

A1 Birtley to Coal House

Scheme Number: TR010031

Technical Note - Temporary Works Hydraulic Modelling

Planning Act 2008

Rule 8(1)(b)

Infrastructure Planning (Examination Procedure Rules) 2010



Infrastructure Planning

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**The Infrastructure Planning
(Examination Procedure Rules)
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A1 Birtley to Coal House
Development Consent Order 20[xx]

**Technical Note - Temporary Works Hydraulic
Modelling**

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1. INTRODUCTION

- 1.1.1. The A1 Birtley to Coal House Scheme requires widening of the Kingsway Viaduct. To enable this to be completed temporary works will be undertaken within the channel of the River Team during the construction phase. This has been assessed within **Chapter 13: Road Drainage and the Water Environment** of the ES [APP-034].
- 1.1.2. A meeting was held between the Environment Agency and the Applicant on 2 April 2020, as part of the finalisation of the Statement of Common Ground (SoCG) between these two parties, the minutes of this meeting are provided within **Appendix P of the SoCG with Environment Agency [REP4-026]**. During this meeting the Environment Agency requested that the Applicant undertake additional hydraulic modelling to assess the impact of the temporary works upon the Environment Agency's Team Valley gauging station¹ at Lamesley Road Bridge. This request was made to enable the Environment Agency to understand whether the construction phase of the Scheme would have any impact upon their ability to continue to issue flood warnings which are used to notify residents / occupants of the downstream properties when a flood is expected.
- 1.1.3. This report summarises the access provision made for the Environment Agency's staff along with the hydraulic modelling of the proposed temporary works to assess the impact on the gauging station.

¹ <https://nrfa.ceh.ac.uk/data/station/info/23017>

2. TEAM VALLEY GAUGING STATION

- 2.1.1. The Environment Agency have provided information on this gauging station to inform this assessment, this includes:
- a. A Location Plan (**Figure 1**)
 - b. Confirmation that the outstation is battery powered which is supplemented by a solar panel (**Figure 2**)
 - c. Confirmation that communication between the gauging station and the Environment Agency's telemetry systems is undertaken via a fixed BT phone line, with a GSM backup
 - d. A summary of the access requirements - the Environment Agency's technicians require access to clean the stilling pipe and gauge board via steps and a locked gate (**Figure 3**);
 - e. A requirement for safe access to the gauging station at all times
 - f. A summary that the river flow is calculated by the known relationship between the defined channel and recorded water level
 - g. Information on how the gauging station works – the gauging station measures flow using a river level sensor only
 - h. Confirmation that as part of the Environmental Permit the Environment Agency will be able to review the design of the temporary works culvert (this is provided within reference [W12] of Table 3-1 Register of Environmental Actions and Commitments (REAC) of the Outline Construction Environmental Management Plan (oCEMP) [**REP4-022 and 023**])
- 2.1.2. As the gauging station uses a river level only, to enable the flow to be calculated a constrained channel such as a weir or culvert with a known relationship between river depth and flow is required. Any changes to the culvert shape or flow / depth relationship that could occur as a result of the temporary works could result in changes to the flows which could then trigger flood warnings at incorrect flows.

