THE OMBLA HPP MULTIPURPOSE HYDRO PROJECT

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The Ombla HPP Multipurpose Hydro Project

PRESENTATION CONTENT :

- GENERAL
- GENERAL SITE DATA
- HYDROLOGICAL DATA
- IDEA
- INVESTIGATION WORKS
- PROJECT BASIC IDEA
- TEHNICAL CONCEPT
- TEHNICAL SOLUTION
- CONCLUSION

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GENERAL

The Ombla HPP Multipurpose Hydro Project

MAIN PURPOSE :

- POWER GENERATION
- THE CITY OF DUBROVNIK POTABLE WATER SUPPLY

The Ombla HPP Multipurpose Hydro Project

is

pioneering attempt to build a power plant using for power generation water from an underground karst aquifer

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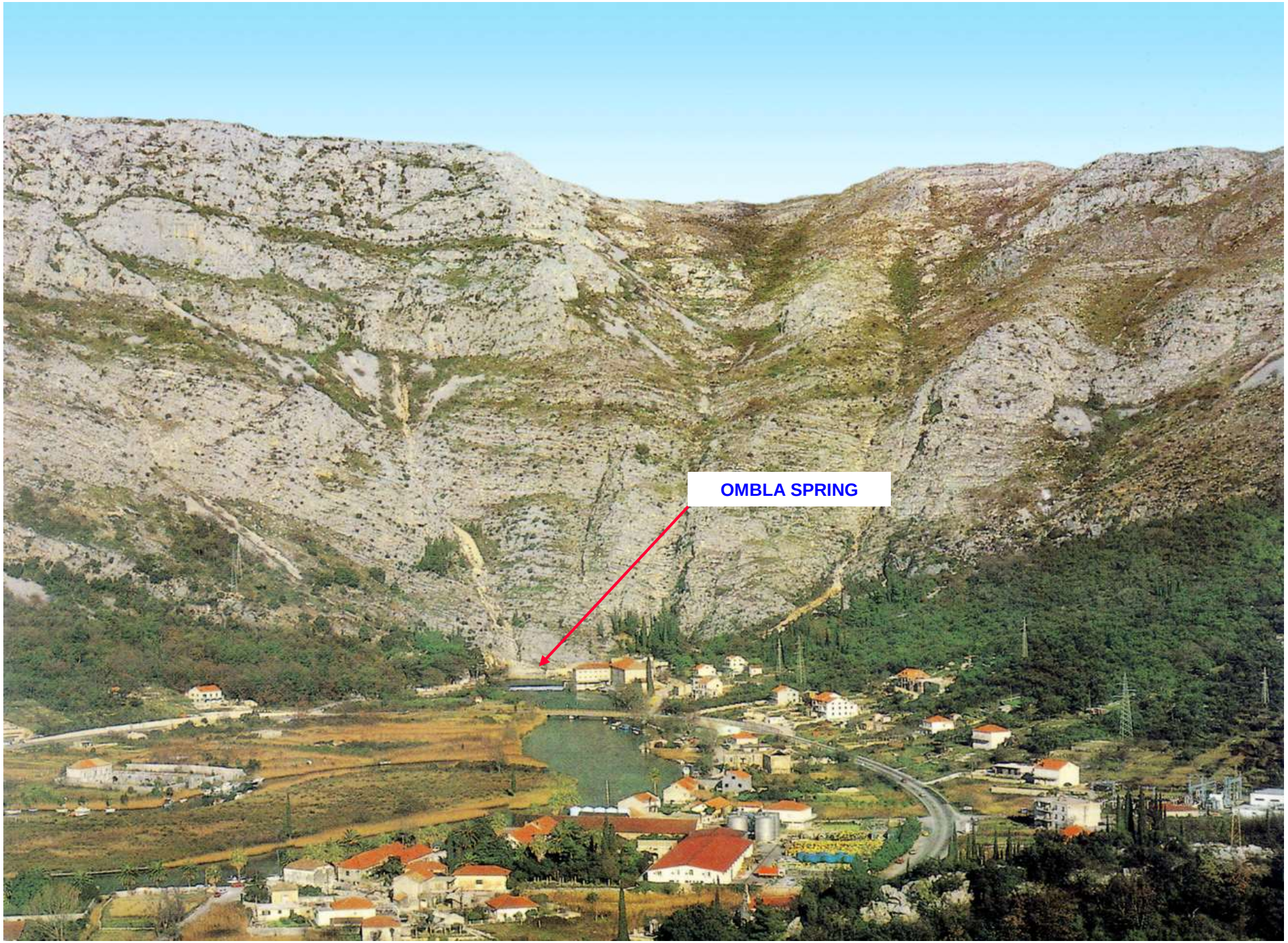
GENERAL SITE DATA

Ombla spring

- Some five kilometers from the Dubrovnik core there is Rijeka Dubrovačka bay.
- At the far end of the bay lies underground Ombla River spring


OMBLA SPRING

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HYDROLOGICAL DATA

Ombla spring hydrologic data

- mean annual discharge…… Qmean= 24,0 m3/s
- max 100-year discharge ……Qmax/100 = 113 m3/s
- min. 100-year discharge ……Qmin/100 = 2,4 m3/s
- dry periods in spring chatchment area may last more than 90 days

THE OMBLA SPRING HAS NEVER DRIED OUT

INDICATION

there must be an large underground reservoir storing water and discharging it at the spring

