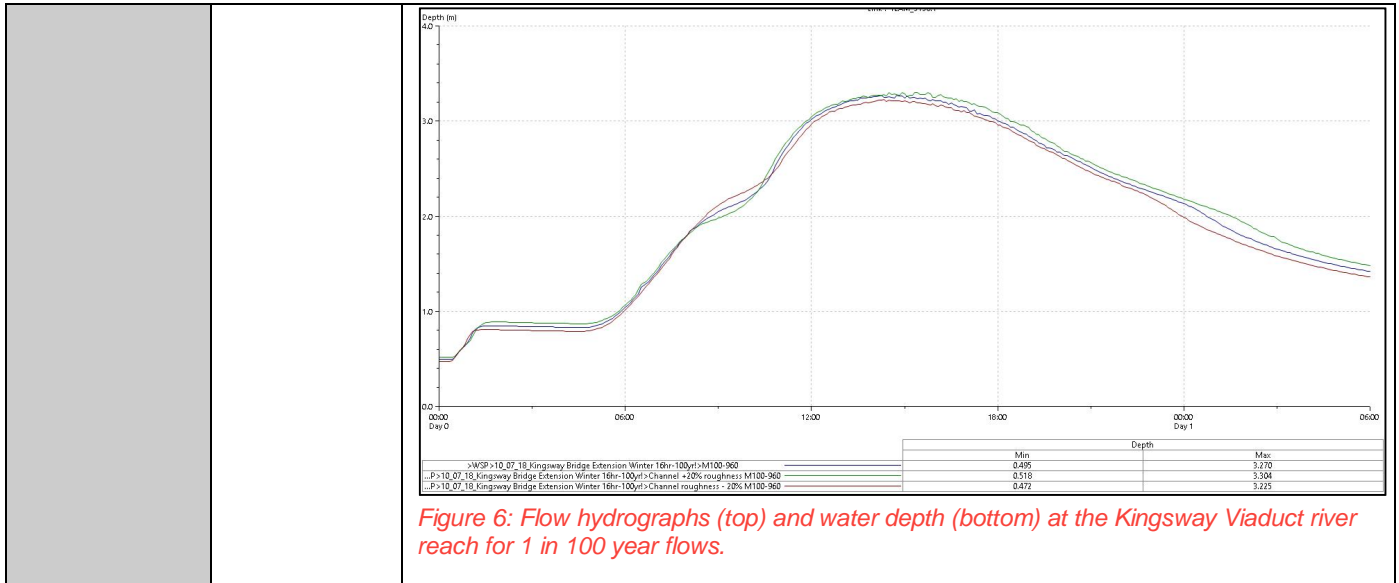
The sensitivity tests were not originally provided however, only sensitivity of channel roughness was undertaken and this is summarised below:

Table 8: Sensitivity Analysis for the River Team at the Kingsway Viaduct

Sensitivity Test	Model changes	Description of sensitivity test and outcome
Downstream Boundary	Channel Roughness Mannings +/- 20%	Channel Mannings roughness value in the model was varied by +/- 20%.  Increasing channel roughness has minimal impact on maximum predicted depths at the Kingsway Viaduct reach (Team_5156.1), shown in Figure 10, with depth varying by +0.034m to -0.045m. This is considered to be within the acceptable model tolerance limits.

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## ID: B-139 BASELINE 0.1% EVENT

The baseline 0.1% event has now been run to completion, this required changes to the tolerances, however, it did not establish any issues.

## ID: B-137 MODEL PERFORMANCE TESTS

No calibration was undertaken as this was deemed outside of the scope of the project considering both the minor amendments made to the model and the proposed A1 scheme. As outlined above only approximately 12m<sup>3</sup> of flood plain compensation is required for the additional bridge piers

# HYDRAULICS - ALLERDENE BURN

## INTRODUCTION

The updates to the hydrology as detailed previously have resulted in increases to the peak flows, unfortunately this means that the original mitigation options no longer perform as intended. Therefore, the mitigation options have been refined to maintain or improve current flood risk.

**Error! Reference source not found.** shows the modelled predicted peak flows prior to and following the revision to the hydrology. The refinements to the mitigation has included the incorporation of additional flow controls within the proposed channels to maximise channel storage. Full descriptions of the options can be found in the Scenario Clarification section below. These mitigation options have been progressed to the



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same level of detail as those originally proposed within the FRA and the Road Drainage and Water Resources ES Chapter, in that they are appropriately designed for this stage and will require refinement during the detail design phase.

*Table 9 : Predicted peak flows at river reach ST02 DS.1 for the Baseline Scenario and Options 1 and 2, grey and green cells show the predicted peak flows prior and following the hydrology revision respectively.*

Hydrology	Scenario	Flood Peaks Flow (m <sup>3</sup> /s)			
		1 in 100 year (1% AEP)	1 in 100 year (1% AEP+25%)	1 in 100 year (1% AEP +50%)	1 in 1000 year (0.1% AEP)
Original	Baseline	2.16	2.53	2.68	2.85
	Option 1	2.10	2.51	2.65	2.83
	Option 2	2.14	2.53	2.70	2.82
Revised	Baseline	2.36	2.63	2.80	2.94
	Option 1	2.28	2.63	2.64	2.65
	Option 2	2.21	2.44	2.47	2.47

## ID: B-8 SCENARIO CLARIFICATION

Two options have proposed in the ES with respect to the Allerdene Bridge replacement and the modifications to the Allerdene Culvert:

- 1 Allerdene embankment option, whereby the Allerdene Culvert will be lengthened downstream to accommodate the bridge replacement and the upstream section will be daylighted to reduce the length of the resulting culvert. Furthermore, an approximate 300m of the open section of the watercourse downstream will be realigned parallel to the new bridge.
- 2 ii. Allerdene viaduct option: whereby the Allerdene Culvert will be replaced by an engineered open channel and the existing watercourse downstream will be realigned to accommodate the new viaduct. The proposed channel (new section and realignment) will be approximately 620m in length and will run under one of the bridge spans of the new structure.

The model scenarios have been simplified in the ICM model with only the baseline model and two option models being provided. The option scenarios have been renamed Option 1 and Option 2 in ICM for simplicity.



-  Option 1 – Allerdene Embankment Option
-  Option 2 – Allerdene Viaduct Option

Figure 7 shows the baseline configuration / model schematisation.

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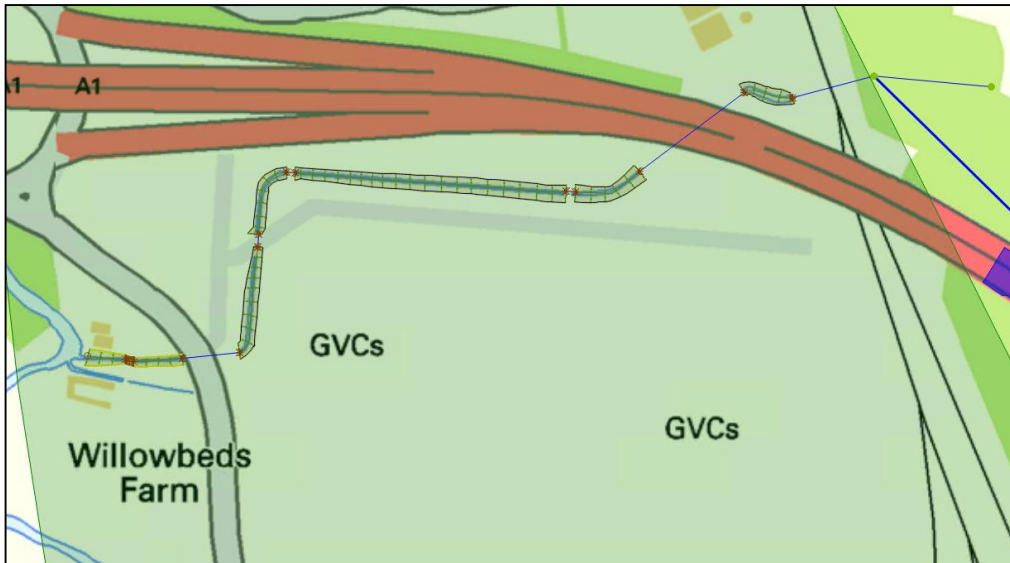


Figure 7: Existing model channel configuration

**Option 1:** requires the extension of the existing Allerdene culvert and realignment of the drainage channel. The proposed drainage channel includes the replacement of four culverts, these are to be replaced with, a 1200mm diameter circular culvert at the downstream end of the channel and a 1350mm and two 1200mm circular culvert at intervals along the channel. In addition, a 900mm diameter circular orifice plate at the upstream end of the existing culvert. These are designed to mimic the existing channel structure, which has three 1350mm culverts, to attenuate peak flows and maximise the available channel storage. The locations and sizes of the flow control structures are shown in Figure 8.

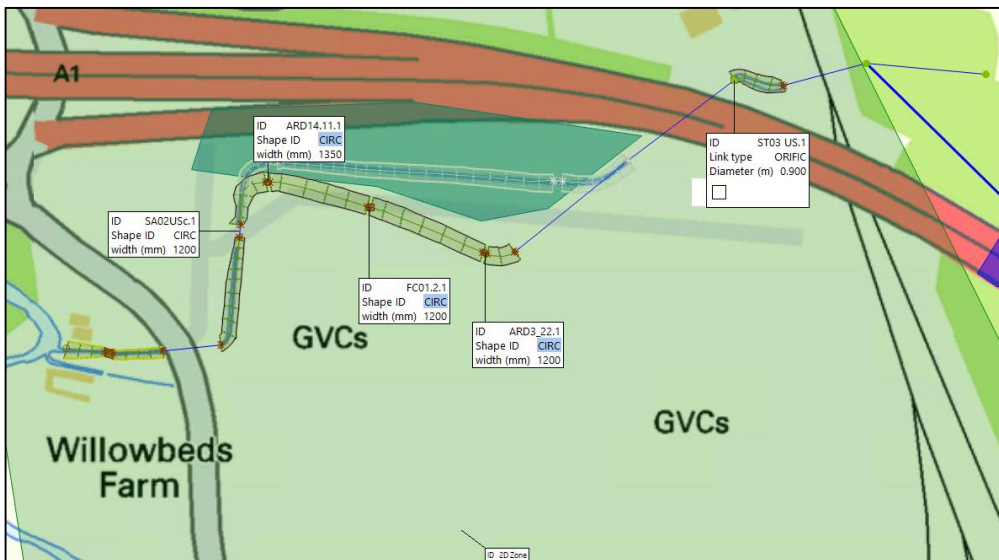


Figure 8: Option 1 channel alignment and flow control locations



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**Option 2:** Requires the daylighting and replacement of Allerdene culvert with a new section of open channel and realignment of the existing channel to accommodate the construction of a new viaduct over the adjacent railway line. Like Option 1 the new drainage channel includes four 1200mm diameter circular flow control culverts, one at the downstream end and three at intervals along the new channel to attenuate peak flows. Figure 9 shows the alignment of the new channel and location of the flow control culverts.

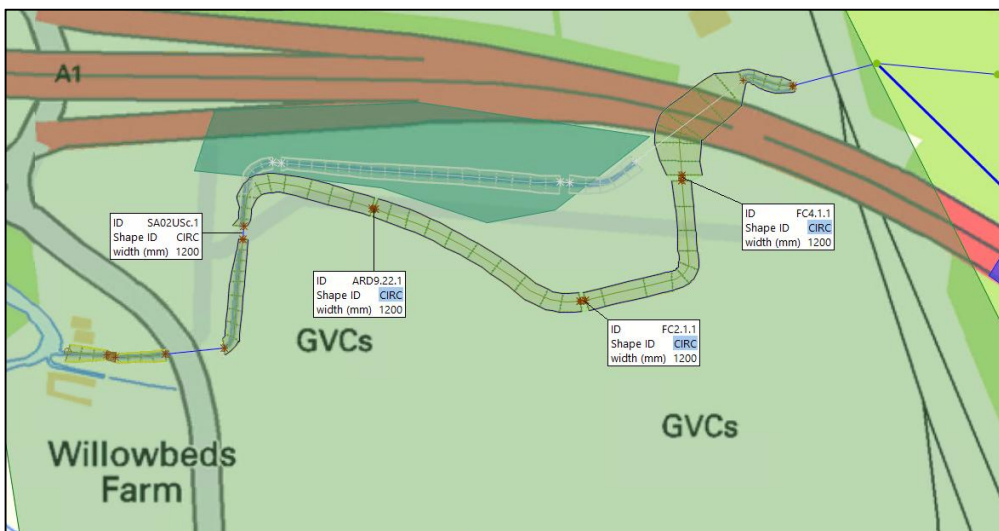


Figure 9: Option 1 channel alignment and flow control locations

## ID: B-14 PROVISION OF DIGITAL TERRAIN MODELS

Digital terrain models of the existing model and two options have been provided.

## ID: B-31 WATERCOURSE BANK LINES (EXISTING MODEL)

For the existing model the banklines were interpolated between survey sections, as the existing channel (for most of its length) is a uniform shape. At the time of survey, the channel was mainly within dense scrub and woodland therefore there is low confidence in the Lidar data which is one of the main reasons for using interpolation of survey data.

## ID: B-42 REPRESENTATION OF ROADS AND BUILDINGS

The Allerdene model covers a small area and this level of detail is not required in this instance.

## ID: B46 & B47 WATERCOURSE CONVEYANCE (OPTION MODELS)

For the option models the watercourse cross sections have been trimmed to top of banks at the sections identified and panel markers added to improve conveyance at higher flows.

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## ID: B145 & B152 SENSITIVITY TESTING

Sensitivity testing has been undertaken on the Allerdene Burn for the downstream boundary, the channel roughness and flow duration, these are summarised in Table 10.

Table 10: Sensitivity Analysis for the Allerdene Burn

Sensitivity Test	Model changes	Description of sensitivity test and outcome																																	
<b>Downstream Boundary</b>	Set downstream boundary to 13m AOD	<p>The original downstream boundary was taken from the River Team model for the matching critical duration for the closest cross section to the confluence with the Allerdene Burn. To test the impact of the downstream boundary on the model a boundary level of 13m AOD has been applied. The River Team model demonstrates that this is approximately the highest level predicted for the 1 in 1000 year critical duration event at the confluence with the Allerdene Burn.</p> <p>Results indicate that an extreme downstream boundary has no impact on the 1 in 100 year flows or depths. Figure 10 shows peak flows and depth for the 1 in 100 year event at the river reach ST02 DS.1. As there is negligible difference between the design and boundary test runs, the test run results mirror the design run, hence no impact and thus it is not visible.</p>																																	
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Figure 10: Flow hydrographs (top) and water depth (bottom) at river reach ST02 DS.1 for 1 in 100 year flows.

# TECHNICAL NOTE

**DATE:** 28 January 2020      **CONFIDENTIALITY:** Public  
**SUBJECT:** Flood Modelling Response to EA Comments  
**PROJECT:** A1 BCH      **AUTHOR:** Chris Parker  
**CHECKED:**      **APPROVED:** Andy Smith

## Channel Roughness

Channel Roughness Mannings +/- 20%

Increasing channel roughness by  $\pm 20\%$  has no impact on peak flows (Figure 10). However, for channel depths it does cause the maximum depth to vary by approximately 140-150mm (Figure 11) or approximate  $\pm 70$ -80mm compared with the baseline roughness values. This is considered to be within the acceptable model tolerance limits.

