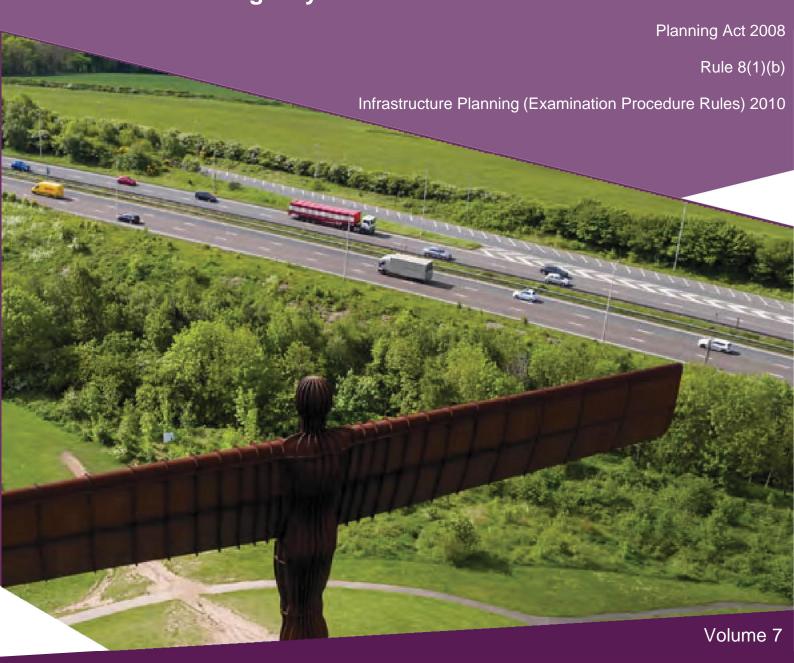


A1 Birtley to Coal House

April 2020

Scheme Number: TR010031

Applicant's Responses to ExA's Second Written Questions - Appendix 2.10C - Environment Agency confirmation of Flood Model





Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Examination Procedure Rules) 2010

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

Applicant's Response to ExA's Second Written Questions Appendix 2.10C - Environment Agency confirmation of Flood Model

| Rule number: | Rule 8(1)(b) |
|--------------------------------|---------------------------------------------------------|
| Planning Inspectorate Scheme | TR010031 |
| Reference | |
| Application Document Reference | N/A |
| Author: | A1 Birtley to Coal House Project Team, Highways England |

| Version | Date | Status of Version |
|---------|---------------|-------------------|
| Rev 0 | 20 April 2020 | Application Issue |

| Technical Model Review Report | | | | | |
|---------------------------------------------|-----------------------------------------------------------------------|--------------------------|--|--|--|
| Client | Enviro | nment 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 - A | A1 Birtley to Coal House | | | |
| JBA Project Number (or overarching project) | 2018s0387 | | | | |
| JBA Sub-Project Number (if applicable) | 57 | | | | |
| | A) Previous project - hydrology | | | | |
| | B) Previous project - hydraulic | | | | |
| Review requirements | C) New project - hydrology | Yes | | | |
| iteview requirements | D) New project - hydraulics | Yes | | | |
| | E) Survey data | | | | |
| | F) Reporting | | | | |

| .IRA |
|------------|
| consulting |
| |

| "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

Hydrology 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.

Summary of 1st hydraulics review findings

Allerdene Burn model:

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.

Kingsway Viaduct model:

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.

Summary of 2nd hydrology review findings

Hydrology review

Thank you for addressing the comments from the first review, the vast majortiy 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 profies, 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 remianning 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.

| A | Hydrology Review | |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Date of hydrology analysis | Dec-18 | 1 |
| Name of reviewer | James Molloy BE(Hons) MEngSc | 4 |
| Date of review | 08/07/2019 | |
| Revision | V1 | |
| | Flood Estimation Handbook (IH, 1999) updates including Kjeldsen (DEFRA, 2008), and recent outputs from the FEH Local project | 4 |
| Applicable standards or guidance | ReFH1 and/or ReFH2 guidance documents | 4 |
| | EA Flood Estimation Guidelines (Operational instruction 197_08, V6) | 4 |
| Nature of study | 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. | |
| watercourse(s)/constraints | 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. | |
| 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. | Ke Pu Re |
| 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. | Tha Bes |



Key Purple - no change Red - changes made

anges made

hank 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.

Summary of 2nd review

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 profies, 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 remianning 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 | | | | |
| General comments | Method statement | A-1 | Ouite 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?) | Significiant 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 | | | | Method statement | | T | | |
| | provided? | A-4 | Yes in Section 3.3. | Acceptable | | N/A | ĺ | | |
| | 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. | |
| Flow estimation points and descriptors | 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. | | Thank you for updating this. The updated DPLBAR and URBEXT values should give more conservative results in ReFHI2. Good method used to update DPLBAR, acknowledging the uncertainty in the AERA*0.548 method for small catchments. | Happy with the given changes. | |
| | 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 | See comments below | mappy marane grow smartgees | |
| | Review of hydrometric data | A-8 | No local hydrometric data available to calibrate hydrological methods unfortunately. | Acceptable | | N/A | | | |
| Data review | 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 (http://www.cbhe.hydrology.org.uk/index.php), 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-part check on the peak flow produced from ReFH2. | The ReFH2 analysis was undertaken outside of ICM within the ReFH2 software. This is addressed within | 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 compelteness, which is a good idea. | The ReFH1 checks given at the bottom of p.6 / top of p.7 use a different storm duraiton (1.25hrs) to the ReFH2 results presented further above (3.5hrs). Therefore the comparison of methods in Table 5 of the additioal 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 | | n/a, as a single inflow to the model is sufficient for this case for the Allerdene model. | Acceptable | | N/A | | | |
| | | A-14 | | | | | | | |