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IDEA

Use water at the Ombla spring for power generation

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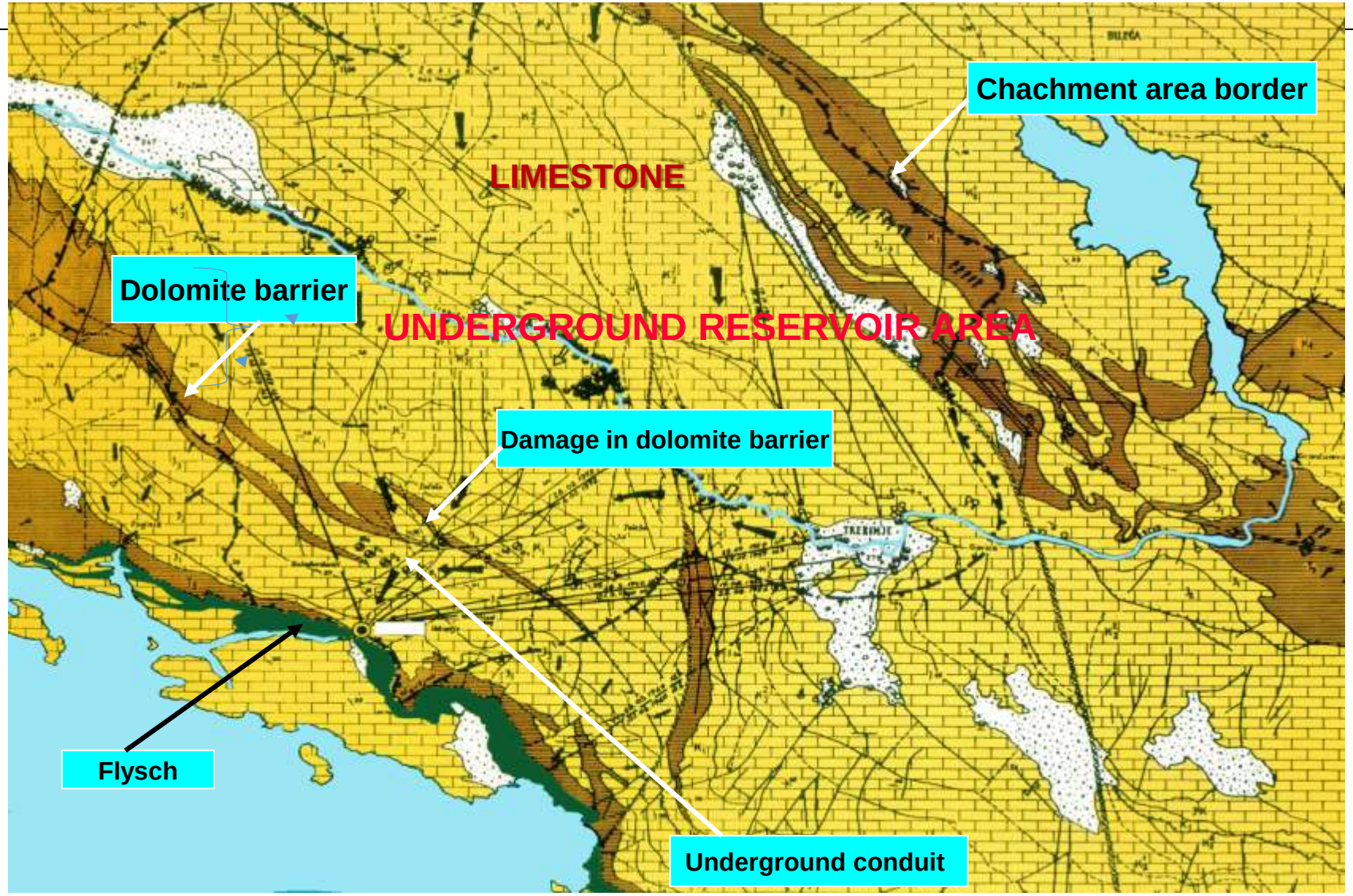
INVESTIGATION WORKS

Investigation work tasks

Determination of underground reservoir

- Determine possible impoundment of the underground reservoir
- Determine underground flow directions
- Locate all active and fossil cave conduits
- Filling and emptyng process

Ombla spring chachment area hydrogeologic caracheristics



Rock categories

- Eocene flysch represents impermeable hydrogeological barrier
- Triassic dolomite is a poorly permeable rock with local deviations
- Jurassic limestone is permeable rock. The limestone is dominated by typical karst porosity with conduits and caverns of large sizes (hydrogeological collector/aquifer

Ombla catchment area filling and emptying investigations

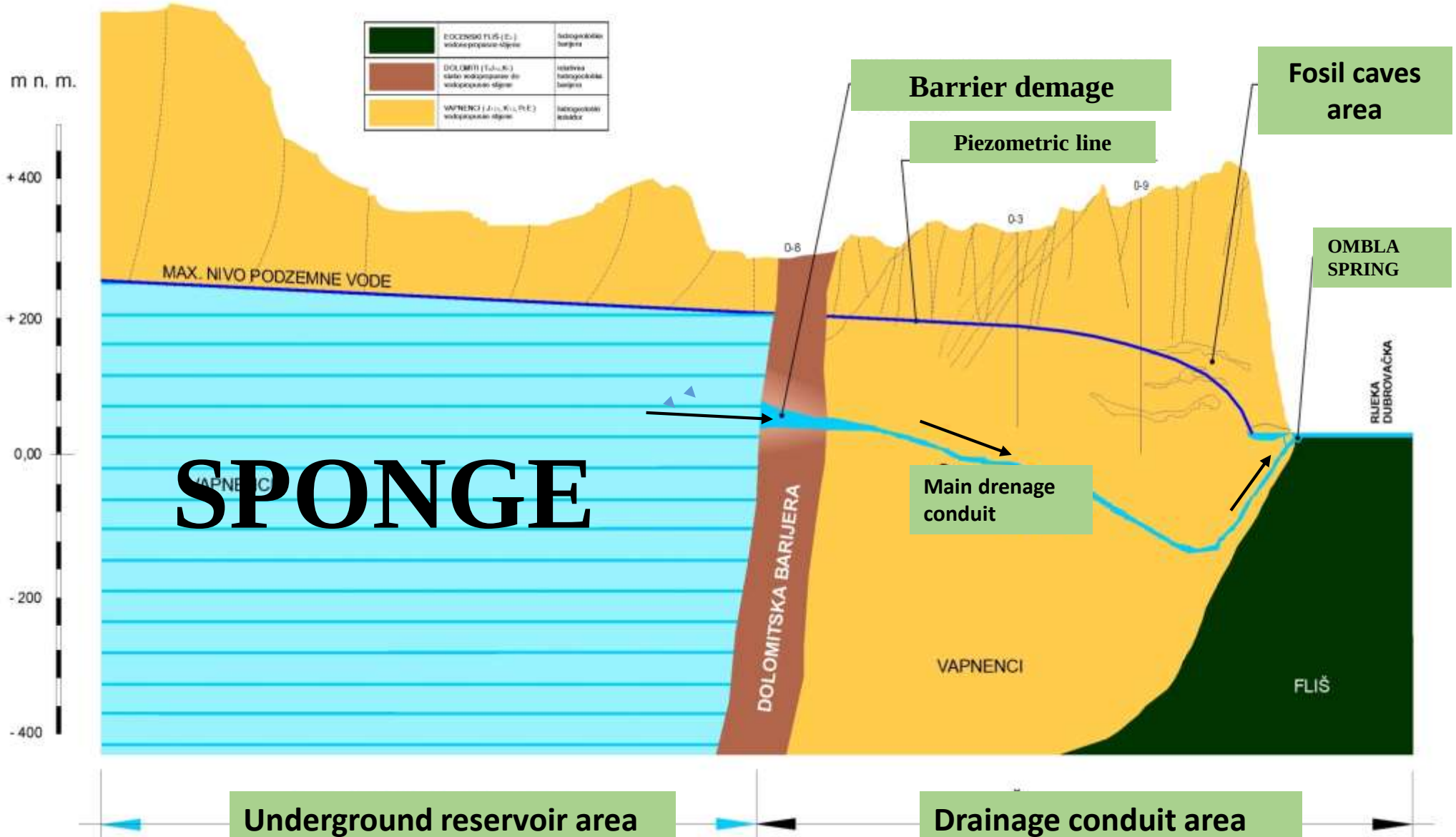
Filling and emptyng process and underground reservoir behaviour was considered and clarified in numerical model