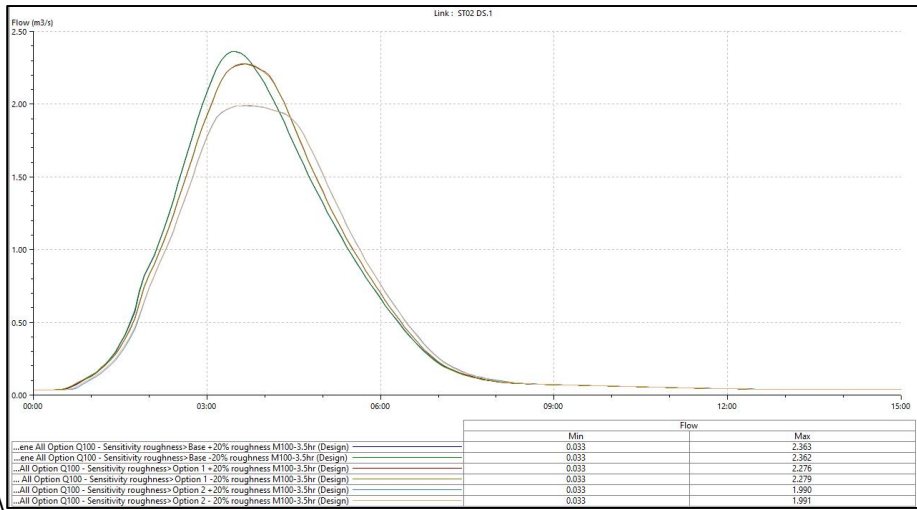


Figure 11: Flow hydrographs at river reach ST02 DS.1 for 1 in 100 year flows with varying roughness

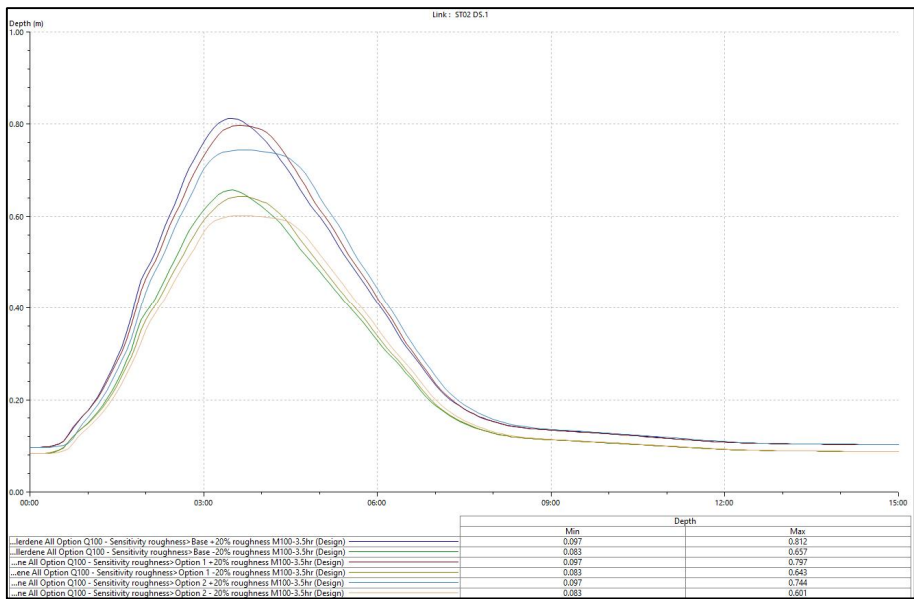
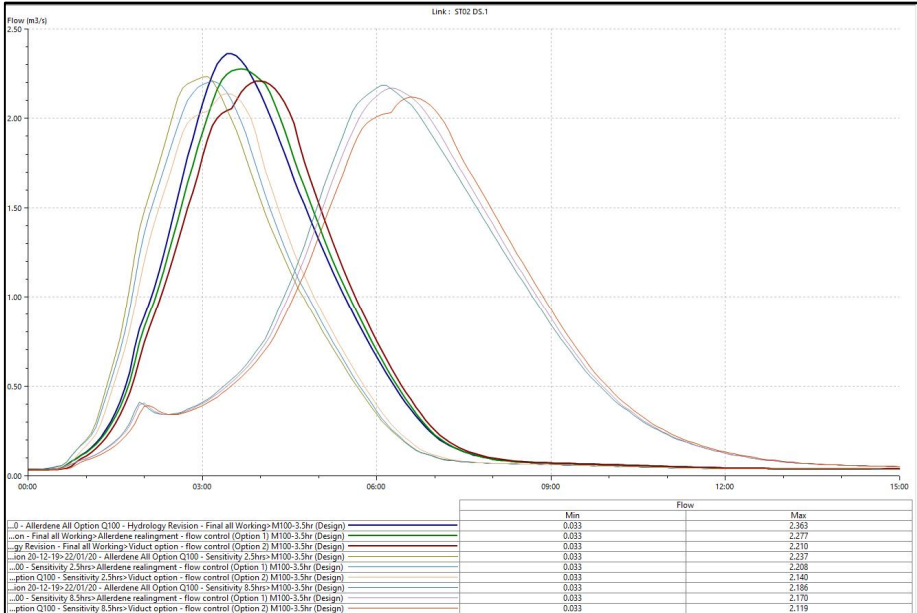


Figure 12: Water depth at river reach ST02 DS.1 for 1 in 100 year flows with varying roughness.

# TECHNICAL NOTE

<b>DATE:</b>	28 January 2020	<b>CONFIDENTIALITY:</b>	Public
<b>SUBJECT:</b>	Flood Modelling Response to EA Comments		
<b>PROJECT:</b>	A1 BCH	<b>AUTHOR:</b>	Chris Parker
<b>CHECKED:</b>		<b>APPROVED:</b>	Andy Smith

<b>Flow duration</b>	Run 1 in 100 year 2.5 and 8.5 hour duration flows	<p>Flows for the 1 in 100 year 2.5 hour and 8.5 hour duration where run to test the model sensitivity to different length flood events (Figure 13). Results show that the highest flow is achieved for the 3.5 hour duration flow hydrograph which was used as the critical design event.</p>  <table border="1"> <thead> <tr> <th></th> <th>Min</th> <th>Max</th> </tr> </thead> <tbody> <tr> <td>...0 - Allerdene All Option Q100 - Hydrology Revision - Final all Workings M100-3.5hr (Design)</td> <td>0.033</td> <td>2.363</td> </tr> <tr> <td>...on - Final all Workings Allerdene realignment - flow control (Option 1) M100-3.5hr (Design)</td> <td>0.033</td> <td>2.277</td> </tr> <tr> <td>...y Revision - Final all Workings Viduct option - flow control (Option 2) M100-3.5hr (Design)</td> <td>0.033</td> <td>2.210</td> </tr> <tr> <td>...on 20-12-19-22/01/20 - Allerdene All Option Q100 - Sensitivity 2.5hrs M100-3.5hr (Design)</td> <td>0.033</td> <td>2.237</td> </tr> <tr> <td>...00 - Sensitivity 2.5hrs Allerdene realignment - flow control (Option 1) M100-3.5hr (Design)</td> <td>0.033</td> <td>2.308</td> </tr> <tr> <td>...ption Q100 - Sensitivity 2.5hrs Viduct option - flow control (Option 2) M100-3.5hr (Design)</td> <td>0.033</td> <td>2.140</td> </tr> <tr> <td>...on 20-12-19-22/01/20 - Allerdene All Option Q100 - Sensitivity 8.5hrs M100-3.5hr (Design)</td> <td>0.033</td> <td>2.186</td> </tr> <tr> <td>...00 - Sensitivity 8.5hrs Allerdene realignment - flow control (Option 1) M100-3.5hr (Design)</td> <td>0.033</td> <td>2.170</td> </tr> <tr> <td>...ption Q100 - Sensitivity 8.5hrs Viduct option - flow control (Option 2) M100-3.5hr (Design)</td> <td>0.033</td> <td>2.119</td> </tr> </tbody> </table>		Min	Max	...0 - Allerdene All Option Q100 - Hydrology Revision - Final all Workings M100-3.5hr (Design)	0.033	2.363	...on - Final all Workings Allerdene realignment - flow control (Option 1) M100-3.5hr (Design)	0.033	2.277	...y Revision - Final all Workings Viduct option - flow control (Option 2) M100-3.5hr (Design)	0.033	2.210	...on 20-12-19-22/01/20 - Allerdene All Option Q100 - Sensitivity 2.5hrs M100-3.5hr (Design)	0.033	2.237	...00 - Sensitivity 2.5hrs Allerdene realignment - flow control (Option 1) M100-3.5hr (Design)	0.033	2.308	...ption Q100 - Sensitivity 2.5hrs Viduct option - flow control (Option 2) M100-3.5hr (Design)	0.033	2.140	...on 20-12-19-22/01/20 - Allerdene All Option Q100 - Sensitivity 8.5hrs M100-3.5hr (Design)	0.033	2.186	...00 - Sensitivity 8.5hrs Allerdene realignment - flow control (Option 1) M100-3.5hr (Design)	0.033	2.170	...ption Q100 - Sensitivity 8.5hrs Viduct option - flow control (Option 2) M100-3.5hr (Design)	0.033	2.119
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## ID: B-153 MODEL PERFORMANCE TESTS

As the Allerdene burn is a minor watercourse with no available event data for calibration. The model performs well for all flow conditions modelled including the extreme 1 in 1000 year and 1 in 100 +50% climate change allowance.



Technical Model Review Report		
Client	Environment Agency	
Single project or WEM package?	WEM Package	
Package name (if applicable)	2018-19 National Modelling and Forecasting Technical Support Contract	
Project name	Review No. 57 - A1 Birtley to Coal House	
JBA Project Number (or overarching project)	2018s0387	
JBA Sub-Project Number (if applicable)	57	
Review requirements	A) Previous project - hydrology	
	B) Previous project - hydraulic	
	C) New project - hydrology	Yes
	D) New project - hydraulics	Yes
	E) Survey data	
	F) Reporting	

"RAG" key	
Major issue	Omission that could make the findings subject to challenge and which requires correction/further work.
Minor issue	Non-standard method or method not following guidance but unlikely to have impacted on results
Clarification required	The approach used is unclear and requires further clarification before it can be reviewed
Recommendations	Suggestion for improved / good practice but which is unlikely to change the project outcomes.
Acceptable (but does not meet best practice)	The approach is acceptable, however it is not in line with standard industry best practice
Acceptable	Suggestion for improved / good practice but which is unlikely to change the project outcomes.

Summary of 1st hydrology review findings
<p><b>Hydrology review</b></p> <p>A few suggestions have been given below, which may give more conservative results. The reporting in Appendix A regarding the inflow calculations would benefit from additional detail, but is generally well written. The maps provided are excellent and are very helpful. There are a few omissions that should be addressed, see individual comments below.</p>
Summary of 1st hydraulics review findings
<p><b>Allerdene Burn model:</b></p> <p>Minor issues have been identified. Generally the baseline model and option 1 are well constructed. There were some issues identified in Option 2 that could be impacting the results. Therefore it is recommended that this model is revised.</p> <p>As for all modelling studies, results of the sensitivity testing and model proving, should be provided for review.</p>
<p><b>Kingsway Viaduct model:</b></p> <p>As the baseline model was constructed by JBA, only the described changes at the viaduct have been reviewed to avoid a conflict of interest. The representation of the existing and proposed viaduct has been done well. However, the stability of out of bank flows in the area of interest is a concern in the 0.1% AEP event, proposed scenario examined.</p>



A Hydrology Review	
Date of hydrology analysis	Dec-18
Name of reviewer	James Molloy BE(Hons) MEngSc
Date of review	08/07/2019
Revision	V1
Applicable standards or guidance	Flood Estimation Handbook (IH, 1999) updates including Kjeldsen (DEFRA, 2008), and recent outputs from the FEH Local project ReFH1 and/or ReFH2 guidance documents EA Flood Estimation Guidelines (Operational instruction 197_08, V6)
Nature of study watercourse(s)/constraints	The study looks at various sources of flood risk along a reach of the A1 road, to the south of Allerdene near Newcastle. Various proposed engineering works along the road require an assessment of (a) fluvial flood risk from Allerdene Burn, a small tributary of the River Team and (b) surface water flood risk around Longacre Dean a short distance to the south-east.  <b>The report also looks at flood risk from the River Team, however as no changes have been applied to the hydrology used in the underlying model for this watercourse (previously signed off by the Environment Agency), this aspect is not reviewed in this document.</b>
Study objectives	The aim of the analysis is to determine if the proposed changes to the road layout have any effect on local flood risk. Information provided in Appendix A of the provided modelling report is used as the basis of this review.
Summary of 1st review	A few suggestions have been given below, which may give more conservative results. The reporting in Appendix A regarding the inflow calculations would benefit from additional detail, but is generally well written. The maps provided are excellent and are very helpful. There are a few omissions that should be addressed, see individual comments below.

**Key**  
Purple - no change  
Red - changes made

Category	Detail	ID	1st review			Consultants Response (if required)
			Comment	Suitability	Suggested actions	
<b>General comments</b>						
General comments	Method statement	A-1	Quite detailed in places, as various sources of flood risk need to be considered in the analysis. The maps provided alongside the report are very useful and clear.  Some of the details regarding the hydrological inflows are quite sparse however, see individual comments below.	Clarification required	Reasoning is given in the main report text (Chapter 3) for the study requirements at each watercourse crossing of the A1 road. It seems an unusual decision why fluvial modelling was carried out on Allerdene Burn, but only pluvial modelling around Longacre Dean (why not carry out fluvial modelling at the latter site also?)	Significant works are proposed on the channel at Allerdene Burn, no works are proposed at Longacre Dean. Therefore, fluvial modelling was not required at Longacre Dean due to the proposals not impacting the main channel. At Long acre dean the culvert is substantially lower than the road, with no flow route on to the A1 and no changes are proposed but the surface flow routes to the channel are of interest.
	Previous studies	A-2	It is understood that there are no previous studies looking at flood risk for Allerdene Burn, and that only broad-scale pluvial mapping has been carried out in the region surrounding Longacre Dean, which the authors correctly point out does not account for local drainage features that would affect local flood risk.	Acceptable		N/A
	Catchment description (any unusual features such as pumps, reservoirs, heavy urbanisation?)	A-3	Small catchments, some of which drain densely urbanised areas.	Recommendations	Has the Urban ReFH2 method been considered adequately? Checked in further detail below.	This is addressed within the accompanying technical note
<b>Method statement</b>						
Flow estimation points and descriptors	Location of FEPs / catchment descriptors provided?	A-4	Yes in Section 3.3.	Acceptable		N/A
	Unusual catchment features (which may influence choice of approach)	A-5	The Allerdene catchment is heavily urbanised, and also has a moderately high BFIHOST, noted by the authors.	Recommendations	It may also be useful to obtain sewer drainage information for the area around the Allerdene Burn catchment, in case there are sewered areas outside the topographic catchment draining into this watercourse. However, this is unlikely given the steep slope in the urban area, but still would be a useful to check.	Sewer plans were not available for use within the project, we agree that additional inflows are unlikely given the local topography.
	Checks on catchment descriptors	A-6	The catchment area has been correctly checked using LIDAR data, noted that this gives a larger area compared to the "default" FEH catchment.	Major issue	No further reporting given on how the change in catchment area influences other key catchment descriptors. DPLBAR should increase, and there could be significant changes to URBEXT2000 from the change in catchment boundary. Both of these need to be altered, and could have a big effect on calculated flows.	This is addressed within the accompanying technical note
Data review	Hiflows-UK version	A-7	NRFA V7 is the latest version	Recommendations	Should be used in FEH statistical as an independent check on ReFH2, see below.	This is addressed within the accompanying technical note
	Review of hydrometric data	A-8	No local hydrometric data available to calibrate hydrological methods unfortunately.	Acceptable		N/A
	Rating reviews	A-9	n/a, no local gauges in the area apart from on the River Team, not reviewed here.	Acceptable		N/A
	Flood history	A-10	Yes, the authors have queried data held by the Environment Agency and briefly reported this in Chapter 4 of the main report, giving some details of recent floods. This shows that the region assessed here is vulnerable to a range of flood mechanisms.	Acceptable - but does not meet best practice	There are other useful sources of flood history as well. I would recommend having a look on the CBHE website ( <a href="http://www.cbhe.hydrology.org.uk/index.php">http://www.cbhe.hydrology.org.uk/index.php</a> ), and a general internet search also.	No changes proposed
Initial choice of methods	Approaches suggested	A-11	Only the ReFH2 method is proposed for use for the Allerdene modelling. Depending on the software implementation used, urbanisation adjustments may/may not have been automatically applied given the very high URBEXT200 values.	Major issue	Confirm whether or not the ICM implementation of ReFH2 automatically applies the urban adjustment, giving faster response times and peak flows on highly urbanised catchments.  There is no mention anywhere in the document of the FEH statistical method, which should also be applied here, given the uncertainty from catchment-descriptor methods. This at least would be useful as ball-park check on the peak flow produced from ReFH2.	The ReFH2 analysis was undertaken outside of ICM within the ReFH2 software. This is addressed within the accompanying technical note