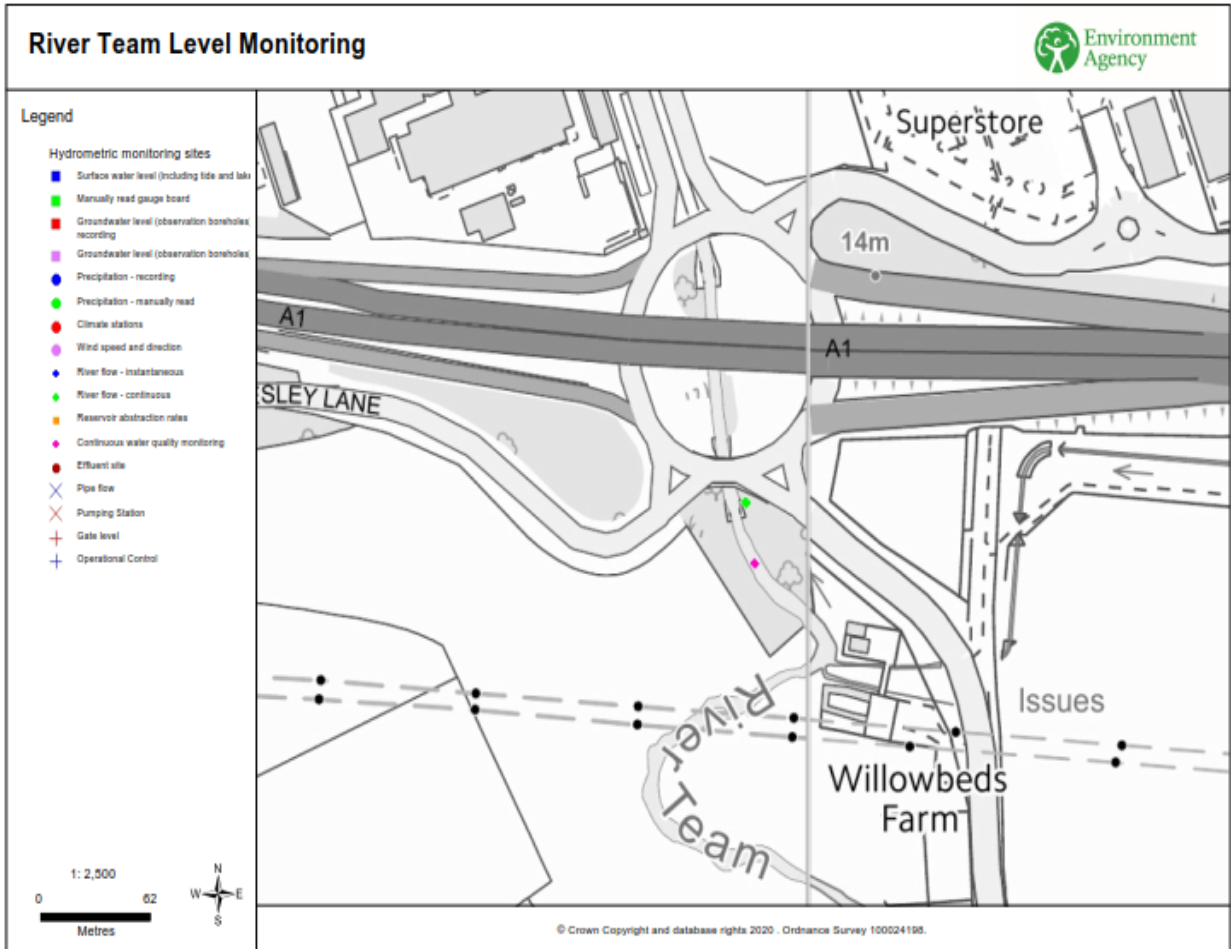


Figure 1 - Location of the Environment Agency's Team Valley Flow Gauging Station (green symbol)



Figure 2 – Views of the Outstation and access



Figure 3 - Environment Agency Access to the River Team

3. ACCESS PROVISION

- 3.1.1. The current construction programme for the Scheme, details that the works for the widening of Kingsway Viaduct (which includes provision for a temporary culvert within the River Team) are for a period of approximately 12 months and not the full duration of the scheme. The temporary culverting will be approximately 8 months of these 12 months.
- 3.1.2. Provisions relating to the Environment Agency's gauging station have been made within reference [W20] of Table 3-1 REAC of the oCEMP **[REP4-022 and 023]** which states that:
- "A Method Statement will be produced in consultation with the Environment Agency which will include the following:*
- A drawing to show the location of the gauging station and telephone connection routes*
 - Measures to protect the gauging station if works are to be undertaken in close proximity to the station or that could affect the gauging station including its telephone connection*
 - The operational and emergency access requirements including protocols for site induction arrangements, contact details and out of working hours access arrangements, for any periods when the land is fenced*
 - The Environment Agency are to be notified of the timing and duration of any works in the vicinity of the gauging station and Coal House roundabout"*
- 3.1.3. These provisions will be refined during detailed design.
- 3.1.4. Provision has also been included in Part 4 of Schedule 12 to the draft DCO to protect the interests of the Environment Agency including specific provision to protect the gauging station.

