Politecnico di Torino

Dams & Reservoirs DAY 2025

Water and Energy security for Europe

ITCOLD

ITYP

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OPEN DAY ON DAMS



Dams and environment: engineering solutions for the future

TORINO – May 28, 2025

"Project to Improve the Hydraulic Safety of the Gorzente Lakes: Lake Lavagnina Dam".

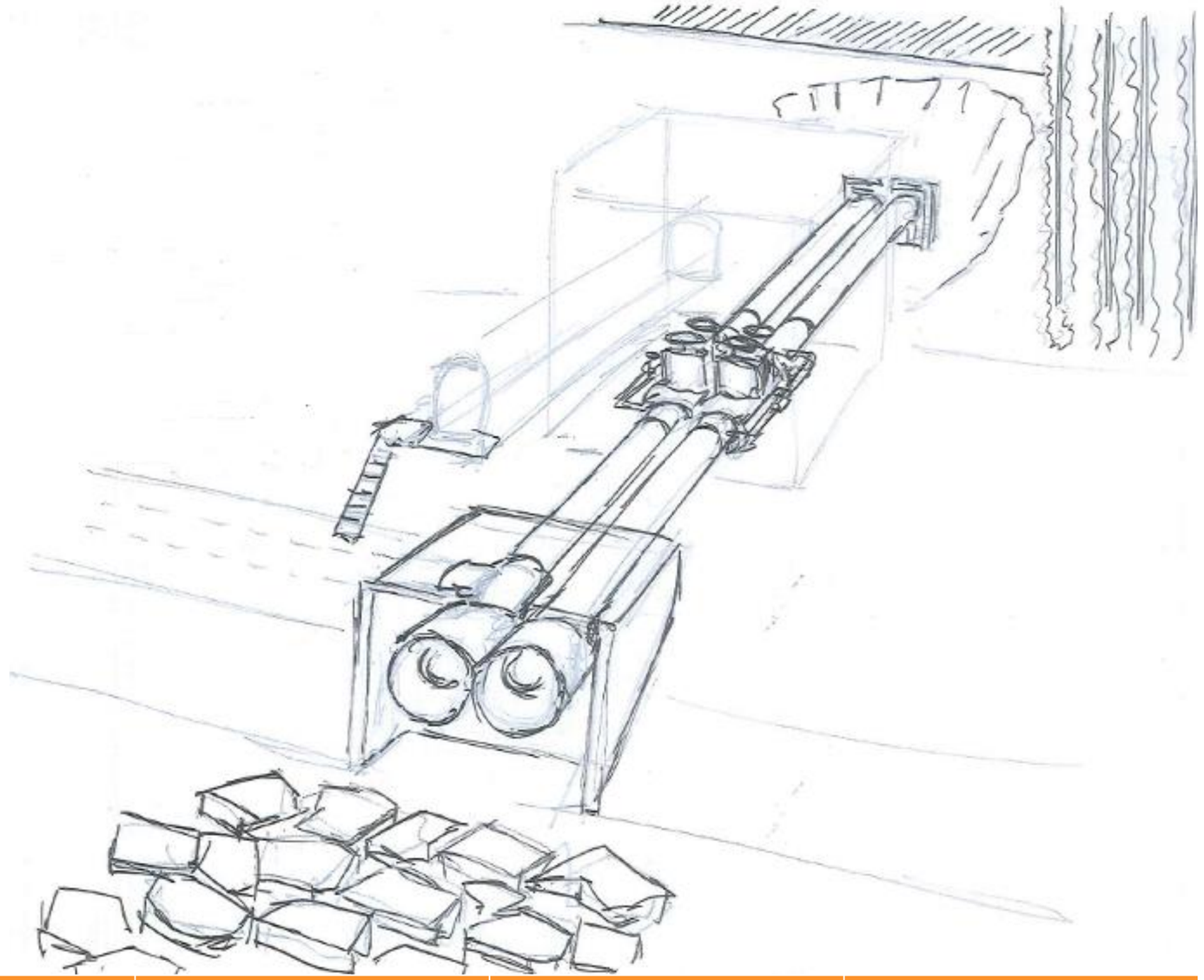
GIT

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Municipality of Casaleggio Boiro (AL)