Ombla catchment area filling and emptying

- Stormwater penetrates the soil and creates an underground reservoir in the Ombla spring catchment area of 600 km^2
- Underground reservoir is emptied through the damaged dolomite barrier and the main conduit placed in the southern part of the catchment area
- Difference between min. and max.groundwater table reaches up to 200 m
- The underground stream length from the sinks to the spring reaches up to 30 km

UNDERGROUND RESERVOIR-HYDROGEOLOGICAL PROFILE

NATURAL CONDITION



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PROJECT BASIC CONCEPT IDEA

At the Ombla spring construct the dam to create the sufficient water pressure needed for power generation

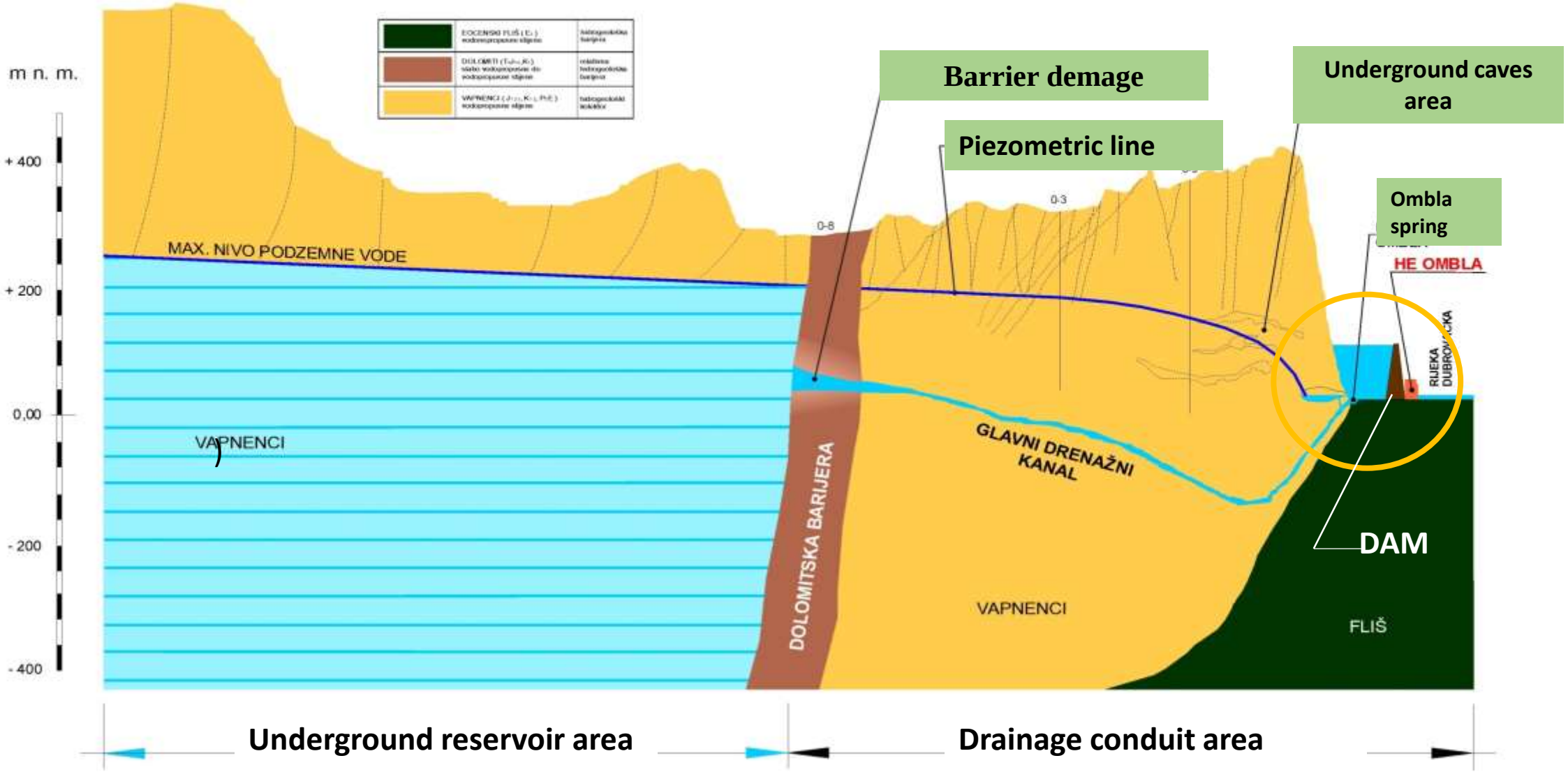
DAM SITING

Basic condition - find location of the dam without causing environmental damage????

