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INTRODUCTION TO GEOMATICS and GEOSPATIAL TECHNOLOGIES

New Technologies for water management

The Apulian Acqueduct

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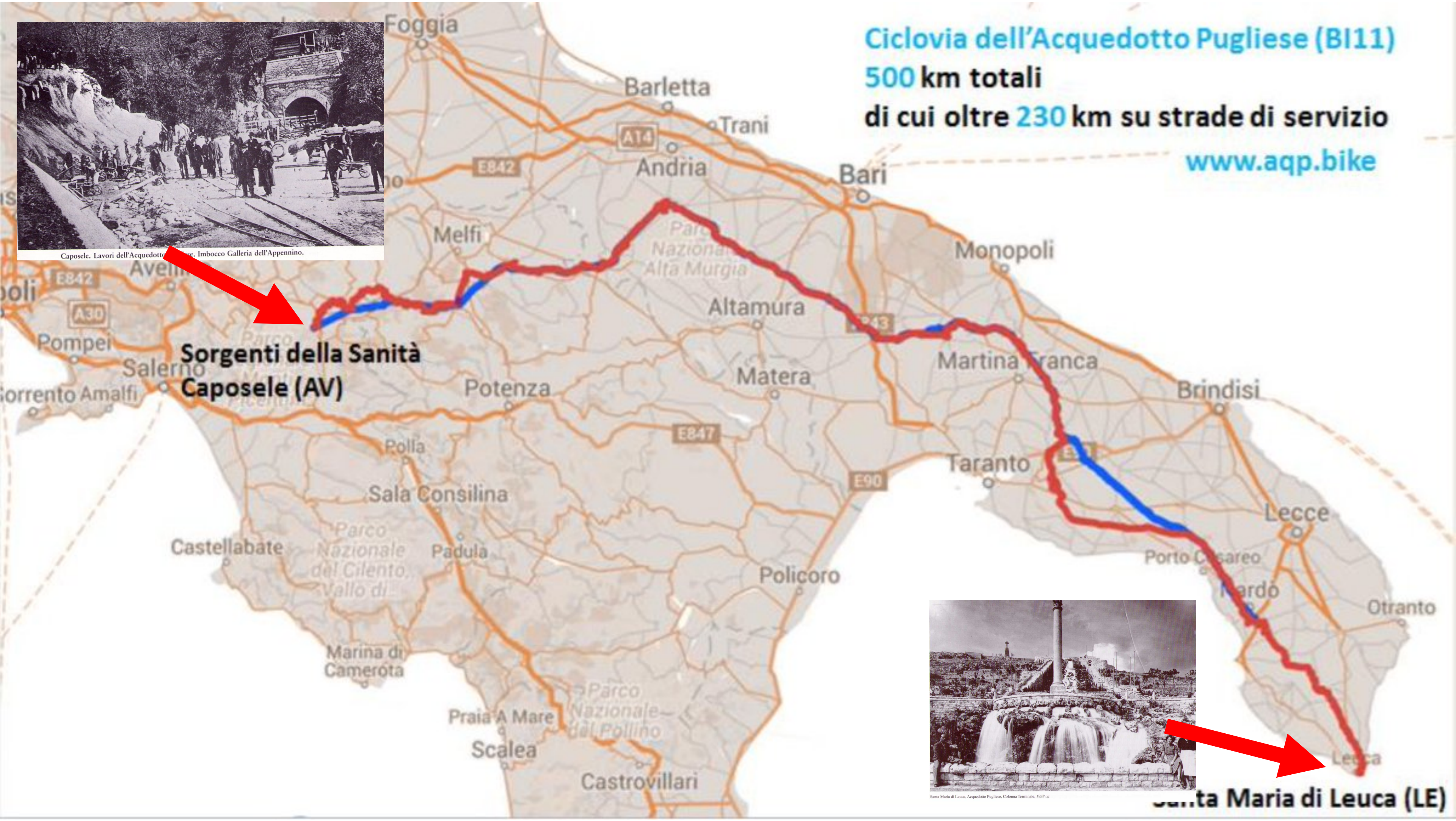
The Apulian Acqueduct case

AQP is the most important, modern, most technologically advanced public aqueduct in Italy, but probably also in Europe. It is managed by a state company (AQP Spa) according to the rules set for publicly owned joint-stock companies, which are not rules comparable to that of a wholesome Spa. Everything happens through public procedures and with great attention to impartiality, transparency, compliance with the rules.