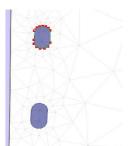
| Section 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. | | | | | | Flow estimation | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------|------|---------------------------------------------------------------------------------------------------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|------------------------------------------------------|--------------------------------------------------------------------------------|
| ## 12 Part 1 Part | | | | | | Tion communon | | | |
| Part | | Suitable for statistical? | A-15 | | | | | | |
| Mark | | QMED estimation - CDs | A-16 | | | | | | |
| The content of the | | OMED actimation AMAY / POT | Λ 17 | | | | | large in the case. | |
| Part | | QWED estillation - AWAX / FOT | A-17 | | | | | n/a, the catchment is ungauged | |
| Part | | | | | | | | The authors have attempted to find a QMED | |
| Professional Continues Professional Contin | | Choice of donors | A-18 | | | | | donor, demonstrating that due to the small size of | |
| Page | FEH Statistical | | | Yes, as a check on ReFH2 results, but not used, see above. | Major issue | See above | | on this occasion. This is a common issue in such | The search for potential QMED donors is well documented in the additional |
| ## 1 | | | | | | | | cases. | note. No further action needed. |
| ## 1 | | | | | | | | Pooling group method applied, with manual | A bit overkill to be honest (these methods are somewhat uncertain on small |
| Part | | Growth curve methodology | A-19 | | | | | modifications to remove impermeable | |
| A Company of the Comp | | | | | | | | | |
| A Company of the Comp | | | | | | | | | |
| The state of the | | Hydrology shape | A-20 | | | | | | |
| ### 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 1985 | | | | | | | As above | From ReFH2 | |
| ## 1 | | | | | | | N/A N/A | | |
| Service of the large of the lar | | Calibration | N-ZZ | iva, the small catchinent assessed nere is ungauged. | Ассергавіе | | IVA | | |
| Service of the property of the | | | | | | the largest peak flows for Allerdene Burn. Assuming the same critical | | | |
| Part | | Chains of dealer storm | A 22 | Summer rainstorm profile is suitable in this case. However only very little discussion given for the choice of | Majarjanua | | , | | |
| And the part of th | | Choice of design storm | A-23 | | Major Issue | | | | |
| Service (and 1) | | | | | | model and the Allerdene model, to give conservative results). Give a | This is addressed within the accompanying technical | | |
| Martin 19 | | | | | | table of poak notice from the first factor and the first factor and the factor an | note | conservative peak flow adopted for modelling. | No further action required |
| 1 | | Suitable for urban ReFH? | A-24 | Yes, see previous comments | Major issue | | This is addressed within the accompanying technical | Thank you for clarifying. Yes the ReFH2 software | L |
| Marie 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 1970 | | Catchment delineation | A-25 | n/a, a lumped approach is OK here. | Acceptable | | note N/A | applies urbanisation adjustments automatically. | No further action required |
| The first production of the control | Urban DaCid variant | | | | | | N/A This is addressed within the accompanying technical | | |
| The contract of the contract o | Urban Refin Variant | Choice of URBEXT values | A-27 | See comments above | Major issue | See adjustments for URBEXT200 required above. | note | Addressed further above | |
| The contract of the contract o | | | | ReFH? defaults are presumably applied for the Allerdene Rurn model, this should be OK (but should be | | | | | |
| Section of the control of the contro | | Choice of percentage runoff | A-28 | | Acceptable | | This is addressed within the accompanying technical | | |
| Secretary of the control of the cont | Final choice of method | Final flows | A 20 | N/A as only one method used. Given reliance on (uncertain) catchment descriptor methods, it is important to | Pasammandations | | note | | No further action required |
| The control of the co | T ITAL CHOICE OF THE LIOU | Tillai liows | A-23 | look at both FEH statistical and ReFH2. | Recommendations | Miscellaneous | N/A | | |
| Contract Managery 10 mentals and 10 | | Direct rainfall modelling - 2D domain | A-30 | | Accentable | | | | |
| And make a part was all ma | | extent | | The plot in Table 6 in Appendix A is very useful to demonstrate this. | 13334,3333 | | N/A | | |
| Note of the control of the processor of | | | A-31 | | Minor issue | | | | |
| The state of the s | | boundary condition | | ponding at the southern edge of the model. | | | | Thank you for clarifying. | No further action required |
| The secretary of the se | | | | | | | duration for the catchment, the national modelling was | | |
| Describing single of size. A 20 In the control mountain of the control mountain or signed and secure or signed an | | | | | | | wasn't looking at an individual catchment and couldn't | | |
| Section of section of the country of section | | | | | | | | | |
| A 25 Orace interview of the control | | | | 6hrs, then merges the modelled maximum depths in a final grid. This allows for runoff rates on regions with | Major issue | Run the direct rainfall model for a range of storm durations, then merge | | | |
| A 23 Per central modeling. Therefore, and of the first in the contraction of the first in the | | | | | | | routes and flood depths on a slip road which will need | | |
| A 33 We not all and price or the second or the second or the second or the production or the second | | | | | | | | | |
| This is addressed within the accompanying sortical of the first companying sortical control to the first companying sortical control to the first companying sortical control to the first control to the control to the first control to the fi | | | | | | | or flow routes or buildings are proposed | | |
| A 23 Other model modeling - Preventing and file modeling - Preventing - P | | | | | | | This is addressed within the accompanying technical | noting that the 1-hr storm gives the most | No feet and the second second |
| Less calcular moduling. Provincing the provincing of the PRPF loss model (a. a. groot or of annial social? Author force the first or social description of the provincing of t | | | | | | | note | conservative result. | No further action required |
| Discus clarified modeling. Percentage and a second control in the model decreases. A. 3. | | | | | | | | | Suggested more representative method for pluvial runoff modelling: |
| A 2D The last in Section 2 and are made in a section 2 and a | | | | | | | | | - Use base mapping to determine a split between 1) paved areas and 2) |
| Note an available modelling. Persussion model of the RPFI to be model i.e., a grees or ret resided userly for the bear of the persussion of the RPFI to be model i.e., a grees or ret resided userly for the bear on special product of the RPFI to be model i.e., a grees or ret resided userly for the bear on special product of the RPFI to be model i.e., a grees or ret resided userly for the bear on special product of the RPFI to be model i.e., a grees or ret resided userly for the bear on special product of the policy of activities and collaboration. For a concluded for the pluvial activities and collaboration for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a concluded for the pluvial activities and collaboration. For a collaboration of the pluvial activities and collaboration. For a collaboration of the pluvial activities and collaboration. For a collaboration of the pluvial activities and collaboration. For a collaboration of the pluvial activities and collaboration. For a collaboration of the pluvial activities and collaboration. For a co | | | | | | | | | unpaved areas in the model domain. |
| Not stained mobility - Percentage and a second presentation of the properties of the mobility of the properties | | | | | | | | | |
| Direct rantal modelling - Percentage until until modelling - Percentage until modelling - Percentage un | | | | | | | | | scale" button in the ReFH2 software. This saves you having to alter things |
| Add Considered with Intested guidances? The list of procession of the first of procession of the | | Direct rainfall modelling - Porcentogs | | after application of the ReFH2 loss model (i.e., is gross or net rainfall used)? Another issue is the use of | | | | | like DPLBAR, which is not needed here). |
| Note from the additional information (bettom of a byte a surpose of the cauchmant, options of the purpose of installing or the purpose of the catching or the purpose of the catch | | | | percentage runoff should be increased on urban surfaces? This is typically set at 70% but can be altered in | Major issue | See list of issues to the left. | | | |
| Climate change Consistent with latest guidence? A 34 The next is Section 3.9.4 of Agendius Assigness an unusual method was used to supply elimited change analysis (the Re-Fill control state) analysis, it is established. From the supply assigness was to be recommendated from the processing analysis and part of the supply as fluxed analysis, it is established. From the supply assigness and analysis, it is established assigned as a power state of the supply as fluxed analysis, it is established. From the first review was carried out, the supplementation. Therefore no changes a large analysis (the Re-Fill control was present) analysis (the Re-Fill control was pre | | | | | | | | | |
| desided study, this approach is over-emptified. The above method will therefore give two rainfall profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, one for the parellal profiles to apply to the model for each run, and apply the format apply to the model for each run, and apply to the model for each run, and apply to the model for each run, and apply to the model for the parellal profiles to apply to the model for the parellal profiles to apply to the model for each run, and apply to the model for each run, and apply to the model for the parellal profiles to apply to the model for the model fo | | | | | | | | calculated for the pluvial calculations. For a | |
| Interest in Section 3.3.4 of Appendix A suggests an unusual method was used to sprill continued. Additionable in the continued of the spring for the standard practice to simply multiply the final fluvial hydrographs by the percentage increase. **Climate change** **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 analysis, it is standard practice to simply multiply the final fluvial hydrographs by the percentage increase. **Climate change*** **Climate change*** **Climate change*** **Climate change*** **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 analysis. White some UCCP18 outputs national process to simple upon the formation of the standard practice to simply multiply the final fluvial hydrographs by the percentage increase. **Climate change*** **Climate change*** **Climate change*** **Climate change*** **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 analysis. White some UCCP18 outputs national process to simple upon the required. The control of the standard practice to simply multiply the final fluvial hydrographs by the percentage increase. **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 analysis. White some UCCP18 outputs national process to simple upon the required. The control of the standard practice to simply multiply the final fluvial hydrographs by the percentage increase. **Comment of the standard practice to simply multiply the final fluvial hydrographs by the percentage increase.** **Increase the applies of the standard practice to simply multiply the final fluvial hydrographs by the percentage increase.** **Increase the ap | | | | | | | | | |
| The text in Section 3.3.4 of Appendix A suggests an unusual method was used to spply climate change analysis, it standard praction to simply multiplying the institution of the supplying climate change analysis, it standard praction to simply multiplying the institution of the supplying climate change analysis, it standard praction to simply multiplying the final fluvial spring and of the Park 2. As the Alpendix A suggests an unusual method was used to spply climate change analysis. It is a milior issue of the complicated method is needed for applying climate change analysis. White some UKCP18 cutputs visited of UKCP18 cutputs visited visited proposed to the used of uptit factors from the cutput shift better to the displacement of the unusual method was used to spply climate change was agreed with the latest published factors, these many only application visited visited proposed to cutput shift factors from the cutput shift of the proposed to cutput shift factors from the cutput shift of the proposed to cutput shift factors from the cutput shift of the proposed to cutput shift factors from the cutput shift f | | | | | | | | informing surface water flow routes. See | model for each run, one for the paved surfaces and a second for the |
| (Minor issue) For climate change runs on the Allerdone catchment, recommend instead simply multiplying the initial flow hydrographs using the fluvial upilif ractors, instead of altering the input rainfal to ReF12. As the street of the study is a fluvial analysis, it is attended practice to simply multiply the final fluvial hydrographs by the percentage increase. **Minor issue** The text in Section 3.3.4 of Appendix A suggests an unusual method was used to apply climate change upilits for the pluvial analysis, it is derived by the final fluvial hydrographs by the percentage increase. **Minor issue** **Minor | | | | | | | | future, but depending on the required outcomes | region as partially urbanised, potentially under-estimating runoff on the road |
| recommend in line for this unusual method are not too far off the regulated percentages, this is a minor issue only, herefore A the results of this unusual method are not too far off the regulated method is needed for applying climate change elementages, this is a minor issue only. In the season of the sun of the season of | | | | | | | This is addressed within the accompanying technical note | of the modelling may be OK for a first-run analysis. | and other hard surfaces and over-estimating runoff on bare-earth surfaces. |
| recommend in line for this unusual method are not too far off the regulated percentages, this is a minor issue only, herefore A the results of this unusual method are not too far off the regulated method is needed for applying climate change elementages, this is a minor issue only. In the season of the sun of the season of | | | | | | (Minor issue) For climate change runs on the Allerdene catchment | | | |
| The text in Section 3.3.4 of Appendix A suggests an unusual method was used to apply climate change uplifts for the pluvial analysis (the ReFHz 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 | | | | | | recommend instead simply multiplying the initial flow hydrographs using | | | |
| method is needed for applying climate change uplifts for the pluvial analysis (the ReFH loss model is non-linear). The text in Section 3.3.4 of Appendix A suggests an unusual method was used to apply climate change analysis, it is standard practice to simply multiply the final fluvial hydrographs by the percentage increase. Minor issue The River Team model is direct rainfall s | | | | | | the results of this unusual method are not too far off the required | | | |
| 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 sundard practice to simply multiply the final fluvial hydrographs by the percentage increase. Minor issue Minor | | | | | | method is needed for applying climate change uplifts for the pluvial | | | |
| Climate change Consistent with latest guidance? A-34 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 instead of UKCP09 in search to come ovavailable in this case. (https://www.gov.uk/guidance/flood-risk-assessments-climate-change analysis. With latest guidance? A-34 allowances, altering the rainfall applied to ReFH2. As the Allerdene part of the study is a fluvial analysis, it is sundared practice to simply multiply the final fluvial hydrographs by the percentage increase. Minor issue instead of UKCP018 cuitates change analysis. While some UKCP18 or coverable and the proposal fluvial analysis, it is standard practice to simply multiply the final fluvial hydrographs by the percentage increase. Minor issue instead of UKCP018 cuitates change analysis. While some UKCP18 climate change upilit factors for luvial / rainfall so therefore the review of the standard practice to simply multiply the final fluvial hydrographs by the percentage increase. The River Team model is direct rainfall so therefore the normal fluvial approach is not available. As the review of the normal fluvial approach is not available. As the review of the normal fluvial approach is not available. As the review of the normal fluvial approach is not available. As the review of the normal fluvial approach is not available. As the review of the normal fluvial approach is not available. As the review of the normal fluvial approach is not available. As the review of the normal fluvial appr | | | | The tout in Section 2.2.4 of Appendix A guarante on unusual mathed | | | | | |
| datasets to simple uplift factors for fluvial / rainfall inputs, due to be released later to inform updy year beet duplift factors, but current guidance annually to inform updy year beet duplift factors from the update uplift factors for fluvial proach is not available. As the reviewer outlines this approach gives very similar answers, therefore no change is required. Since the first review was carried out, the update uplift factors from UKCP09. No action required apart from the update uplift factors from UKCP09 to UKCP18 occurred over the life of the update uplift factors for fluvial proach is not available. As the reviewer outlines this approach gives very similar answers, therefore no change is required. Since the first review was carried out, the update uplift factors have now this, given the transition from UKCP09 to UKCP18 occurred over the life of the normal fluvial approach is not available. As the reviewer outlines this approach gives very similar answers, therefore no change is required. 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 River Team model is direct rainfall so therefore the normal fluvial approach gives very similar answers, therefore no change is required. The River Team model is direct rainfall so therefore the normal fluvial approach gives very similar answers, therefore no change is required. The River Team mo | Climate change | Consistent with latest guidance? | A-34 | allowances, altering the rainfall applied to ReFH2. As the Allerdene part of the study is a fluvial analysis, it is | Minor issue | instead of UKCP09 for climate change analysis. While some UKCP18 | | | |
| manually to inform updated updiff factors, but current guidance recommend fluvial approach is not available. As the reveiwer outlines this approach gives very similar answers, therefore no change is required. the normal fluvial approach is not available. As the reveiwer outlines this approach gives very similar answers, therefore no change is required. Since the first review was carried out, the not have changed significantly from UKCP09. No action required apart from the proach to climate change upinf factors have now this, given the transition from UKCP09 to UKCP18 occurred over the life of | | | | staniuaru practice to simply multiply the tinal fluvial hydrographs by the percentage increase. | | datasets to simple uplift factors for fluvial / rainfall inputs, due to be | | | |
| recommends this so the use of up first prime face (req.) power stations). Therefore the up do up first prime face (req.) power stations). Therefore the up do up first prime face (req.) power stations). Therefore the up do up first prime face (req.) power stations). Therefore the up do up first prime face (req.) power stations). The up first prime face (req.) power stations). The supproach is up first prime face (req.) power stations). The up first prime face (req.) power stations (red.) power stations (req.) power stations (red.) power st | | | | | | manually to inform updated uplift factors, but current guidance | | | |
| guidance (2016 document) using the cross suitable if this case. (https://www.ncss) Since the first review was carried out, the lower change uplift factors have now this, given the transition from UKCP09. No action required apart from UKCP08 to limit the change uplift factors have now this, given the transition from UKCP09 to UKCP18 occurred over the life of | | | | | | stations). Therefore the use of uplift factors from the current EA | reveiwer outlines this approach gives very similar | | Perhans worth a quick chack with the latest published factors, there |
| allowances) The approach to climate change was agreed with UKCP18 climate change uplift factors have now this, given the transition from UKCP09 to UKCP18 occurred over the life of | | | | | | (https://www.gov.uk/guidance/flood-risk-assessments-climate-change- | | | not have changed significantly from UKCP09. No action required apart from |
| | | | | | | | Line approach to climate change was agreed with | ELIKE P18 climate change unlift factors have now | |

