Politecnico di Torino

Dams & Reservoirs DAY 2025

Water and Energy security for Europe

OPEN DAY ON DAMS



Dams and environment: engineering solutions for the future

TORINO, May 28th, 2025

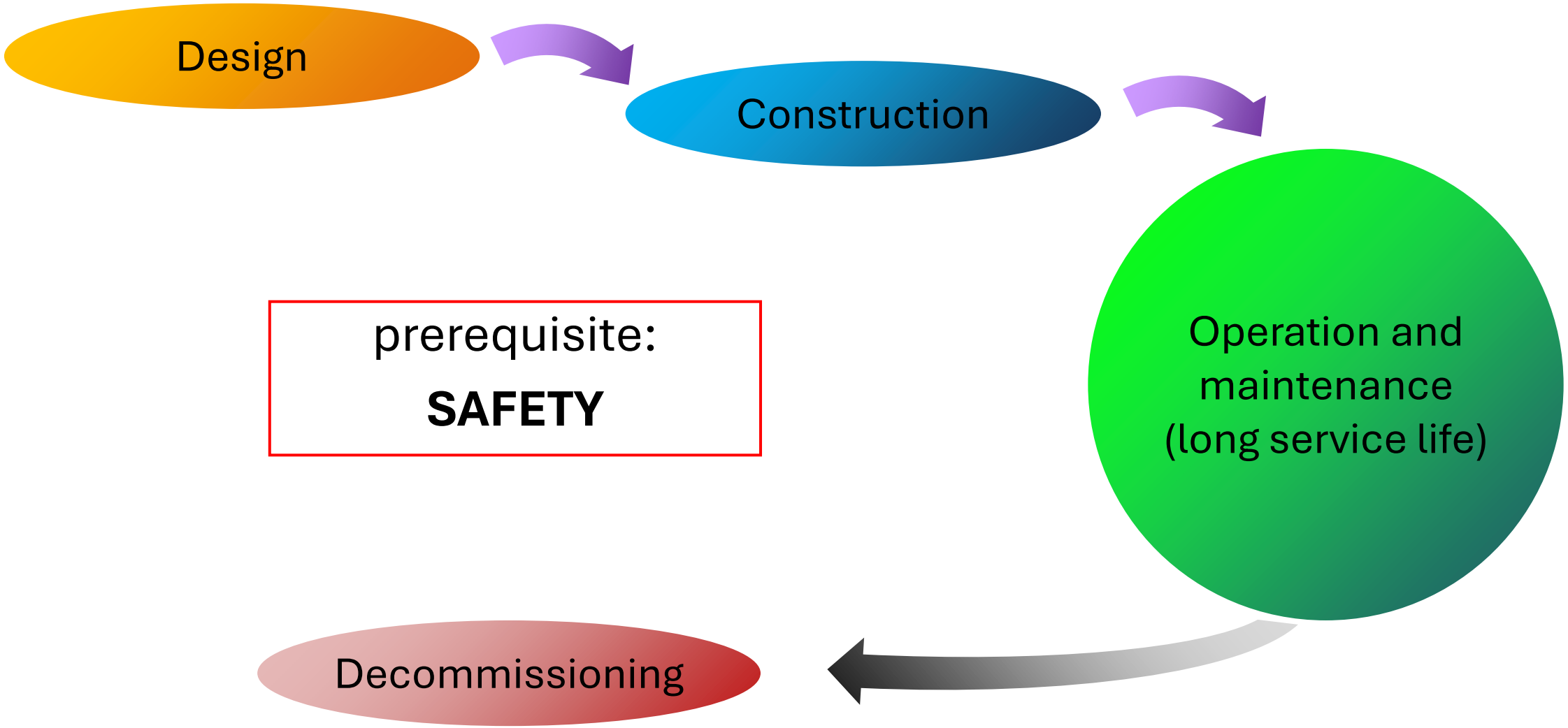
The Role of the Engineer Responsible for the Dam

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ITCOLD – II Concorso Fotografico