4. TEMPORARY WORKS

- 4.1.1. The temporary culvert will be designed during the detailed design stage. The preliminary design works which have been undertaken to date show that the temporary works culvert to be a similar size to that of the upstream bridge (i.e. that adjacent to the gauging station) and this is considered to minimise any associated influence on the river flows. The details of the temporary works (including the culvert) will be submitted to Environment Agency for approval at construction stage (as detailed in reference [W12] of Table 3-1 REAC of the oCEMP [REP4-022 and 023]) and Requirement 41 of the draft DCO.
- 4.1.2. The preliminary design of the temporary works is shown in **Figure 4**. This shows a temporary culvert and sheet piling walls along the banks of the River Team channel to protect the working area during the installation of the new viaduct piers. This information has been used as the basis of the temporary works modelling outlined in later sections of this report.

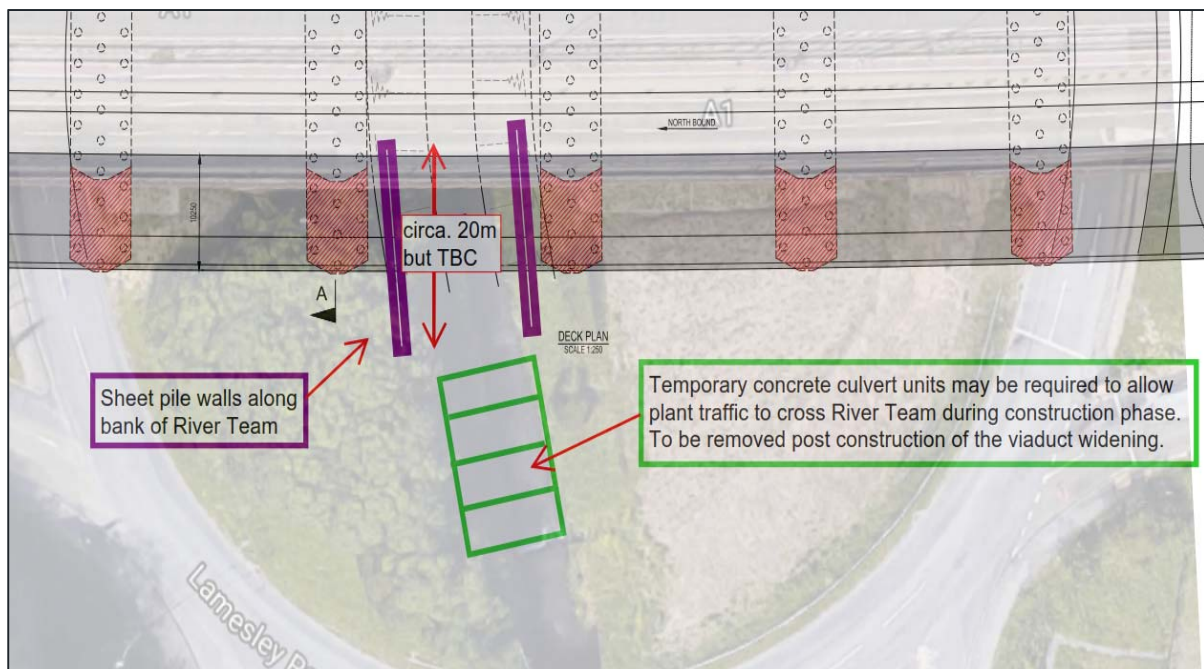


Figure 4: Sketch of the proposed temporary works

5. HYDRAULIC MODELLING

- 5.1.1. The existing River Team hydraulic model for the Scheme, as approved by the Environment Agency, has been used for the purposes of this assessment, this is an Integrated Catchment Model (ICM) and has been developed in version 6.5 of ICM².

5.2. MODEL APPROACH

- 5.2.1. The temporary culvert has been modelled as a culvert in ICM located downstream of the existing weir. The culvert is the same size and shape as the road culvert (rectangular 6000mm x 3500mm) on Lamesley Road / Coal House roundabout and is approximately 20m in length.
- 5.2.2. The sheet piles have been modelled by constraining the cross section with a vertical wall approximately halfway up the river bank. This constriction in the channel is approximately 20m in length and is located just downstream of the temporary culvert.

