

- **Bridge Abutment Justification**

The geomorphology report recommends that the structure should have as large an opening as feasible to minimise flow contraction and scour between abutments. Therefore we request the applicant clarifies the following:

- Justification as to why the right-bank abutment must extend into the river;
- whether a set-back design was considered and ruled out;
- the geomorphological implications of the intrusion, including effects on flow constriction and sediment movement.

The west abutment must extend into the river for the following reasons:

- There is a 1.2m sewer buried 5m below Viaduct Way. This cannot feasibly be diverted due to its depth and size. Therefore, an easement has been provided from the bridge foundations to mitigate the risk of damage to this asset.
- There is also an intermediate pressure gas main under Viaduct Way – the cost to divert this asset would be a significant proportion of the overall scheme budget. Locating the abutment into the river channel provides more opportunity for the gas main to remain in-situ during the works.
- Viaduct Way is the sole access to several residential properties. This road must remain open during construction. The abutment ingress into the river channel provides more space for temporary works and traffic management.
- The junction onto Viaduct Way requires a bell mouth opening, resulting in an overall widening of the bridge. Setting the abutment back would result in a need to widen the bridge deck, increasing superstructure costs.

In terms of the geomorphological impact, it is noted that the river channel is highly constrained by the existing bridge and extensive existing bank protection. The replacement bridge has a 4m wider span across the river than the current bridge's central span, and will constrict flow less than at present. The Geomorphology Report included hydraulic analysis to consider the potential impacts of alterations to flow velocity and depth and the likely morphological implications – the outcomes are summarised in sections 6.2 and 6.3 of the report.

- **Scour and Bed Protection Design**

In line with the geomorphology recommendation that channel bed modification should be avoided as far as possible, and that any unavoidable works should be justified and designed to preserve sediment continuity, we request that further information to justify the extent and depth of bed protection proposed is submitted including:

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- rationale for the use of 25 m of riprap upstream and downstream of the bridge, particularly in the absence of in-channel piers;
 - hydraulic modelling outputs demonstrating the need for such protection;
 - explanation of how sediment transport and bedform dynamics will be maintained;
 - consideration of alternative, greener methods of bed protection.

Rationale for use of 25m of rip rap up/downstream of bridge:

The bed scour protection extends up and down stream away from the bridge for a minimum of 2x the predicted scour depth around the bridge abutment and wing wall foundations as per CIRIA guidance. This accounts for the maximum predicted scour depth under the bridge and the reduced amount of predicted scour either side of the bridge. The calculated scour depth was significant, due to the scour component resulting from the west abutment ingress into the 'channel' (the justification for this is explained above).

Hydraulic modelling results:

Please see below the flood event flow rates, velocities and flow levels for the node relevant to the proposed bridge within the hydraulic model.

Flood event	Flow (m ³ /s)	Level (mAOD)	Velocity (m/s)*
50% AEP	105.842	20.76	2.644
0.5% AEP +70% CC	289.735	23.666	3.409
0.1% AEP +70% CC	313.798	24.214	3.415

How are sediment and bedform dynamics maintained?

During previous consultation with Dale Cox from NRW, we were advised that any rip rap that was protecting the bed must be installed a minimum of 600mm below the existing bed level and that it must be reinstated to the existing river bed level with the arisings. This has been done and it is understood that this would allow the river bed to perform as it currently does (roughness, depth to allow for surface material to re-distribute locally, and sediment transport processes to continue to function similar to the existing situation).