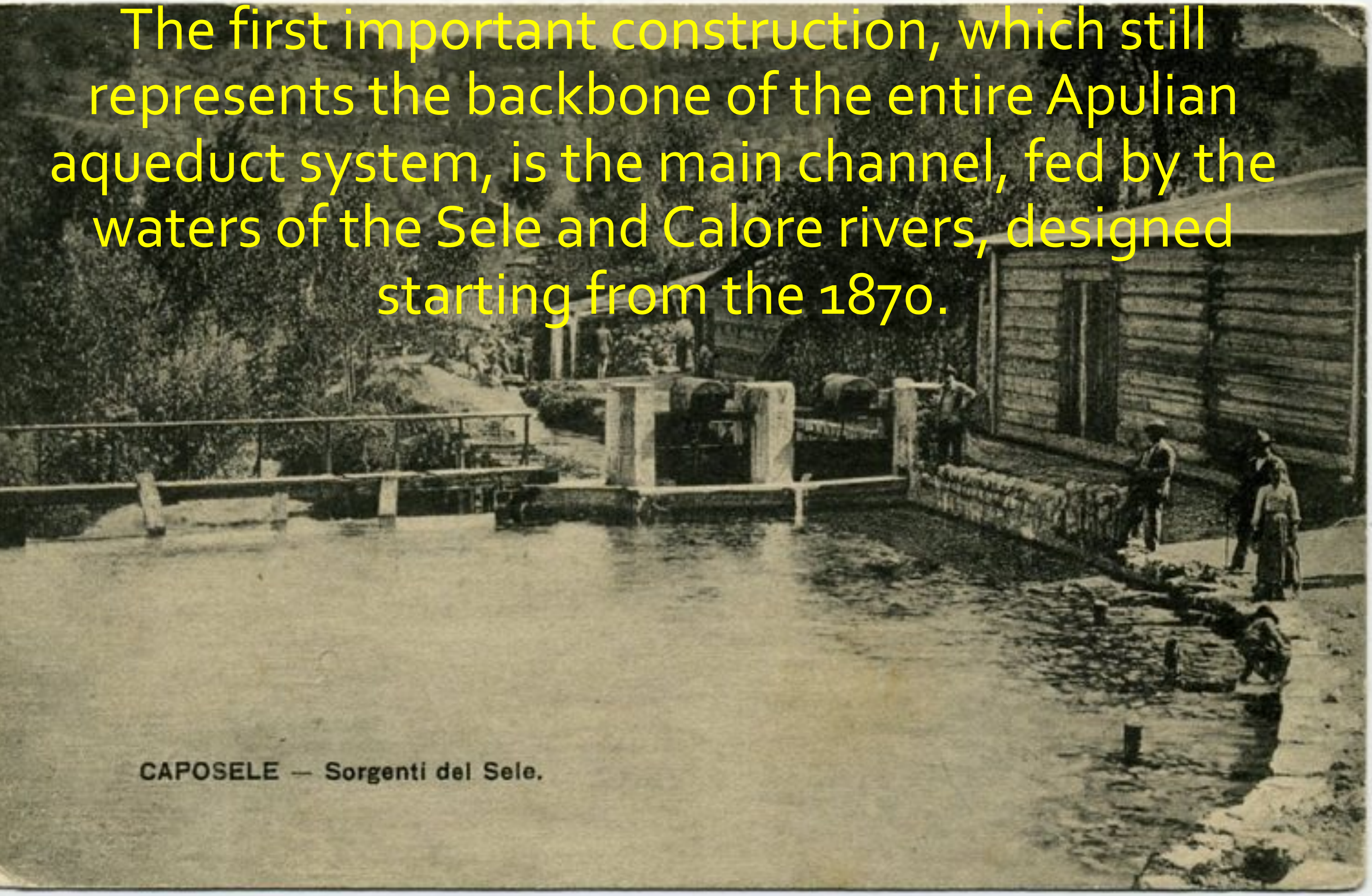
Ciclovia dell'Acquedotto Pugliese (BI11)
500 km totali
di cui oltre 230 km su strade di servizio
www.aqp.bike
Sorgenti della Sanità
Caposele (AV)
Caposele. Lavori dell'Acquedotto ... Imbocco Galleria dell'Appennino.
...ta Maria di Leuca (LE)
Foggia
Barletta
Trani
Andria
Bari
Melfi
Parco Nazionale Alta Murgia
Monopoli
Altamura
Martina Franca
Matera
Potenza
Pompei
Salerno
Sorrento Amalfi
Brindisi
Taranto
Lecce
Porto Cesareo
Otranto
Polla
Sala Consilina
Castellabate
Parco Nazionale del Cilento, Vallo di...
Padula
Policoro
Marina di Camerota
Praia A Mare
Scalea
Parco Nazionale del Pollino
Castrovillari
A14
E842
A30
E847
E90

The water network managed by AQP has a development of over 20,000 km and the total flow delivered is around 19,000 l / sec.

