



Scoping study on the need for additional research and/or guidance on reservoir conduits

Project Summary SC080049/S1

The Environment Agency is the regulatory authority for reservoirs in England and Wales and is charged with monitoring compliance with The Reservoirs Act 1975.

The draft Defra Reservoir Safety Research Strategy (2008) recognised that there have been several reported incidents and dam failures as a result of defects in conduits in dams. The strategy recommended a research project review the guidance that is available on the management of reservoir conduits.

In response to the recommendation, we commissioned this scoping study to review the guidance available to reservoir practitioners and to consider the need for further research and/or guidance on the inspection, monitoring, maintenance and repair of conduits in UK reservoirs.

The authors of this study make three main recommendations:

- that no further research is conducted into failure mechanisms as these are well understood;
- that there are several publications and ongoing research studies that have some relevance to the management of conduits in UK reservoirs, but these are not sufficiently focussed and so a consolidated document is needed;
- that there is demand within the industry for consolidated and specific guidance on the inspection, monitoring and maintenance of reservoir conduits.

The authors conclude that a consolidated guidance document on reservoir conduits would assist in identifying conduit defects at an early stage and help reduce the risk of serious incidents and failures.

Conduits through dams take a variety of forms, including tunnels, culverts and draw-off pipes. They are often an integral part of the safety measures for reservoirs. Over the past 100 years there have been several reported incidents and reservoir dam failures due to defects in conduits.

The most dangerous mechanism of failure is internal erosion of an embankment dam's fill by water flowing along the contact between the conduit and the fill. These problems are often difficult to identify during routine inspections. Notably, contact erosion can occur without there being any physical damage to the conduit.

This desk study reviewed the available, and soon to be published, guidance on the management of conduits and consulted with key members of the industry over the perceived requirement for a single guidance document.

Consultation with the industry

The authors consulted 225 active reservoir practitioners in England and Wales, including Panel Engineers and Undertakers. Sixty-four responses were received. This was considered a representative proportion of the reservoir community.

Based on the responses, a 'gap analysis' was conducted to identify information that is not currently available, but would be beneficial to reservoir practitioners.

This process identified that:

- the mechanisms of failure resulting from culvert defects have been widely documented and are well understood by practitioners;
- there are several publications and ongoing research studies that consider the inspection, monitoring and maintenance of conduits. However, these are not specifically related to reservoir applications and contain some information that is not relevant for reservoir practitioners. Certain aspects that relate to reservoir safety are not covered;
- There is an overwhelming demand for consolidated guidance on the visual inspection, monitoring, and maintenance of reservoir conduits.

The need for further research

The authors conclude that no further research is required into the failure mechanisms arising from conduit defects. However, there is no consolidated bibliography of the research and a bibliography would be beneficial, especially if appended to a guidance document.

The need for further guidance

The authors recommend the preparation of a document that provides guidance for safety assessments on conduits at reservoirs in the UK. The audience for this document would be those assessing the condition of conduits laid through reservoir dams and their foundations. The guidance should be a complete and compact manual designed to assist at all levels of conduit inspection.

Production of a consolidated guidance document on reservoir conduits will assist in identifying conduit defects at an early stage and help reduce the risk of serious incidents and failures.

The authors recommend that the guidance document includes:

- a description of the various types of reservoir conduit covered by the guidance;
- a description of the principal failure modes associated with conduit defects;
- guidance on visual inspection techniques, including discussion of the risks associated with undertaking inspections in confined spaces and means of avoiding entry into confined spaces;
- guidance on monitoring techniques, such as measuring deviations in alignment and means of gauging seepage flows;
- discussion of intrusive and non-intrusive investigation techniques to inform condition assessment;
- consideration of routine maintenance activities;
- a bibliography of relevant publications and sources of information.

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