Dam Life Cycle



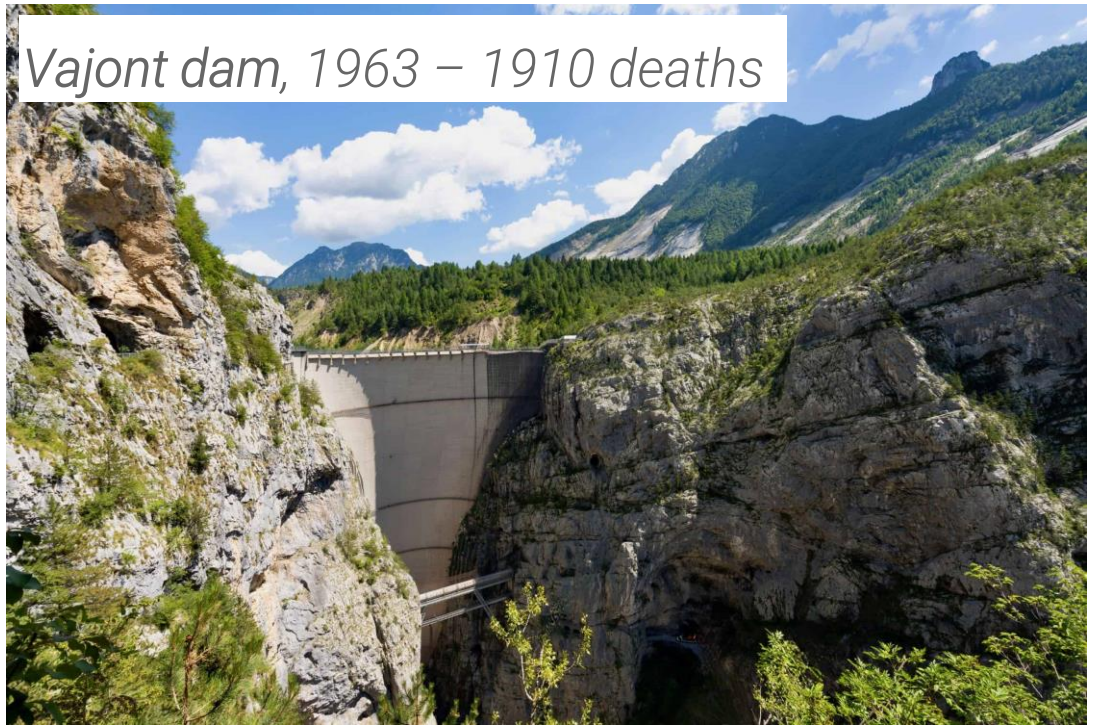
Dam Safety



Gleno dam, 1923 – 356 deaths

the dam itself

the surrounding territory



Vajont dam, 1963 – 1910 deaths

Italian Legislation

Legge n. 584/1994 – «Misure urgenti in materia di dighe»



Al fine di garantire l'azione di controllo esercitata nella costruzione e nell'esercizio delle dighe da parte della pubblica amministrazione, ogni concessionario o gestore delle opere è tenuto ad individuare [...] un ***ingegnere****, designato* ***responsabile della sicurezza delle opere e dell'esercizio dell'impianto****.*



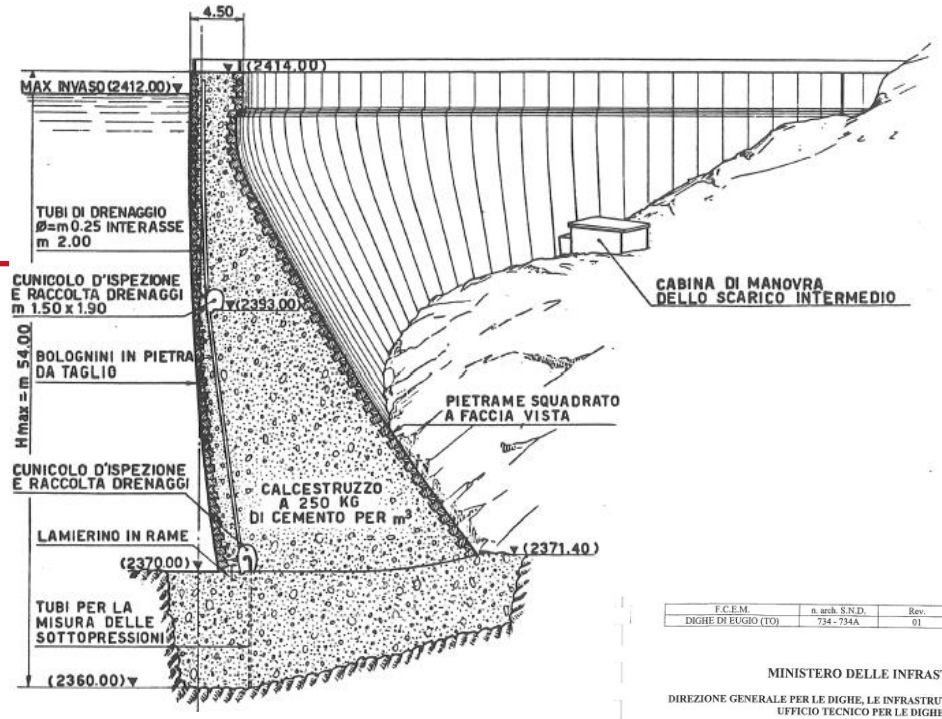
In order to guarantee the control action carried out in the construction and operation of dams by the public administration, each concessionaire or operator of the works must identify [...] an ***engineer****, designated as* ***responsible for the safety of the works and the operation of the plant****.*