ITCOLD – II Concorso Fotografico

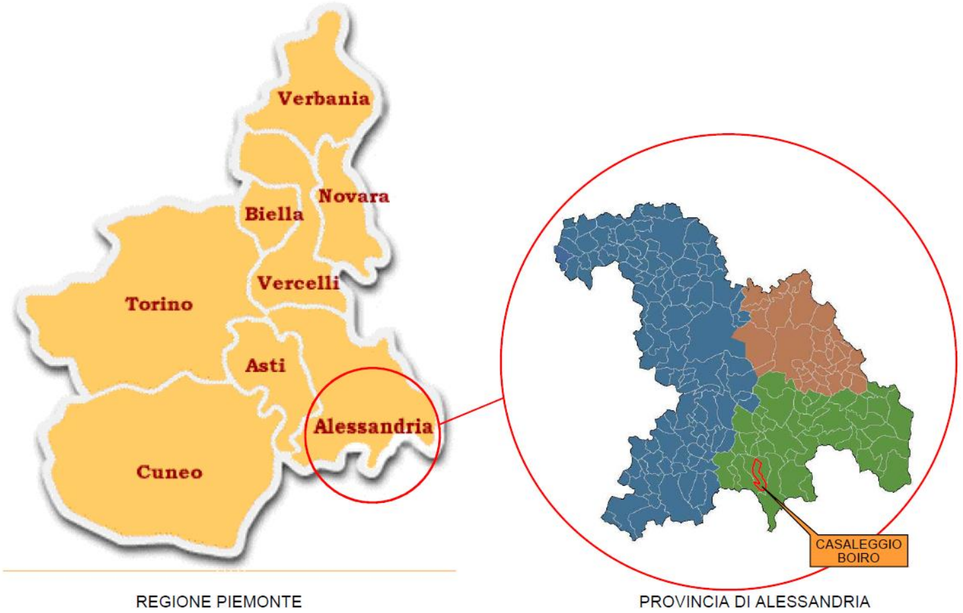
- *A. TERRITORIAL CONTEXT*
- *B. THE DAM*
- *C. THE PROJECT*
- *D. HYDRAULIC AND ELECTROMECHANICAL WORKS*
- *E. CIVIL STRUCTURAL WORKS*
- *F. CONSTRUCTION STAGING*



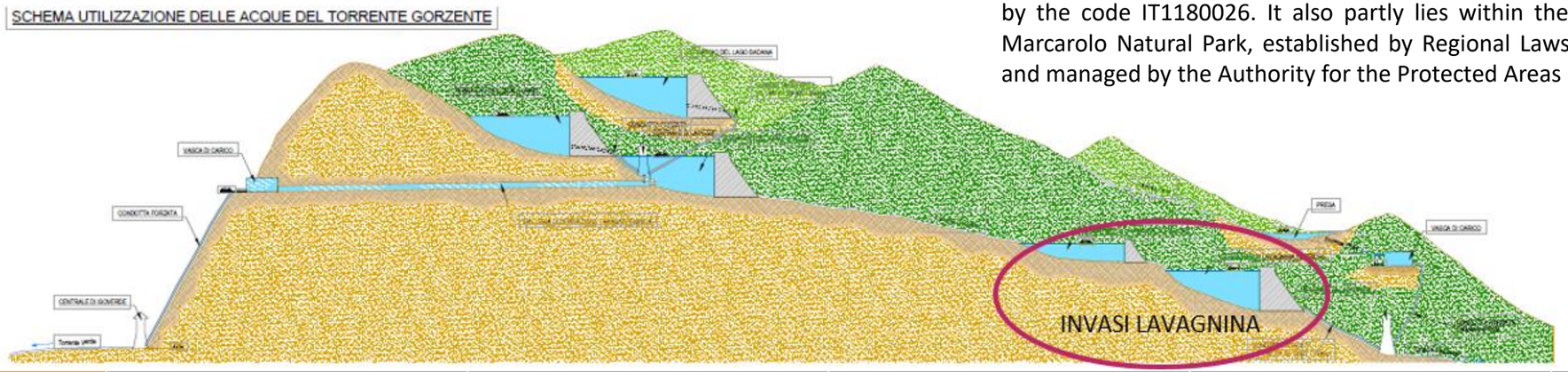
A. TERRITORIAL CONTEXT

The Upper and Lower Lavagnina Lakes are two artificial reservoirs located in the Ligurian Apennines, in the Province of Alessandria. They were formed by damming the Gorzente Stream. The project focuses on the dam of the Lower Lake, situated in the municipality of Casaleggio Boiro. This dam, operational since 1917, has a total storage capacity of approximately 2.7 million cubic meters.



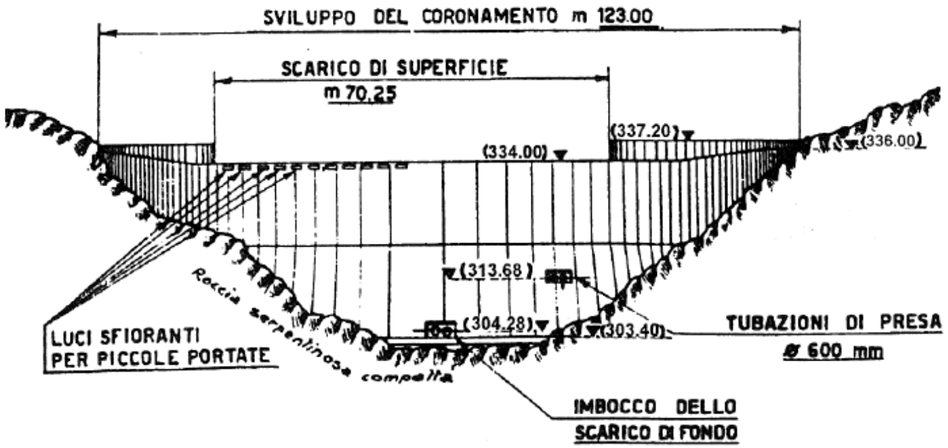


The project area falls within a zone designated as a Site of Community Importance (SCI), Special Protection Area (SPA), and Special Area of Conservation (SAC), identified by the code IT1180026. It also partly lies within the boundaries of the Capanne di Marcarolo Natural Park, established by Regional Laws no. 52/1979 and no. 13/1989, and managed by the Authority for the Protected Areas of the Piedmont Apennines.

