



CLIENTS | PEOPLE | PERFORMANCE

DAMS ENGINEERING



GHD IS AN INTERNATIONAL PROFESSIONAL SERVICES COMPANY. OUR PEOPLE DELIVER INNOVATIVE SOLUTIONS BY COMBINING TECHNICAL SKILL AND EXPERIENCE WITH AN UNDERSTANDING OF OUR CLIENTS' OBJECTIVES AND ASPIRATIONS.

Dams engineering is the understanding and control of the enormous forces and potential energy of water and combination of technical experience from many disciplines. From foundation and seismic assessments to geotechnical, hydrological, hydraulic and structural design, dams engineering requires specialist skills and a commonsense approach.

Our experienced professionals, with their innovative outlook, proven track record, team culture and commitment to delivery, provide successful and practical outcomes for our clients. We deliver in all methods of project delivery, from the conventional approach to design and construct and alliances.

OUR COMMITMENT

Since 1928, GHD has been providing innovative, safe, and optimised solutions for large and small dams in Australia and around the world.

We have developed an insight and understanding of the complex and critical issues relating to individual dam locations and environments and as a result, can provide reliable advice, tailor design solutions and deliver successful outcomes. We are supported by specialist software and design aids, state-of-the-art technology and access to international knowledge databases.

GHD's senior dams engineers have gained local and international recognition for their specialist knowledge resulting in selection as leaders on community boards, owner's review boards or as design advisors, both in Australia and in countries such as New Zealand, USA,

China, Chile, Colombia, Brazil, Malaysia, Oman, Jordan, Algeria, Pakistan and India. We are active participants and supporters of the International Commission of Large Dams (ICOLD) and the Australian National Committee on Large Dams (ANCOLD).

GHD has received numerous awards for innovation and excellence in dams engineering. These include:

- Copperfield Dam (QLD, Australia) – World's second and Australia's first Roller Compacted Concrete (RCC) dam
- Hunter Valley Coal Mine (NSW, Australia) – Slurry trench cutoff 4-kilometre long in 30-metre deep alluvium
- Wurdee Boluc (VIC, Australia) – Reservoir enlargement and seepage control
- Julius Dam (QLD, Australia) – Detailed safety review and 3D numerical modelling
- Canning Dam (WA, Australia) – Post tensioning remedial works (world's largest at the time)
- Harvey Dam (WA, Australia) – Investigation, design and construction advice

Our experienced and talented team of engineers, scientists and planners are committed to providing clients with creative, cost-effective, practical, safe, and technically sound solutions. We tailor our project team to provide personalised and specialised service to our clients and are committed to timely project delivery, from environmental impact statements, through planning to detailed design and construction, and beyond.



Glenmaggie Dam, VIC Australia. Seismic and detailed risk assessment



Candangullong Dam, NSW Australia. RCC design and construction advice



Little Para Dam, SA Australia. Dam safety investigations & remedial works.



OUR EXPERIENCE

INVESTIGATIONS AND APPRAISALS

- ▶ Site identification and topographical survey
- ▶ Foundation and materials investigations and geotechnics
- ▶ Stream gauging, flood assessment and reservoir yield studies

STUDIES

- ▶ Feasibility studies
- ▶ Hydrological analysis and review (flood studies, reservoir sizing, yield analysis and optimisation, catchment management)
- ▶ Hydraulic design, analysis and assessment (spillway capacity, spillway hydraulics, wave and freeboard allowance)
- ▶ Spillway and outlet works model studies (physical and computer modelling) including erosion modelling and protection design
- ▶ Options studies for spillway upgrading, dam strengthening
- ▶ Environmental assessment and management
- ▶ Groundwater/recharge modelling and yield analysis
- ▶ Dam break analysis

DESIGN, COST ESTIMATES AND DOCUMENTATION

- ▶ Foundation treatment and improvement
- ▶ Foundation and consolidation grouting and cut-offs, including slurry trenches

- ▶ Slope stability, embankment zoning and abutment stability/settlement
- ▶ Stability of concrete dams and structural analysis
- ▶ Numerical modelling (2D & 3D) for thermal, seismic and structural effects
- ▶ Analysis and design of spillways, intake towers and outlet works
- ▶ Diversion works including tunnels and conduits
- ▶ Associated gates, valves and mechanical and electrical equipment
- ▶ Design of groundwater recharge weirs
- ▶ Concrete and RCC mix design and trial mix studies
- ▶ Tender documentation including specifications, engineering cost estimates and construction programming
- ▶ Bidding and award assistance