Documentation

- design and commissioning documents (technical reports and drawings)
- past studies and analysis
- «**Foglio di Condizioni per l'Esercizio e la Manutenzione**» (FCEM):
  - description
  - surveillance and control procedures

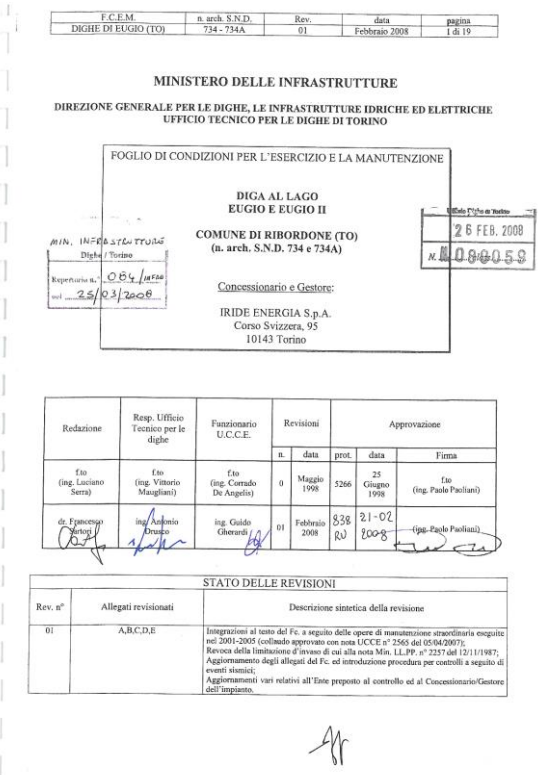
monitoring

safety assessment









Dam Safety

- dam body
- foundation and abutments
- outlet and intake works
- reservoir banks
- accessory works (dam keeper's house and service buildings)



overall safety assessment

Dam Safety



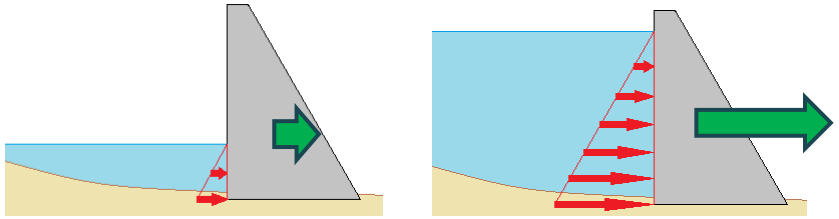
- Structural Mechanics
- Hydrology and Hydraulics
- Geology and Geotechnics
- Topography
- Statistics
- Materials Science

multidisciplinary approach

Monitoring process

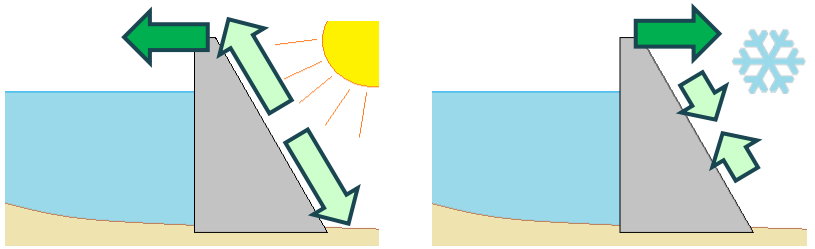
Loads:

- hydraulic pressure (fonction of the water level)
- thermal loads
- …



Effects, e.g. deformations:

- high water level → downstream displacement
- winter season → downstream displacement (and vice versa)



verify the absence of structural anomalies (or highlight them)

Monitoring process

Causal parameters:

- water level
- temperature (air, water, concrete)

Effect parameters:

- leakages
- planimetric and altimetric displacements
- rotations
- opening of structural joints and cracks
- uplift pressures
- stresses
- deformations of the structure and foundation rock
- settlements
- seismic acceleration

automatic measures

+

manual measures

+

topographic measures

(redundancy)