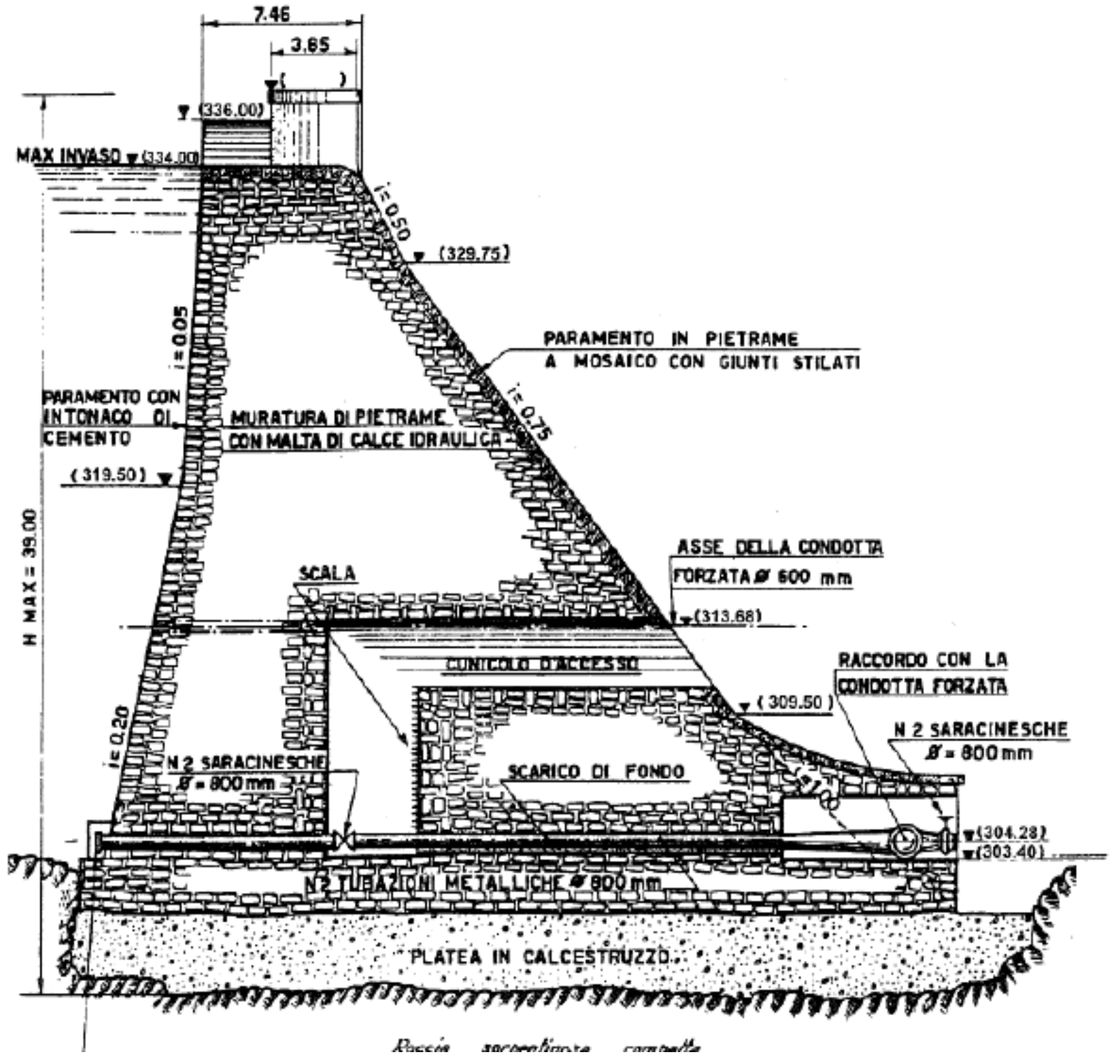


B. THE DAM

It is a gravity dam with a curved plan layout, characterized by a 200-meter curvature radius and a total crest length of 120 meters. The maximum impoundment height is approximately 40 meters. The dam is located in a mountainous area falling within a protected zone subject to landscape, hydrogeological, and Natura 2000 constraints.







