GHD Experience

Embankment Dams Design and Construction

Identifying needs

Embankment dams are commonly the lowest cost alternative type to construct because they can utilise locally available earth and rock fill materials and can be built on lower quality foundations than other dam types. Embankment dams are the most prevalent worldwide, ranging from small ponds to some of the highest dams.

Embankment dams often have significant challenges and require an experienced team of professionals to achieve appropriately low risk and cost effective projects. These challenges can include:

- Foundation conditions with potential for settlement, instability, or excessive seepage
- Embankment materials selection to control seepage, achieve stability and optimise use of available materials
- Seepage and piping control including appropriate design of filters, cutoffs and liners
- Seismic response including liquefaction and deformation

Service Offering

GHD can offer the following professional services associated with embankment dam design, construction and operation:

- Geotechnical site investigations including evaluation of foundations and identification and testing of construction materials
- Detailed dam safety risk assessment
- Concept and detailed design for new projects or upgrades
- Seismic analysis including liquefaction assessment and deformation analysis using numerical modelling
- Hydrological analysis
- River diversion design
- Spillway design
- Structural analysis and design of appurtenant structures
- Access layout design
- Construction support
- Instrumentation installation and monitoring
- Safety evaluation of dams, spillways, outlet works, gates, valves and penstocks
- Mechanical control equipment for outlets and spillways
- Environmental studies and permitting assistance
- Preparation of operation and maintenance manuals and dam safety emergency plans
- Dam safety inspections, monitoring and surveillance

Benefits

Our extensive range of capabilities in dam design and related fields allows us to draw on a wealth of experience to satisfy specific project objectives. We have ready access to a global network of 8500 dedicated professionals and one of the largest dedicated dam engineering teams worldwide. Our clients can expect to have access to the best people for their projects.

Experience

We have specialist dams and geotechnical engineers with a broad range of experience in delivering solutions to the challenging requirements of embankment dams. Examples of GHD's completed projects are described below.

Harvey Dam – Water Corporation
Western Australia

GHD provided planning, site investigations, detailed design and documentation for a 45m high earth core rockfill dam for local irrigation supply as part of its Stirling-Harvey Redevelopment Scheme. The new Harvey dam replaced the existing upstream Harvey Weir, which remained in operation during construction of the new dam. Complex site geology determined a change in embankment type from earth-core rockfill to earthfill, part way along the crest

Eildon Dam- Goulburn-Murray Water
Victoria

The Eildon Dam Improvement Project was a $52.5 million upgrade of the 80 m high, 3 300 GL capacity Eildon Dam, undertaken to secure the future of the dam. The works involved: reconstruction of the crest and downstream shoulder of the dam and raising by around 4 m; post tensioned anchor works in the chute downstream of the spillway to strengthen the chute floor to cope with extreme floods. GHD were designer within an Alliance to deliver the upgrade project.

Enlarged Cotter Dam - ACTEW-AGL Bulk Water Alliance
Canberra

GHD designed the Enlarged Cotter Dam which included two earth and rockfill saddle dams approximately 20m and 16m high. The fractured and variably weathered foundations required carefully managed foundation excavation and GIN grouting. The ridge location of the dams and constrained site limited availability of clay core material, with unusually gravelly material used for the embankment core requiring detailed seepage analysis and testing to confirm suitability, then careful screening, testing and moisture conditioning .

Bowraville Off-river Storage Dam – Nambucca Shire Council
Nambucca, NSW

Bowraville Off-river Storage Dam is a 22.5 m high earth embankment dam, constructed to store water pumped from nearby wellfields. The dam is situated on deeply weathered phyllite and alluvial foundations. Both a partial cutoff (into the weathered phyllite) and a clay blanket that extended some distance upstream was provided to reduce the potential for seepage from the dam. GHD undertook the concept design, site investigations, detailed design and provided construction stage design support.

Irrigation Off-Stream Storages – Tasmanian Irrigation
Tasmania

Embankment dams providing off-stream storages form key parts of Tasmanian Irrigation's schemes that enhance productive capacity in Tasmania's agricultural industries. GHD have delivered designs for Milford, Southernfield and Melrose Dams, all zoned earthfill embankments up to 30m high with pressure grouted foundations and floating HDPE intakes. GHD have provided a broad range of services for other schemes including due diligence, geotechnical investigations, concept designs and design reviews.

Samson Brook Dam – Water Corporation
Western Australia

GHD provided planning, investigation, preliminary to detailed design and construction support services for the staged upgrade of Samson Brook Dam, which is a High A consequence category zoned embankment dam providing water to the Perth Integrated Water Supply System. The works included raising and strengthening the embankment and providing improved internal drainage; sleeving the outlet tunnel and replacing associated outlet works structures; and the construction of a new spillway on the right abutment.

Stirling Dam – Water Corporation
Western Australia

The Stirling Dam Upgrade Project (2001-2009) improved the safety of a 46 m high zoned earthfill/rockfill dam that feeds the Perth metropolitan water supply and Stirling-Harvey irrigation scheme. The upgrade program included a new intake tower and access bridge, modifications to the outlet tunnel and pipework, installation of instrumentation and power supply, upgrading the spillway to increase its capacity and raising the embankment by placing fill material against the downstream face and including drainage filters.

Arthur Creek Dam – Tropical Forestry Services
Western Australia

In 2007 GHD was engaged by Tropical Forestry Services (TFS) to review the safety of Arthur Creek Dam and to identify and assist with implementing a sustainable program of appropriate risk reduction measures without interrupting water supply for irrigation. The program of works included enlargement of the spillway, lining the outlet pipe and refurbishing/replacing the control gates and valves, raising and strengthening of the embankment to provide additional flood handling capacity and improve stability of the dam.

Kelalong Dam – Bintulu District
Sarawak, Malaysia

Kelalong dam is a water supply dam for the Bintulu District. The main dam is a zoned earthfill with a maximum height of 30 m and includes a cut-off trench extending 410 m beyond the dam through two low saddles. GHD was engaged to deliver yield analysis, feasibility studies, geotechnical investigations and detailed design of the embankment dam including embankment design, the spillway and downstream stilling basin, outlet works and diversion works.

Quipolly Dam – Liverpool Plains Shire Council
Quirindi, NSW

Council upgraded the 21 m high embankment dam to address deficiencies in regard to spillway capacity and risk of piping in the embankment. GHD prepared concept and detailed designs for the upgrade works, including review of hydrology, geotechnical investigations, detailed design. The storage capacity of the dam was increased by 50% at the same time.

Eraring Attemperating Reservoir – Eraring Power Station
Dora Creek, NSW

Eraring Attemperating Reservoir is a 26 m high off river storage used to store saline water for use in the cooling process for Eraring power station to maintain peak production during the hot summer months. An extensive clay lining and under-drainage system ensures that pollution of groundwater by the saline water in storage does not occur. GHD undertook concept design, site investigations, detailed design and provided construction stage support.

Spring Creek Dam Upgrading – Orange City Council
Orange, NSW

Spring Creek Dam is an earth dam with a concrete core wall, constructed in the 1930's. The dam sustained a major 80m long slump in the 1960's. Whilst repairs were undertaken at the time, the concrete core was compromised and concerns regarding the stability of the embankment remained. GHD undertook the concept design, site investigations, detailed design and provided construction stage design support for remedial works including raising the embankment to safely pass the 1 in100,000 AEP flood. .

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