5.3. MODEL RESULTS

- 5.3.1. The model has been run for the 1 in 100 year flood event. The results of this show that the temporary works have no impact on the water levels for the rising limb at the location of the Team Valley gauging station until the levels exceed 2m or flows greater than 30m³/s, as shown in **Figure 5**.
- 5.3.2. The published rating curve (NRFA³) for the Team Valley gauge station (**Figure 6**) shows that the bank full capacity is at a level of 1.5m which corresponds to a peak flow of approximately 30m³/s. The highest annual maximum flow recorded at the site is 28.96m³/s within the 40 year period of record. The maximum observed flow is 10m³/s with the rating being theoretical above this.
- 5.3.3. Although there are discrepancies between the rating curve and the corresponding model results (in terms of equivalent stage discharge), these are not considered to be critical for the purposes of this study. This is because the model is comparing a like for like relationship between the baseline and temporary works scenarios and demonstrates that there is no impact before bank full scenario, by which time it would be too late to provide a meaningful flood warning to residents /businesses who are located immediately downstream. Furthermore, the bank full scenario is achieved significantly beyond the gauged flows and there is therefore associated uncertainty in the rating curve..
- 5.3.4. As there are no changes on the rising limb of the hydrograph until the depths / flows exceed 2.0m and 30m³/s respectively it is fully expected that the flood warning trigger levels would have already been exceeded by this point and thus the Scheme would have no adverse

² <https://www.innovyze.com/en-us/products/infoworks-icm>

³ <https://nrfa.ceh.ac.uk/data/station/info/23017>

impact on the operation of the gauging station for this critical purpose. Furthermore, given that the largest flood event contained within the 40 years of this stations record is below this critical level, it is considered unlikely that the Scheme would impact the accuracy of any observed flood peaks that could occur should a flood event pass through the gauging station in the 8 months of construction when the culvert is present.