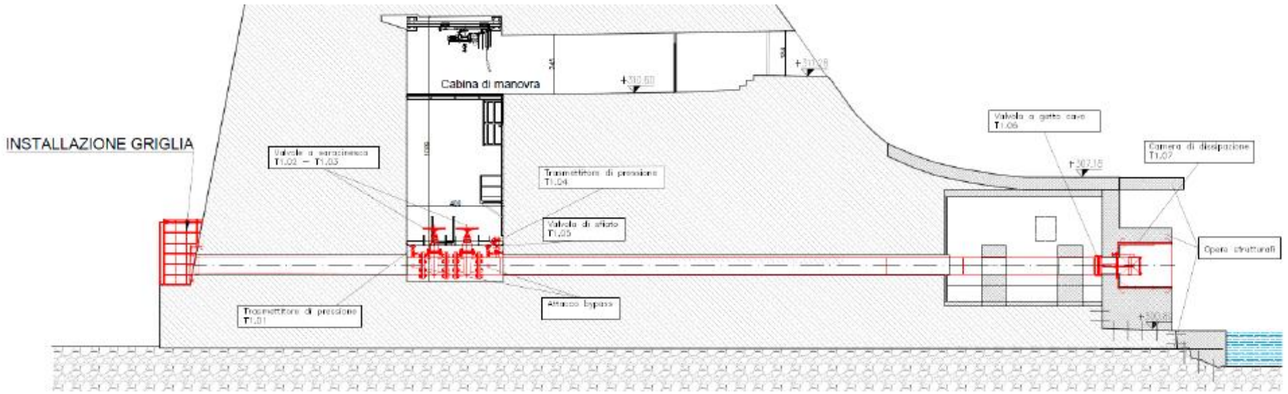
C. THE PROJECT

❖ Hydraulic safety of the bottom outlet

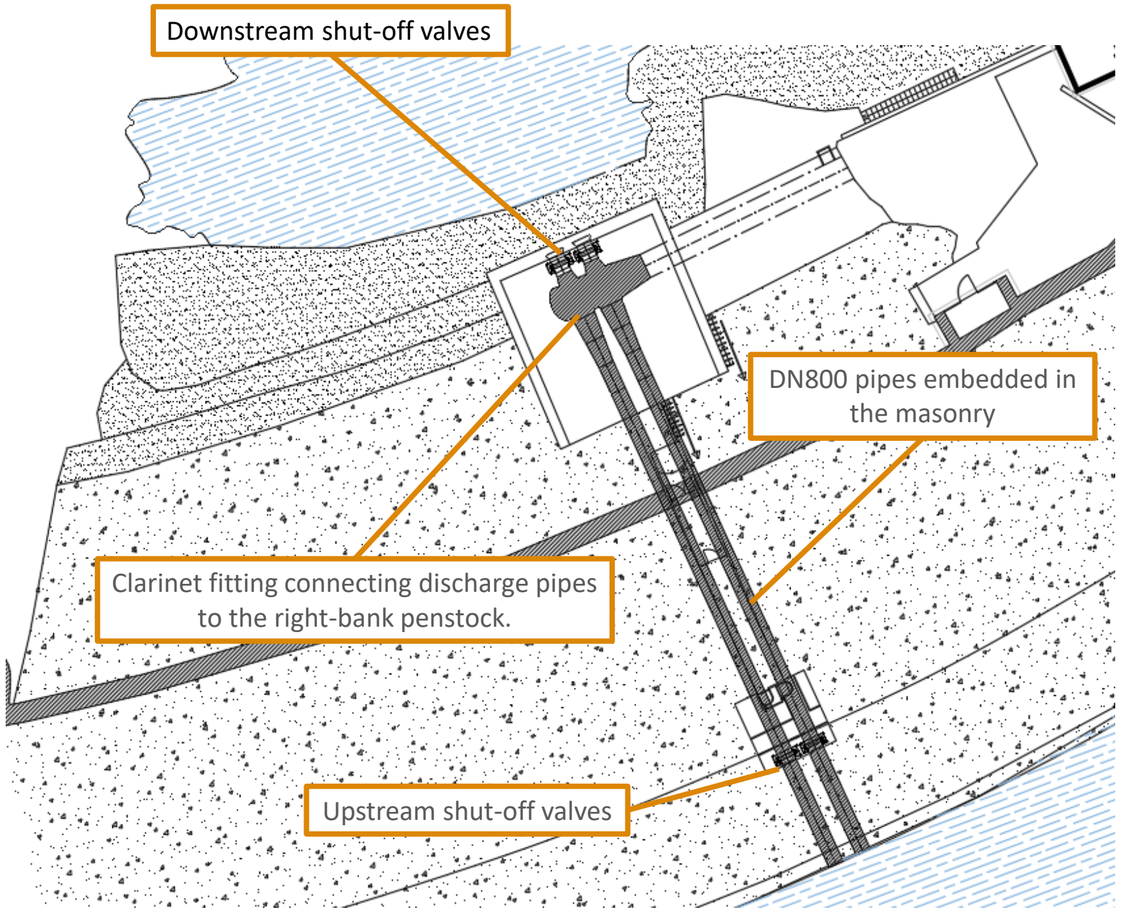
The existing bottom outlet system consists of two DN 800 pipes, controlled upstream by two gate valves accessible from a control room. At the downstream base of the dam, two additional gate valves are installed to manage the outflow.



