

A Case Study for Infrastructure Scour Management

Introduction / Background

Scour is the leading cause of bridge collapse worldwide, being responsible for compromising the stability of structures’ foundations. Scour and erosion can take place without prior warning and cause sudden failure.

Assessment of Scour:

Transport Scotland’s Highway Structures crossing a watercourse are assessed through the Design Manual for Roads and Bridges (DMRB) BD 97/12 Standard entitled ‘The Assessment of Scour and Other Hydraulic Actions at Highway Structures’.

- Level 1 Scour Assessment
- Level 2 Scour Assessment

Monitoring and Identification of Scour:

- Reactive Structures Safety Inspections
- Special Inspections.

A Reactive Structures Safety Inspection was carried out at the A68 Galadean Bridge, which is carrying the A68 Road across Leader Water, between the towns of Lauder and Earlston, in the Scottish Borders (Fig.1).

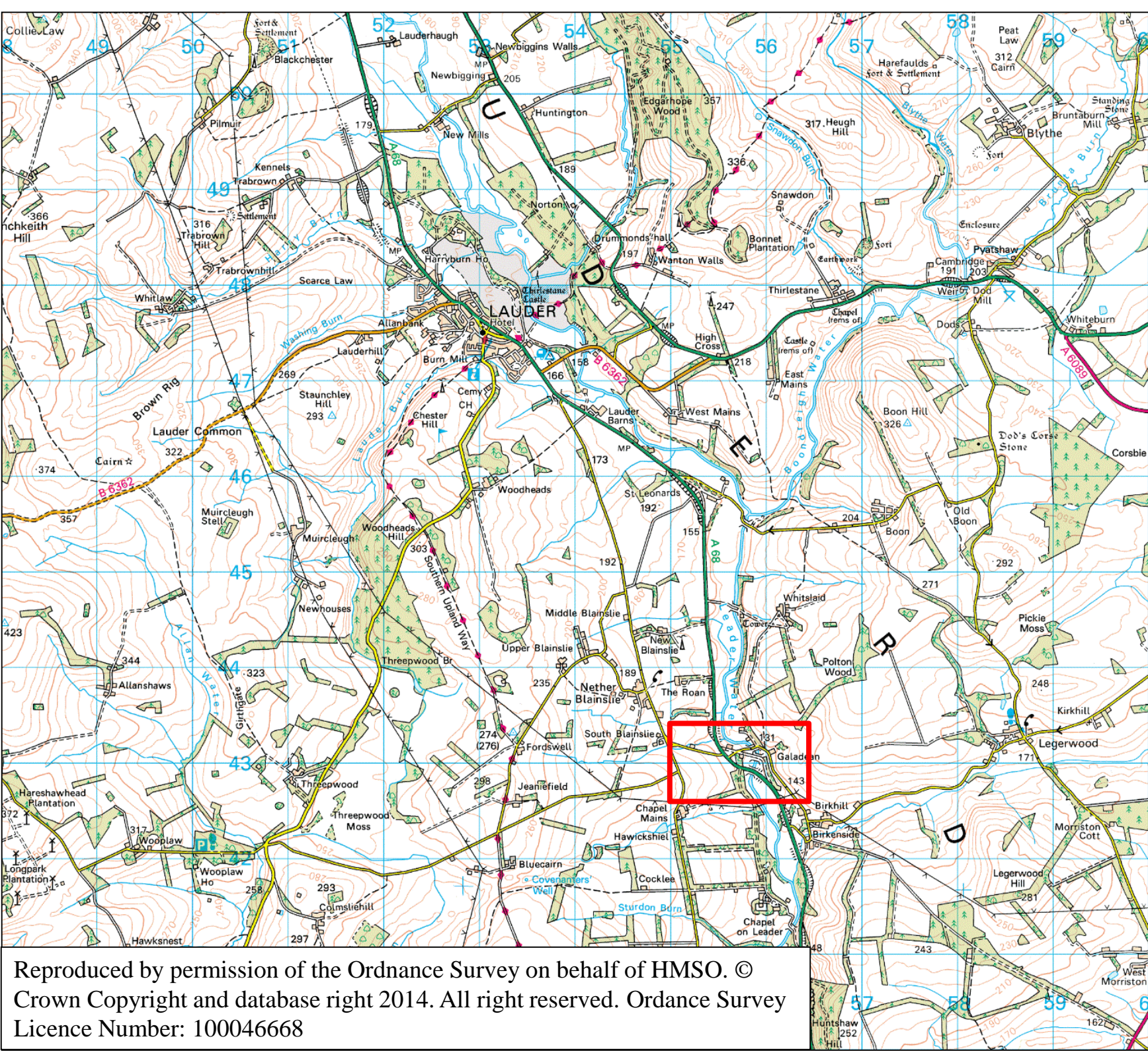


Figure 1 Location Plan

Reactive Structures Safety Inspection Findings

- Sediment transport has been the cause of the formation of an ‘island’ from depositing sediment, upstream of the structure (Fig.2).
- The course of the river has been redirected towards the western river bank, significantly eroding it, forming a bend (Fig.2 & 3).
- The flow has been directed on to the northwest embankment of the A68, deteriorating it and compromising the stability of the road (Fig.3).