Monitoring process

measurement acquisition

analysis and control

validation → database

safety assessment (to the Directorate for Dams)

studies and in-depth analysis

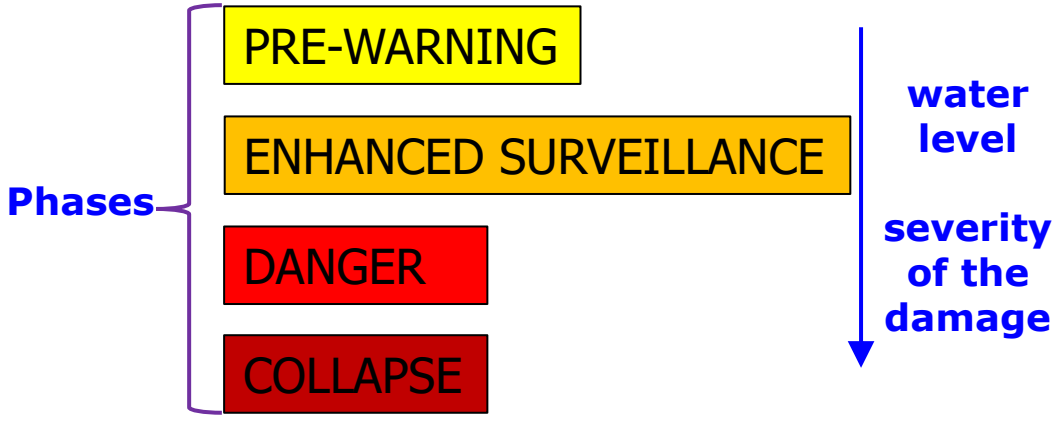


Public Safety

Civil Protection Document → public safety alert

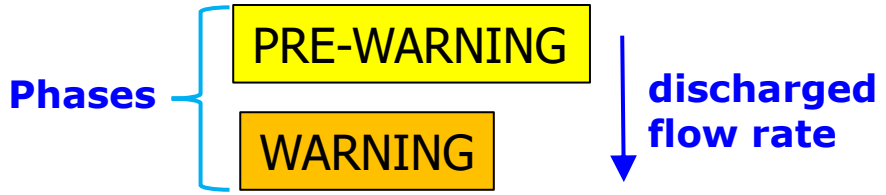
DAM RISK

events relevant to the safety of the dam and downstream territories



DOWNSTREAM HYDRAULIC RISK

activation of the dam's outlets with flow rates for the downstream channel that may cause flood wave phenomena and risk of overflow



Operation – sedimentation management

- «Progetto di gestione» of the reservoir
- possible activities:
  - emptying of the reservoir
  - controlled flushing of sediments
  - mechanical removal of sediments