	Justification of approach	A-12	A sensible argument is given for using FEH99 rainfalls over FEH13 (although it's hidden in a footnote!), given that the former is reported to give higher rainfall totals in this case. For the purposes of construction options modelling this is a good idea. Some data needs to be presented in the Appendix however to back this up, perhaps a table comparing rainfall totals across multiple storm durations.  However using FEH99 rainfall in the ReFH2 model may have an unforeseen drawback. In this situation with FEH99 rainfall, ReFH2 applies the "alpha" factor when calculating runoff (essentially a fudge factor that reduces runoff for increasing return periods - introduced to try to match FEH statistical peaks, but conceptually does not make a lot of sense!). So even though FEH99 might give more rainfall, the "alpha" factor may cancel out the effect. This factor is not used with FEH13 rainfall in the model.	Major issue	Add a table comparing FEH99 and FEH13 rainfalls to back up the argument given in Chapter 2 of Appendix A.  Run the ReFH2 model for the 100 and 1,000yr events with the FEH13 rainfall also, to test if this gives larger peak flows, due to the "alpha" issue discussed to the left.	This is addressed within the accompanying technical note	
	Lumped / distributed	A-13 A-14	n/a, as a single inflow to the model is sufficient for this case for the Allerdene model.	Acceptable		N/A	
<b>Flow estimation</b>							
FEH Statistical	Suitable for statistical?	A-15	Yes, as a check on ReFH2 results, but not used, see above.	Major issue	See above	As above	
	QMED estimation - CDs	A-16					
	QMED estimation - AMAX / POT	A-17					
	Choice of donors	A-18					
	Growth curve methodology	A-19					
	Hydrology shape	A-20					
ReFH method	Suitable for ReFH?	A-21	Yes with caution given the heavy urbanisation	Acceptable		N/A	
	Calibration	A-22	n/a, the small catchment assessed here is ungauged.	Acceptable		N/A	
		Choice of design storm	A-23	Summer rainstorm profile is suitable in this case. However only very little discussion given for the choice of design storm duration, choosing the value used in the existing River Team model, simply assuming this will also be critical for Allerdene Burn.	Major issue	Run the ReFH2 model for a range of storm durations to see which gives the largest peak flows for Allerdene Burn. Assuming the same critical storm duration as the downstream River Team model could underestimate peak flows on this small and fast-responding stream, especially important when testing models needed to size culverts, bridges, etc (in this case I think it's OK to mix and match durations from the main Team model and the Allerdene model, to give conservative results). Give a table of peak flows from ReFH2 versus storm duration in the text.	This is addressed within the accompanying technical note
		Suitable for urban ReFH?	A-24	Yes, see previous comments	Major issue	Clarify in the text if the ICM implementation applies the urban adjustments from ReFH2.	This is addressed within the accompanying technical note
Urban ReFH variant	Catchment delineation	A-25	n/a, a lumped approach is OK here.	Acceptable		N/A	
	Calibration	A-26	n/a, no gauges available to calibrate the ReFH2 model on these small streams.			N/A	
	Choice of URBEXT values	A-27	See comments above	Major issue	See adjustments for URBEXT200 required above.	This is addressed within the accompanying technical note	
	Choice of percentage runoff	A-28	ReFH2 defaults are presumably applied for the Allerdene Burn model, this should be OK (but should be reported, e.g. was urbanised %runoff left at the default 70%?)	Acceptable		This is addressed within the accompanying technical note	
Final choice of method	Final flows	A-29	N/A as only one method used. Given reliance on (uncertain) catchment descriptor methods, it is important to look at both FEH statistical and ReFH2.	Recommendations		N/A	
<b>Miscellaneous</b>							
	Direct rainfall modelling - 2D domain extent	A-30	The model domain for the direct-rainfall modelling around Longacre Dene looks sensible, based on LIDAR. The plot in Table 6 in Appendix A is very useful to demonstrate this.	Acceptable		N/A	
	Direct rainfall modelling - 2D downstream boundary condition	A-31	The authors state that there was no need to apply a 2D downstream boundary condition to remove excess ponding at the southern edge of the model.	Minor issue	It is usually best practice to place a downstream boundary on a direct rainfall model, to stop any glasswalling affecting results. This might be more important if longer rainstorms are being tested.	To clarify, a normal flow boundary condition was applied to the 2D mesh in ICM rather than no boundary condition.	
	Direct rainfall modelling - range of storm durations tested	A-32	There is no information given on the range of storm durations used in this direct rainfall modelling in the report. The EA national-scale pluvial mapping runs separate models for storm durations of 1hr, 3hrs and 6hrs, then merges the modelled maximum depths in a final grid. This allows for runoff rates on regions with different topography to influence the results. A similar method needs to be adopted for this more detailed assessment.	Major issue	Run the direct rainfall model for a range of storm durations, then merge the results taking the maximum from each individual model grid.	The model has been tested against the critical duration for the catchment, the national modelling was undertaken at a significantly larger scale and therefore wasn't looking at an individual catchment and couldn't be certain on the impacts /critical duration in scheme specific terms.  In this instance, we are assessing the potential flow routes and flood depths on a slip road which will need to be managed, it is not considered necessary to undertake further analysis, as no changes to surfaces or flow routes or buildings are proposed  This is addressed within the accompanying technical note	
	Direct rainfall modelling - Percentage runoff	A-33	Not much detail given on this, other than use of the ReFH rainfall. Not clear from the text if this is before or after application of the ReFH2 loss model (i.e., is gross or net rainfall used)? Another issue is the use of different percentage runoff on different parts of the model. Has base mapping been used to inform where percentage runoff should be increased on urban surfaces? This is typically set at 70% but can be altered in some cases, with the ReFH model used to inform %runoff on other surfaces.	Major issue	See list of issues to the left.	This is addressed within the accompanying technical note	

Climate change	Consistent with latest guidance?	A-34	The text in Section 3.3.4 of Appendix A suggests an unusual method was used to apply climate change allowances, altering the rainfall applied to ReFH2. As the Allerdene part of the study is a fluvial analysis, it is standard practice to simply multiply the final fluvial hydrographs by the percentage increase.	Minor issue	<p>(Minor issue) For climate change runs on the Allerdene catchment, recommend instead simply multiplying the initial flow hydrographs using the fluvial uplift factors, instead of altering the input rainfall to ReFH2. As the results of this unusual method are not too far off the required percentages, this is a minor issue only. However this complicated method is needed for applying climate change uplifts for the pluvial analysis (the ReFH loss model is non-linear).</p> <p>(comment for EA) The EA also had a query on use of UKCP18 outputs instead of UKCP09 for climate change analysis. While some UKCP18 outputs are now available, research is ongoing to convert these large datasets to simple uplift factors for fluvial / rainfall inputs, due to be released later this year by CEH. Data from UKCP18 can be used manually to inform updated uplift factors, but current guidance recommends this is only needed on very high-risk areas (e.g. power stations). Therefore the use of uplift factors from the current EA guidance (2016 document) using UKCP09 is suitable in this case. (<a href="https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances">https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances</a>)</p>	<p>The River Team model is direct rainfall so therefore the normal fluvial approach is not available. As the reveiwer outlines this approach gives very similar answers, therefore no change is required.</p> <p>The approach to climate change was agreed with Caroline seperatly.</p>
Reporting and Results.	Suitability of reporting	A-35	Quite detailed in places, but lacking detail in others, see the list above. The maps given alongside the report are very well put together and are very helpful.	Minor issue		No changes other than above are proposed
	Results	A-36	Some issues and omissions spotted, as listed above.	Major issue	See above	No changes other than above are proposed
	Recommendations	A-37	<p>Key recommendations as follows:</p> <ul style="list-style-type: none"> <li>- Consider if fluvial modelling on Longacre Dene is needed as well as general pluvial modelling?</li> <li>- Carry out FEH statistical method as an independent ball-park check on the ReFH2 fluvial calculations</li> <li>- Consider sensitivity of using FEH13 rainfall due the "alpha" issue discussed above</li> <li>- Look at sensitivity of results to storm duration, for both fluvial and pluvial analysis.</li> </ul>	Major issue	See above	No changes other than above are proposed



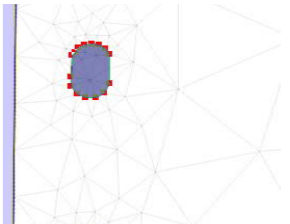


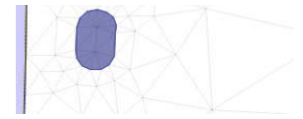
<b>B</b>	<b>Review of River Team Viaduct</b>
Date of model	August 2018
Name of reviewer	Jenny Hill
Date of review	24/07/2019
Revision	v2
Applicable standards or guidance	
Nature of study watercourse(s)/constraints	Allerdene Burn
Study objectives	The reporting states: Flood Risk Assessment (FRA) to support the Environmental Impact Assessment (EIA) and DCO Application for the A1 Birtley to Coal House Scheme. Three areas were identified for further modelling: - Hydraulic modelling to the River Team at Junction 67 to assess the impact of the extension of the Kingsway Viaduct. This modelling utilises an existing Environment Agency hydraulic model of the River Team constructed by JBA in 2014. - Hydraulic modelling of the Allerdene Burn to understand the impact of the A1 realignment which will require either: a. the extension of the existing Allerdene culvert and replacement of the existing section of the Burn; b. or daylighting of the existing culvert and replacement and realignment of the existing burn to accommodate a new viaduct over the existing railway line. - Hydraulic modelling of the surface water flood risk at Junction 66.  <b>This review focusses on the River Team at Junction 67</b>
Summary of 1st review	As the baseline model was constructed by JBA, only the described changes at the viaduct have been reviewed to avoid a conflict of interest. The representation of the existing and proposed viaduct has been done well. However, the stability of out of bank flows in the area of interest is a concern in the 0.1% AEP event, proposed scenario examined.

**Key**  
Purple - no change  
Red - changes made

Category	Detail	Prompts	ID	Comment	Suitability	Suggested actions	Consultants Response (if required)
<b>Data to be reviewed</b>							
Data to be reviewed	Software	- Versions	B-1	InfoWorks ICM v6	Acceptable		N/A
			B-2	Updated to v6 for the purpose of this review	Acceptable		N/A
	AEPs provided / reviewed		B-3	1% AEP + 20 or 40% and 0.1% AEP.	Acceptable		N/A
			B-4	1% AEP event reviewed.	Acceptable		N/A
	Scenarios provided / reviewed		B-5	Base and 'Kingsway Bridge Extension'. The Kingsway Bridge Extension scenario has been the focus of this review.	Acceptable		N/A
	Reports	- Reference versions - Technical reporting - General reporting	B-6	FRA report with technical appendices	Acceptable		N/A
<b>Reporting</b>							
Reporting	Reporting	- Objectives - Constraints - Approach Justification (both model scale and structure scale) - Clarity - Assumptions	B-8	The report states that Modelling changes are confined to the A1 junction 67 roundabout 424950, 558550 and included the modelling of the existing Kingsway Viaduct and the proposed widening of the viaduct to include an additional pillar.	Acceptable		N/A
			B-9	Reporting generally clear and thorough	Acceptable		N/A
			B-10	Results discussed	Acceptable		N/A
<b>General comments</b>							
General comments	File organisation / naming convention	- Scenarios - Naming - Flags	B-12	Flags ED and AD have been used at the changed structure, although flags have not been included in the model describe what this means.	Clarification required	In future include a CSV export of flags or a table of flags in the report	ED = Engineering Design, based upon Scheme drawings AD = Assumed Data, engineering judgement used
			B-13	The viaduct option has been created as a scenario from the base model, which follows best practice.	Acceptable		N/A
			B-14	The scenario is clearly named which is helpful for future users.	Acceptable		N/A
	Survey / topographic data	- Age - Quality	B-15	Source of data is unknown as flag not included, although it is assumed that ED refers to Engineering Drawings.	Clarification required		See B-12 response
Other	- Any significant missing data	B-16	DTM was not provided although the commit history suggests a custom DTM which included topographic survey was used.	Clarification required	In future, provide the DTM used	DTM issued	
<b>General modelling approach</b>							
General modelling approach	Model extents	- Domain boundaries - Upstream/downstream boundaries - Potential downstream influences on water levels - Glass walling	B-18	Domain is unchanged from the base model	Acceptable		N/A
	Modelling approach	- 1D / 2D / Linked - georeferenced (xy/gxy/2d links)	B-19	A 1D-2D approach has been used for the watercourse and a 2D representation of the viaduct pillars has been used.	Acceptable		N/A
			B-20	The model is fully geo-referenced.	Acceptable		N/A
Application of hydrological estimates	- Lumped / distributed - Applied to 1D or 2D domain - Lateral or point inflows - Consistency with reporting	B-21	The application of the hydrology is unchanged from the base model	Acceptable		N/A	
<b>InfoWorks ICM</b>							
InfoWorks ICM	Model build	- Hard bed / soft bed - Accuracy of modelled channel length	B-23	The model is an adapted version of the JBA built, Environment Agency approved model. The changes made to the existing model have been documented in the commit history. Changes listed are all in relation to Kingsway Viaduct. The 'compare network' tool has been run on the WSP and existing EA model. This concluded that WSP's description of the changes was accurate.	Acceptable		N/A
			B-24	The modelling report does not comment on whether hard or soft bed have been modelled. However, as the is a proposed design, it is assumed a hard bed level was implemented.	Acceptable		N/A
			B-25	The modelled length has been calculated from the centre line and the centre line matches the mapped watercourse well.	Acceptable		N/A
	Watercourses	- Deactivation - Interpolates - Bank level and DTM matchup - Bank coefficients - Baseflow	B-26	1D river reaches have been voided from the 2D zone to avoid double counting	Acceptable		N/A
			B-27	Based on the cross section naming convention, it is not thought that any interpolates have been applied. The resolution of cross sections in the study area mean no interpolates were necessary.	Acceptable		N/A
			B-28	Discharge coefficient of 1 and modular limit of 0.9 consistently used.	Acceptable		N/A
			B-29	The 1D river banks generally track the DTM level well. However, at chainage 50m on river reach TEAM_5156.1 the 1D bank is 1m higher than the 2D level. The 0.1% AEP water level predicted to exceed bank tops so this has potential to impact the results.	Minor issue	Modify 1D or 2D water levels to allow a better match of levels in area of interest	This is addressed within the accompanying technical note
			B-30	River sections look sensible but few panel markers have been used.	Acceptable		N/A
	Watercourse structures	- Bridges - Culverts - Screens - Weirs - Flap valves - Sluices	B-31	Conveyance plots for TE05365 and TE05340 are kinked at higher depths.	Minor issue	Update panel markers and channel roughness to smooth conveyance plots at deeper flows.	See B-29 response
			B-32	25 mesh zones have been used to represent viaduct pillars in the flood plain	Acceptable		N/A
			B-33	In the proposed scenario, all the pillars use a level of 20mAOD. This is 7.5m above ground level which seems appropriate. In the base scenario, the proposed pillars are included but with a level change of 0m.	Acceptable		N/A
			B-34	Notes have been used to describe which pillars are existing and which are proposed, which is helpful.	Acceptable		N/A
	Mesh	- Mesh optimisation - Infiltration surfaces - Initial conditions - Rainfall applied to the mesh. Use of sub catchments - 1D/2D linking: bank lines, manhole flood types, inline banks	B-35	The use of mesh zones with small footprints is causing the generation of small triangles (Figure 1) around the area of interest which could slow model run times.	Minor issue	In future models, simplify the geometry of 2D features (while retaining area) to avoid small triangles.	We haven't had a significant issue with model run times, therefore no changes have been made
	Mesh modifications	- Representation of roads and buildings	B-36	See watercourse structures above	Acceptable		N/A
Scenarios	- Do minimum (baseline) - Do nothing - Do something	B-38	As the baseline model was constructed by JBA, only the described changes at the viaduct have been reviewed to avoid a conflict of interest.	Acceptable		N/A	
		B-39	Only Kingsway Bridge Extension scenario has been reviewed.	Acceptable		N/A	

