Guide to drawdown capacity for reservoir safety and emergency planning

Project Summary SC130001/R1 and SC130001/R2

This project has researched the preferred drawdown capacity for reservoirs in the UK and provides guidance on consistent methods for assessing the adequacy of existing drawdown facilities. The guidance is intended for reservoir inspecting engineers who are required under UK reservoir legislation to review the drawdown capacity of reservoirs. Reservoir owners may also find the guidance useful.

The ability to lower a reservoir's water level quickly in an emergency is a key factor in ensuring reservoir safety in the event of a problem occurring which threatens the structural performance of the dam. Drawdown may be a precautionary measure while the problem is investigated, or an emergency measure. In either case, the aim is to reduce the load on the dam, and thereby prevent failure. If a full drawdown cannot be achieved then partial drawdown may buy time to make repairs, evacuate downstream, or employ other techniques to avert failure. The consequences of failure can be limited by reducing the volume of water released in a breach. The ability to drawdown a reservoir is also important to allow routine inspection and maintenance of the structures retaining the reservoir.

Guidance is specifically provided on the following aspects:

- types of drawdown facility and general considerations for designing, maintaining and operating them
- characterising a reservoir site in order to evaluate the drawdown capacity
- determining the existing drawdown capacity, taking into account concurrent inflows and the reliability of the drawdown facilities
- determining an appropriate drawdown capacity for reservoirs in the UK
- mitigation measures to be used if existing facilities do not meet the drawdown capacity

The drawdown capacity is made up of two components, the reservoir lowering capacity and the inflow pass-through allowance. The general standard recommended for the inflow pass-through allowance is the Q_{50} (i.e. the daily inflow to the reservoir that is exceeded on average for half of the year) but sensitivity checks are recommended to consider how higher inflows such as the Q_{10} could affect the ability to lower the reservoir.

The recommended approach for assessing whether the installed drawdown capacity is adequate should be based on judgement by an experienced dam engineer taking into account various considerations. For embankment dams, basic minimum recommended standards are proposed for the rate of drawdown, which vary depending on the potential consequences of the dam failing. These standards are based on a number of assumptions which should be reviewed as part of the assessment. For example the standards may need to be adjusted depending on the vulnerability of a dam to rapid failure, and the time it may take to detect symptoms of failure and to activate drawdown. The assessment should also consider the time it would take to lower a significant proportion of the reservoir depth (normally one-third) and the ability to keep the reservoir drawn down to enable repairs. Precedent practices may also be taken into consideration as part of the judgement.

For concrete and masonry gravity dams, and service reservoirs, the potential failure modes are different and specific guidance is provided to reflect this.

This summary relates to information from project SC130001, reported in detail in the following output(s):

Report: SC130001/V01 and SC130001/V02

Title: Guide to drawdown capacity for reservoir safety and emergency planning

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