| | | | | | Reporting and follow up actions | | | | |
|------------------------|--------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------------------|------------------------------------------|--|--|--|
| | Suitability of reporting | | 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 | A-36 | Some issues and omissions spotted, as listed above. | Major issue | See above | No changes other than above are proposed | | | |
| Reporting and Results. | Recommendations | | 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 | No changes other than above are proposed | | | |

| В | Review of River Team Viaduct | | | | | | | | | | | |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------|--------------------------------|--|--|--|--|--|
| Date of model | August 2018 | | | | | | | | | | | |
| Name of reviewer | Jenny Hill | | | | | | П | | | | | |
| Date of review | 03/03/2020 | | | | | | J | | | | | |
| Revision | v3 | | | | | | cor | | | | | |
| | | | | | | | | | | | | |
| Applicable standards or guidance | | | | | | | _ | | | | | |
| | | | | | | | 1 | | | | | |
| Nature of study watercourse(s)/constraints | Allerdene Burn | | | | | | ı | | | | | |
| Study objectives | Hydraulic modelling to the River Team at J Hydraulic modelling of the Allerdene Burn a. the extension of the existing Allerdene cu | Junction 67 to assess the impact of the extension of the Kingsw to understand the impact of the A1 realignment which will requi juvert and replacement of the existing section of the Burn; replacement and realignment of the existing burn to accommoda lood risk at Junction 66. | ray Viaduct. This re either: | ley to Coal House Scheme. Three areas were identified for further modelling: modelling utilises an existing Environment Agency hydraulic model of the River Team constructed by over the existing railway line. | JBA in 2014. | | Key Purple - I Red - cha | | | | | |
| Summary of 1st review | As the baseline model was constructed by oppoposed scenario examined. | he 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, | | | | | | | | | | |
| Category | Detail | Prompts | ID | Comment | Suitability | Suggested actions | Const | | | | | |