Figure 1: Small triangles around pillars





Run parameters and output data	- Results generated - Temporal resolution of results - Run parameters	B-40	Results are saved every 5 minutes.	Acceptable		N/A
		B-41	Timestep used was 4 seconds	Acceptable		N/A
		B-42	Simulation was run for 30-hours which allows the full storm to pass in the area of interest.	Acceptable		N/A
<b>Runs</b>						
Model simulations	Model simulation runs - Existing (baseline) - Climate change - Sensitivity	B-136	Sims provided for the base and scenario for the 1, 1 +20 or 40% and 0.1% AEP events.	Acceptable		N/A
		B-137	No sensitivity tests were provided.	Minor issue	Run sensitivity tests	This is addressed within the accompanying technical note
<b>Model results, interpretation, verification and stability</b>						
Model results, interpretation, verification and stability	Model stability - zzd, eof, tif - Model warnings and errors - Non-convergence - Mass balance - unrealistic oscillations (water level / flow / boundaries / dVol).	B-139	The base 0.1% AEP event ended incomplete.	Minor issue		See response to B-29
		B-140	Total mass error = 9.9 m3	Acceptable		N/A
		B-141	Volume balance error = 0.9 %	Acceptable		N/A
		B-142	There is some oscillation in the peak flows in the area of interest during a 0.1% AEP event (Figure 2)	Minor issue	Make updates to conveyance and bank lines to improve stability	See response to B-29
		B-143	There is some significant oscillations in the out of bank flows in the area of interest during the 0.1% AEP event (figure 3)	Major issue	Make updates to conveyance and bank lines to improve stability. If appropriate, lower bank co-efficient	See response to B-29
	Sensitivity testing	- Suitability of sensitivity testing undertaken - Results & interpretation of sensitivity testing	B-144	Sensitivity tests not provided for review	Minor issue	Run sensitivity tests
Calibration / performance		B-145	No model performance testing was provided for review.	Minor issue	Use the model report to provide commentary on the sensibility of predicted flooding.	This is addressed within the accompanying technical note

Acceptable
Acceptable - but does not meet best practice
Clarification required
Minor issue
Major issue
Recommendations

Figure 2: In channel flows at TEAM\_5156.1

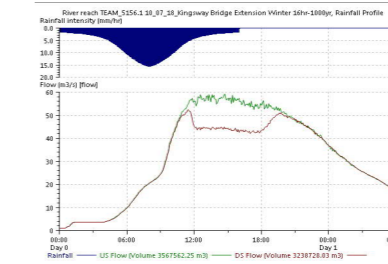
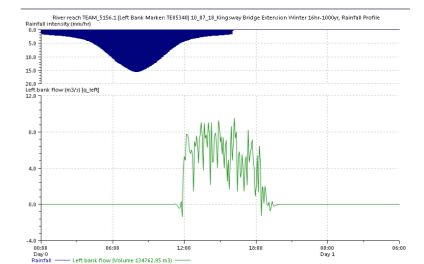


Figure 3: Left bank flows at TEAM\_5156.1



<b>B</b>	<b>Review of Alledene Burn</b>
Date of model	August 2018
Name of reviewer	Jenny Hill
Date of review	19/07/2019
Revision	v1
Applicable standards or guidance	
Nature of study watercourse(s)/constraints	Alledene Burn
Study objectives	The reporting states: Flood Risk Assessment (FRA) to support the Environmental Impact Assessment (EIA) and DCO Application for the A1 Birtley to Coal House Scheme. Three areas were identified for further modelling: - Hydraulic modelling to the River Team at Junction 67 to assess the impact of the extension of the Kingsway Viaduct. This modelling utilises an existing Environment Agency hydraulic model of the River Team constructed by JBA in 2014. - Hydraulic modelling of the Alledene Burn to understand the impact of the A1 realignment which will require either: a. the extension of the existing Alledene culvert and replacement of the existing section of the Burn; b. or daylighting of the existing culvert and replacement and realignment of the existing burn to accommodate a new viaduct over the existing railway line. - Hydraulic modelling of the surface water flood risk at Junction 66.
Summary of 1st review	<b>This review focusses on the Alledene Burn options</b> Minor issues have been identified. Generally the baseline model and option 1 are well constructed. There were some issues identified in Option 2 that could be impacting the results. Therefore it is recommended that this model is revised. As for all modelling studies, results of the sensitivity testing and model proving, should be provided for review.



**Key**  
Purple - no change  
Red - changes made

Category	Detail	Prompts	ID	Comment	Suitability	Suggested actions	Consultants Response (if required)
<b>Data to be reviewed</b>							
Data to be reviewed	Software	- Versions	B-1	InfoWorks ICM v8	Acceptable		N/A
	AEPs provided / reviewed		B-2	0.1% AEP model files and results	Acceptable		N/A
	Scenarios provided / reviewed		B-3	Base, Option 1 ditch realignment, Option 1 realignment flow control, Option 2 and Option 3	Acceptable		N/A
	Reports	- Reference versions - Technical reporting - General reporting	B-4	FRA report with technical appendices	Acceptable		N/A
<b>Reporting</b>							
Reporting	Reporting	- Objectives - Constraints - Approach Justification (both model scale and structure scale) - Clarity - Assumptions - Interpretation of results	B-6	Objectives clearly stated in the reporting	Acceptable		N/A
		B-7	Reporting generally clear and thorough	Acceptable		N/A	
		B-8	The scenarios are a bit unclear - more models provided than options discussed.	Clarification required	Check consistency between model and reporting provided for review.	This is addressed within the accompanying technical note	
		B-9	Results discussed	Acceptable			
<b>General comments</b>							
General comments	File organisation / naming convention	- Scenarios - Naming - Flags	B-11	Scenarios and files well labelled although it was a bit confusing to establish what is the base scenario. One model network with all options as scenarios could have been a neater way to organise the options.	Acceptable - but does not meet best practice	In future, use one model network with a series of scenarios to represent options	N/A
		B-12	Flags have not been included although data has been flagged.	Acceptable - but does not meet best practice	In future include a CSV export of flags or a table of flags in the report	N/A	
		B-13	Naming conventions are clear and descriptive	Acceptable		N/A	
		B-14	The DTM has not been provided which makes comparisons more difficult. A lidar clip has been made but it is understood that the model DTM was a composite of three sources	Clarification required	In future, provide the DTM used	DTM provided	
	Survey / topographic data	- Age - Quality - Suitability	B-15	According to the report, Channel survey for Alledene Culvert was undertaken by Longdin and Browning in March 2018	Acceptable		N/A
	B-16	Lidar data was supplemented by topo survey in the study area.	Acceptable		N/A		
	Other	- Any significant missing data	B-17	NextMap 5m has been used to north east of the A1 which has partial or no Lidar coverage.	Acceptable		N/A
<b>General modelling approach</b>							
General modelling approach	Model extents	- Domain boundaries - Upstream/downstream boundaries - Potential downstream influences on water levels - Glass walling	B-19	The Alledene Burn is not mapped. However, a check against 1m Lidar suggests that the full length of the watercourse has been modelled in 1D with 2D linking.	Acceptable		N/A
		B-20	A check on the maximum flood extent for the 0.1% AEP event showed no glass walling. Therefore the extent of the 2D model is considered appropriated.	Acceptable		N/A	
	Modelling approach	- 1D / 2D / Linked - georeferenced (xy/py/2d links)	B-21	1D river reaches are linked to the 2D domain at banks.	Acceptable		N/A
		B-22	Model is fully georeferenced	Acceptable		N/A	
	Application of hydrological estimates	- Lumped / distributed - Applied to 1D or 2D domain - Lateral or point inflows - Consistency with reporting	B-23	Inflows have been applied at the upstream extent of the model	Acceptable		N/A
		B-24	No lateral inflows are made, but it is not anticipated that these would be required for a watercourse of this size.	Acceptable		N/A	
B-25	A downstream water level from the River Team for the same AEP has been applied.	Acceptable		N/A			
<b>InfoWorks ICM</b>							
Model build	- Hard bed / soft bed - Accuracy of modelled channel length	B-27	Hard bed/ soft bed not specified in the reporting	Clarification required	Specify if hard or soft bed levels were used.	Hard bed levels used.	
		B-28	All river reach lengths have been calculated based on the length of the centre line and the centreline follows the channel indicated in the DTM well.	Acceptable		N/A	
Watercourses	- Deactivation - Interpolates - Bank level and DTM matchup - Bank coefficients - Baseflow	B-29	1D river reaches have been voided from the 2D zone to avoid double counting	Acceptable		N/A	
		B-30	Interpolates have been used excessively, with an interpolate every 10m. The interpolates have not caused any kinks in the conveyance plots so it is concluded that this is unlikely to impact results.	Acceptable - but does not meet best practice		N/A	
		B-31	Bank levels are interpolated between survey points rather than updated from the DTM. In some cases this can make the 1D bank 2m above the 2D level	Minor issue	In future, update bank levels from DTM in between surveyed cross sections if there is good confidence in the DTM levels.	This is addressed within the accompanying technical note	
		B-32	Discharge coefficient of 1 and modular limit of 0.8 consistently used.	Acceptable		N/A	
Watercourse structures	- Bridges - Culverts - Screens - Weirs - Flap valves - Sluices	B-33	No inflow applied to the river reach link as inflow hydrograph has been used.	Acceptable		N/A	
		B-34	7 culverts have been modelled. The data flags suggested 6 of these 7 have been modelled from survey data and 1 from As Built drawings. The size and roughness looks sensible although I would recommend that Manning's n is used for fluvial culverts over Colebrook White.	Acceptable		N/A	
		B-35	Culvert inlets and outlets consistently used with appropriate coefficients applied.	Acceptable		N/A	
		B-36	1 bridge has been modelled. The bridge opening (flagged as survey data) and deck look sensible compared to the river cross section. Bank coefficient and discharge coefficient have been left as default.	Acceptable		N/A	
		B-37	Summary on none modelled: flap valve, orifice, pump, screen, weirs	Acceptable		N/A	
Mesh	- Mesh optimisation - Infiltration surfaces - Initial conditions - Rainfall applied to the mesh. Use of sub catchments - 1D/2D linking: bank lines, manhole flood types, inline banks	B-38	Max triangle area was 20m <sup>2</sup> and minimum element was 10m <sup>2</sup> which is appropriate for a model of this scale. The general roughness was 0.035 which is within typical range.	Acceptable		N/A	
		B-39	No mesh warnings have been produced.	Acceptable		N/A	
		B-40	No rainfall was applied to the mesh, despite rainfall being applied in the run set up. It is understood that this was a fluvial model, and therefore the rainfall was not required. However, clarification on why rainfall files have been included is required.	Clarification required	Clarify if rainfall was an intended inflow to this model.	Rainfall was only applied in a small sub catchment, with the model being predominantly fluvial.	
Mesh modifications	- Representation of roads and buildings - Roughness	B-41	1D-2D linking happens at bank lines which has been successfully achieved.	Acceptable		N/A	
		B-42	There is no representation of the conveyance in highways or the resistance caused by buildings.	Minor issue	Represent buildings, road, woodland, scrub as roughness zones in the 2D model.	This model covers a small area and this level of detail is not required in this instance	
InfoWorks ICM		B-43	However, the raised highway embankment are represented in the DTM and therefore the mesh.	Acceptable		N/A	
		B-44	Option 1a: Ditch re-alignment A Mesh Level Zone has been added over the existing watercourse. This adjusts the DTM elevation to give a minimum elevation of 16 mAOD and maximum elevation of 17.5 mAOD. A 3D view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground levels to tie in with the proposed bank heights. In some locations this can cause a 1m discrepancy between 1D and 2D bank level. This is not shown to impact 0.1% AEP results. The extended culvert has been connected to the proposed culvert with a break node. I would think it more likely that a manhole chamber would be installed to connect these. A manhole would have the potential to flood whereas a break node does not. However, the pipe is not surcharged at the peak of the 0.1% AEP event so this is not thought to impact results. The roughness of the proposed culvert has not been updated from default. The new cross sections mainly look sensible but ARD1 - ARD4 all have left bank lower than the highest point, allowing for premature flooding (Figure 1). However, the max water level doesn't exceed left bank level in the 0.1% AEP event so this is not thought to impact results. The conveyance of the new cross sections is kinked at higher depths (Figure 2). However, the max water depth doesn't reach this level in the 0.1% AEP event so this is not thought to impact results.	Acceptable - but does not meet best practice		N/A	

Figure 1: Bank top higher than left bank

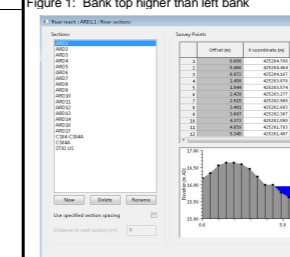
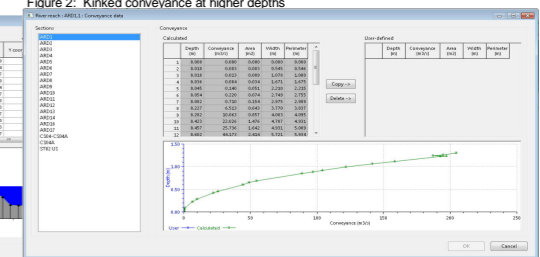
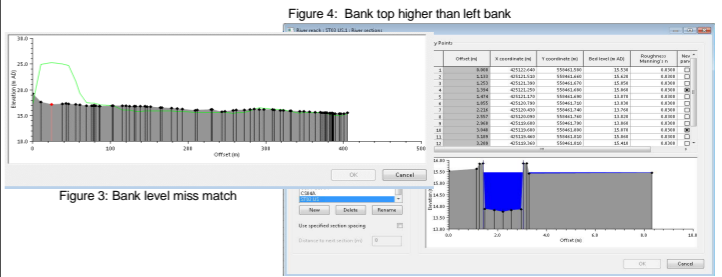


