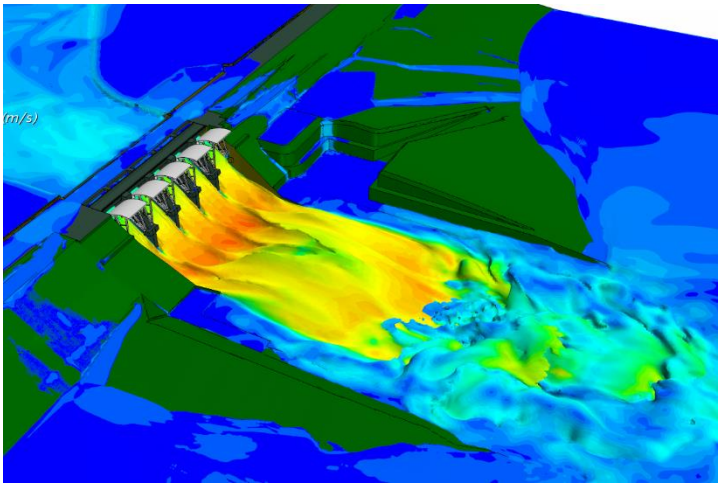
GHD Experience



Hydraulic Design of Spillways for Dams

Identifying needs

Dams are critical infrastructure which provide significant benefits to communities in many ways including provision of water supply, flood mitigation, power generation and irrigation. A key component of a dam is the spillway which provides a means of safely passing flood events through the structure. The hydraulic design of the spillway works is a fundamental task throughout the dam design process from feasibility through to detailed design, including the review of prototype performance once in operation.

Design aspects where hydraulic design of the spillway provides important information include:

- Confirmation of the appropriate sizing of the dam and spillway as an integrated system
- Optimisation of the design layout
- Derivation of static and dynamic loading as an input to structural design
- Modelling, both numerical and physical, to inform, verify and optimise design arrangements
- Consideration of the performance of spillway gates and other hydro-mechanical equipment
- Review of existing structures to assess the need for upgrades or remedial works
- Assessment of potential for erosion around hydraulic structures

Solutions

The professional staff of GHD's dams engineering team possess extensive experience in a wide range of services related to hydraulic design of spillways, including the following:

- Hydrological modelling and flood routing to confirm spillway and dam arrangements
- Development of spillway arrangements based on theoretical and empirical approaches
- Extensive in-house modelling capabilities using Computational Fluid Dynamics (CFD) techniques
- Design of spillway gates and other hydro-mechanical equipment including mechanical, electrical, instrumentation and controls services
- Assessment of the response of spillway structures to hydraulic and structural actions including aspects such as anchorage, uplift and drainage
- Assessment of the potential for erosion as a result of spillway flows

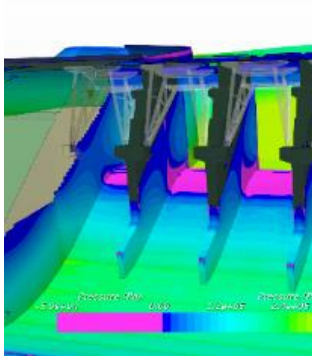
Benefits

GHD has one of the largest dedicated dams engineering teams across the globe. As part of this service offering, our broad range of capabilities and extensive experience related to the hydraulic design of spillways provide our clients with confidence in the final outcome.

Experience

GHD has extensive experience in dam engineering projects including hydraulic design of spillways. GHD applies its client relationship focus and in-depth dams engineering experience, working closely with clients to address key concerns, constraints and issues. Once identified and analysed, sound engineering options are developed to provide tailored solutions to suit the project at hand.

Some recent projects that GHD has delivered for our clients and which detail our experience and capabilities in this field are described below.

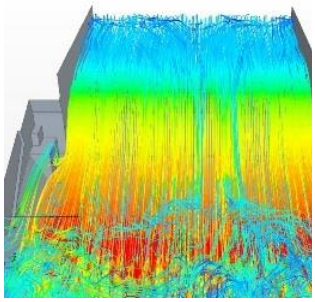


Confidential Project – Flood Upgrade Feasibility Study, Queensland, Australia

As part of the feasibility assessment for the raising of the 50 m high earth and rockfill dam, the project included the hydraulic assessment and design of both the main concrete gravity gated and the fuseplug-controlled auxiliary spillways. This included 3D CFD modelling to assess effects of the spillway bridge and gates, and to better understand the complex approach flow and plunge pool conditions. Key aspects analysed included: discharge efficiency of the main and auxiliary spillways; hydraulic loading on the gates and other structures; jet impingement in the plunge pool and resultant erosion; and loads on sluice gates. The results from the modelling were used as inputs for the hydraulic and structural assessment of the dam and spillway structures, spillway gates, and other associated structures; assessment of potential plunge pool erosion; and assessment of the adequacy of the auxiliary spillway.

Kangaroo Creek Dam Upgrade, South Australia, Australia

GHD was engaged to undertake the design of upgrade works to increase the flood capacity of the concrete-faced rockfill dam and side-channel spillway. Hydraulic design services included review of the proposed concept design, CFD modelling of spillway modification options, management and technical coordination of a physical model study for validation of the design, detailed design of the upgrade and strengthening works and design support services throughout the construction phase. Significant complexities were encountered in the design due to the magnitude of the upgrade required, the topographical constraints of the site and the geometry of the existing spillway structure. These were overcome through an integrated approach to the design utilising our in-house capabilities and experience.



Awoonga Dam – Review of Spillway Hydraulic Performance, Queensland, Australia

Awoonga Dam experienced the flood of record in January 2013 as a result of ex-Tropical Cyclone Oswald, which peaked at about 8.3 m over the spillway crest. The spillway performed well but suffered damage to sections of the concrete, possibly due to cavitation, and erosion of rock in the downstream unlined channel. GHD was engaged to undertake an assessment of the hydraulic performance of the 35 m high ungated concrete gravity spillway structure and downstream channel. This assessment included 2D and 3D CFD modelling of the spillway, engineering geological assessment of the spillway discharge channel, assessment of energy dissipation, comparison with past performance and prediction of future performance during extreme flood events.

Design of the Enlarged Cotter Dam, Canberra, Australia

GHD was the design partner for the Bulk Water Alliance which delivered the Enlarged Cotter Dam, an 85 m high roller-compacted concrete structure. As part of the design optimisation process, GHD was responsible for the development of the spillway arrangement including 2D and 3D CFD modelling of the complex stepped spillway. Prior to commencing a physical model study, the CFD modelling was invaluable in optimising the design of the non-standard stilling basin, and assessing the interaction of flow from the central primary spillway and the secondary spillways over the abutments. GHD was also responsible for technical direction and project management of the 1:45 scale physical model of the spillway that was used for design verification and final optimisation.

Googong Dam Spillway Upgrade, New South Wales, Australia

GHD was engaged to undertake a review of the historical performance and prediction of future performance of the structure. The project included an increase in the capacity of the spillway to discharge the required design flood as well as review of potential for further scour in the unlined section of spillway. Work under this engagement included a review and assessment of previous work, the development and comparison of options and ultimately the detailed design of the preferred arrangement. A scale physical model was constructed to validate the detailed design. GHD had a full-time site role and provided design support throughout construction which was completed in late 2010. The spillway safely passed the flood of record less than one month after the completion of the upgrade works.

To touch base with the key person in your region, visit
www.ghd.com/dams