| Category | Detail | Prompts | ID | Comment | Suitability | Suggested actions | Consultants Response (if required) | Comment | Suggested action |
|----------------------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------------|
| -9-17 | | | | Data to be reviewed | | | management (in required) | | 50 |
| | | Verine | B-1 | InfoWorks ICM v6 | Assessable | <u> </u> | | | |
| | Software | ~ Versions | B-1 B-2 | Updated to v8 for the purpose of this review | Acceptable Acceptable | | N/A | | |
| | | | B-2 | 1% AEP + 20 or 40% and 0.1% AEP. | Acceptable | | N/A N/A | | |
| Data to be reviewed | AEPs provided / reviewed | | B-4 | 1% AEP event reviewed. | Acceptable | | N/A | 1 | |
| | 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 | | |
| | | ~ Reference versions | | | | | 19/11 | | |
| | Reports | ~ Technical reporting ~ General reporting | B-6 | FRA report with technical appendices | Acceptable | | N/A | <u> </u> | |
| | | | | Reporting | | | | • | |
| | | ~ Objectives | | The report states that Modelling changes are confined to the A1 junction 67 roundabout 424950, | | I | | | |
| D 4 | | Constraints Approach Justification (both model scale and structure) | B-8 | 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 | | |
| Reporting | Reporting | scale) ~ Clarity | B-9 | Reporting generally clear and thorough | Acceptable | | N/A | | |
| | | ~ Assumptions | B-10 | Results discussed | Acceptable | | N/A | | |
| | | | | General comments | | | | | |
| | | | | | | | ED = Engineering Design, based upon | | |
| | | ~ Scenarios | 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 | Scheme drawings AD = Assumed Data, engineering | Thank you for clarifying | No further action required. |
| | File organisation / naming convention | ~ Naming | | | | | judgement used | | |
| General comments | | ~ Flags | B-13 | The viaduct option has been created as a scenario from the base model, which follows best practice. | Acceptable | <u> </u> | N/A | <u> </u> | <u> </u> |
| | | Ann | 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 | Thank you for clarifying | No further action 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 | DTM issued | Thank you for supplying | |
| | | | | General modelling approach | | | | | |
| | | ~ Domain boundaries | | | | I | | | |
| | Model extents | ~ Upstream/downstream boundaries | B-18 | Domain is unchanged from the base model | Acceptable | | | | |
| | | ~ Potential downstream influences on water levels ~ Glass walling | | | | | N/A | | |
| 0 | Madellian annual | ~ 1D / 2D / Linked | B-19 | A 1D-2D approach has been used for the watercourse and a 2D representation of the viaduct | Acceptable | | N/A | | |
| General modelling approach | Modelling approach | ~ georeferenced (ixy/gxy/2d links) | B-20 | pillars has been used. The model is fully geo-referenced. | Acceptable | | N/A | | |
| | | ~ Lumped / distributed | | | | | | | |
| | Application of hydrological estimates | ~ Applied to 1D or 2D domain ~ Lateral or point inflows | B-21 | The application of the hydrology is unchanged from the base model | Acceptable | | | | |
| | | ~ Consistency with reporting | | | | | N/A | | |
| | | | | InfoWorks ICM | | | | | |
| | | | | The model is an adapted version of the JBA built, Environment Agency approved model. The | | | | | |
| | | - Hard bed / soft bed - Accuracy of modelled channel length | B-23 | 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 | Acceptable | | | | |
| | Model build | | | existing EA model. This concluded that WSP's description of the changes was accurate. | | <u> </u> | N/A | <u> </u> | |
| | Woodi bullu | | B-24 | The modelling report does not comment on whether hard or soft bed have been modelled. | Acceptable | | | | |
| | | | 5-24 | However, as the is a proposed design, it is assumed a hard bed level was implemented. | , woodang | | 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 | | |
| | | | 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 | | |
| | | ~ Deactivation ~ Interpolates | B-28 | | Acceptable | | N/A N/A | | |
| | Watercourses | ~ Bank level and DTM matchup | 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 | Minor issue | Modify 1D or 2D water levels to allow a better | This is addressed within the | The consultant has documented attempts to improve stability as suitablly justified the apprach and | No further action required. |
| | | ~ Bank coefficients ~ Baseflow | | exceed bank tops so this has potential to impact the results. | | match of levels in area of interest | accompanying technical note | documented the limitations. | no rather action required. |
| | | | B-30 | River sections look sensible but few panel markers have been used. | Acceptable | Update panel markers and channel | N/A | | |
| | | | B-31 | Conveyance plots for TE05365 and TE05340 are kinked at higher depths. | Minor issue | roughness to smooth conveyance plots at | Soo B 20 response | | |
| | | ~ Bridges | B-32 | 25 mesh zones have been used to represent viaduct pillars in the flood plain | Acceptable | deeper flows. | See B-29 response N/A | | |
| InfoWorks ICM | Watercourse structures | ~ Culverts ~ Screens | 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 | Acceptable | | | | |
| | vvatercourse structures | ~ Weirs ~ Flap valves | | change of 0m. | | | N/A | | |
| | | ~ Plap valves ~ Sluices | B-34 | Notes have been used to describe which pillars are existing and which are proposed, which is helpful. | Acceptable | | N/A | | |
| | | ~ Mesh optimisation | | | | la fide an analyla signer of | | | |
| | Mesh | ~ Infiltration surfaces ~ Initial conditions | 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 | We havent had a significant issue with | This was only a suggestion for future models, non changes were required. | No further action required. |
| | | ~ Rainfall applied to the mesh. Use of sub catchments ~ 1D/2D linking: bank lines, manhole flood types, inline banks | | acond and area of interest which could stow model full units. | | triangles. | model run times, therefore no changes | onangos were required. | |
| | Mesh modifications | ~ Representation of roads and buildings | | See watercourse structures above | Acceptable | | have been made N/A | | |
| | | ~ Do minimum (baseline) | 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 | | |
| | Scenarios | ~ Do nothing ~ Do something | B-39 | Deen reviewed to avoid a conflict of interest. Only Kingsway Bridge Extension scenario has been reviewed. | Acceptable | | N/A | | |
| | ~ Results generated | | | Results are saved every 5 minutes. | Acceptable | | N/A N/A | | |
| | Run parameters and output data | ~ Temporal resolution of results ~ Run parameters | B-41 | Timestep used was 4 seconds | Acceptable | | N/A | | |
| | | ~ Run parameters | B-42 | Simulation was run for 30-hours which allows the full storm to pass in the area of interest. | Acceptable | | N/A | | |
| | | | | Runs | | | | | |
| | | | B-136 | Sims provided for the base and scenario for the 1, 1 +20 or 40% and 0.1% AEP events. | Acceptable | | | | |
| | | Model simulation runs ~ Existing (baseline) | | | | | N/A | 1 | |
| | Model simulations | ~ Climate change ~ Sensitivity | B-137 | No sensitivity tests were provided. | Minor issue | Run sensitivity tests | | The consultant has documented the model's sensitivity to channel roughness. This did not suggest any | No further action required. |
| | | Constant | | | | | This is addressed within the accompanying technical note | ammendments to the base model where required. | |
| | | | | II | | I . | punying tooninous note | 1 | |

Figure 1: Small triangles around pillars



| | | | 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. |
|-----------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| | | ~ zzd. eof. tlf | | Total mass error = 9.9 m3 | Acceptable | | N/A | | |
| | | ~ Model warnings and errors | B-141 | Volume balance error = 0.9 % | Acceptable | | N/A | | |
| | Model stability | Non-convergence Mass balance unrealistic oscillations (water level / flow / boundaries / dVol). | | 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 suitablly justified the apprach and documented the limitations. | No further action required. |
| Model results, interpretation, verification and stability | | Circulate Contaction (Material 1996) 1000 (Contaction) | 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 | | The consultant has documented attempts to improve stability as suitablly justified the apprach 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 ammendments 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 justifaction for not completing model proving. | No further action required. |

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

Figure 2: In channel flows ate TEAM_5156.1

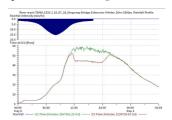
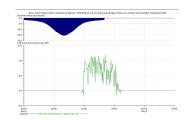
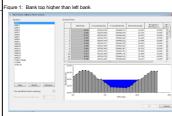


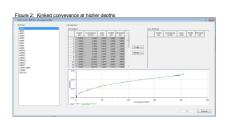
Figure 3: : Left bank flows at TEAM_5156.1

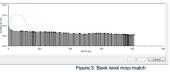


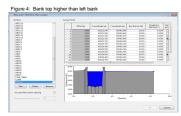
| В | Review of Alledene Burn | | | | | | | | | | |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--|--|--|--|--|--|--|--|--|
| Date of model | August 2018 | | | | | | | | | | |
| Name of reviewer | Jenny Hill | | | | | | | | | | |
| Date of review | 19/07/2019 | | | | | | | | | | |
| Revision | vi . | consulting | | | | | | | | | |
| Applicable standards or guidance | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| Nature of study watercourse(s)/constraints | Alledene Burn | | | | | | | | | | |
| , | The reporting states: Flood Risk Assessment (FRA) to support the Environmental Impact Assessment (EIA) and DCO Application for the A1 Bitfley 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 Valadict. This modelling utilities an existing Environment Agency hydraulic model of the River Team constructed by JBA in 2014 Hydraulic modelling of the Allederies Durin to understant for impact of the register with the regi | | | | | | | | | | |
| 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 resting and model proving, should be provided for review. | | | | | | | | | | |
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| | L | | | | | | | | | | |