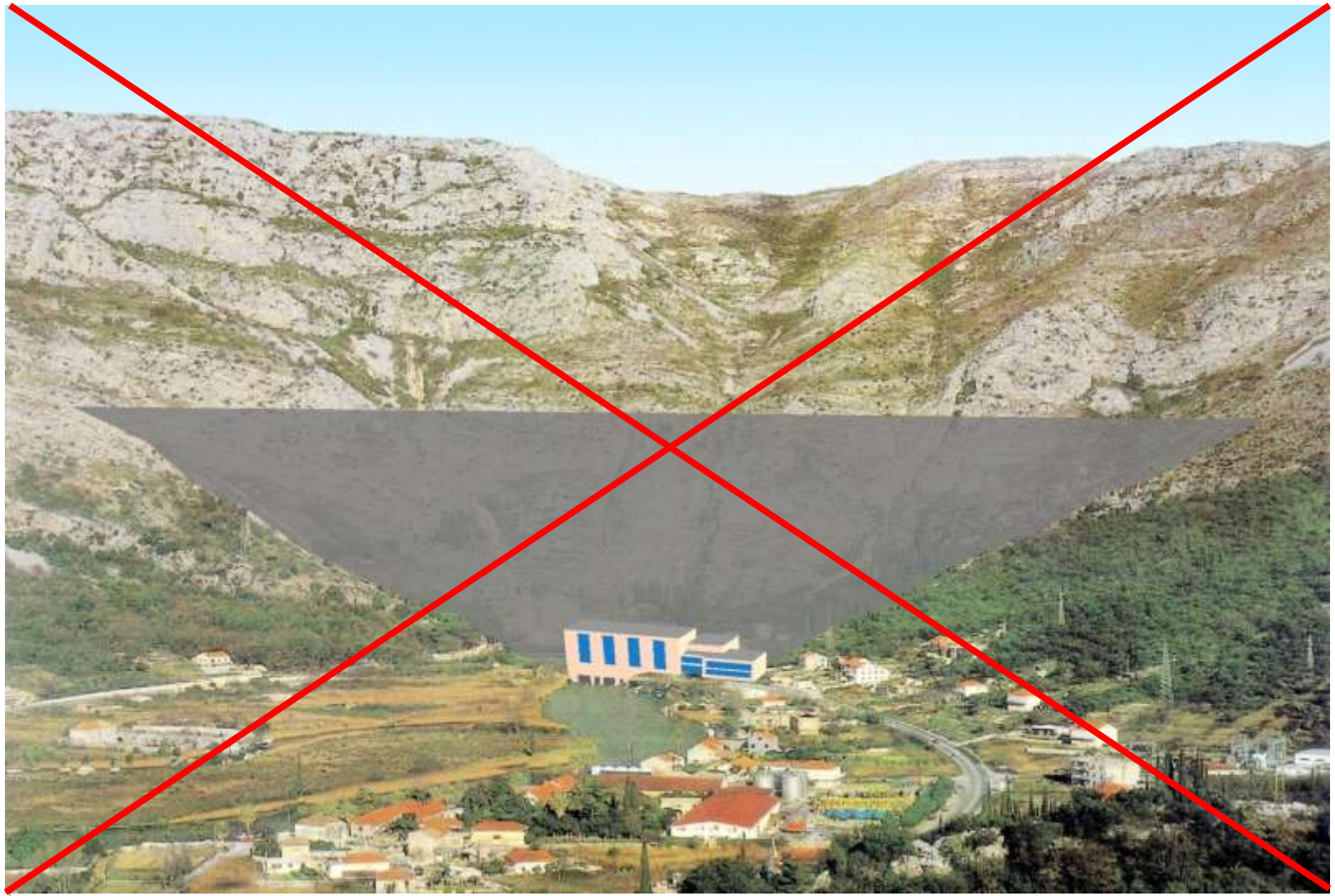
Two possibilities

- **Location in Rijeka Dubrovačka bay in front of spring site**
- **Location under the ground**