Current state of bottom outlet



Updated layout of discharge structures



Current state of bottom outlet

❖ Rehabilitation of the upstream concrete surface and installation of waterproof protection

1) Removal of deteriorated concrete cover using selective hydroscarification techniques.

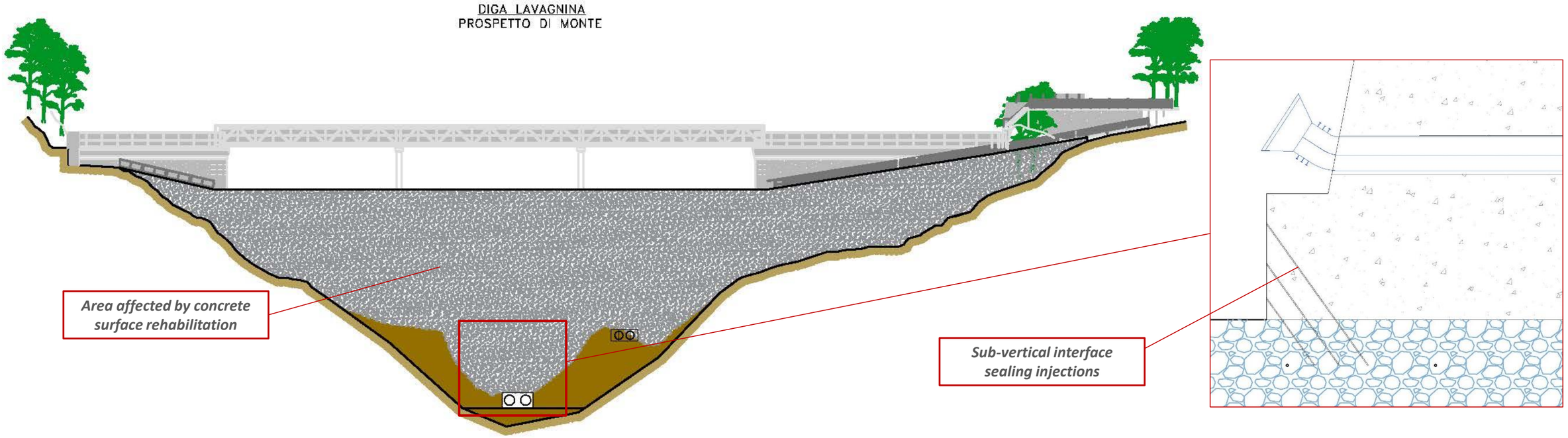
2) Surface regularization to prepare the upstream face for repair.

3) Installation of a bidirectional stainless steel structural mesh over the entire area to be restored.

4) Spray application of structural cement mortar with suitable mechanical properties to restore the original thickness.

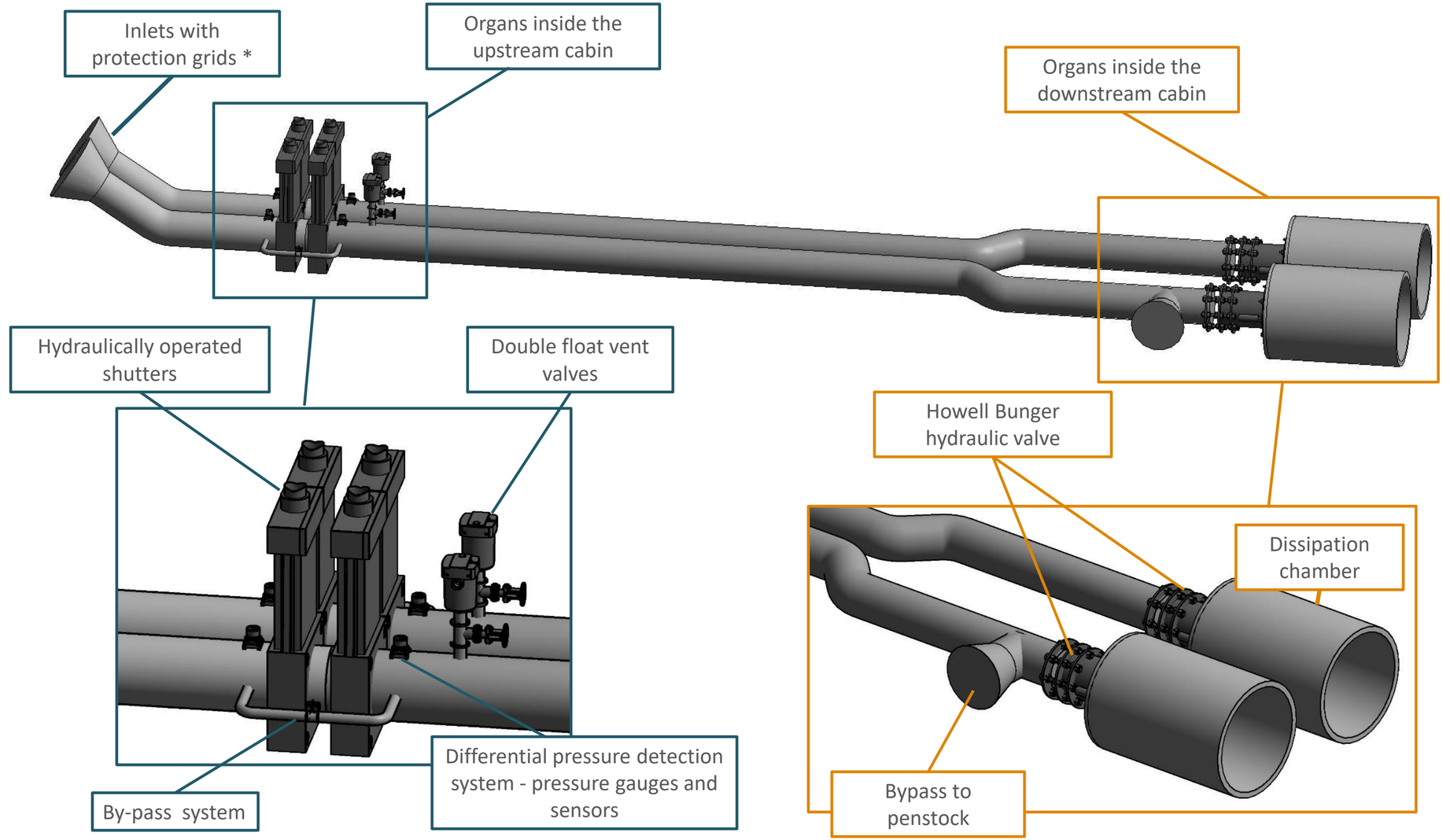
5) Application of a waterproof protective coating using single-component acrylic resin, sprayed on the surface.