| | Detail | Prompts | ID | Comment | Suitability | Suggested actions | Consultants Response (if required) | Comment | Suggested action |
|---------------------------|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| | | | | 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 | - | |
| ata to be reviewed | 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 | B-4 | FRA report with technical appendices | Acceptable | | | | |
| | | - General reporting | | | | | N/A | | |
| | | | | Reporting | | | | | |
| | | - Objectives - Constraints | B-6 B-7 | Objectives clearly stated in the reporting Reporting generally clear and thorough | Acceptable Acceptable | | N/A N/A | | |
| 'enorting | Reporting | 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 | This is addressed within the accompanying | The consultants note clarifies this. | No further action required. |
| cporang | repairing | ~ Clarity | | | - | reporting provided for review. | technical note | | - |
| | | Assumptions Interpretation of results | B-9 | Results discussed | Acceptable | | | | |
| | | | | General comments | | | | | |
| | | | | Scenarios and files well labelled although it was a bit confusing to establish what is the base | | In future, use one model network with a series of | | | |
| General comments | File organisation / naming convention | ~ Scenarios | B-11 | 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 | scenarios to represents 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 The DTM has not been provided which makes comparisons more difficult. A lidar clip has been | Acceptable | | N/A | | |
| | | Ago | B-14 | made but it understood that the model DTM was a composite of three sources According to the report, Channel survey for Alledene Culvert was undertaken by Longdin | Clarification required | In future, provide the DTM used | DTM provided | Thank you for supplying | No further action required. |
| | Survey / topographic data | - Quality - Suitability | B-15 | and Browning in March 2018 | Acceptable | | N/A | | |
| | Other | Suitability Any significant missing data | B-16 B-17 | Lidar data was supplemented by topo survey in the study area. NextMap 5m has been used to north east of the A1 which has partial or no Lidar coverage. | Acceptable Acceptable | | N/A | | |
| | Other | ~ Any significant missing data | D-17 | | Acceptable | | N/A | | |
| | | | | General modelling approach | | | | | |
| | Model extents | Domain boundaries Upstream/downstream boundaries | 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 | | |
| | INJURI EXICITIO | Potential downstream influences on water levels Glass walling | 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/Δ | | |
| eneral modelling approach | Modelling approach | ~ 1D / 2D / Linked | B-21 | 1D river reaches are linked to the 2D domain at banks. | Acceptable | | N/A | | |
| 9 | | - georeferenced (kxy/gxy/2d links) - Lumped / distributed | B-22 B-23 | Model is fully georeferenced Inflows have been applied at the upstream extent of the model | Acceptable Acceptable | | N/A N/A | - | |
| | Application of hydrological estimates | Applied to 1D or 2D domain Lateral or point inflows | B-24 | No lateral inflows are made, but it is not anticipated that these would be required for a | Acceptable | | N/Δ | | |
| | | Lateral or point inflows Consistency with reporting | B-25 | watercourse of this size. A downstream water level from the River Team for the same AEP has bee applied. | Acceptable | | N/A | <u></u> | |
| | | | | InfoWorks ICM | | | | | |
| | Model build | ~ Hard bed / soft bed | 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. |
| | .woder build | - Accuracy of modelled channel length | 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 | | |
| | | | B-29 | 1D river reaches have been voided from the 2D zone to avoid double counting Interpolates have been used excessively, with on interpolate every 10m. The interpolates have | Acceptable | | N/A | | |
| | | ~ Deactivation ~ Interpolates | B-30 | not caused any kinks in the conveyance plots so it is concluded that this is unlikely to impact | Acceptable - but does not meet best practice | | N/Δ | | |
| | Watercourses | ~ Bank level and DTM matchup | | results. Bank levels are interpolated between survey points rather than updated from the DTM. In some | | In future, update bank levels from DTM in | This is addressed within the access and a | | No. 6 and a second |
| | | ~ Bank coefficients ~ Baseflow | B-31 | cases this can make the 1D bank 2m above the 2D level | Minor issue | between surveyed cross sections if there is good confidence in the DTM levels. | technical note | The consultant has justified their approach. | No further action required. |
| | | | B-32 B-33 | Discharge coefficient of 1 and modular limit of 0.8 consistently used. No inflow applied to the river reach link as inflow hydrograph has been used. | Acceptable Acceptable | | N/A | | |
| | | | - 5 55 | 7 culverts have been modelled. The data flags suggested 6 of these 7 have been modelled from | Proception | | | | |
| | | - Bridges - Culverts | B-34 | 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 | | | | |
| | Watercourse structures | ~ Screens | B-35 | Culvert inlets and outlets consistently used with appropriate coefficients applied. | Acceptable | | N/A N/A | | |
| | | ~ Weirs ~ Flap valves | B-36 | 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 | Acceptable | | | | |
| | | ~ Stuices | | been left as default. | | | N/A | | |
| | | ~ Mesh optimisation | B-37 B-38 | Summary on none modelled: flap valve, orifice, pump, screen, weirs Max triangle area was 20m ² and minimum element was 10m ² which is appropriate for a model of | Acceptable Acceptable | | IN/A | + | |
| | Mesh | - Mesn optimisation - Infilitation surfaces - Initial conditions - Rainfall applied to the mesh. Use of sub catchments - 1D/2D linking: bank lines, manhole flood types, inline banks | B-39 | this scale. The general roughness was 0.035 which is within typical range. No mesh warnings have were produced. | Acceptable | | N/A N/A | | |
| | | | B-40 B-41 | 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 required | Clarify if rainfall was an intended inflow to this | Rainfall was only applied in a small sub catchment, with the model being predominantly | Thank you for clarifying. | No further action required. |
| | | | | clarification on why rainfall files have been included is required. | Olambailon required | model. | fluvial. | Thank you to countying. | reo iditilo dollor required. |
| | | | | 1D-2D linking happens at bank lines which has been successfully achieved. | Acceptable | Represent buildings, road, woodland, scrub as | IN/A This model covers a small area and this level of | | No. Control of the Control |
| | Mesh modifications | ~ Representation of roads and buildings ~ Roughness | B-42 | There is no representation of the conveyance in highways or the resistance caused by buildings. | Minor issue | roughness zones in the 2D model. | detail is not required in this instance | Thank you for clarifying. | No further action required. |
| | | ~ Roughness | | However, the raised highway embankment are represented in the DTM and therefore the mesh. | Acceptable | | N/A | | |
| | | | B-43 | noncret, the raised highway embanished are represented in the 21m and discusse the mean. | | | | | |
| | | | B-43 | Option 1a: Ditch re-aligntment | | | 1905 | | |
| | | | B-43 | Option 1a: Ditch re-alightment A Mesh Level Zone has been added over the existing watercourse. This adjusts the DTM | | | INO | | |
| | | | B-43 | Option 1a: Ditch re-alightment 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 3 vive indicates that his level zone has lowered the existing embankment. There has been no | 5 | | INC | | |
| foWorks ICM | | | B-43 | Option 1s: Ditch re-alightment 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 31 view indicates that this level zone has bewere the existing embendment. There has been no are considered to the contract of the | 5 | | 1995 | | |
| Works ICM | | | B-43 | Option 1a: Dilch me-alightment 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 38 view indicates that this level zone has lowered the existing embarkment. There has been no modification of the ground releval to the in worth the proposed bank heights. In some locations this can cause a 1m discrepancy between 10 and 20 bank level. This is not shown to impact 0.1% The estended outlet has been connected to the proposed capter with a brasik node, I would | 5 | | 1900 | | |
| pWorks ICM | | | B-43 | Option 1s: Ditch in-elightment A Mech Level Zone has been added over the existing watercourse. This adjusts the DTM A Mech Level Zone has been added over the existing measurement elevation of 1.5 m AOD. A 30 wire vincitate that this level zone has lowered the existing embankment. There has been no modification of the ground levels to be in worth 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 culver has been connected to the proposed culter with a break node. I would hink it more likely that amanhole chamber would be installed to connect these. A manhole | 5 | | N/A | | |
| loWorks ICM | | | | Option 1s: Ditch ne-alightment 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 31 view indicates that this level zone has bewered the existing embenkment. There has been no view indicates that this level zone has bewered the existing embenkment. There has been no care a first end exceptancy between 10 and 2D bank level. This is not shown to impact 0.1% AEP results. The extended culvent has been connected to the proposed culvert with a break node. I would wrisk it more likely that a markholic chamber would be installed to correct these. A markhol surcharged at the geals of the 0.1% AEP events to this is not lought to impact results. | | | NA NA | | |
| oWorks ICM | | | | Option 1a: Ditch re-alightment A Mesh Level Zone has been added over the existing watercourse. This adjusts the DTM elevation to give an immirrum elevation of 16 mAOD and maximum elevation of 17.5 mAOD. A 38 view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground relevation to it worth the proposed such heights. In some locations this AEP result AEP result The estanded culture has been connected to the proposed culter with a break notice. It would think it more likely that a markhoic chamber would be installed to connect these. A manhoic would have the potential to flood whereas a break node does not. However, the pipe is not surchanged at the peak of the UT is AEP event to this is not thought to impact esults. The new cross sections mainly look sensible but ARD1 - ARD4 all have let the love them the | | | N/A | | |
| oWorks ICM | | | | Option 1a: Dilch ne-alightment 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 31 view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground relevation to it worth the proposed bank heights. In none locations this configuration is not discrepancy between 10 and 20 bean keet. This is not above to impact 0.1% The estended outlet has been connected to the proposed calcular with a break node. I would think it more likely that a manholic chamber would be installed to connect these. A manhole would be not such a proposed to the proposed collect on the sone. If the word is not such apped at the peak of the 0.1% AEP event so this is not thought to impact results. The outginess of the proposed collect him to these injudices of the death. The highest point, allowing for premature fooding (Figure 1). However, the max water level doesn't second bit than keep in the outginess or the in the 11% AEP event so this in not thought to impact results. | | | N/A | | |
| oWarks ICM | | | | Option 1x: Ditch re-alightment 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 3t view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground relevat to its in worth the proposed bank heights. In some locations this can cause a 1m discrepancy between 10 and 2D bank level. This is not shown to impact 0.1% Fresults. Fresults. The control of the proposed could be a proposed collect with a brasis forced, twodid think it more likely that a marbolic chamber would be installed to connect these. A marbole would have the potential to flood whereas a brasis mode does. It chower, 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 culver has not been updated from default. The The rever cross sections mainly look sensible but ARDI - ARDI all howe let bank lower than the highest point, discoving for premature locating (Figure 1). However, the max water level decision is kniked at higher depths (Figure 2). However, the max water depth decent to the 0.1% AEP event to this is not throught to impact. | | | N/A | | |