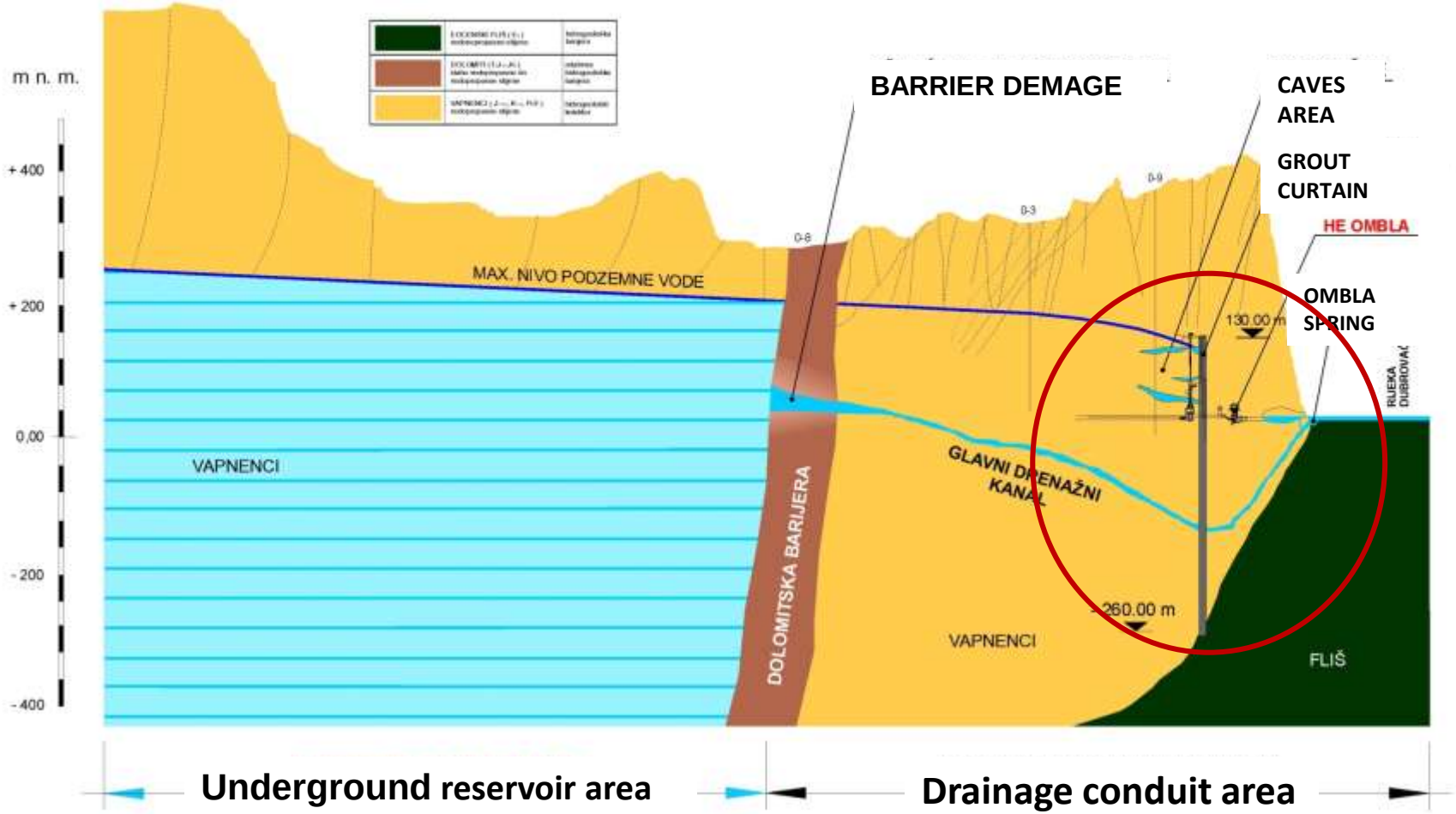
DAM SITE IN THE BAY



DAM SITE IN THE BAY



DAM SITE UNDER THE GROUND



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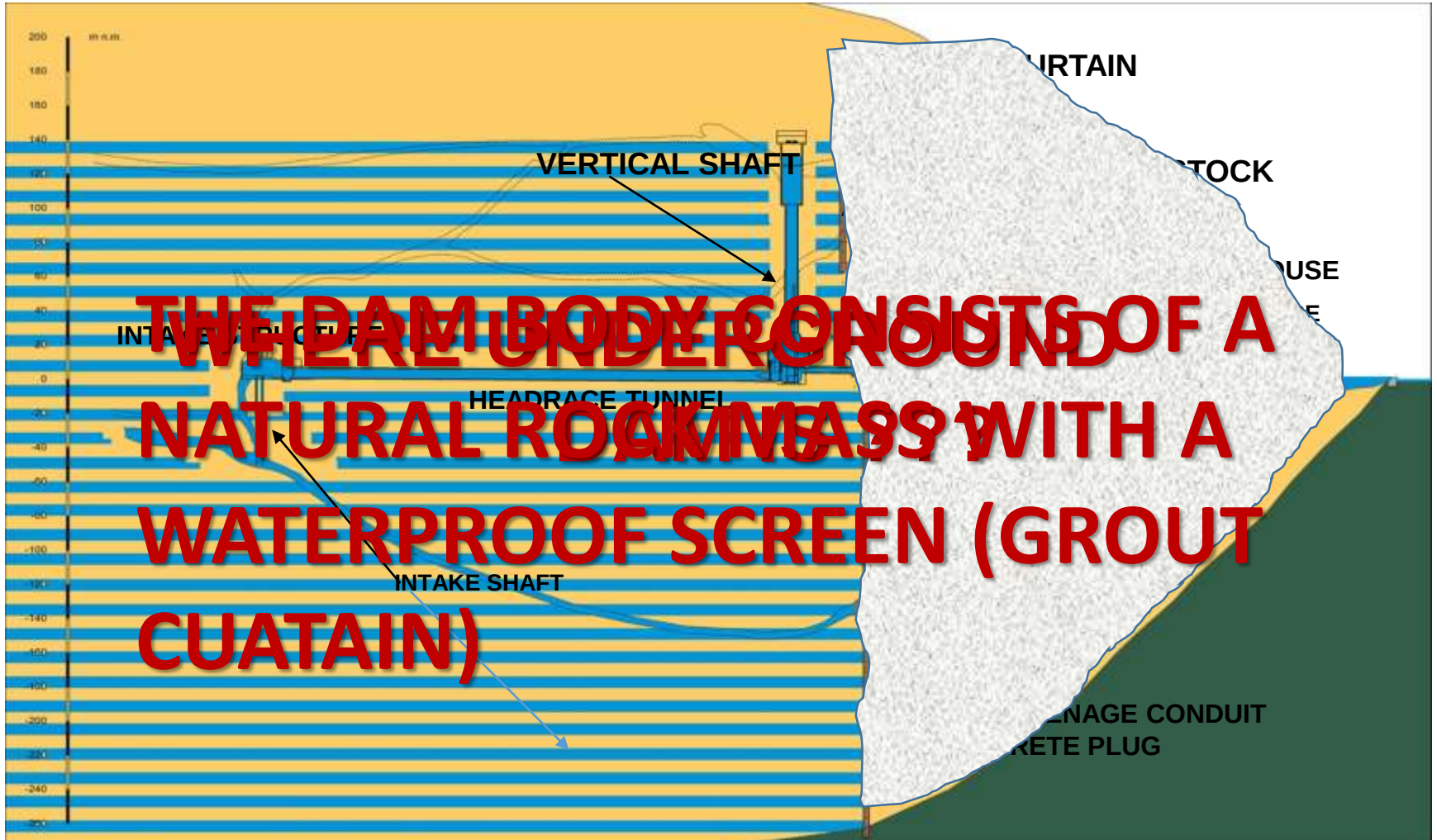
TEHNICAL CONCEPT