→ permitting procedures and regulatory compliance

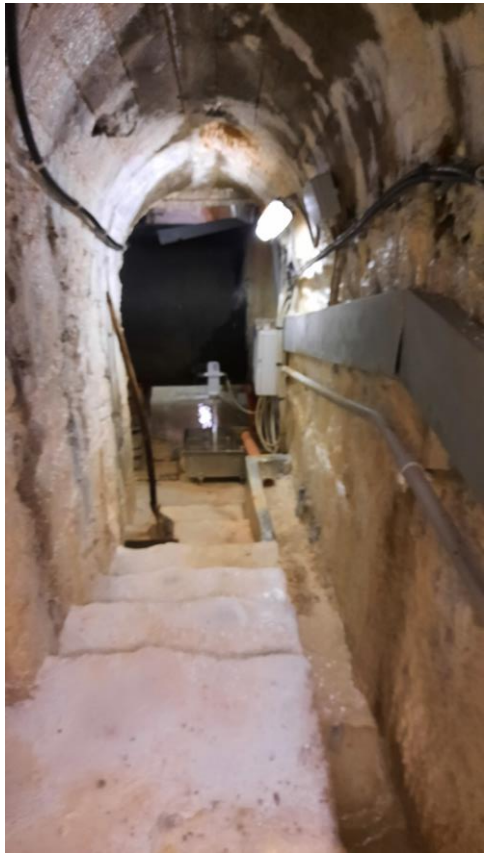


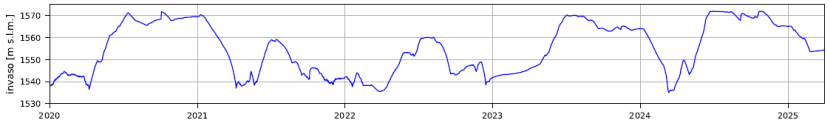


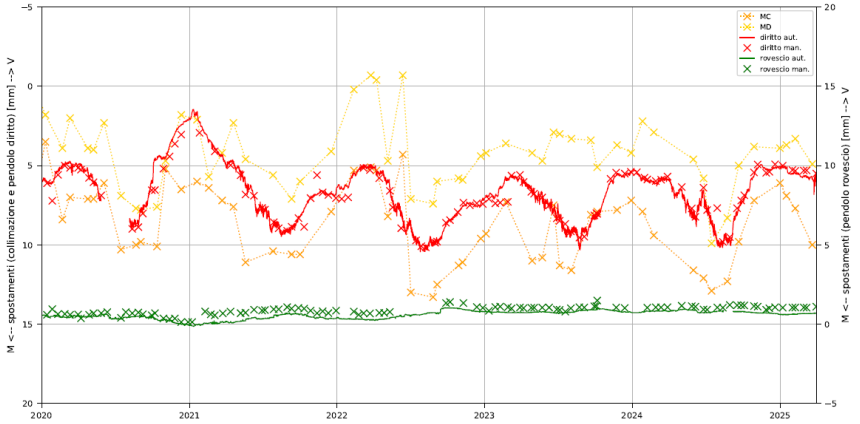
Activities of the Engineer Responsible for the Dam

- Direct inspections
- Inspections carried out by the Directorate of Dams (Ministry of Infrastructure and Transport)
- Analysis and interpretation of the monitoring measurements
- Safety assessment
- Technical reports

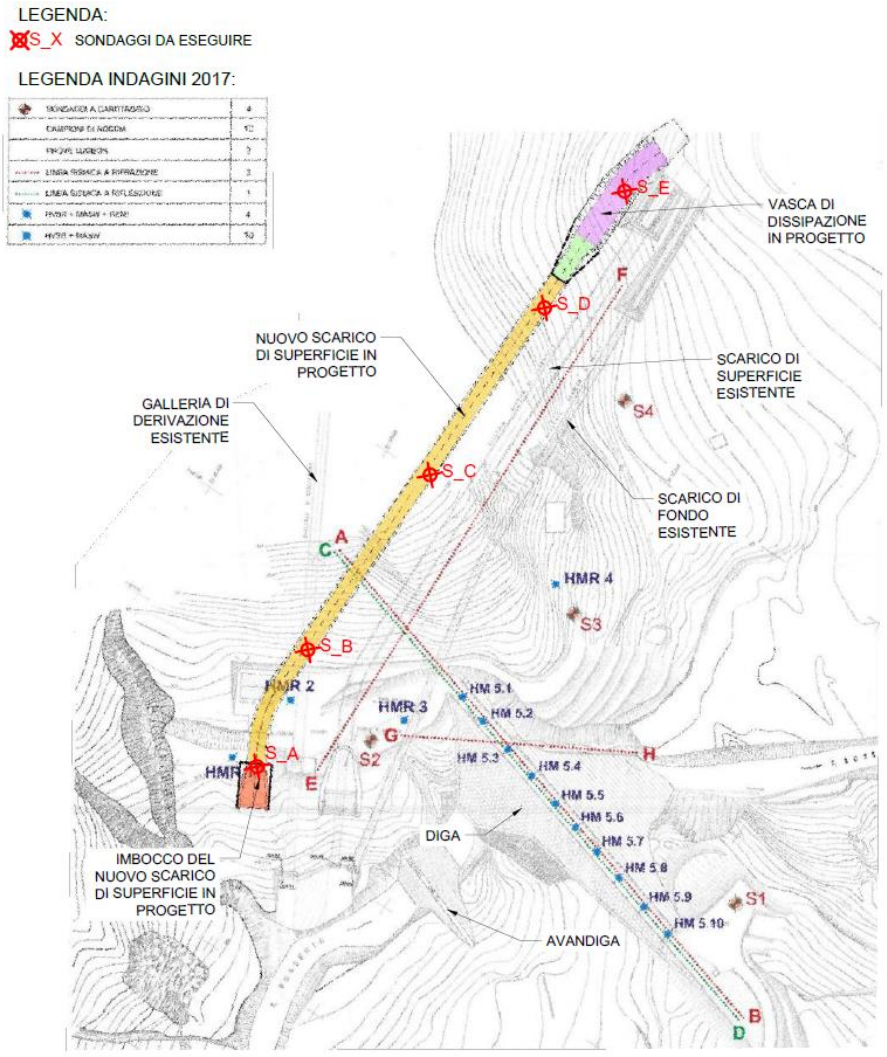








Activities of the Engineer Responsible for the Dam



- Supervision and coordination of design activities
- Technical assistance and/or construction management
- Emergency management (floods, earthquakes, …)
- Sedimentation management




Thank you for your attention