| oWorks ICM | | | | Option 1a: Ditch re-alghtment A Mesh Level Zone has been added over the existing watercourse. This adjusts the DTM elevation to give an immirrum elevation of 15 mAOD and maximum elevation of 17.5 mAOD. A 3 view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground levels to list in worth the proposed bank heights. In some locations this can cause a 1m discrepancy between 10 and 20 bank level. This is not shown to impact 0.1% AEP results. The extended culvent has been connected to the proposed culvert with a break node, it would write in the proposed culvert with a break node would not work to the installed to connect these. A manhole would have the proposed culvert with a break node would be installed to connect these. A manhole would have the proposed culvert has been conditioned from default. The the complexes of the proposed culvert has not been updated from default. The the complexes of the proposed culvert has not been updated from default. The the contract of the proposed culvert has not been updated from default. The level of the 0.15 keP events to this is not thought to impact results acceded the bank level in the 0.15 k.PP events to this is not thought to impact results. The conveyance of the new cross sections is kinked at higher deptin (Figure 2). However, the | | | N/A | | |
| eWorks ICM | Scenarios | - Do minimum (baseline) | | Option 1a: Ditch re-alightment 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 31 view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground relevation to its worth the proposed bank heights. In once locations this consideration of the ground relevation to its worth the proposed bank heights. In once locations this AEP result in the proposed collection of the proposed collection of the proposed collection of the proposed collective with a break node. I would think it more likely that a manifolic chamber would be installed to connect these. A manhole would have the potential to float whereas a break node does not. However, the pipe is not succharged at the peak of the 0.1% AEP event so this is not thought to impact essible. The proposed collection analy lock sensible but ABOT - ABOS all have let both lower than the highest point, allowing for premature flooring (Figure 1). However, the max water level doesn't next the location result lock sensible but ABOT - ABOS at large with business than the convergence 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. | | | NA. | | |
| Works ICM | Scenarios | - Do minimum (baseline) - Do nothing - Do sonthing | | Option 1a: Ditch re-alightment 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 31 view indicates that this level zone has lowered the existing embarkment. There has been no modification of the ground relevation to its worth the proposed bank heights. In some locations this can cause a fin discrepancy between 10 and 20 bank level. This is not shown to impact 0.1% The estended outler has been connected to the proposed cubert with a brasis node. I would think it more likely that a markolic chamber would be installed to connect these. A markole would have the potential to fload whereas a brasis mode done. It between the pipe is not surcharged at the peak of the 0.1% AEP event so this is not thought to impact results. The reciprises of the proposed cuber has not been updated from default. The The time rocus sections mainly look sensible but ARDI - ARDI 48 has well the time than the The time trough the proposed cuber has not been updated from default. The conveyance of the new cross sections is kinked at higher deights (Figure 2). However, the max water depth doesn't exact his level in the 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 exact his level in the 1% AEP event so this is not thought to impact results. Quiton 11b. Distribution for the been added over the existing watercourse, as before (for comments see cotions in all the event as the new of the control.) | | | NA NA | | |
| Works ICM | Scenarios | ~ Do nothing | B-44 | Option 1a: Ditch re-alightment A Mesh Level Zone has been added over the existing wetercourse. This adjusts the DTM elevation to give a minimum elevation of 16 mAOD and maximum elevation of 17.5 mAOD. A 31 view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground elevats to let worth the proposed bank heights. In some locations this can cause a 1m discrepancy between 10 and 2D bank level. This is not shown to impact 0.1% APP results. The standard has been connected on the proposed cuberlaw that brank indice, I would the standard has been connected on the proposed cuberlaw that brank indice, I would the standard has been connected to the proposed cuberlaw that brank indice, I would the standard that the proposed cuberlaw has brank node does not. However, the pipe in not surcharged at the peak of the 0.1% AEP event so this is not thought to impact results. The roughness of the proposed cuberlaw has not been updated from default. The The new cross sections mainly look sensible but ARDI - ARDI 4 all have let bank lower than the highest point, allowing for premature foroiding (Figur 1). However, the max water level doesn't acceded let bank level in the 0.1% AEP event so this is not thought to impact results. The conveyance of the new cross sections is kinkel at higher depth (Figure 2). However, the max water depth doesn't resch this level in the 0.1% AEP event so this is not thought to impact results. Option 11x Disch resignment + flow corter! A Mesh Level 220ne has been added over the existing watercourse, as before (for comments see | Acceptable - but does not meet best practice | | N/A | | |
| 9Works ICM | Scenarios | ~ Do nothing | B-44 | Option 1a: Ditch ne-alightment A Mesh Level Zone has been added over the existing watercourse. This adjusts the DTM elevation to give an immirrum elevation of 15 m AOD and maximum elevation of 17.5 m AOD. A 31 view indicates that this level zone has bestered the existing embarkment. There has been no modification of the ground elevation to seve the proposed such heights. In some beatons this AEP results are considered to the proposed could height be proceed to the store the proposed could write the proposed could hear the seven to the proposed could write the propo | Acceptable - but does not meet best practice | | NAA | | |
| OWorks ICM | Scenarios | ~ Do nothing | B-44 | Option 1a: Ditch re-alightment 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 31 view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground relevation to it work the proposed such heights. In some locations this AEP results. Elevation of the proposed period water than 20 bear level. This is not alrown to impact 0.1%. AEP results Elevated the special conference of the proposed collect with a break non-level would think it more likely that a markhoic chamber would be installed to connect these. A markhoic would have the posterial to flood withered as break node does not. However, the pile is not would have the posterial to flood withered as break node does not. However, the pile is not the roughness of the proposed colvent has not been updated from default. The The rever consistence of the proposed colvent has not been updated from default. The The rever consistence of the proposed colvent has not been updated from default. The The rever consistence of the proposed colvent has not been updated from default. The The rever consistence of the proposed colvent has not been updated from default. The The rever consistence of the proposed colvent has not been updated from default. The The rever consistence of the proposed colvent has not been updated from default. The The rever consistence in the 0.1% AEP events to this is not thought to impact results. The conveyance of the new costs sections is kinkled at higher deptin (Figure 2). However, the new costs described the new of the deptin (Figure 2). However, the proposed to the new costs sections is kinkled at higher deptin (Figure 2). However, the proposed to the new costs sections is kinkled at higher deptin (Figure 2). However, the Option 10: Ditch realignment + flow control A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option | Acceptable - but does not meet best practice Acceptable - but does not meet best practice | | NA NA | | |
| Works ICM | Scenarios | ~ Do nothing | B-44 | Option 1a: Dilch ne-alightment A Mesh Level Zone has been added over the existing watercourse. This adjusts the DTM elevation to give a minimum elevation of 16 mA/OD and maximum elevation of 17.5 mA/OD. A 31 view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground relevate to eit worth the proposed bank heights. In some locations this can cause a 1m discrepancy between 10 and 20 bank level. This is not shown to impact 0.1% The estended outlet has been connected on the proposed cubert with a brasis notice. I would think it more likely that a marshole chamber would be installed to connect these. A marshole would have the potential to flood whereas a brasis node does. It. However, the pipe is not surcharged at the peak of the 0.1% AEP event bits in not floogist to impact results. The roughness of the proposed cuber has not been updated from eleast. The the roughness of the proposed cuber has not been updated from eleast. The the roughness of the proposed cuber has not been updated from eleast. The the compeance of the new cross sections is kinked at higher depths (Figure 2). However, the max water depth cells if the 0.1% AEP event on this is not flooght to impact results. The conveyance of the new cross sections is kinked at higher depths (Figure 2). However, the max water depth cells of the 0.1% AEP event on this is not flooght to impact results. The conveyance of the new cross sections is kinked at higher depths (Figure 2). However, the max water depth observal result has liken and the control A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option 1s). Pipe size of SARQUISC: 1 has been reduced from 1.35 to 1.2m in diameter. No other apparent changes made from 0.50 to 1 as is same comments stated. Option 2. Waduct A Mesh Level Zone has been added over the existing watercourse, as before (for comments see | Acceptable - but does not meet best practice Acceptable - but does not meet best practice | | NA NA | | |
| Works ICM | Scenarios | ~ Do nothing | B-44 | Option 1a: Ditch ne-alightment A Mesh Level Zone has been added over the existing watercourse. This adjusts the DTM elevation to give an immirrum elevation of 16 mAOD and maximum elevation of 17.5 mAOD. A 31 view indicates that this level zone has bestered the existing embarkment. There has been not view indicates that this level zone has bestered the existing embarkment. There has been not make the proposed beath heights. In some bestere the control of the proposed could height be the proposed could height be proposed to 18.6 AEP results of the proposed could height be proposed to 18.6 AEP results of the proposed could height be proposed could think it more likely that a manifolic chamber would be entailled to connect these. A manhole would have the potential to food whereas a break mode does not. However, the page is not of the proposed coulvert has not been updated from default. The The revort one control of the proposed coulvert has not been updated from default. The The revort one control of the proposed coulvert has not been updated from default. The The revort one control of the proposed coulvert has not been updated from default. The The revort one control of the proposed coulvert has not been updated from default. The The revort one control of the proposed coulvert has not been updated from default. The the new cross sections mainly look sensible but ARDIT - ARDIA of all have left back lover than the highest port, allowing for premature fooding (Figure 1). However, the max water level doesn't need to the proposed coulvert has not been updated from default to the control of the proposed coulvert has not been updated from default. The max water depth doesn't reach this level in the 0.1% AEP event so this is not thought to impact results. Option 11. Disch readigment + flow control Option 12. Disch readigment + flow control Option 12. Disch readigment + flow control A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option 1.3 to 1.2 m in diameter. No other appa | Acceptable - but does not meet best practice Acceptable - but does not meet best practice | Trim 1D cross sections to the highest point on the left bank. Update panel markers and | N/A | The documentation states that the model | No further action remirred |