POWER-GENERATION HERNESSING USING UNDERGROUND DAM

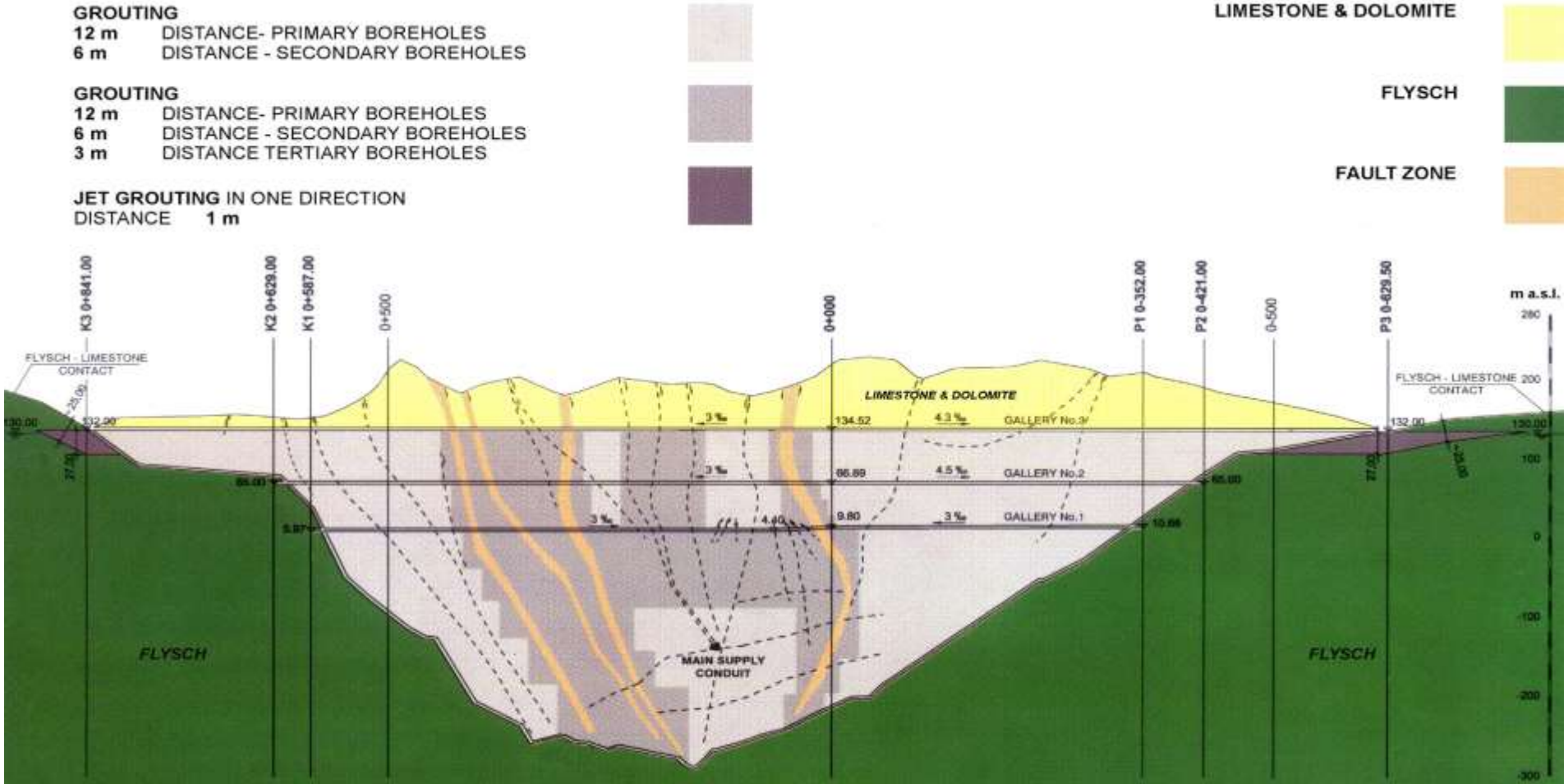


THE DAM BODY CONSISTS OF A NATURAL ROCKMASS WITH A WATERPROOF SCREEN (GROUT CUATAIN)

DETERMINATION MAIN DAM CHARACTERISTICS AND PRECISE DAM SECTION LOCATION

- Dam hight over sea level
- Dam perimeter

Grout curtain (300.000 m2)



PROJECT CAPACITY SELECTION AND DETERMINING CHARACTERISTICS OF GENERATING UNITS

Key points for project capacity selection (turbine discharge) and determining characteristics of generating units ware

- discharge duration curve along conected with possible mean annual output
- pool elevation lowering during one year
- biological minimum discharge 4 m^3/s