6) Injection of sub-vertical micro-perforations with expanding resin and saturating gel to ensure hydraulic sealing between the dam toe and the underlying rock foundation.



C

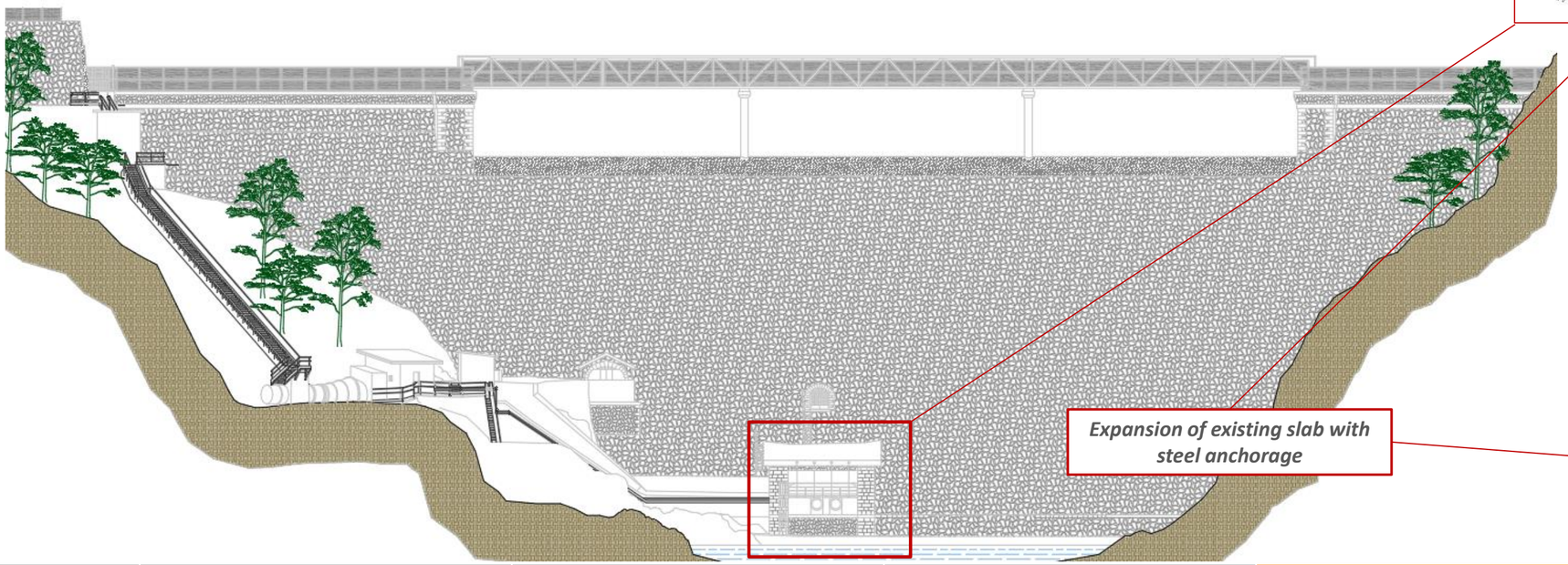
D. HYDRAULIC AND ELECTROMECHANICAL WORKS