- **Bank Protection Alternatives**

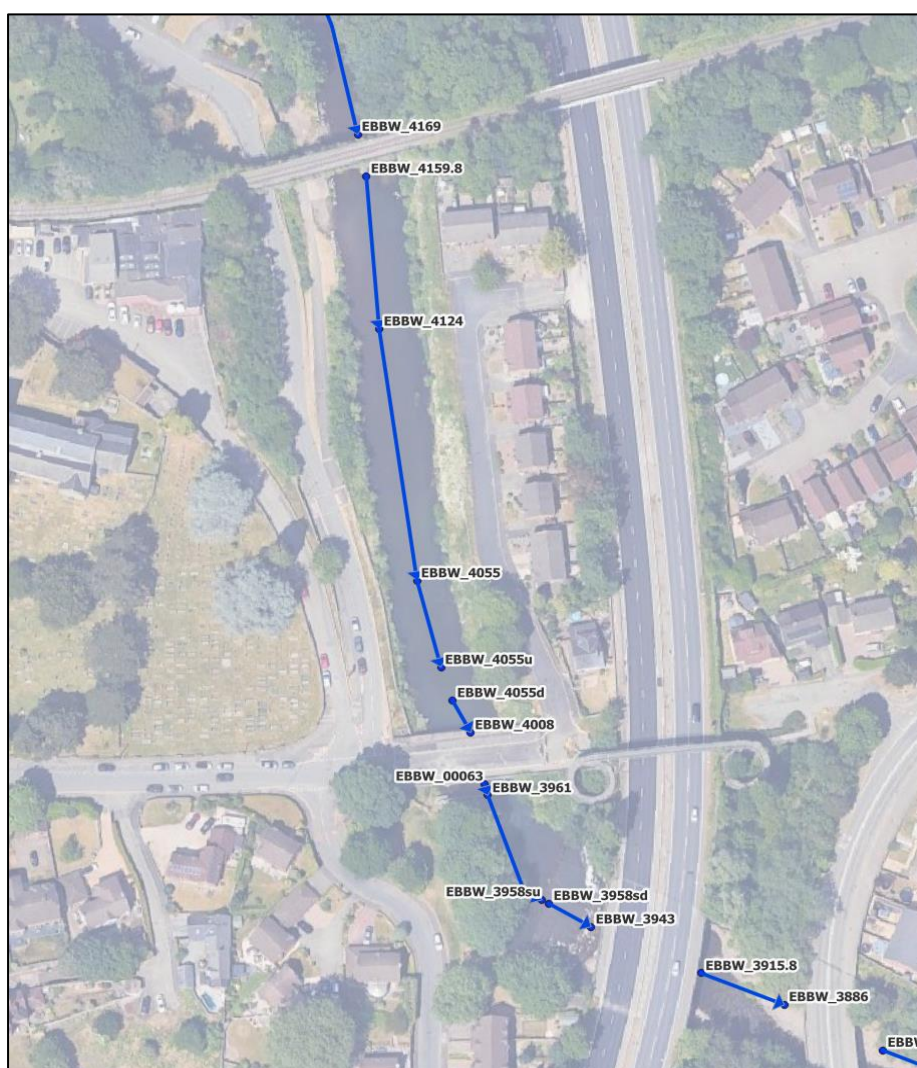
We request that a review of alternative bank protection methods be considered to reflect the geomorphology recommendation that green engineering solutions should be considered, to include:

- assessment of greener options such as vegetated rock rolls or bioengineering;
 - justification for the use of blockstone in the watercourse;
 - evidence that the selected method will not exacerbate bed scour or energy reflection.
- The bridge is required to have a design life of 120 years. The stability of the bridge is dependant on the performance of the scour protection as the bridge foundations have been designed assuming full embedment (i.e. no scour).
- Greener options were considered and investigated, however a product with a suitable design life, resistance to the expected velocities and that would be in keeping with the existing materials on site could not be identified. In addition, the difficulty, H&S risks and costs associated with replacing the scour protection once in-situ, meant that blockstones and rip rap were selected as the preferred scour protection options as these would require minimal maintenance during the design life. The blockstone protection also matches that which is currently in place, providing opportunity for material reuse and also blending the proposed design into the existing aesthetics of the area.
- Historic photos of the site (circa 2000/2001) show large rocky material being present around the old bridge, which suggests that this was present along the channel before the housing development at Viaduct Way was built. Therefore introduction of blockstone would be in keeping with this.
- In addition, due to the constraints of the site, such as: presence of mains utilities on the right bank and ensuring minimal changes to flooding up and down stream, the bank protection needed to have as small a footprint as possible to ensure that the cross sectional area of the opening under the bridge was as close to that of the original bridge as possible. The blockstone chosen ensured that these constraints could be met.
- The sediment transport process in a 50%AEP velocity, suggests that some size of material, if entrained by the flow from upstream, could deposit on the bed, rather than erode. This is then evened out by the effects of the calculated flood scour (ie a stop-start 'conveyor belt' of sediment transport). It is assumed that this episodic nature of sediment transport is what happens currently. We have provided protection for the length of the river bed where an increase in velocity at high flows is predicted due to the flow constriction that currently happens at the existing bridge.

- **Weir Sensitivity Assessment**

In line with the recommendations in the the geomorphology report that the design should consider the potential implications of weir failure on bed levels and scour risk, we request an evaluation of the implications of downstream weir failure or removal on upstream hydraulics and scour risk be submitted. This should confirm whether the proposed bed protection remains effective under altered control conditions.

The proposed development would not have a detrimental impact on the weir and found that water velocities and flow rates are comparable to the baseline situation - please find below the extracted flow velocity data from the nodes adjacent to the weir, as exported from the hydraulic model. However, it must be stressed that it is outside the scope of this planning application to run flood risk assessments for the potential deterioration or collapse of an asset outside of the project boundary.



Node Number	Baseline Flow Velocity (m/s)		Proposed Flow Velocity (m/s)	
	0.5% AEP CC+70	0.1% AEP CC+70	0.5% AEP CC+70	0.1% AEP CC+70
EBBW_3961 (Downstream of existing Bassaleg Bridge)	3.5	3.7	3.7	3.7

EBBW_3958sd (Upstream of weir)	3.2	3.3	3.5	3.6
EBBW_3943 (Downstream of weir)	3.5	3.8	3.6	3.9

Construction/Demolition Environmental Management Plan

It is accepted that a condition be attached to the planning approval to require a Demolition and Construction Environmental Management Plan (DCEMP) to be submitted and approved by NCC prior to the commencement of development.