PROJECT CAPACITY SLECTION ALONG WITH OPTIMUM DAM HIGHT ELEVATION WAS DETERMINED ON MATHEMATICAL MODEL

CAPACITY SELECTION

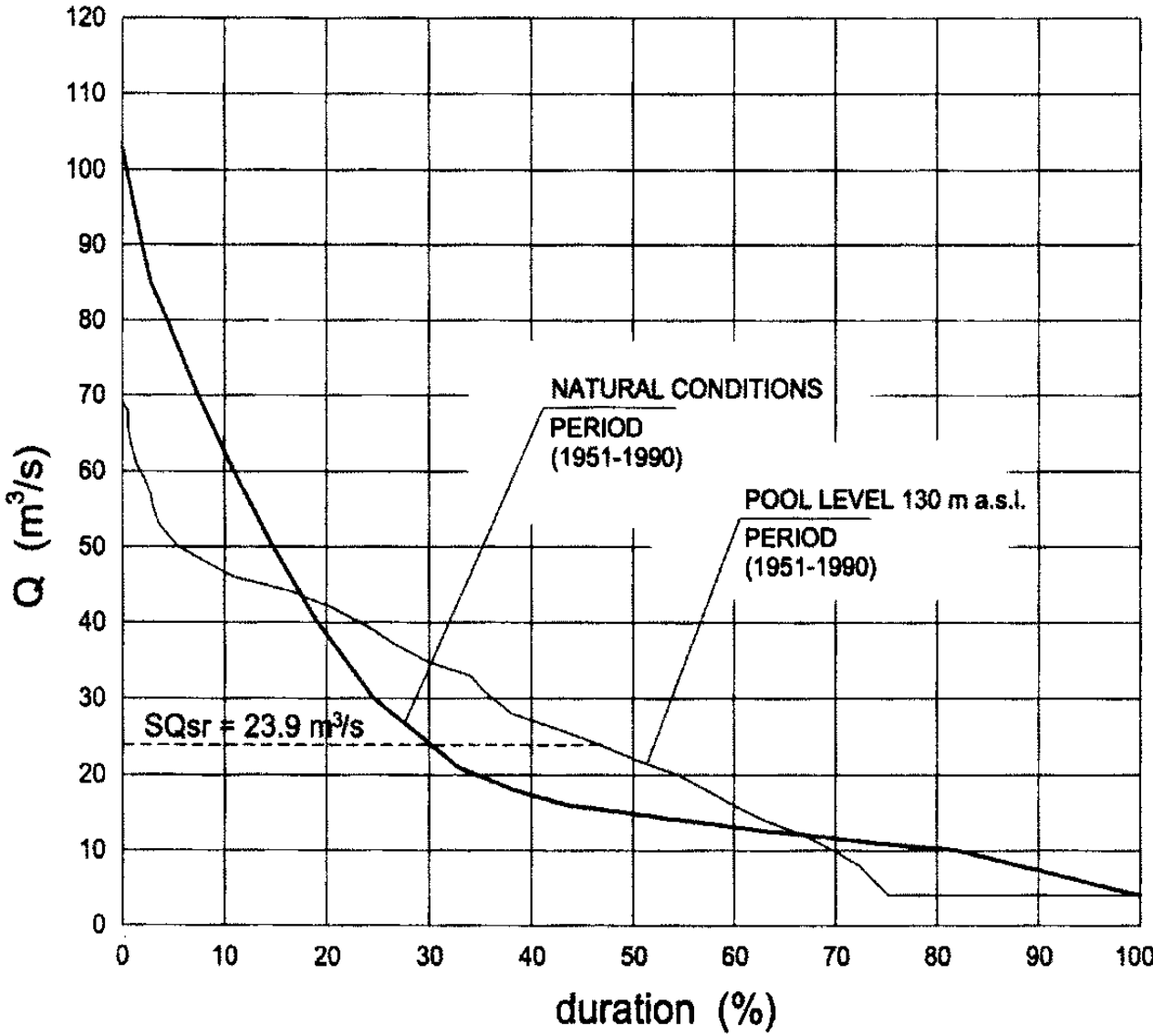
Research result on a mathematical model

- Under the condition when the pool elevation is at 130.00 m a.s.l. and the biological minimum at low streamflow totals 4.0 m3/s, the natural outflow duration curve is visibly transformed
- The pool elevation lowering is planned to the level of 75.00 m a.s.l..

- Power Plant discharge 60 m^3/s

- Genaratig units 2x 24 m^3/s+2x6m^3/s

- Optimum dam hight 130 m a.s.l.