Figure 2 Upstream View 2017

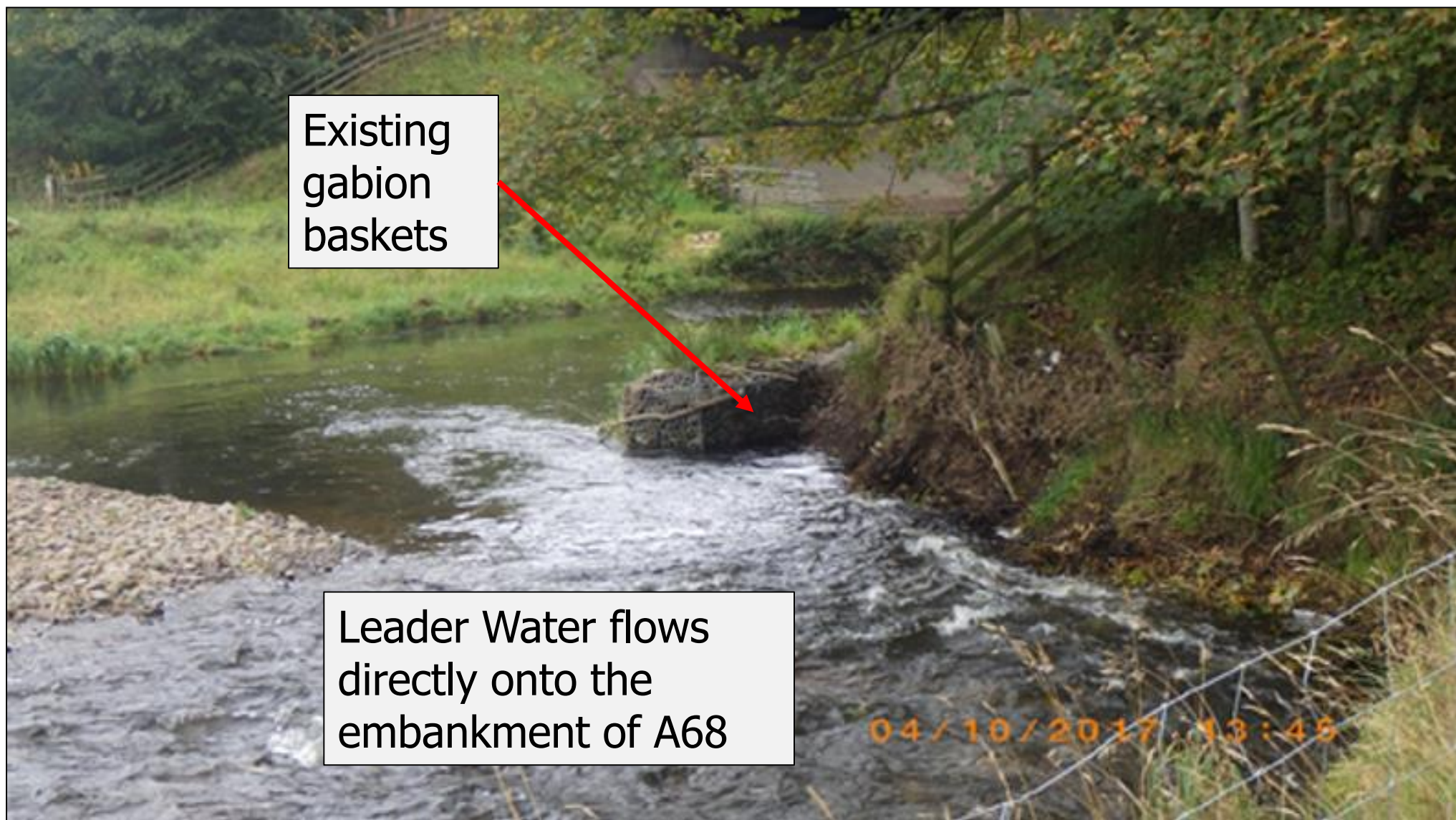


Figure 3 Eroded Embankment

Emergency Scour Protection Design

Challenges:

- Leader Water designated as one of the Tweed Special Areas of Conservation.
- Emergency works being carried out during Winter.
- Location – access; flow conditions.

Solution:

- Rock rolls chosen as best solution.
- Three rows of rock rolls placed in front of the eroded embankment, 30 metres length.
- Sediment from the ‘island’ used to fill the rock rolls.

Scour Exacerbation



Figure 4 Eroded Embankment (Feb 2018)



Figure 5 Eroded Embankment (Mar 2018)

Design Alteration & Monitoring

- A visual monitoring regime was implemented until the construction of the new design proposal.
- The new proposal included a two-phase approach in the design and construction of the scour measures. The first phase included the construction of a platform in front of the road embankment and the implementation of rock rolls, forming the scour protection (Fig.6). The second phase included the reconstruction of the affected embankment (Fig.7).



Figure 6 Construction Phase 1



Figure 7 Construction Phase 2

Conclusions

- The implementation of both a proactive and a reactive response to scour is critical.
- The implementation of a scour management strategy reduces the risk of failure of highways and structures.