| Works ICM | Scenarios | ~ Do nothing | B-44 | Option 1a: Dilch ne-alightment A Mesh Level Zone has been added over the existing watercourse. This adjusts the DTM elevation to give a minimum elevation of 16 mA/OD and maximum elevation of 17.5 mA/OD. A 31 view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground relevate to eit worth the proposed bank heights. In some locations this can cause a 1m discrepancy between 10 and 20 bank level. This is not shown to impact 0.1% The estended outlet has been connected on the proposed cubert with a brasis notice. I would think it more likely that a marshole chamber would be installed to connect these. A marshole would have the potential to flood whereas a brasis node does. It. However, the pipe is not surcharged at the peak of the 0.1% AEP event bits in not floogist to impact results. The roughness of the proposed cuber has not been updated from eleast. The the roughness of the proposed cuber has not been updated from eleast. The the roughness of the proposed cuber has not been updated from eleast. The the compeance of the new cross sections is kinked at higher depths (Figure 2). However, the max water depth cells if the 0.1% AEP event on this is not flooght to impact results. The conveyance of the new cross sections is kinked at higher depths (Figure 2). However, the max water depth cells of the 0.1% AEP event on this is not flooght to impact results. The conveyance of the new cross sections is kinked at higher depths (Figure 2). However, the max water depth observal result has liken and the control A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option 1s). Pipe size of SARQUISC: 1 has been reduced from 1.35 to 1.2m in diameter. No other apparent changes made from 0.50 to 1 as is same comments stated. Option 2. Waduct A Mesh Level Zone has been added over the existing watercourse, as before (for comments see | Acceptable - but does not meet best practice Acceptable - but does not meet best practice | Triin 1D cross sections to the highest point on the left bank. Update panel markers and channel roughness to smooth conveyance pilots at deeper floor. | NA NA | The documentation states that the model has been updated | No further action required. |
| Works ICM | Scenarios | ~ Do nothing | B-44 | Option 1a: Ditch re-alightment A Mesh Level Zone has been added over the existing watercourse. This adjusts the DTM elevation to give an imminum elevation of 16 mAOD and maximum elevation of 17.5 mAOD. A 31 view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground relevation to its worth the proposed bank heights. In some locations this consideration of 15 mAOD and relevant to the proposed bank heights. In some locations the AEP results. AEP results. The extended culture has been connected to the proposed culture with a break node, I would think it more likely that a markolic chamber would be installed to connect these. A manhole would have the potential to flood whereas a break node does not. However, the piec is not surcharged at the peak of the 0.1% AEP event so this is not hought to impact results. The nemous proposition single lock sensible but AED1 - AED4 all these levels are the highest point, allowing for premature flooding (Figure 1). However, the max water level doesn't. The conveyance of the new costs sections is kniked at higher depths (Figure 2). However, the max valuer captor have level to the single control of the new cross sections is kniked at higher depths (Figure 2). However, the max valuer captor have high the proposition of the new cross sections is kniked at higher depths (Figure 2). However, the max valuer captor have high the proposition of the new cross sections is kniked at higher depths (Figure 2). However, the max valuer captor high the proposition of the new cross sections is kniked at higher depths (Figure 2). However, the max valuer captor high the proposition of the new cross sections is kniked at higher depths (Figure 2). However, the max valuer captor have high the proposition of the new cross sections is kniked at higher depths (Figure 2). However, the max valuer captor high the control of the new cross sections is a both the highest proposition of the new cross of the new cross sections in the control of the new c | Acceptable - but does not meet best practice Acceptable - but does not meet best practice Acceptable - but does not meet best practice | the left bank. Update panel markers and channel roughness to smooth conveyance plots | NA NA | | No further action required. |
| Works ICM | Scenarios | ~ Do nothing | B-44 | Option 1a: Dilch ne-alightment 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 31 view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground relevation of 16 mAOD and maximum elevation of 17.5 mAOD. A 31 view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground relevation to its work the proposed bank heights. In some locations this case are such as a single proposed to the proposed collect of the proposed collect with a break node. I would think it more likely that a manholic chamber would be installed to connect these. A manhole would have the potential to float whereas a break node does not. However, the pipe is not surcharged at the peak of the 0.1% AEP event bits in not thought to impact results. The conjunct of the proposed collect has not been updated from eleath. The roughest of the proposed collect has not been updated from eleath. The roughest of the proposed collect has not been updated from eleath. The roughest of the proposed collect has not been updated from eleath. The acceptance of the new consists of the proposed collect has not been updated from eleath. The acceptance of the new consists of the new consists of the new consists. The conveyance of the new costs sections is kinked at higher depths (Figure 2). However, the max water depth obsert reach this level of the new consists and consists of the new consists of the new consists and the proposed collect in the 0.1% AEP event so this is not thought to impact results. Option 12. Unabut A Mach Level Zone has been added over the existing watercourse, as belone (for comments see Option 1a). Option 2. Visabut A Ment Level Zone has been added over the existing watercourse, as belone (for comments see Option 1a). Option 2. Visabut A Ment Level Zone has been added over the existing watercourse, as belone (for | Acceptable - but does not meet best practice Acceptable - but does not meet best practice Acceptable - but does not meet best practice | the left bank. Update panel markers and channel roughness to smooth conveyance plots | NIA NIA This is addressed within the accompanying | | No further action required. |
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| Works ICM | Scenarios | - Do nothing - Do something | B-44 B-45 B-46 | Option 1a: Ditch re-alightment A Mesh Level Zone has been added over the existing watercourse. This adjusts the DTM elevation to byte an immirrum elevation of 16 mAOD and maximum elevation of 17 mAOD. A 31 view indicates that this level zone has bowered the existing embankment. There has been no modification of the ground relevation of 16 mAOD and maximum elevation of 17.5 mAOD. A 31 view indicates that this level zone has been seen to work the proposed such heights. In some locations this consideration of 18 may 1 | Acceptable - but does not meet best practice Acceptable - but does not meet best practice Minor issue | the left bank. Update panel markers and channel roughness to smooth conveyance plots at deeper flows. Trim 1D cross sections to the highest point on | | has been updated | |
| Works ICM | | - Do nothing - Do something | B-45 B-46 B-47 B-48 | Option 1a: Ditch ne-alightment 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 31 view indicates that this level zone has besided the season of 18.7 mAOD and maximum elevation of 17.5 mAOD. A 31 view indicates that this level zone has besided the season of 18.7 mAOD and 20 bank level. This is not about to impact 0.1% AEP results. The estended culvert has been connected to the proposed culvert with a break node. I would think it nore likely that a marchine chamber would be installed to connect these. A machine surcharged at the pass of the 0.1% AEP events to this is not hought to impact results. The roughness of the proposed culvert has not been updated from default. The The new cross section mainly look ensuits but ARD1 - ARD4 all have left bank lover than the highest point, allowing for premiture fooding (frigure 1). However, the max water level doesn't necessity to the control of the control | Acceptable - but does not meet best practice Acceptable - but does not meet best practice Acceptable - but does not meet best practice Minor issue Acceptable | the left bank. Update panel markers and channel roughness to smooth conveyance pilots at deeper flows. Trim 1D cross sections to the highest point on the left bank. Update panel markers and channel roughness to smooth conveyance pilots. | technical note | has been updated The documentation states that the model | |
| Works ICM | Scenarios Run parameters and output data | - Do nothing - Do something | B-45 B-46 B-47 B-48 | Option 1a: Ditch re-alightment A Mesh Level Zone has been added over the existing watercourse. This adjusts the DTM elevation to byte an immirrum elevation of 16 mAOD and maximum elevation of 17 mAOD. A 31 view indicates that this level zone has bowered the existing embankment. There has been no modification of the ground relevation of 16 mAOD and maximum elevation of 17.5 mAOD. A 31 view indicates that this level zone has been seen to work the proposed such heights. In some locations this consideration of 18 may 1 | Acceptable - but does not meet best practice Acceptable - but does not meet best practice Minor issue | the left bank. Update panel markers and channel roughness to smooth conveyance pilots at deeper flows. Trim 1D cross sections to the highest point on the left bank. Update panel markers and channel roughness to smooth conveyance pilots. | technical note | has been updated The documentation states that the model | |
| Works ICM | | - Do nothing - Do something - Results generated - Temporal resolution of results | B-44 B-45 B-46 B-47 | Option 1a: Ditch re-alightment A Mesh Level Zone has been added over the existing watercourse. This adjusts the DTM elevation to give an immirmum elevation of 16 mAOD and maximum elevation of 17 mAOD. A 31 view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground relevation of 16 mAOD and maximum elevation of 17.5 mAOD. A 31 view indicates that this level zone has lowered the existing embankment. There has been non-classions this conditional property between 10 and 20 bank level. This is not afrown to impact 0.1% AEP results. The extended cuber has been connected to the proposed cuber with a brask node. I would think it more likely that a markholic chamber would be installed to connect these. A manhole would have the potential to flood witheres a brask node does not. However, the pipe is not surcharged at the peak of the 0.1% AEP event to this is not thought to impact essults. The new cross sections mainly look sensible but ARDI - ARDIS at law eller bank lower than the highest point, allowing for premature flooding (Figure 1). However, the max water level doesn't. The new cross sections mainly look sensible but ARDI - ARDIS at law eller bank lower than the highest point, allowing for premature flooding fiftings 1). However, the max water level doesn't. The conveyance of the new cross sections is kinked at higher depths (Figure 2). However, the max water level doesn't. Quite 10 control of the new cross sections is kinked at higher depths (Figure 2). However, the max water selected the new cross sections is kinked at higher depths (Figure 2). However, the max water seven to the new cross sections is kinked at higher depths (Figure 2). However, the max water seven to the new cross sections is kinked at higher depths (Figure 2). However, the nature water level doesn't. A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option 1), and the level Zone has been added over the existing watercourse, as before (for com | Acceptable - but does not meet best practice Acceptable - but does not meet best practice Minor issue Acceptable Acceptable Acceptable Acceptable | the left bank. Update panel markers and channel roughness to smooth conveyance pilots at deeper flows. Trim 1D cross sections to the highest point on the left bank. Update panel markers and channel roughness to smooth conveyance pilots. | technical note | has been updated The documentation states that the model | |