Figure 2: Kinked conveyance at higher depths



	Scenarios	<ul style="list-style-type: none"> <li>- Do minimum (baseline)</li> <li>- Do nothing</li> <li>- Do something</li> </ul>	B-45	Option 1b: Ditch realignment + flow control A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option 1a). Pipe size of SA02USc.1 has been reduced from 1.35 to 1.2m in diameter. No other apparent changes made from Option 1a so same comments stand.	Acceptable - but does not meet best practice		N/A
			B-46	Option 2: Viaduct A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option 1a). There is no apparent level change in the model to account for lowering the highway embankment which is present in the DTM JBA imported (no DTM provided). As a result, in some places there is a 9m miss match between the 1D and 2D bank levels modelled. In channel water levels do not exceed bank top during the 0.1% AEP so this is not impacting results. The open channel has been extended to replace the culvert. As per Option 1a, sections ARD1-ARD4 have lower left bank to the bank top (Figure 1). The same is true for ARD14-17 and ST02 US. Here channel flow does exceed bank top in the 0.1% AEP event (Figure 4) so this is impacting results. As per Option 1a, conveyance plots are kinked in at greater depths, which in this instance could impact the results as in channel depths exceed 1m.	Minor issue	Trim 1D cross sections to the highest point on the left bank. Update panel markers and channel roughness to smooth conveyance plots at deeper flows.	This is addressed within the accompanying technical note
			B-47	Option 3: Viaduct There are no apparent changes between Options 2 and 3 so the same comments stand unless clarification of changes is provided.	Minor issue	Trim 1D cross sections to the highest point on the left bank. Update panel markers and channel roughness to smooth conveyance plots at deeper flows.	See response to B-47
	Run parameters and output data	<ul style="list-style-type: none"> <li>- Results generated</li> <li>- Temporal resolution of results</li> <li>- Run parameters</li> </ul>	B-48	Results saved at a 1minute interval which is high but acceptable.	Acceptable		N/A
	B-49	Model is run for 12 hours which allows the full storm to pass	Acceptable		N/A		
B-50	Run use a GPU card but don't link 1D and 2D calculations at minor timesteps.	Acceptable		N/A			
<b>Runs</b>							
	Model simulations	<ul style="list-style-type: none"> <li>- Model simulation runs</li> <li>- Existing (baseline)</li> <li>- Climate change</li> <li>- Sensitivity</li> </ul>	B-144	The model has been run and reviewed for the baseline and options. All results use the 0.1% AEP event.	Acceptable		N/A
			B-145	There were no sensitivity tests provided.	Minor issue	Run sensitivity tests	This is addressed within the accompanying technical note
<b>Model results, interpretation, verification and stability</b>							
Model results, interpretation, verification and stability	Model stability	<ul style="list-style-type: none"> <li>- zzi, eof, ill</li> <li>- Model warnings and errors</li> <li>- Non-convergence</li> <li>- Mass balance</li> <li>- unrealistic oscillations (water level / flow / boundaries / dVoi)</li> </ul>	B-147	Total mass error = 0.0 m3	Acceptable		N/A
			B-148	Volume balance error = 0.0 %	Acceptable		N/A
			B-149	In channel flows raise and fall in a smooth hydrograph	Acceptable		N/A
			B-150	Out of bank flows are generally stable	Acceptable		N/A
			B-151	There is some instability at the downstream boundary due to the backing up of the River Team 0.1% AEP level but this is not impacting the results in the area of interest.	Acceptable		N/A
	Sensitivity testing	<ul style="list-style-type: none"> <li>- Suitability of sensitivity testing undertaken</li> <li>- Results &amp; interpretation of sensitivity testing</li> </ul>	B-152	Sensitivity tests not provided for review	Minor issue	Run sensitivity tests	See response to B-145
Calibration / performance		B-153	No model performance testing was provided for review.	Minor issue	Use the model report to provide commentary on the sensibility of predicted flooding.	This is addressed within the accompanying technical note	



Acceptable
Acceptable - but does not meet best practice
Classification required
Minor issue
Major issue
Recommendations

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**Appendix O – Spreadsheet Environment Agency Model Review Certificate  
(20/03/2020)**



Technical Model Review Report		
Client	Environment Agency	
Single project or WEM package?	WEM Package	
Package name (if applicable)	2018-19 National Modelling and Forecasting Technical Support Contract	
Project name	Review No. 57 - A1 Birtley to Coal House	
JBA Project Number (or overarching project)	2018s0387	
JBA Sub-Project Number (if applicable)	57	
Review requirements	A) Previous project - hydrology	
	B) Previous project - hydraulic	
	C) New project - hydrology	Yes
	D) New project - hydraulics	Yes
	E) Survey data	
	F) Reporting	

"RAG" key	
Major issue	Omission that could make the findings subject to challenge and which requires correction/further work.
Minor issue	Non-standard method or method not following guidance but unlikely to have impacted on results
Clarification required	The approach used is unclear and requires further clarification before it can be reviewed
Recommendations	Suggestion for improved / good practice but which is unlikely to change the project outcomes.
Acceptable (but does not meet best practice)	The approach is acceptable, however it is not in line with standard industry best practice
Acceptable	Suggestion for improved / good practice but which is unlikely to change the project outcomes.

Summary of 1st hydrology review findings
<p><b>Hydrology review</b></p> <p>A few suggestions have been given below, which may give more conservative results. The reporting in Appendix A regarding the inflow calculations would benefit from additional detail, but is generally well written. The maps provided are excellent and are very helpful. There are a few omissions that should be addressed, see individual comments below.</p>
Summary of 1st hydraulics review findings
<p><b>Allerdene Burn model:</b></p> <p>Minor issues have been identified. Generally the baseline model and option 1 are well constructed. There were some issues identified in Option 2 that could be impacting the results. Therefore it is recommended that this model is revised.</p> <p>As for all modelling studies, results of the sensitivity testing and model proving, should be provided for review.</p>
<p><b>Kingsway Viaduct model:</b></p> <p>As the baseline model was constructed by JBA, only the described changes at the viaduct have been reviewed to avoid a conflict of interest. The representation of the existing and proposed viaduct has been done well. However, the stability of out of bank flows in the area of interest is a concern in the 0.1% AEP event, proposed scenario examined.</p>

### Summary of 2nd hydrology review findings

#### Hydrology review

Thank you for addressing the comments from the first review, the vast majority of these have now been rectified. Minor comment below on using a different storm duration when checking the ReFH1 method.

Best practice for pluvial modelling has not been followed regarding use of different %runoffs on different land types, but the broad-scale method used by the authors likely gives an indicative result. Generally recommended in detailed studies to calculate two rainfall profiles, one with a large %runoff applied on hard surfaces (roads, buildings, etc) and a second with smaller %runoff - usually informed from the rural ReFH2 loss model - to apply to the remaining rural surfaces. The lumped method used by the authors essentially averages these two mechanisms out; for the purposes of informing likely surface water flow routes this approach is not ideal but OK. **A detailed assessment, eg, if surface water drainage is being designed, would require the above approach however.**

### Summary of 2nd hydraulics review findings

#### Allerdene Burn model:

No further actions required.

#### Kingsway Viaduct model:

No further actions required.





<b>A</b>	<b>Hydrology Review</b>
Date of hydrology analysis	Dec-18
Name of reviewer	James Molloy BE(Hons) MEngSc
Date of review	08/07/2019
Revision	V1
Applicable standards or guidance	Flood Estimation Handbook (IH, 1999) updates including Kjeldsen (DEFRA, 2008), and recent outputs from the FEH Local project ReFH1 and/or ReFH2 guidance documents EA Flood Estimation Guidelines (Operational instruction 197_08, V6)
Nature of study watercourse(s)/constraints	The study looks at various sources of flood risk along a reach of the A1 road, to the south of Allerdene near Newcastle. Various proposed engineering works along the road require an assessment of (a) fluvial flood risk from Allerdene Burn, a small tributary of the River Team and (b) surface water flood risk around Longacre Dean a short distance to the south-east.  <b>The report also looks at flood risk from the River Team, however as no changes have been applied to the hydrology used in the underlying model for this watercourse (previously signed off by the Environment Agency), this aspect is not reviewed in this document.</b>
Study objectives	The aim of the analysis is to determine if the proposed changes to the road layout have any effect on local flood risk. Information provided in Appendix A of the provided modelling report is used as the basis of this review.
Summary of 1st review	A few suggestions have been given below, which may give more conservative results. The reporting in Appendix A regarding the inflow calculations would benefit from additional detail, but is generally well written. The maps provided are excellent and are very helpful. There are a few omissions that should be addressed, see individual comments below.

**Key**  
Purple - no change  
Red - changes made

**Summary of 2nd review**

Thank you for addressing the comments from the first review, the vast majority of these have now been rectified. Minor comment below on using a different storm duration when checking the ReFH1 method.

Best practice for pluvial modelling has not been followed regarding use of different %runoffs on different land types, but the broad-scale method used by the authors likely gives an indicative result. Generally recommended in detailed studies to calculate two rainfall profiles, **one with a large %runoff applied on hard surfaces** (roads, buildings, etc) and **a second with smaller %runoff - usually informed from the rural ReFH2 loss model - to apply to the remaining rural surfaces.** The lumped method used by the authors essentially averages these two mechanisms out, for the purposes of informing likely surface water flow routes this approach is not ideal but OK. **A detailed assessment, eg, if surface water drainage is being designed, would require the above approach however.**

Category	Detail	ID	1st review			2nd review		
			Comment	Suitability	Suggested actions	Consultants Response (if required)	Review comment	Suggested action
General comments	Method statement	A-1	Quite detailed in places, as various sources of flood risk need to be considered in the analysis. The maps provided alongside the report are very useful and clear.  Some of the details regarding the hydrological inflows are quite sparse however, see individual comments below.	Clarification required	Reasoning is given in the main report text (Chapter 3) for the study requirements at each watercourse crossing of the A1 road. It seems an unusual decision why fluvial modelling was carried out on Allerdene Burn, but only pluvial modelling around Longacre Dean (why not carry out fluvial modelling at the latter site also?)	Significant works are proposed on the channel at Allerdene Burn, no works are proposed at Longacre Dean. Therefore, fluvial modelling was not required at Longacre Dean due to the proposals not impacting the main channel. At Long acre dean the culvert is substantially lower than the road, with no flow route on to the A1 and no changes are proposed but the surface flow routes to the channel are of interest.	Thank you for clarifying.	No further action required, this is now discussed in the accompanying note.
	Previous studies	A-2	It is understood that there are no previous studies looking at flood risk for Allerdene Burn, and that only broad-scale pluvial mapping has been carried out in the region surrounding Longacre Dean, which the authors correctly point out does not account for local drainage features that would affect local flood risk.	Acceptable		N/A		
	Catchment description (any unusual features such as pumps, reservoirs, heavy urbanisation?)	A-3	Small catchments, some of which drain densely urbanised areas.	Recommendations	Has the Urban ReFH2 method been considered adequately? Checked in further detail below.	This is addressed within the accompanying technical note	Individual comments checked below.	
	Location of FEPs / catchment descriptors provided?	A-4	Yes in Section 3.3.	Acceptable		N/A		
	Unusual catchment features (which may influence choice of approach)	A-5	The Allerdene catchment is heavily urbanised, and also has a moderately high BFIHOST, noted by the authors.	Recommendations	It may also be useful to obtain sewer drainage information for the area around the Allerdene Burn catchment, in case there are sewered areas outside the topographic catchment draining into this watercourse. However, this is unlikely given the steep slope in the urban area, but still would be a useful to check.	Sewer plans were not available for use within the project, we agree that additional inflows are unlikely given the local topography.	Agreed, but should be acknowledged as an assumption in the report text.	Mention this in an "Assumptions" section of the report or in the accompanying revision note.
	Checks on catchment descriptors	A-6	The catchment area has been correctly checked using LIDAR data, noted that this gives a larger area compared to the "default" FEH catchment.	Major issue	No further reporting given on how the change in catchment area influences other key catchment descriptors. DPLBAR should increase, and there could be significant changes to URBEXT2000 from the change in catchment boundary. Both of these need to be altered, and could have a big effect on calculated flows.	This is addressed within the accompanying technical note	Thank you for updating this. The updated DPLBAR and URBEXT values should give more conservative results in ReFH2. Good method used to update DPLBAR, acknowledging the uncertainty in the AERA*0.548 method for small catchments.	Happy with the given changes.
Data review	Hillfows-UK version	A-7	NRFA V7 is the latest version	Recommendations	Should be used in FEH statistical as an independent check on ReFH2, see below.	This is addressed within the accompanying technical note	See comments below	
	Review of hydrometric data	A-8	No local hydrometric data available to calibrate hydrological methods unfortunately.	Acceptable		N/A		
	Rating reviews	A-9	n/a, no local gauges in the area apart from on the River Team, not reviewed here.	Acceptable		N/A		
	Flood history	A-10	Yes, the authors have queried data held by the Environment Agency and briefly reported this in Chapter 4 of the main report, giving some details of recent floods. This shows that the region assessed here is vulnerable to a range of flood mechanisms.	Acceptable - but does not meet best practice	There are other useful sources of flood history as well. I would recommend having a look on the CBHE website ( <a href="http://www.cbhe.hydrology.org.uk/index.php">http://www.cbhe.hydrology.org.uk/index.php</a> ), and a general internet search also.	No changes proposed		No further action required.
Initial choice of methods	Approaches suggested	A-11	Only the ReFH2 method is proposed for use for the Allerdene modelling. Depending on the software implementation used, urbanisation adjustments may/may not have been automatically applied given the very high URBEXT200 values.	Major issue	Confirm whether or not the ICM implementation of ReFH2 automatically applies the urban adjustment, giving faster response times and peak flows on highly urbanised catchments.  There is no mention anywhere in the document of the FEH statistical method, which should also be applied here, given the uncertainty from catchment-descriptor methods. This at least would be useful as ball-park check on the peak flow produced from ReFH2.	The ReFH2 analysis was undertaken outside of ICM within the ReFH2 software. This is addressed within the accompanying technical note	Thank you for confirming how the ReFH2 and FEH methods were implemented.	Implementation of the FEH statistical method checked below.
	Justification of approach	A-12	A sensible argument is given for using FEH99 rainfalls over FEH13 (although it's hidden in a footnote!), given that the former is reported to give higher rainfall totals in this case. For the purposes of construction options modelling this is a good idea. Some data needs to be presented in the Appendix however to back this up, perhaps a table comparing rainfall totals across multiple storm durations.  However using FEH99 rainfall in the ReFH2 model may have an unforeseen drawback. In this situation with FEH99 rainfall, ReFH2 applies the "alpha" factor when calculating runoff (essentially a fudge factor that reduces runoff for increasing return periods - introduced to try to match FEH statistical peaks, but conceptually does not make a lot of sense). So even though FEH99 might give more rainfall, the "alpha" factor may cancel out the effect. This factor is not used with FEH13 rainfall in the model.	Major issue	Add a table comparing FEH99 and FEH13 rainfalls to back up the argument given in Chapter 2 of Appendix A.  Run the ReFH2 model for the 100 and 1,000yr events with the FEH13 rainfall also, to test if this gives larger peak flows, due to the "alpha" issue discussed to the left.	This is addressed within the accompanying technical note	Thank you for checking this, Table 2 in the additional note shows using the 1999 rainfall still gives larger peak flows with ReFH2, for various storm durations. Noted that the authors have also checked the ReFH1 method as well for completeness, which is a good idea.	The ReFH1 checks given at the bottom of p.6 / top of p.7 use a different storm duration (1.25hrs) to the ReFH2 results presented further above (3.5hrs). Therefore the comparison of methods in Table 5 of the additional note is not a true like-for-like check. (on permeable catchments ReFH2 is generally preferred to ReFH1 however, so the overall effect on final calculations is likely low).
Lumped / distributed		A-13	n/a, as a single inflow to the model is sufficient for this case for the Allerdene model.	Acceptable		N/A		
		A-14						



