Basic Details

Publish Date

08 October 2025

Case ID#

3337

Title

Swallow hole caused by deterioration of ageing masonry outlet culvert

Nation

England

Regulator Reference No.

512

Legal Status

Statutory

Reservoir Type

Impounding

Reservoir Capacity

25,000 - 99,999m3

Year of Construction

1800 - 1849

Main Construction Type

Earth fill embankment

Dam Height

2 - 4.99 metres

Dam Flood Category

B

Hazard Class

High-risk reservoir

Reservoir Use

- Conservation (ornamental / heritage)

Owner Type

Private individual(s)

Incident Details

Date & Time of Incident

07 October 2024 - 12:00

Date Incident Closed

07 September 2026

Observations that Caused the Incident to be Declared

- Slope or face deformation (slippage, cracking, slumps, mounds, depressions)

Describe the Incident

A small swallow hole appeared in the upstream face of the dam adjacent to the overflow structure during higher than normal water level conditions. The overflow structure was undergoing examination by the County Council as the Highway Authority who have a stake in the reservoir with their responsibility for the road along its crest and the two overflow culverts. The overflow consists of two culverts through the dam, each with an inlet weir at its upstream end. At the time the incident was identified the entrance to one culvert had been isolated by installation of a limpet dam as enabling works to examine the culvert. Heavy rainfall had caused the water level in the reservoir to rise to a higher level than normal. It is possible that the swallow hole might be an indication of internal erosion either to the earth embankment dam or the overflow structure and, if left unchecked, could have led to significant damage to the dam or even its failure.

No obvious symptoms of structural deterioration of the masonry were evident prior to the routine investigations carried out by the HA as part of their bridges and culverts inspection programme. It is likely however that the cracking and internal erosion situation had developed over many years. The RA 1975 inspection regime and the HA Bridges & Culverts inspection programmes are not in sync and neither party seems to be legally obligated to share information with the other.

Supporting Photos

No images provided.

Causes and Impacts

Natural Processes which Initiated or Contributed to the Incident

- Heavy/persistent rain (no flood)

Main Contributing Factors to the Incident Occurring

Dam Factors

- Deterioration of materials
- Failure or damage to pipes or culverts

External Factors

- Other external factors (describe below)

Shortcomings

- No apparent shortcoming

Root Cause of the Incident

The root cause of the incident was ageing of the twin overflow culverts.

The masonry had deteriorated and cracking therein had allowed fine soil materials to be eroded from the embankment and carried away into the overflow culvert. Leakage over time had allowed the flow path to become enlargened and a small swallow hole had developed alongside the structure.

Impacts on the Reservoir

- Failure or damage to tunnel or culvert
- Internal erosion (adjacent to structures)
- Spillway or overflow - failure or instability

Supporting Photos

No images provided.

Supporting Contributions and Studies

Human Factors which Influenced the Incident

- A portable pump was installed to control the water at its normal level and sandbags were placed around the swallow hole to reduce significantly the flow of water entering it.
- The brought-in pumping equipment was provided and operated by the undertaker's contractor.
- A planned surveillance regime with prompt reaction from the personnel involved enabled an appropriate and timely response involving attendance at the reservoir by an ARPE.
- The absence of any forewarning is not perceived to be a surveillance failing on the part of the Undertaker or reservoir safety professionals. The chances of detection were considered to be small given that the eroded soil particles would be swept away downstream by normal baseflow.

Instrumentation at the Reservoir

Was Instrumentation Effective?

Not Applicable

Assistance by External Parties and Impacts on Downstream Population

Summary of Studies or Investigations Undertaken

Further investigations were carried out as part of the design of the remedial works. These included ground investigations with boreholes, geophysical assessment and lab testing.

Lessons Learnt

Lesson 1

- Operation and maintenance

The importance of understanding the condition of buried structures.

Lesson 2

- Human factors
- Operation and maintenance
- Regulatory

The need to establish responsibility for maintenance and inspection of assets associated with reservoirs which might impact its safety. This is particularly important where multiple parties use, or own, associated structures

Lesson 3

- Human factors
- Records and studies

Information sharing between parties associated with reservoir safety structures is recommended to ensure all involved with their operation and maintenance have as much information as possible to understand the design, construction and condition of these assets.

Lesson 4

Closing Comments

Supporting Photos

No images provided.

Information provided has been sent from reservoir owners and engineers, and cleansed of personal information by the enforcement authority. We cannot guarantee the accuracy of the data, but if you find an error please contact the relevant enforcement authority.