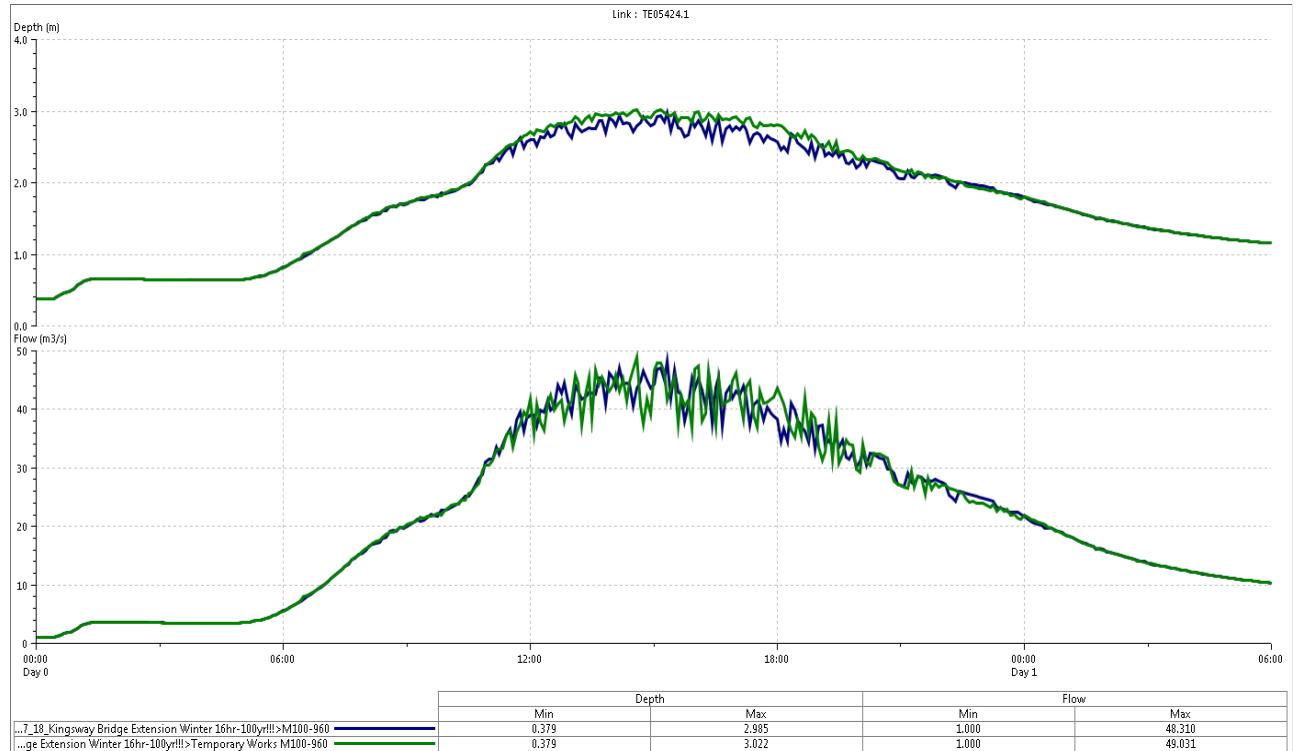


Figure 5: Predicted water depths (top) and flow (bottom) at the River Team - Team Valley Gauging station for the baseline model (blue line) and the temporary works model (green line) for the 1 in 100 year flood event

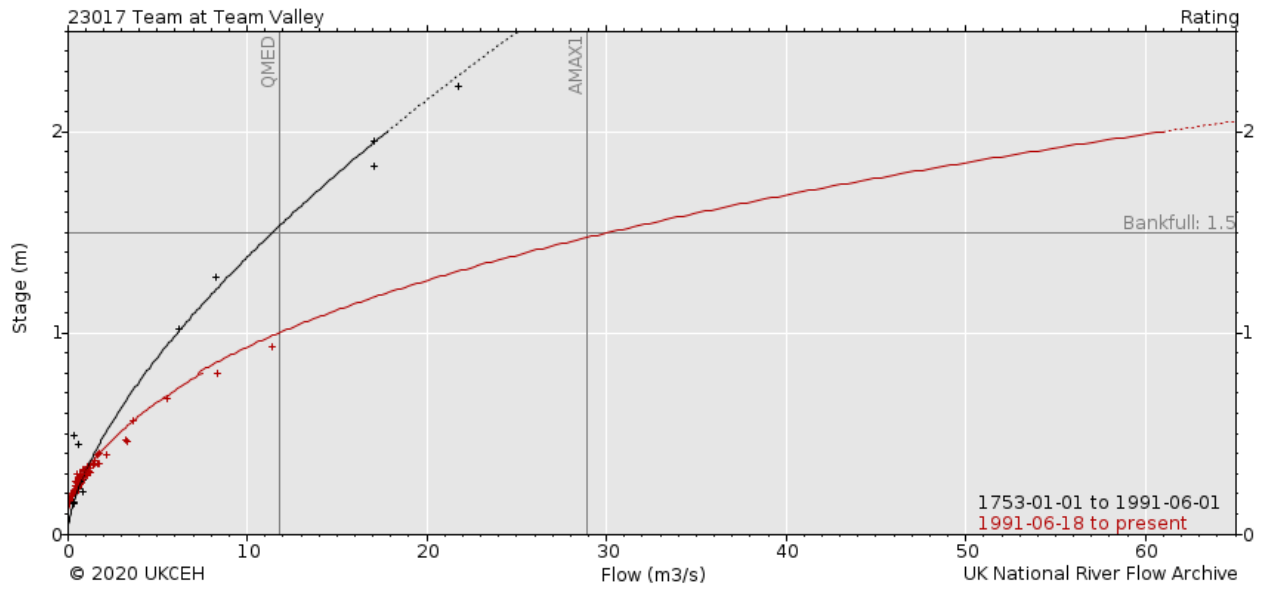


Figure 6: Rating curve for the River Team - Team Valley gauging station

6. CONCLUSIONS

- 6.1.1. The hydraulic modelling of the temporary works demonstrates that there would be no impact on the provision of the flood warnings that are delivered by the Environment Agency to the downstream residents / occupiers.
- 6.1.2. The assessment also discusses that measures have been included in the oCEMP [**REP4-022 and 023**] which will provide for a review during the detailed design phase of the Scheme for the Environment Agency to consider the impacts of the final design of the temporary works culvert, which will be required as part of the Environmental Permit. As detailed in the oCEMP a method statement would be produced in consultation with the Environment Agency which would ensure sufficient provision for maintenance and emergency access for the Environment Agency's staff and contractors to the gauging station is made.

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