Flow estimation								
FEH Statistical	Suitable for statistical?	A-15					Yes the FEH statistical method has now been used as an independent check on ReFH2 results. Appears sensible. The urban adjustment is quite large in this case.	
	QMED estimation - CDs	A-16						
	QMED estimation - AMAX / POT	A-17					n/a, the catchment is ungauged	
	Choice of donors	A-18	Yes, as a check on ReFH2 results, but not used, see above.	Major issue	See above		The authors have attempted to find a QMED donor, demonstrating that due to the small size of the target catchment the process was unsuccessful on this occasion. This is a common issue in such cases.	The search for potential QMED donors is well documented in the additional note. No further action needed.
	Growth curve methodology	A-19					Pooling group method applied, with manual modifications to remove impermeable catchments and one site with a short record. Individual permeable adjustments also applied.	A bit overkill to be honest (these methods are somewhat uncertain on small catchments!), but the calculations presented look sensible. The permeable adjustment usually does not significantly alter the flood-frequency curve. No further action needed.
	Hydrology shape	A-20				As above	From ReFH2	
ReFH method	Suitable for ReFH?	A-21	Yes with caution given the heavy urbanisation	Acceptable		N/A		
	Calibration	A-22	n/a, the small catchment assessed here is ungauged.	Acceptable		N/A		
	Choice of design storm	A-23	Summer rainstorm profile is suitable in this case. However only very little discussion given for the choice of design storm duration, choosing the value used in the existing River Team model, simply assuming this will also be critical for Allerdene Burn.	Major issue	Run the ReFH2 model for a range of storm durations to see which gives the largest peak flows for Allerdene Burn. Assuming the same critical storm duration as the downstream River Team model could underestimate peak flows on this small and fast-responding stream, especially important when testing models needed to size culverts, bridges, etc (in this case I think it's OK to mix and match durations from the main Team model and the Allerdene model, to give conservative results). Give a table of peak flows from ReFH2 versus storm duration in the text.	This is addressed within the accompanying technical note	Thank you for checking this. ReFH2 has now been run for some representative storm durations, with the one giving the most conservative peak flow adopted for modelling.	No further action required
Urban ReFH variant	Suitable for urban ReFH?	A-24	Yes, see previous comments	Major issue	Clarify in the text if the ICM implementation applies the urban adjustments from ReFH2.	This is addressed within the accompanying technical note	Thank you for clarifying. Yes the ReFH2 software applies urbanisation adjustments automatically.	No further action required
	Catchment delineation	A-25	n/a, a lumped approach is OK here.	Acceptable		N/A		
	Calibration	A-26	n/a, no gauges available to calibrate the ReFH2 model on these small streams.	Acceptable		N/A		
	Choice of URBEXT values	A-27	See comments above	Major issue	See adjustments for URBEXT200 required above.	This is addressed within the accompanying technical note	Addressed further above	
	Choice of percentage runoff	A-28	ReFH2 defaults are presumably applied for the Allerdene Burn model, this should be OK (but should be reported, e.g. was urbanised %runoff left at the default 70%?)	Acceptable		This is addressed within the accompanying technical note		No further action required
Final choice of method	Final flows	A-29	N/A as only one method used. Given reliance on (uncertain) catchment descriptor methods, it is important to look at both FEH statistical and ReFH2.	Recommendations		N/A		
Miscellaneous								
	Direct rainfall modelling - 2D domain extent	A-30	The model domain for the direct-rainfall modelling around Longacre Dene looks sensible, based on LIDAR. The plot in Table 6 in Appendix A is very useful to demonstrate this.	Acceptable		N/A		
	Direct rainfall modelling - 2D downstream boundary condition	A-31	The authors state that there was no need to apply a 2D downstream boundary condition to remove excess ponding at the southern edge of the model.	Minor issue	It is usually best practice to place a downstream boundary on a direct rainfall model, to stop any glasswaling affecting results. This might be more important if longer rainstorms are being tested.	To clarify, a normal flow boundary condition was applied to the 2D mesh in ICM rather than no boundary condition.	Thank you for clarifying.	No further action required
	Direct rainfall modelling - range of storm durations tested	A-32	There is no information given on the range of storm durations used in this direct rainfall modelling in the report. The EA national-scale pluvial mapping runs separate models for storm durations of 1hr, 3hrs and 6hrs, then merges the modelled maximum depths in a final grid. This allows for runoff rates on regions with different topography to influence the results. A similar method needs to be adopted for this more detailed assessment.	Major issue	Run the direct rainfall model for a range of storm durations, then merge the results taking the maximum from each individual model grid.	The model has been tested against the critical duration for the catchment, the national modelling was undertaken at a significantly larger scale and therefore wasn't looking at an individual catchment and couldn't be certain on the impacts/critical duration in scheme specific terms.  In this instance, we are assessing the potential flow routes and flood depths on a slip road which will need to be managed, it is not considered necessary to undertake further analysis, as no changes to surfaces or flow routes or buildings are proposed  This is addressed within the accompanying technical note	Noted. Information given in the additional note seems to have carried out this procedure anyway, noting that the 1-hr storm gives the most conservative result.	No further action required
	Direct rainfall modelling - Percentage runoff	A-33	Not much detail given on this, other than use of the ReFH rainfall. Not clear from the text if this is before or after application of the ReFH2 loss model (i.e., is gross or net rainfall used)? Another issue is the use of different percentage runoff on different parts of the model. Has base mapping been used to inform where percentage runoff should be increased on urban surfaces? This is typically set at 70% but can be altered in some cases, with the ReFH model used to inform %runoff on other surfaces.	Major issue	See list of issues to the left.		Noted from the additional information (bottom of p.8) that a lumped NET rainfall has been calculated for the pluvial calculations. For a detailed study, this approach is over-simplified, but might be OK for the purposes of initially informing surface water flow routes. See suggested method to the right for best practice in future, but depending on the required outcomes of the modelling may be OK for a first-run analysis.	Suggested more representative method for pluvial runoff modelling:  - Use base mapping to determine a split between 1) paved areas and 2) unpaved areas in the model domain.  - Get a starting GROSS rainfall from ReFH2 (no need to buy a catchment from FEH Web Service, just get the nearest point rainfall and tick the "plot-scale" button in the ReFH2 software. This saves you having to alter things like DPLBAR, which is not needed here).  - As a worst-case assume 100% runoff on the fully paved parts of the model domain from the gross rainfall series.  - Use the rural ReFH2 loss model to get a second rainfall series for the remaining unpaved regions of the catchment.  The above method will therefore give two rainfall profiles to apply to the model for each run, one for the paved surfaces and a second for the unpaved. The "lumped" method used by the authors represents the entire region as partially urbanised, potentially under-estimating runoff on the road and other hard surfaces and over-estimating runoff on bare-earth surfaces.
Climate change	Consistent with latest guidance?	A-34	The text in Section 3.3.4 of Appendix A suggests an unusual method was used to apply climate change allowances, altering the rainfall applied to ReFH2. As the Allerdene part of the study is a fluvial analysis, it is standard practice to simply multiply the final fluvial hydrographs by the percentage increase.	Minor issue	(Minor issue) For climate change runs on the Allerdene catchment, recommend instead simply multiplying the initial flow hydrographs using the fluvial uplift factors, instead of altering the input rainfall to ReFH2. As the results of this unusual method are not too far off the required percentages, this is a minor issue only. However this complicated method is needed for applying climate change uplifts for the pluvial analysis (the ReFH loss model is non-linear).  (comment for EA) The EA also had a query on use of UKCP18 outputs instead of UKCP09 for climate change analysis. While some UKCP18 outputs are now available, research is ongoing to convert these large datasets to simple uplift factors for fluvial / rainfall inputs, due to be released later this year by CEH. Data from UKCP18 can be used manually to inform updated uplift factors, but current guidance recommends this is only needed on very high-risk areas (e.g. power stations). Therefore the use of uplift factors from the current EA guidance (2016 document) using UKCP09 is suitable in this case. ( <a href="https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances">https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances</a> )	The River Team model is direct rainfall so therefore the normal fluvial approach is not available. As the reviewer outlines this approach gives very similar answers, therefore no change is required.  The approach to climate change was agreed with Caroline separately.	Since the first review was carried out, the UKCP18 climate change uplift factors have now been published.	Perhaps worth a quick check with the latest published factors, these may not have changed significantly from UKCP09. No action required apart from this, given the transition from UKCP09 to UKCP18 occurred over the life of this project.

Reporting and follow up actions							
Reporting and Results.	Suitability of reporting	A-35	Quite detailed in places, but lacking detail in others, see the list above. The maps given alongside the report are very well put together and are very helpful.	Minor issue		No changes other than above are proposed	
	Results	A-36	Some issues and omissions spotted, as listed above.	Major issue	See above	No changes other than above are proposed	
	Recommendations	A-37	Key recommendations as follows: <ul style="list-style-type: none"> <li>- Consider if fluvial modelling on Longacre Dene is needed as well as general pluvial modelling?</li> <li>- Carry out FEH statistical method as an independent ball-park check on the RefH2 fluvial calculations</li> <li>- Consider sensitivity of using FEH13 rainfall due the "alpha" issue discussed above</li> <li>- Look at sensitivity of results to storm duration, for both fluvial and pluvial analysis.</li> </ul>	Major issue	See above	No changes other than above are proposed	

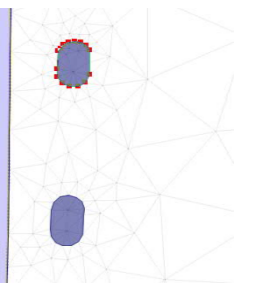
<b>B</b>	<b>Review of River Team Viaduct</b>
Date of model	August 2018
Name of reviewer	Jenny Hill
Date of review	03/03/2020
Revision	v3
Applicable standards or guidance	
Nature of study watercourse(s)/constraints	Allerdene Burn
Study objectives	The reporting states: Flood Risk Assessment (FRA) to support the Environmental Impact Assessment (EIA) and DCO Application for the A1 Birtley to Coal House Scheme. Three areas were identified for further modelling: - Hydraulic modelling to the River Team at Junction 67 to assess the impact of the extension of the Kingsway Viaduct. This modelling utilises an existing Environment Agency hydraulic model of the River Team constructed by JBA in 2014. - Hydraulic modelling of the Allerdene Burn to understand the impact of the A1 realignment which will require either: a. the extension of the existing Allerdene culvert and replacement of the existing section of the Burn; b. or daylighting of the existing culvert and replacement and realignment of the existing burn to accommodate a new viaduct over the existing railway line. - Hydraulic modelling of the surface water flood risk at Junction 66.
Summary of 1st review	<b>This review focusses on the River Team at Junction 67</b> As the baseline model was constructed by JBA, only the described changes at the viaduct have been reviewed to avoid a conflict of interest. The representation of the existing and proposed viaduct has been done well. However, the stability of out of bank flows in the area of interest is a concern in the 0.1% AEP event, proposed scenario examined.



**Key**  
Purple - no change  
Red - changes made

Category	Detail	Prompts	ID	Comment	Suitability	Suggested actions	Consultants Response (if required)	Comment	Suggested action
<b>Data to be reviewed</b>									
Data to be reviewed	Software	- Versions	B-1	InfoWorks ICM v6	Acceptable		N/A		
			B-2	Updated to v6 for the purpose of this review	Acceptable		N/A		
	AEPs provided / reviewed		B-3	1% AEP + 20 or 40% and 0.1% AEP.	Acceptable		N/A		
			B-4	1% AEP event reviewed.	Acceptable		N/A		
	Scenarios provided / reviewed		B-5	Base and 'Kingsway Bridge Extension'. The Kingsway Bridge Extension scenario has been the focus of this review.	Acceptable		N/A		
	Reports	- Reference versions - Technical reporting - General reporting	B-6	FRA report with technical appendices	Acceptable		N/A		
<b>Reporting</b>									
Reporting	Reporting	- Objectives - Constraints - Approach Justification (both model scale and structure scale) - Clarity - Assumptions	B-8	The report states that Modelling changes are confined to the A1 junction 67 roundabout 424950, 558550 and included the modelling of the existing Kingsway Viaduct and the proposed widening of the viaduct to include an additional pillar.	Acceptable		N/A		
			B-9	Reporting generally clear and thorough	Acceptable		N/A		
			B-10	Results discussed	Acceptable		N/A		
<b>General comments</b>									
General comments	File organisation / naming convention	- Scenarios - Naming - Flags	B-12	Flags ED and AD have been used at the changed structure, although flags have not been included in the model describe what this means.	Clarification required	In future include a CSV export of flags or a table of flags in the report	ED = Engineering Design, based upon Scheme drawings AD = Assumed Data, engineering judgement used	Thank you for clarifying	No further action required.
			B-13	The viaduct option has been created as a scenario from the base model, which follows best practice.	Acceptable		N/A		
			B-14	The scenario is clearly named which is helpful for future users.	Acceptable		N/A		
	Survey / topographic data	- Age - Quality	B-15	Source of data is unknown as flag not included, although it is assumed that ED refers to Engineering Drawings. DTM was not provided although the commit history suggests a custom DTM which included topographic survey was used.	Clarification required		See B-12 response	Thank you for clarifying	No further action required.
Other	- Any significant missing data	B-16		Clarification required	In future, provide the DTM used	DTM issued	Thank you for supplying		
<b>General modelling approach</b>									
General modelling approach	Model extents	- Domain boundaries - Upstream/downstream boundaries - Potential downstream influences on water levels - Glass walling	B-18	Domain is unchanged from the base model	Acceptable		N/A		
	Modelling approach	- 1D / 2D / Linked - georeferenced (xy/pgy/2d links)	B-19	A 1D-2D approach has been used for the watercourse and a 2D representation of the viaduct pillars has been used.	Acceptable		N/A		
			B-20	The model is fully geo-referenced.	Acceptable		N/A		
Application of hydrological estimates	- Lumped / distributed - Applied to 1D or 2D domain - Lateral or point inflows - Consistency with reporting	B-21	The application of the hydrology is unchanged from the base model	Acceptable		N/A			
<b>InfoWorks ICM</b>									
InfoWorks ICM	Model build	- Hard bed / soft bed - Accuracy of modelled channel length	B-23	The model is an adapted version of the JBA built, Environment Agency approved model. The changes made to the existing model have been documented in the commit history. Changes listed are all in relation to Kingsway Viaduct. The 'compare network' tool has been run on the WSP and existing EA model. This concluded that WSP's description of the changes was accurate.	Acceptable		N/A		
			B-24	The modelling report does not comment on whether hard or soft bed have been modelled. However, as the is a proposed design, it is assumed a hard bed level was implemented.	Acceptable		N/A		
			B-25	The modelled length has been calculated from the centre line and the centre line matches the mapped watercourse well.	Acceptable		N/A		
	Watercourses	- Deactivation - Interpolates - Bank level and DTM matchup - Bank coefficients - Baseflow	B-26	1D river reaches have been voided from the 2D zone to avoid double counting	Acceptable		N/A		
			B-27	Based on the cross section naming convention, it is not thought that any interpolates have been applied. The resolution of cross sections in the study area mean no interpolates were necessary.	Acceptable		N/A		
			B-28	Discharge coefficient of 1 and modular limit of 0.9 consistently used.	Acceptable		N/A		
			B-29	The 1D river banks generally track the DTM level well. However, at chainage 50m on river reach TEAM_S156, the 1D bank is 1m higher than the 2D level. The 0.1% AEP water level predicted to exceed bank tops so this has potential to impact the results.	Minor issue	Modify 1D or 2D water levels to allow a better match of levels in area of interest	This is addressed within the accompanying technical note	The consultant has documented attempts to improve stability as suitably justified the approach and documented the limitations.	No further action required.
			B-30	River sections look sensible but few panel markers have been used.	Acceptable		N/A		
			B-31	Conveyance plots for TE05365 and TE05340 are kinked at higher depths.	Minor issue	Update panel markers and channel roughness to smooth conveyance plots at deeper flows.	See B-29 response		
	Watercourse structures	- Bridges - Culverts - Screens - Weirs - Flap valves - Sluices	B-32	25 mesh zones have been used to represent viaduct pillars in the flood plain In the proposed scenario, all the pillars use a level of 20mAOD. This is 7.5m above ground level which seems appropriate. In the base scenario, the proposed pillars are included but with a level change of 0m.	Acceptable		N/A		
			B-33	Notes have been used to describe which pillars are existing and which are proposed, which is helpful.	Acceptable		N/A		
			B-34		Acceptable		N/A		
	Mesh	- Mesh optimisation - Infiltration surfaces - Initial conditions - Rainfall applied to the mesh. Use of sub catchments - 1D/2D linking: bank lines, manhole flood types, inline banks	B-35	The use of mesh zones with small footprints is causing the generation of small triangles (Figure 1) around the area of interest which could slow model run times.	Minor issue	In future models, simplify the geometry of 2D features (while retaining area) to avoid small triangles.	We haven't had a significant issue with model run times, therefore no changes have been made	This was only a suggestion for future models, non changes were required.	No further action required.
	Mesh modifications	- Representation of roads and buildings	B-36	See watercourse structures above	Acceptable		N/A		
Scenarios	- Do minimum (baseline) - Do nothing - Do something	B-38	As the baseline model was constructed by JBA, only the described changes at the viaduct have been reviewed to avoid a conflict of interest.	Acceptable		N/A			
		B-39	Only Kingsway Bridge Extension scenario has been reviewed.	Acceptable		N/A			
Run parameters and output data	- Results generated - Temporal resolution of results - Run parameters	B-40	Results are saved every 5 minutes.	Acceptable		N/A			
		B-41	Timestep used was 4 seconds	Acceptable		N/A			
		B-42	Simulation was run for 30-hours which allows the full storm to pass in the area of interest.	Acceptable		N/A			
<b>Runs</b>									
Model simulations	Model simulation runs - Existing (baseline) - Climate change - Sensitivity	B-136	Sims provided for the base and scenario for the 1, 1 +20 or 40% and 0.1% AEP events.	Acceptable		N/A			
		B-137	No sensitivity tests were provided.	Minor issue	Run sensitivity tests	This is addressed within the accompanying technical note	The consultant has documented the model's sensitivity to channel roughness. This did not suggest any amendments to the base model where required.	No further action required.	