CONSTRUCTION

- ▶ Construction supervision, project and technical management
- ▶ Materials management and quality control

OPERATIONAL

- ▶ Asset Management including insurance and asset valuations and assessment of associated plant and equipment
- ▶ Emergency action plans (audit, design and training)
- ▶ Emergency response services
- ▶ Surveillance and instrumentation - dam monitoring



Kinta Dam, Malaysia. Feasibility study, engineering design and project management services.



Jindabyne Dam, NSW Australia. Auxiliary spillway



Canning Dam, WA Australia. Dam post tensioning project

- ▶ Operations and maintenance manuals including training
- ▶ Rehabilitation works, including corrosion control, concrete repair, spillway and freeboard improvements and upgrades, structural adequacy and stabilisation
- ▶ Asset valuations and condition assessments
- ▶ Sediment deposition management, seepage analysis and control solutions

SAFETY AND RISK ASSESSMENT

- ▶ Dam safety inspections
- ▶ Dam surveillance and dam safety reviews
- ▶ Conditional and failure impact assessments, hazard classification, safety review reporting and post disaster stability analysis
- ▶ Risk assessment (event trees, detailed, flood, piping, seismic and liquefaction, consequence assessment)
- ▶ Spillway gate failure probability assessment

OUR INNOVATIONS

- ▶ Roller compacted concrete for new dams, scour protection for overtopping earth dams, and the use of 'grout enriched RCC' and the 'sloping layer method'
- ▶ The installation of a vertical chimney sand filter to existing embankment dams by slurry trenching methods
- ▶ Deep soil-bentonite slurry cut-off trenches
- ▶ Use of automatic 'TOPS' tilting spillway gates and 'Hydroplus' fuse gates
- ▶ Pumped seepage removal facilities in the toe drains of clay embankments

In all cases, these innovations led to reduced construction periods from conventional methods resulting in cost savings to the client, increased stability and being internationally recognised by the dams engineering industry.

OUR CLIENT-FOCUSED SERVICES

GHD provides services in all phases of dams engineering including feasibility studies, risk assessments, design, construction phase services, operational, dam safety, and upgrading of the following dam types and appurtenant structures:

- ▶ Earth and rockfill
- ▶ Concrete faced rockfill or membrane faced embankments
- ▶ Concrete gravity
- ▶ Roller compacted concrete
- ▶ Concrete arch and multiple barrel arch
- ▶ Concrete buttress (including diamond-head)
- ▶ Inflatable and gated
- ▶ Tailings and mining



ABOUT GHD

GHD is an international professional services company. Our people deliver innovative solutions by combining technical skill and experience with an understanding of our clients' objectives and aspirations.

With more than 6000 people in a network of 100-plus offices throughout Australia, New Zealand, Asia, the Middle East, the Americas and Europe, we serve clients in the global market sectors of infrastructure, mining and industry, defence, property and buildings and the environment.

Central to our clients' prosperity and GHD's success are forward-thinking engineers, architects, planners, scientists, drafters, project managers, economists and supporting staff. Our people embrace the core values that have sustained the company since inception – **Teamwork, Respect and Integrity.**

Established in 1928, GHD is ranked as one of the world's leading engineering, architecture and consultancy firms. We are dedicated to our clients and their stakeholders, to being a responsible corporate citizen and to improving the quality of life around the world.

We contribute to the goals of sustainable development and are committed to managing the social, economic and environmental impacts of our operations and assisting our clients to manage theirs in the provision of our technical consulting services. We recognise innovation as the key to realising this objective.

As a member of the World Business Council for Sustainable Development (WBCSD), GHD actively participates in the public debate on the role business has to play in managing climate change, energy, development and ecosystems.

GHD operates under a Practice Quality Management System that is certified to AS/NZS ISO 9001:2000 and our Environmental Management System (EMS) is accredited to international standard ISO 14001 by NATA Certification Services International (NCSI).

For more information, visit www.ghd.com.au



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