E. CIVIL STRUCTURAL WORKS

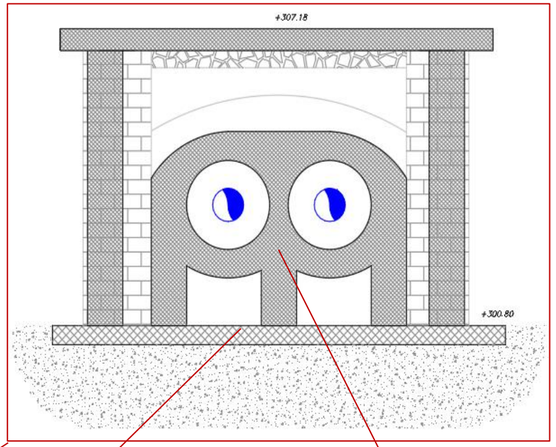
❖ Downstream Structural works – control cabin rehabilition and valve support

1. Demolition of non-structural internal components using techniques that preserve the integrity of the downstream control cabin. Upon completion, the cabin will be fully accessible for inspection.
2. Construction of a reinforced concrete structural block to support the valve system.
3. Extension of the existing platform across the full width of the downstream area (approx. 4.00–5.00 m), anchored to the rock using steel connectors.
4. To protect the reinforced concrete structure supporting the Howell-Bunger valve energy dissipators, the control cabin will be expanded. The roof will be extended and new 80 cm-thick side walls will be built, using construction techniques and materials consistent with the existing structure.

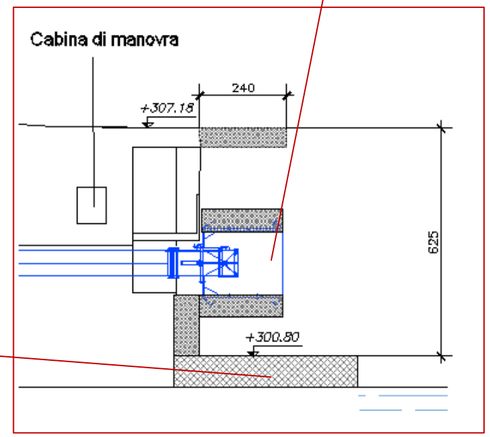


Expansion of existing slab with steel anchorage

Cab expansion

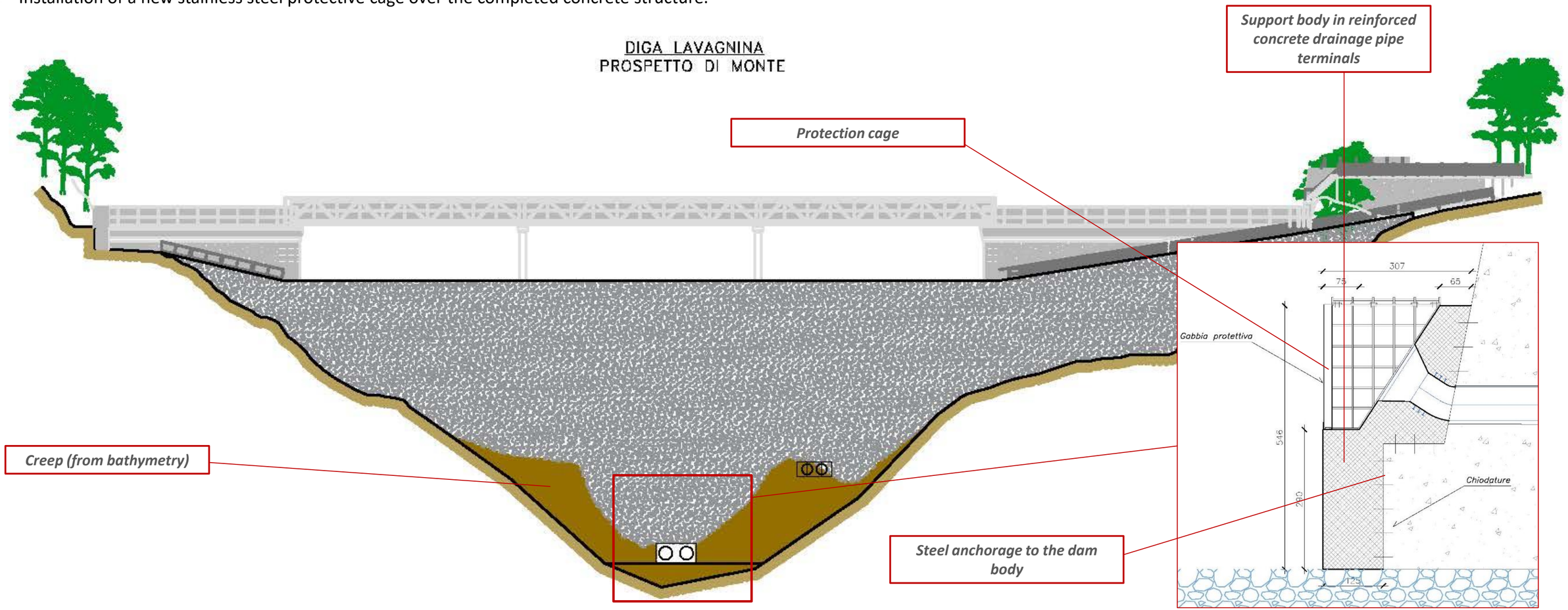


Heatsink support body



❖ Upstream Structural Works – Anchoring of Discharge Pipes

1. Construction of a reinforced concrete anchoring block for the pipes, specifically shaped to ensure optimal hydraulic sealing and designed to accommodate steel anchorage to the dam body.
2. Installation of a new stainless steel protective cage over the completed concrete structure.