Figure 1: Small triangles around pillars



Model results, interpretation, verification and stability								
Model results, interpretation, verification and stability	Model stability	- zsd, eod, tff - Model warnings and errors - Non-convergence - Mass balance - unrealistic oscillations (water level / flow / boundaries / dVoi)	B-139	The base 0.1% AEP event ended incomplete.	Minor issue	See response to B-29	The consultant has reported that the 0.1% AEP event has now been run to completion.	No further action required.
			B-140	Total mass error = 9.9 m3	Acceptable	N/A		
			B-141	Volume balance error = 0.9 %	Acceptable	N/A		
			B-142	There is some oscillation in the peak flows in the area of interest during a 0.1% AEP event (Figure 2)	Minor issue	Make updates to conveyance and bank lines to improve stability	See response to B-29	The consultant has documented attempts to improve stability as suitably justified the approach and documented the limitations.
	B-143	There is some significant oscillations in the out of bank flows in the area of interest during the 0.1% AEP event (figure 3)	Major issue	Make updates to conveyance and bank lines to improve stability. If appropriate, lower bank co-efficient	See response to B-29	The consultant has documented attempts to improve stability as suitably justified the approach and documented the limitations.	No further action required.	
Sensitivity testing	- Suitability of sensitivity testing undertaken - Results & interpretation of sensitivity testing	B-144	Sensitivity tests not provided for review	Minor issue	Run sensitivity tests	See response to B-137	The consultant has documented the model's sensitivity to channel roughness. This did not suggest any amendments to the base model where required.	No further action required.
Calibration / performance		B-145	No model performance testing was provided for review.	Minor issue	Use the model report to provide commentary on the sensibility of predicted flooding.	This is addressed within the accompanying technical note	The consultatn has provided justification for not completing model proving.	No further action required.

Acceptable
Acceptable - but does not meet best practice
Clarification required
Minor issue
Major issue
Recommendations

Figure 2: In channel flows at TEAM\_5156.1

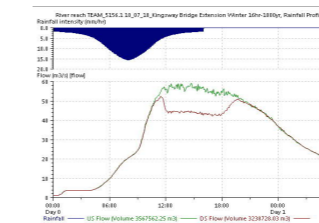
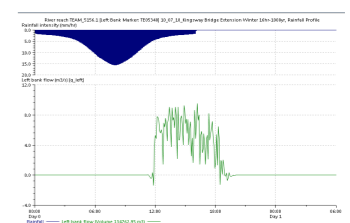


Figure 3: Left bank flows at TEAM\_5156.1

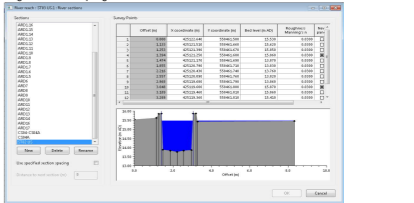
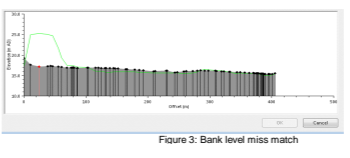
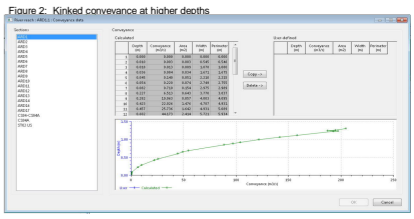
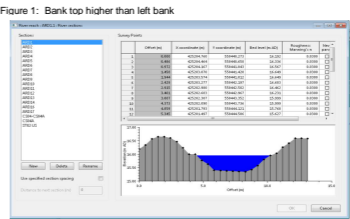




Key  
Purple - no change  
Red - changes made

<b>B</b>	<b>Review of Allendene Burn</b>									
Date of model	August 2018									
Name of reviewer	Jenny Hill									
Date of review	19/07/2019									
Revision	v1									
Applicable standards or guidance										
Nature of study watercourse/s/constraints	Allendene Burn									
Study objectives	The reporting states: Flood Risk Assessment (FRA) to support the Environmental Impact Assessment (EIA) and DCO Application for the A1 Birtley to Coal House Scheme. Three areas were identified for further modelling: - Hydraulic modelling of the River Team at Junction 67 to assess the impact of the extension of the Kingsway Viaduct. This modelling utilises an existing Environment Agency hydraulic model of the River Team constructed by JBA in 2014. - Hydraulic modelling of the Allendene Burn to understand the impact of the A1 realignment which will require either: a. the extension of the existing Allendene culvert and replacement of the existing section of the Burn. b. or daylighting of the existing culvert and replacement and realignment of the existing burn to accommodate a new viaduct over the existing railway line. - Hydraulic modelling of the surface water flood risk at Junction 66.									
Summary of 1st review	This review focusses on the Allendene Burn options Minor issues have been identified. Generally the baseline model and option 1 are well constructed. There were some issues identified in Option 2 that could be impacting the results. Therefore it is recommended that this model is revised. As for all modelling studies, results of the sensitivity testing and model proving, should be provided for review.									

Category	Detail	Prompts	ID	Comment	Suitability	Suggested actions	Consultants Response (if required)	Comment	Suggested action
<b>Data to be reviewed</b>									
Data to be reviewed	Software	- Versions	B-1	InfoWorks ICM v8	Acceptable		N/A		
	AEPs provided / reviewed		B-2	0.1% AEP model files and results	Acceptable		N/A		
	Scenarios provided / reviewed		B-3	Base, Option 1 ditch realignment, Option 1 realignment flow control, Option 2 and Option 3	Acceptable		N/A		
	Reports	- Reference versions - Technical reporting - General reporting	B-4	FRA report with technical appendices	Acceptable		N/A		
<b>Reporting</b>									
Reporting	Reporting	- Objectives	B-6	Objectives clearly stated in the reporting	Acceptable		N/A		
		- Constraints	B-7	Reporting generally clear and thorough	Acceptable		N/A		
		- Approach Justification (both model scale and structure scale)	B-8	The scenarios are a bit unclear - more models provided than options discussed.	Clarification required	Check consistency between model and reporting provided for review.	This is addressed within the accompanying technical note	The consultants note clarifies this.	No further action required.
		- Clarity - Assumptions - Interpretation of results	B-9	Results discussed	Acceptable		N/A		
<b>General comments</b>									
General comments	File organisation / naming convention	- Scenarios	B-11	Scenarios and files well labelled although it was a bit confusing to establish what is the base scenario. One model network with all options as scenarios could have been a neater way to organise the options.	Acceptable - but does not meet best practice	In future, use one model network with a series of scenarios to represent options	N/A		
		- Naming	B-12	Flags have not been included although data has been flagged.	Acceptable - but does not meet best practice	In future include a CSV export of flags or a table of flags in the report.	N/A		
		- Flags	B-13	Naming conventions are clear and descriptive	Acceptable		N/A		
	Survey / topographic data	- Age	B-14	The DTM has not been provided which makes comparisons more difficult. A lidar clip has been made but I understand that the model DTM was a composite of three sources.	Clarification required	In future, provide the DTM used	DTM provided	Thank you for supplying	No further action required.
		- Quality	B-15	According to the report, Channel survey for Allendene Culvert was undertaken by Longdin and Brownlow in March 2018	Acceptable		N/A		
		- Suitability	B-16	Lidar data was supplemented by topo survey in the study area.	Acceptable		N/A		
Other	- Any significant missing data	B-17	Nextmap 5m has been used to north east of the A1 which has partial or no Lidar coverage.	Acceptable		N/A			
<b>General modelling approach</b>									
General modelling approach	Model extents	- Domain boundaries	B-19	The Allendene Burn is not mapped. However, a check against 1m Lidar suggests that the full length of this watercourse has been modelled in 1D with 2D inflows.	Acceptable		N/A		
		- Upstream/downstream boundaries	B-20	A check on the maximum flood extent for the 0.1% AEP event showed no glass walling. Therefore the extent of the 2D model is considered appropriate.	Acceptable		N/A		
	Modelling approach	- 1D / 2D / Linked	B-21	1D river reaches are linked to the 2D domain at banks.	Acceptable		N/A		
		- generalised (by river/2d links)	B-22	Model is fully generalised	Acceptable		N/A		
	Application of hydrological estimates	- Lumped / distributed	B-23	Inflows have been applied at the upstream extent of the model	Acceptable		N/A		
		- Applied to 1D or 2D domain	B-24	No lateral inflows are made, but it is not anticipated that these would be required for a watercourse of this size	Acceptable		N/A		
	- Lateral or point inflows	B-25	A downstream water level from the River Team for the same AEP has been applied.	Acceptable		N/A			
	- Consistency with reporting								
<b>InfoWorks ICM</b>									
Model build	Hard bed / soft bed	- Accuracy of modelled channel length	B-27	Hard bed / soft bed not specified in the reporting	Clarification required	Specify if hard or soft bed levels were used.	Hard bed levels used	Thank you for clarifying	No further action required.
			B-28	All river reach lengths have been calculated based on the length of the centre line and the centreline follows the channel indicated in the DTM wall.	Acceptable		N/A		
	Watercourses	- Deactivation	B-29	1D river reaches have been voided from the 2D zone to avoid double counting	Acceptable		N/A		
		- Interpolates	B-30	Interpolates have been used excessively, with on interpolate every 10m. The interpolates have not caused any kinks in the conveyance plots so it is concluded that this is unlikely to impact results.	Acceptable - but does not meet best practice		N/A		
		- Bank level and DTM matchup	B-31	Bank levels are interpolated between survey points rather than updated from the DTM. In some cases this can make the 1D bank 2m above the 2D level	Minor issue	In future, update bank levels from DTM in between surveyed cross sections if there is good confidence in the DTM levels	This is addressed within the accompanying technical note	The consultant has justified their approach.	No further action required.
	Watercourse structures	- Bank coefficients	B-32	Discharge coefficient of 1 and modular limit of 0.8 consistently used	Acceptable		N/A		
		- Baseline	B-33	No inflow applied to the river reach link as inflow hydrograph has been used	Acceptable		N/A		
		- Bridges	B-34	7 culverts have been modelled. The data flags suggested 6 of these 7 have been modelled from survey data and 1 from As Built drawings. The size and roughness looks sensible although I would recommend that Manning's n is used for fluvial culverts over Colebrook White.	Acceptable		N/A		
		- Culverts	B-35	Culvert inlets and outlets consistently used with appropriate coefficients applied	Acceptable		N/A		
	Mesh	- Screens	B-36	1 bridge has been modelled. The bridge opening (flagged as survey data) and deck look sensible compared to the river cross section. Bank coefficient and discharge coefficient have been left as default.	Acceptable		N/A		
- Weirs		B-37	Summary on none modelled: flap valve, orifice, pump, screen, weirs	Acceptable		N/A			
- Flap valves		B-38	Max triangle area was 20m <sup>2</sup> and minimum element was 10m <sup>2</sup> which is appropriate for a model of this scale. The general roughness was 0.035 which is within typical range.	Acceptable		N/A			
- Sluices		B-39	No mesh warnings have been produced.	Acceptable		N/A			
- Mesh optimisation		B-40	No rainfall was applied to the mesh, despite rainfall being applied in the run set up. It is understood that this was a fluvial model, and therefore the rainfall was not required. However, clarification on why rainfall files have been included is required.	Clarification required	Clarify if rainfall was an intended inflow to this model.	Rainfall was only applied in a small sub catchment, with the model being predominantly fluvial.	Thank you for clarifying.	No further action required.	
- Infiltration surfaces		B-41	1D-2D linking happens at bank lines which has been successfully achieved.	Acceptable		N/A			
- Initial conditions		B-42	There is no representation of the conveyance in highways or the resistance caused by buildings.	Minor issue	Represent buildings, road, woodland, scrub as roughness zones in the 2D model.	This model covers a small area and this level of detail is not required in this instance	Thank you for clarifying.	No further action required.	
Mesh modifications	- Representation of roads and buildings	B-43	However, the raised highway embankment are represented in the DTM and therefore the mesh.	Acceptable		N/A			
	- Roughness								
InfoWorks ICM	Scenarios	- Do minimum (baseline)	B-44	Option 1a: Ditch re-alignment A Mesh Level Zone has been added over the existing watercourse. This adjusts the DTM elevation to give a minimum elevation of 16 mAOD and maximum elevation of 17.5 mAOD. A 3D view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground levels to be in with the proposed bank heights. In some locations this can cause a 1m discrepancy between 1D and 2D bank level. This is not shown to impact 0.1% AEP results. The extended culvert has been connected to the proposed culvert with a break node. I would think it more likely that a manhole chamber would be installed to connect these. A manhole would have the potential to flood whereas a break node does not. However, the pipe is not surcharged at the peak of the 0.1% AEP event so this is not thought to impact results. The roughness of the proposed culvert has not been updated from default. The open channel has been extended to replace the culvert. The new cross sections ARD1-ARD4 have lower left bank to the bank top (Figure 1). The same is true for ARD14-17 and ST02 US. Here channel flow does exceed bank top in the 0.1% AEP event (Figure 4) so this is impacting results. As per Option 1a, conveyance plots are kinked at greater depths, which in this instance could impact the results as in channel depths exceed 1m.	Acceptable - but does not meet best practice		N/A		
		- Do nothing	B-45	Option 1b: Ditch realignment + flow control A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option 1a). Pipe size of SA02US:1 has been reduced from 1.35 to 1.2m in diameter. No other apparent changes made from Option 1a so same comments stand.	Acceptable - but does not meet best practice		N/A		
	Scenarios	- Do something	B-46	Option 2: Viaduct A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option 1a). There is no apparent level change in the model to account for lowering the highway embankment which is present in the DTM (JBA imposed no DTM provided). As a result, in some places there is a 9m miss match between the 1D and 2D bank levels modelled. In channel water levels do not exceed bank top during the 0.1% AEP so this is not impacting results. The open channel has been extended to replace the culvert. As per Option 1a, sections ARD1-ARD4 have lower left bank to the bank top (Figure 1). The same is true for ARD14-17 and ST02 US. Here channel flow does exceed bank top in the 0.1% AEP event (Figure 4) so this is impacting results. As per Option 1a, conveyance plots are kinked at greater depths, which in this instance could impact the results as in channel depths exceed 1m.	Minor issue	Trim 1D cross sections to the highest point on the left bank. Update panel markers and channel roughness to smooth conveyance plots at deeper flows.	The documentation states that the model has been updated	No further action required.	
		- Do something	B-47	Option 3: Viaduct There are no apparent changes between Options 2 and 3 so the same comments stand unless clarification of changes is provided.	Minor issue	Trim 1D cross sections to the highest point on the left bank. Update panel markers and channel roughness to smooth conveyance plots at deeper flows.	The documentation states that the model has been updated	No further action required.	
Run parameters and output data	- Results generated	B-48	Results saved at a 1minute interval which is high but acceptable.	Acceptable		N/A			
	- Temporal resolution of results	B-49	Model is run for 12 hours which allows the full storm to pass	Acceptable		N/A			
	- Run parameters	B-50	Run use a GPU card but don't link 1D and 2D calculations at minor timesteps.	Acceptable		N/A			
<b>Runs</b>									
Model simulations	Model simulation runs	- Existing (baseline)	B-144	The model has been run and reviewed for the baseline and options. All results use the 0.1% AEP event.	Acceptable		N/A		
		- Climate change	B-145	There were no sensitivity tests provided.	Minor issue	Run sensitivity tests	This is addressed within the accompanying technical note	The consultant has documented the model's sensitivity to downstream boundary, channel roughness and flow duration. This did not suggest any amendments to the base model where required.	