| oWorks ICM | | - Do nothing - Do something - Results generated - Temporal resolution of results | B-45 B-46 B-47 B-48 B-50 | Option 1s: Ditch ne-alightment 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 31 view indicates that this level zone has besided per elevation to give a minimum elevation of 16 mAOD and maximum elevation of 17.5 mAOD. A 31 view indicates that this level zone has besided per elevations. The set has been no impact of 15.6 AEP results. The estended culvent has been connected to the proposed culver with a break node. I would think it more likely that a marchial chamber would be installed to correct these. A marchial variat in more likely that a marchial chamber would be installed to correct these. A marchial variation per proposed culver has not been updated from default. The The rever cross section mainly took employed been updated from default. The The rever cross section mainly took employed been updated from default. The The rever cross sections mainly took employed been updated from default. The The rever cross section mainly took employed been sto this is not hought to impact results. The roughness of the proposed culvert has not been updated from default. The The new cross sections is kinked at higher depth (Figure 21.) However, the max water depth doesn't resch this level in the 0.1% AEP event so this is not thought to impact results. Option 11b. Ditch healignment 4 few control A Ment Level Zone has been added over the existing watercourse, as before (for comments see Option 1a). Pipe size of SAGUISc.1 has been reduced from 1.35 to 1.2m in diameter. No other apparent chances made from Cption 1 as to same comments stand. Option 2. Valuach the section of the proposed | Acceptable - but does not meet best practice Acceptable - but does not meet best practice Acceptable - but does not meet best practice Minor issue Acceptable Acceptable Acceptable Acceptable Acceptable | the left bank. Update panel markers and channel roughness to smooth conveyance pilots at deeper flows. Trim 1D cross sections to the highest point on the left bank. Update panel markers and channel roughness to smooth conveyance pilots. | technical note | has been updated The documentation states that the model | |
| 60Works ICM | | - Do nothing - Do something - Results generated - Temporal resolution of results - Run parameters | B-44 B-45 B-46 B-47 | Option 1a: Ditch re-alightment 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 31 view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground relevation to its worth the proposed bank heights. In some locations this view indicates that this level zone has lowered the existing embankment. There has been not modification of the ground relevation to its worth the proposed bank heights. In some locations this AEP results of the proposed collection of the AEP results of the proposed collective with a break node. I would think it more likely that a manifolic chamber would be installed to connect these. A manhole would have the potential to float whereas a break node does not. However, the pipe is not such repaid at the peak of the 0.1% AEP event so this is not flought to impact results. The conveyance of the new cross sections is kinkled at higher depths (Figure 2). However, the max water level does in the collection of the proposed collection and in the collection is a collection of the new cross sections is kinkled at higher depths (Figure 2). However, the max water clepts hear if not 15 mEze heart so this is not flought to impact results. The conveyance of the new cross sections is kinkled at higher depths (Figure 2). However, the max water clepts heart in the 0.1% AEP event so this is not flought to impact results. The conveyance of the new cross sections is kinkled at higher depths (Figure 2). However, the max water clepts heart in the 0.1% AEP event so this is not flought to impact results. The conveyance of the new cross sections is kinkled at higher depths (Figure 2). However, the max water clepts heart in the 0.1% AEP event to the loss is not thought to impact results. A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option 1a). Pipe size of SARQUISC. I has been reduced from 1.35 to 1 | Acceptable - but does not meet best practice Acceptable - but does not meet best practice Minor issue Minor issue Acceptable Acceptable Acceptable Acceptable | the left bank. Update panel markers and channel roughness to smooth conveyance pilots at deeper flows. Trim 1D cross sections to the highest point on the left bank. Update panel markers and channel roughness to smooth conveyance pilots. | technical note | has been updated The documentation states that the model has been updated | |
| eworks ICM | | - Do nothing - Do something - Results generated - Temporal resolution of results - Run parameters Model simulation runs - Existing (baseline) | B-45 B-46 B-47 B-48 B-50 | Option 1a: Ditch re-alightment 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 31 view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground relevation to its worth the proposed bank heights. In some locations this AEP results. The estanded cuber has been connected to the proposed cuber with a break no- tion of the state of the proposed as break node does not. However, the pile in not work that it man to level that a markhoic chamber would be installed to connect these. A markhoic would have the potential to flood whereas a break node does not. However, the pile in not think it more likely that a markhoic chamber would be installed to connect these. A markhoic would have the potential to flood whereas a break node does not. However, the pile in not the roughness of the proposed cubert has not been updated from default. The The new cross sections mainly lock sensible but ARD1 - ARD4 all have left bank lower than the highest print, allowing for premature flooding (Figure 1). However, the max water level doesn't. The roughness of the rise of 15 x EPP event so this is not being the topic of the rise or costs sections is kinkled at higher depths (Figure 2). However, the new cross sections mainly lock sensible but ARD1 - ARD4 all howeld to high results. Option 10: Ditch realignment + flow control A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option 13). Option 10: Ditch realignment + flow control A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option 14). There is no apparent level change in the model to account for lowering the highway enhaniment within is present in the DTM ARP imprond (in DTM) provided. As a result, in some places the new control of the control and the results as in | Acceptable - but does not meet best practice Acceptable - but does not meet best practice Acceptable - but does not meet best practice Minor issue Acceptable Acceptable Acceptable Acceptable Acceptable | the left bank. Update panel markers and channel roughness to smooth conveyance pilots at deeper flows. Trim 1D cross sections to the highest point on the left bank. Update panel markers and channel roughness to smooth conveyance pilots. | technical note | The documentation states that the model has been updated The been updated The consultant has documented the model's sensitivity to downstream | |
| Works ICM | Run parameters and output data | - Do nothing - Do something - Results generated - Temporal resolution of results - Run parameters Model simulation runs | B-45 B-46 B-47 B-48 B-50 | Option 1a: Ditch re-alightment 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 31 view indicates that this level zone has lowered the existing embankment. There has been no modification of the ground relevation to its worth the proposed bank heights. In some locations this AEP results. The estanded cuber has been connected to the proposed cuber with a break no- tion of the state of the proposed as break node does not. However, the pile in not work that it man to level that a markhoic chamber would be installed to connect these. A markhoic would have the potential to flood whereas a break node does not. However, the pile in not think it more likely that a markhoic chamber would be installed to connect these. A markhoic would have the potential to flood whereas a break node does not. However, the pile in not the roughness of the proposed cubert has not been updated from default. The The new cross sections mainly lock sensible but ARD1 - ARD4 all have left bank lower than the highest print, allowing for premature flooding (Figure 1). However, the max water level doesn't. The roughness of the rise of 15 x EPP event so this is not being the topic of the rise or costs sections is kinkled at higher depths (Figure 2). However, the new cross sections mainly lock sensible but ARD1 - ARD4 all howeld to high results. Option 10: Ditch realignment + flow control A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option 13). Option 10: Ditch realignment + flow control A Mesh Level Zone has been added over the existing watercourse, as before (for comments see Option 14). There is no apparent level change in the model to account for lowering the highway enhaniment within is present in the DTM ARP imprond (in DTM) provided. As a result, in some places the new control of the control and the results as in | Acceptable - but does not meet best practice Acceptable - but does not meet best practice Acceptable - but does not meet best practice Minor issue Acceptable Acceptable Acceptable Acceptable Acceptable | the left bank. Update panel markers and channel roughness to smooth conveyance pilots at deeper flows. Trim 1D cross sections to the highest point on the left bank. Update panel markers and channel roughness to smooth conveyance pilots. | See response to 8-47 NA NA NA NA NA | has been updated The documentation states that the model has been updated The consultant has documented the | |









| Model results, interpretation, verification and stability | | | | | | | | | | | |
|-----------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------------------|----------------------------------------------------------|---------------------------|-----------------------------|--|--|
| Model results, interpretation, verification and stability | Model stability | ~ zzd, eof, tif | 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 flows raise and fall in a smooth hydrograph | Acceptable | | N/A | | | | |
| | | Mass balance unrealistic oscillations (water level / flow / boundaries / dVol). | 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 | | | | |
| , | | Suitability of sensitivity testing undertaken Results & interpretation of sensitivity testing | 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. | | |
| | 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 | Thank you for clarifying. | No further action required. | | |

Acceptable
Acceptable - but does not meet best practice
Clinification required
Monor issue
Major issue
Recommendations

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