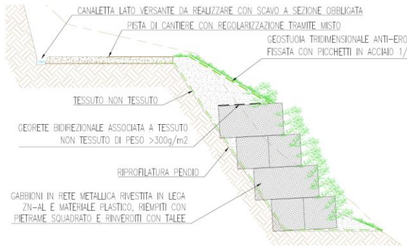


F. CONSTRUCTION PHASES

Particular attention was given to the construction phase due to the sensitive environmental context in which the works are located.
The area is subject to multiple environmental constraints, including:

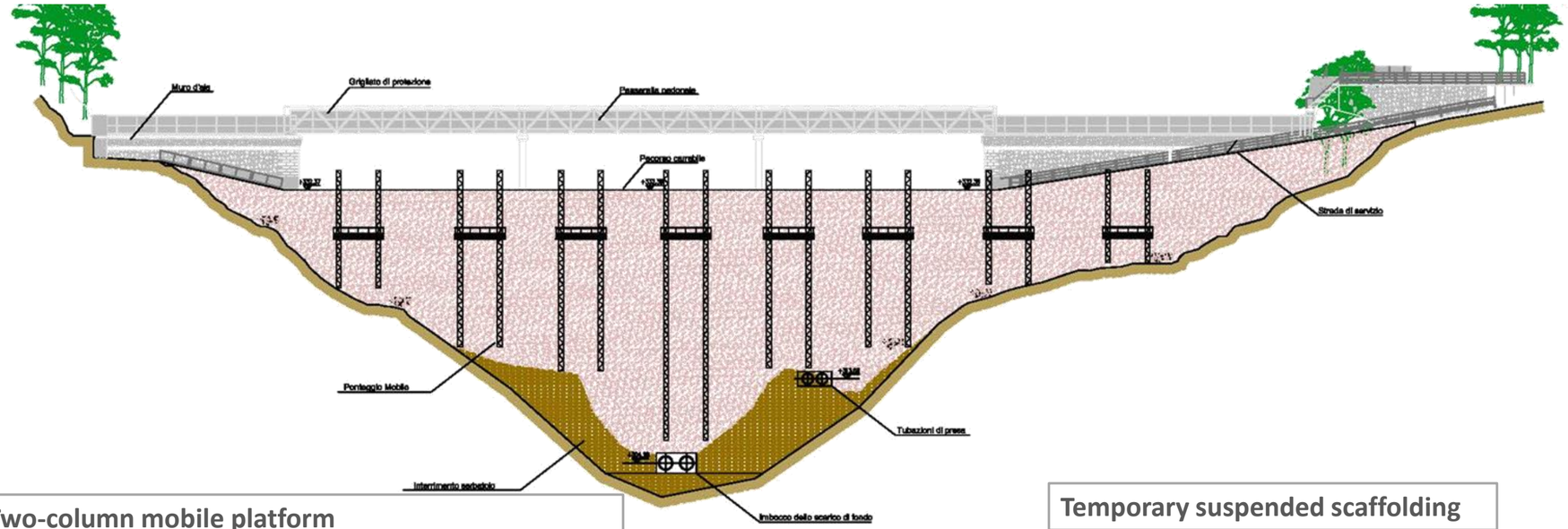
- hydrogeological and landscape protection;
- designation as a SIC-ZPS-ZSC site (code IT1180026);
- partial inclusion within the boundaries of the Capanne di Marcarolo Natural Park, established by Regional Laws no. 52/1979 and no. 13/1989, and managed by the Authority for the Protected Areas of the Piedmont Apennines.





As an example, the figure illustrates the only viable access route for construction vehicles to the downstream area of the dam—a site track made safe through the use of non-invasive naturalistic engineering techniques

To restore the upstream face with appropriate waterproofing measures, two intervention methods have been proposed—both of which can be implemented by working exclusively from the dam crest.



Two-column mobile platform

- Platform supported by one or more columns composed of 1.5 m modular elements.
- The vertical columns are anchored to the facing by means of tubes welded to plates or by means of tubes and clamps.
- Advantages: shorter assembly and disassembly times compared to traditional scaffolding, high load capacity (up to 4000 kg); self-braking electric motor and rack-pinion coupling mechanism for easy platform movement.
- In the event of a flood, it will be possible to lift the platform by keeping only the vertical guides in the riverbed.

Temporary suspended scaffolding

- Mobile modular platform of variable length anchored from above.
- Flexible parts for suspension.
- Advantages: low cost, speed of movement of the platform.
- Critical aspect to be explored: anchoring method to the dam block structure and creation of the counterweight.



THANKS FOR YOUR ATTENTION

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