Model results, interpretation, verification and stability									
Model results, interpretation, verification and stability	Model stability	- 22d, wof, 0f	B-147	Total mass error = 0.0 m3	Acceptable			N/A	
		- Model warnings and errors	B-148	Volume balance error = 0.0 %	Acceptable			N/A	
		- Non-convergence	B-149	In channel flow raise and fall in a smooth hydrograph	Acceptable			N/A	
		- Mass balance	B-150	Out of bank flows are generally stable	Acceptable			N/A	
		- unrealistic oscillations (water level / flow / boundaries / d/dt)	B-151	There is some instability at the downstream boundary due to the backing up of the River Team 0.1% AEP level but this is not impacting the results in the area of interest.	Acceptable			N/A	
	Sensitivity testing	- Suitability of sensitivity testing undertaken	B-152	Sensitivity tests not provided for review	Minor issue	Run sensitivity tests	See response to B-145	Thank you for clarifying.	No further action required.
		- Results & interpretation of sensitivity testing							
	Calibration / performance		B-153	No model performance testing was provided for review.	Minor issue	Use the model report to provide commentary on the sensitivity of predicted flooding.	This is addressed within the accompanying technical note	Thank you for clarifying.	No further action required.

Acceptable
Acceptable - but does not meet best practice
Clarification required
Minor issue
Major issue
Recommendations

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**Appendix P- Meeting Minutes [REDACTED], Environment  
Agency (02/04/2020)**





	<p>█ discussed that they were sent via usb stick to the offices but may not have made it to the relevant people due to lock</p> <p>█: WSP has assessed the worst-case scenario which has been submitted as part of the Allerdene Three Span Viaduct addendum.</p> <p><b>Action:</b> █ to send a link to the Addendums to the EA █.</p>	█	Complete
2	<p><b>Flood risk (model and FRA approval)</b></p> <p>█ and █ outlined that they have approved the flood model, however, they require additional clarification on the operation of the flood plain compensation.</p> <p><b>Compensation areas</b></p> <p>█ asked if the local authority (Gateshead Council) has agreed the location of the attenuation crates within the Coal House roundabout.</p> <p>█ discussed that with regard to flood compensation on the opposite bank to the attenuation crates as shown in ES Figure 13.7: Flood Plain Compensation Area, the EA are concerned that in their interpretation of the written representations flood plain compensation is only provided for the climate change scenarios.</p> <p>█ stated that modelling shows that for the non climate change scenarios the flows are within the banks – impacting 12m<sup>2</sup> of the area, only additional piers (max 2 piers in future that will require the provision of flood compensation for the climate change scenarios in the roundabout area).</p> <p><b>Action:</b> █ to confirm that the location of these attenuation crates is confirmed within the SoCG with Gateshead Council.</p> <p><b>Action:</b> █ to include technical note in the SoCG of how flood compensation will work.</p>	█	
3	<p><b>Gauging Station</b></p> <p>█ discussed that the EA are currently waiting for comments and information on access issues to gauging station from their Lawyers.</p> <p>█ discussed that the gauging station is the only one that EA has within this location. It gives river levels and rainfall levels, therefore gives good flood warnings for the area. After studies, this was the only position that the gauging station could be located so that flood warnings can be issued.</p> <p>Access to the Gauging station must remain accessible 24 hours a day, every day. There will be monthly checks undertaken at the gauging station. The other concern is the temporary works downstream of the gauging station and the receptors (i.e. the urban area) of possible floods therefore the EA needs to understand the impacts associated with the temporary works and any changes this may have on the rating curve.</p> <p>█ discussed that he could discuss with contractor and provide more detail. For example visits could be pre-arranged with the contractor to solve access</p>	█	

	<p>and Health and Safety issues, including possibly a 24-hour notice excluding emergency scenarios. A telephone number could be provided to notify each affected party.</p> <p>█ discussed that the Roundabout will be maintained for traffic and so access will be operational throughout the project. The work at this location will only be for a period of the 2.5-year long Scheme.</p> <p><b>Action:</b> █ to investigate if 24-hour access will be possible and investigate concerns of impacts downstream works during construction, and to discuss the above processes and how they can be secured.</p> <p><b>Action:</b> █ to investigate how long the works will be at this location.</p> <p>█: Will this area be fenced?</p> <p><b>Action:</b> █ to discuss with contractor to try to give more explanation on fencing. If there is limited access, WSP will put in provisions to get access.</p> <p><b>Action:</b> █ to put method statement in the Construction Environmental Management Plan (CEMP) outlining how access will be arranged for the parcel of land. A statement that covers fences, introduction to site, parking location, notification, identification of British Telecommunications (BT) lines so this is not damaged accidentally during construction. Confirmation of this will then be sent to EA.</p> <p>█: Could we locate a second gauging station or temporarily move it downstream?</p> <p><b>Action:</b> EA to get guidance from hydrologist team if there is anything EA could do. Based on funding on temporary gauging station, one needs to be removed so that a new one can be installed. Budget and timescales are dependent on Highways England and so an understanding is required from them.</p> <p><b>Action:</b> █ to gather information on temporary works. There will be no effects to the river in any scenario. To have discussion about working around the gauging station.</p>		
<p>4</p>	<p><b>Temporary Works – Hydraulic Modelling</b></p> <p>█ highlighted that temporary works can alter flood risk – for example culverting short lengths can increase flood risk temporarily during construction, and asked when the EA would be able to see modelling information?</p> <p>█ stated that no modelling of temporary works has currently not been completed.</p> <p>█: WSP have assessed the worst-case scenario as submitted in the Allerdene three span viaduct addendum.</p>	<p>█</p>	

## MEETING NOTES

	<p><b>Action:</b> EA to provide information how temporary works will affect forecasts and if validity of the gauging station will be removed.</p> <p><b>Action:</b> ■■■ to undertake hydraulic modelling of the temporary works culvert and provide a Technical Note outlining the impacts on the gauging station in the SoCG.</p>		
5	<p><b>WFDa (if Environment Agency wish to discuss)</b></p> <p>■■■ stated that the EA approve the WFDa.</p>		
6	<p><b>Biodiversity</b></p> <p>■■■■■ not present. All ecology issues will be picked up in the upcoming meeting on 6 April 2020.</p>		
7	<p><b>Statement of Common Ground</b></p> <p>■■■ discussed that once all actions points in this meeting are addressed, the EA will be in a position where the SoCG can be formalised and agreed.</p> <p>NA stated that the draft SoCG will be submitted at Deadline 4 (20<sup>th</sup> April), comments on SoCG at Deadline 5 (1<sup>st</sup> May) and a final version to be completed by Deadline 8 (7<sup>th</sup> July).</p>		
8	<p><b>AOB</b></p> <p>■■■ discussed that the consultation period for the ES Addendums finished on 14 April and that they would be submitted to the ExA on 20 April 2020.</p> <p><b>Action:</b> ■■■ to send over a summary paragraph detailing Allerdene three span option to assist the EA in their understanding.</p>	■■■	

## NEXT MEETING

An invitation will be issued if an additional meeting is required.

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**Appendix Q - Meeting Minutes [REDACTED], Environment Agency (07/04/2020)**



<p><b>2.1</b></p>	<p>Environment Agency (EA) point of discussion from their email dated 7<sup>th</sup> April 2020:</p> <p>“Clarification is needed to determine whether the unassessed parts of the watercourses have been assessed.</p> <ul style="list-style-type: none"> <li>• If so, how were these assessed?</li> <li>• How was a judgement made to determine low risk?</li> <li>• Why were certain areas not surveyed?</li> <li>• What proportion of the watercourses are not surveyed?</li> <li>• Are the un-surveyed areas considered good or poor habitat for water vole?”</li> </ul> <p>█ discussed that a Phase 1 Habitat Survey was carried out in 2016 and updated in 2018 – this included an assessment of whether the habitat were suitable for Water Vole. █ discussed that the Phase 1 Habitat Survey had not been done in the central location at Coal House roundabout. However, this stretch of the River Team is partly culverted (so unsuitable), but that there are some natural sections which would be considered suitable but not optimal. No targeted water vole surveys have been carried out.</p> <p>█ stated that water vole surveys would be done pre-construction and that this is included in the Outline Construction Environmental Management Plan (oCEMP) at [REP2-050 and 051] (Revision 2).</p> <p>█ stated that he was content with this assessment.</p> <p><b>Action: WSP to share updated oCEMP with the Environment Agency.</b></p>	<p>█</p>	
<p><b>3</b></p>	<p><b>oCEMP Reference [B11]</b></p>		
<p><b>3.1</b></p>	<p>█ discussed that the ecological brief should be expanded beyond in channel works and should include works within 5 metres of the bank in order to accommodate risks to riparian mammals such as water voles.</p> <p><b>Action: WSP update oCEMP to add in distance from the banks. “within the channel and within 5 metres of the bank”.</b></p>	<p>█</p>	<p>Complete</p>
<p><b>4</b></p>	<p><b>oCEMP Reference [B24]</b></p>		
<p><b>4.1</b></p>	<p>The content of the oCEMP reference [B24] was discussed and █ confirmed that he was content with the wording, and in particular reference to water vole.</p> <p>█ discussed that the same comment as that made on [B11] applies here with regards to adding the distance from the banks where pre-construction checks will be made.</p> <p><b>Action: WSP update oCEMP to add in distance from the banks. “within the channel and within 5 metres of the bank”.</b></p>	<p>█</p>	<p>Complete</p>
<p><b>5</b></p>	<p><b>oCEMP Reference [W10]</b></p>		

MEETING NOTES

<p>5.1</p>	<p>█ discussed that they would welcome further consultation on the specific design regarding the enhancements to river morphology, natural design features, bed cover and levels etc.</p> <p>█ confirmed that consultation with the EA on these aspects could be added to [W10].</p> <p><b>Action: WSP to add the requirement to consult with the EA into [W10].</b></p>	<p>█</p>	<p>Complete</p>
<p>6</p>	<p><b>oCEMP Reference [B3]</b></p>		
<p>6.1</p>	<p>Text from the oCEMP:</p> <p>[B3] <i>“Culverts will be designed, where possible, to include natural beds (between 100mm and 250mm) to maintain and assist fish passage. To mitigate for potential downstream impacts and maintain passage along watercourses, baffles or similar structures will be installed within existing culverts”.</i></p> <p>█ discussed that the oCEMP still needs to be updated to address this following our comments previously. The statement on fish passage in culverts should be clarified in order to ensure fish passage is maintained at all times, use of the term ‘where possible’ could imply that fish passage is beneficial but not mandatory. Fish passage needs to be in place at all times. The statement could be reworded as follows: “Culverts will be designed taking into account fish migratory requirements to ensure that they do not present an obstruction to fish migration.”</p> <p>█ discussed that the text relating to fish passage is specifically in relation to the River Team. Culvert design is in relation to Allerdene culvert / Allerdene burn.</p> <p>█ discussed that it would be useful to clarify each of the points of natural beds and fish passage separately instead of in a combined sentence. The use of ‘where possible’ relating specifically to fish passage is not acceptable.</p> <p><b>Action: WSP to review oCEMP and update as appropriate. Separate bed material and fish pass into separate points.</b></p> <p><u>Post meeting note:</u></p> <p>[B3] has been updated as follows - Culverts will be designed, where possible, to include natural beds (between 100mm and 250mm)</p> <p>A new measure [B26] has been included as follows: Culverts will be designed taking into account fish migratory requirements to ensure that they do not present an obstruction to fish migration.</p> <p>To mitigate for potential downstream impacts and maintain passage along watercourses, baffles or similar structures will be installed within existing culverts.</p>	<p>█</p>	

	<p>Details and location of baffles or similar structures, e.g. pre barrages, to be installed either within or close to existing culverts for fish passage will be agreed with the Environment Agency.</p>		
<b>7</b>	<p><b>oCEMP references [B9], [B10] and [W15]</b></p>		
<b>7.1</b>	<p>█ discussed that oCEMP references [B9], [B10] and [W15] need to be updated as follows:</p> <ul style="list-style-type: none"> <li>Any watercourse diversion work, coffer dams or other in-channel works must ensure fish passage is maintained and designed in such a way as to allow fish movement at times they are actively migrating. This includes maintaining adequate space and depth of water, as well as flow velocity, for fish passage.</li> </ul> <p>█ confirmed that this has been updated in the oCEMP.</p> <p><u>Post meeting note:</u> The text below has been added to [B10] and [B11]. This particular text does not apply to [B9]. This has not been added to [W15] as this relates to specifically to minimising impacts to water quality and given that it is now included in [B10] and [B11] it is now secured.</p> <p>[B10], [B11] <i>“October to May inclusive, is the fish spawning period to avoid, rather than September to April”.</i></p> <p>█ confirmed that this has been updated in the oCEMP at [B10].</p>		
<b>8</b>	<p><b>Biodiversity Mitigation Measures</b></p>		
<b>8.1</b>	<p>█ discussed that document - <i>TR010031-000804-Appendix 1.2 A - Biodiversity Mitigation Measures (Written Question 1.2.3)</i> needs updating to reflect the oCEMP to include water vole.</p> <p>█ discussed that as this supported the responses to the Examining Authority (ExA) Written Questions, that she was unsure how this could be updated.</p> <p><b>Action: WSP to check with WSP Development Consent Order (DCO) team as to how to deal with this.</b></p> <p><b>Action: EA to feedback if there is anything additional to add into the Statement of Common Ground (SoCG), send through any questions on the Environmental Statement (ES) Addendums, and any questions / points to agree in response to the ExA’s Further Written Questions.</b></p>	<p>█</p> <p>█</p>	



## MEETING NOTES

	<b>Action: WSP to send through the EA SoCG.</b>	■	
<b>9</b>	<b>AOB</b>		
<b>9.1</b>	<b>Action: EA to feedback if there is anything additional to add into the SoCG, send through any questions on the ES Addendums, and any questions / points to agree in response to the ExA's Further Written Questions.</b> <b>Action: WSP to send through the EA SoCG.</b>	■  ■	

### NEXT MEETING

An invitation will be issued if an additional meeting is required.

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