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TECHNICAL SOLUTION

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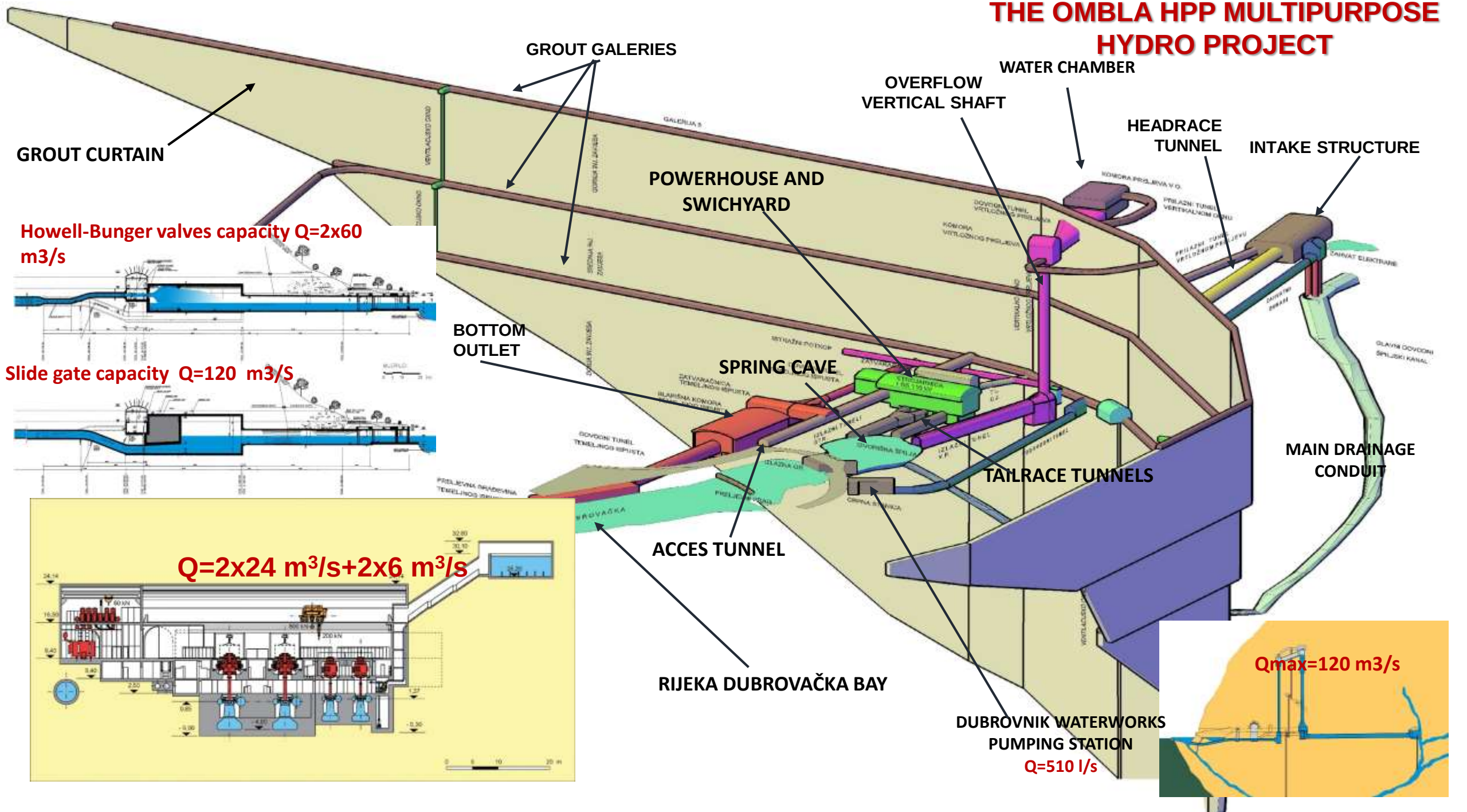
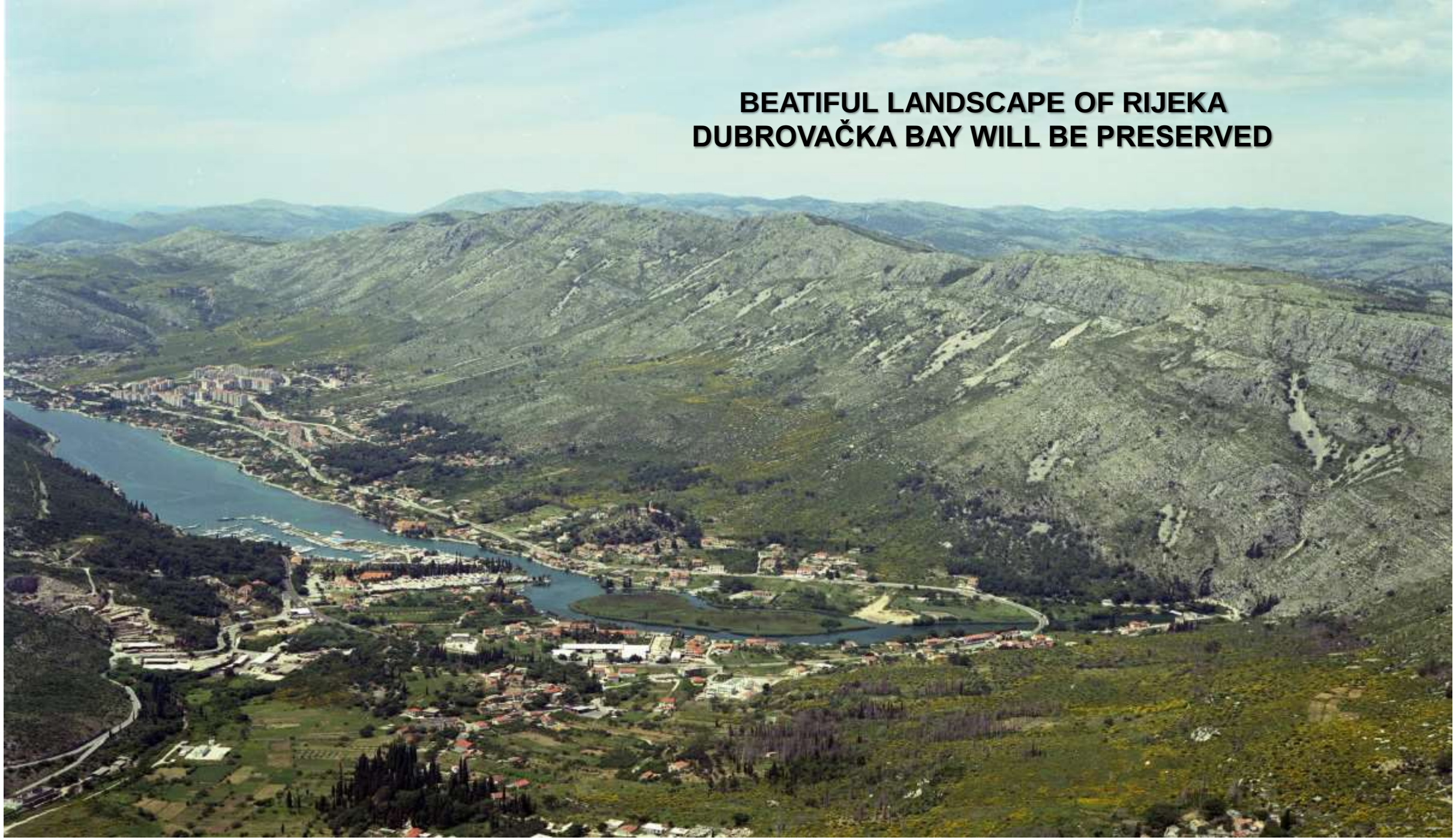


HPP Ombla in Rijeka Dubrovačka bay


BEATIFUL LANDSCAPE OF RIJEKA
DUBROVAČKA BAY WILL BE PRESERVED

HPP TEHNICAL DATA

- Mean annual discharge….....24.0 m^3/sec
- Max. gross head…….....…..... 128.8 m
- The power plant capacity .....68 MW
- Rated discharge..... 60 m3/s
- Average annual output .....225 GWh
- Turbines
  - rated discharge.....….....2x24 m^3/s+2x6 m^3/s
  - rated power.....….....2x27.6 MW+2X5.6 MW
- Generator.....2x30 MVA+2x8 MVA
- Switchyard 110 KV…….....metal-enclosed, three-pole, SF_6
- Operating mode.....run-off-the-river

- Planned Dubrovnik Waterworks capacity is about 1500 l/s potable water
- The project costs are estimated at EUR 150 millions
- The construction is planned to last about 4,5 years.

HPP location characteristics

- All the Ombla HPP equipment and structures will be placed under the ground
- The plant is completely hidden under the ground
- The natural harmony of the Ombla spring area will be conserved

CONCLUSION

- **The Ombla HPP concept is a completely new approach to the water power harnessing in power generation which can only be implemented under adequate hydrogeological conditions**

- **Locating of the entire facility under the ground reduces the construction costs and prevents its environmental impact**

- **Successful implementation of this project could encourage other countries with karst areas to look into the possibility of building similar project**


THANK YOU FOR
YOUR ATTENTION