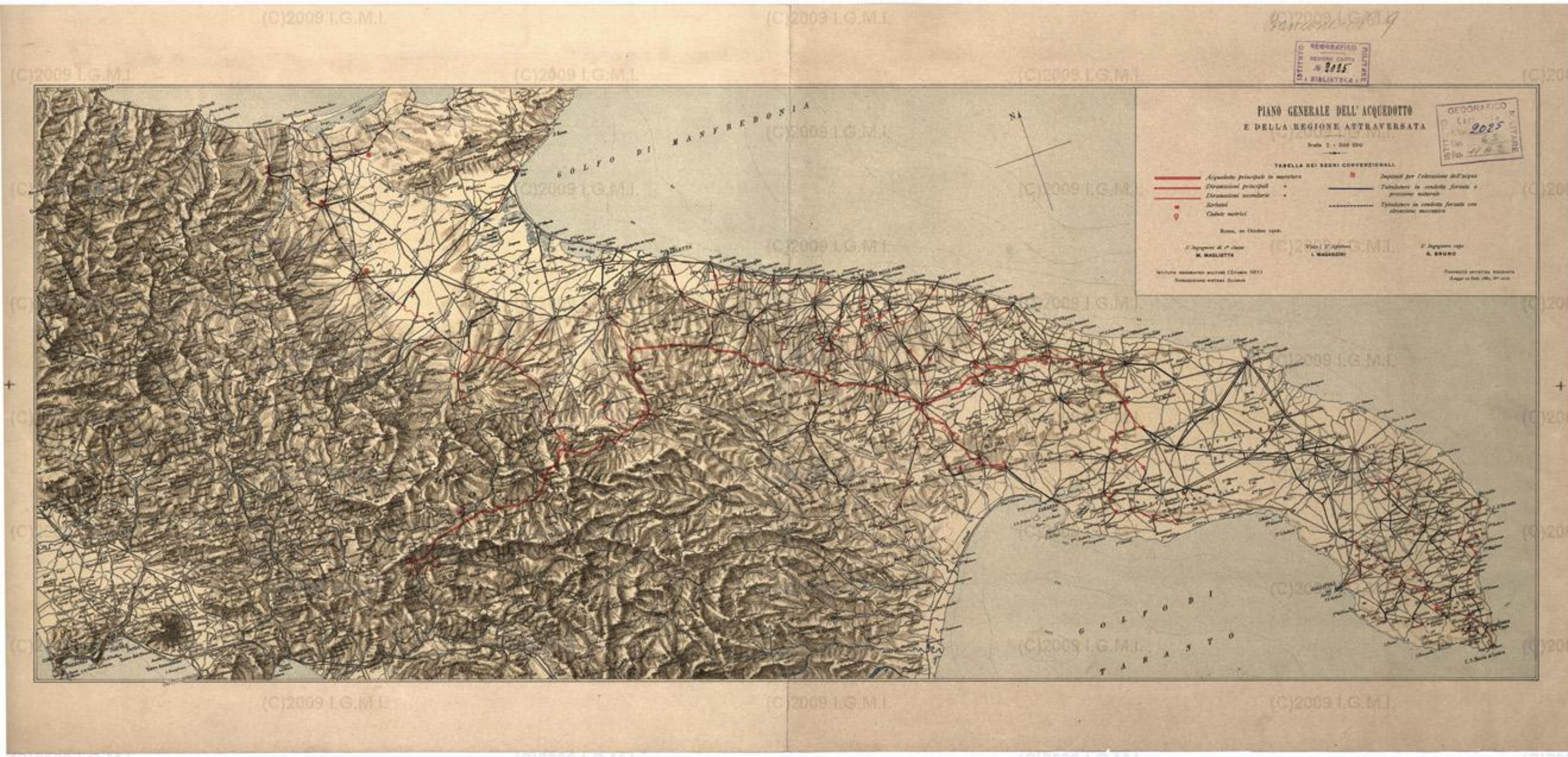
The water system serves more than 4 million inhabitants, residing in the 249 municipalities managed in Puglia and Campania.

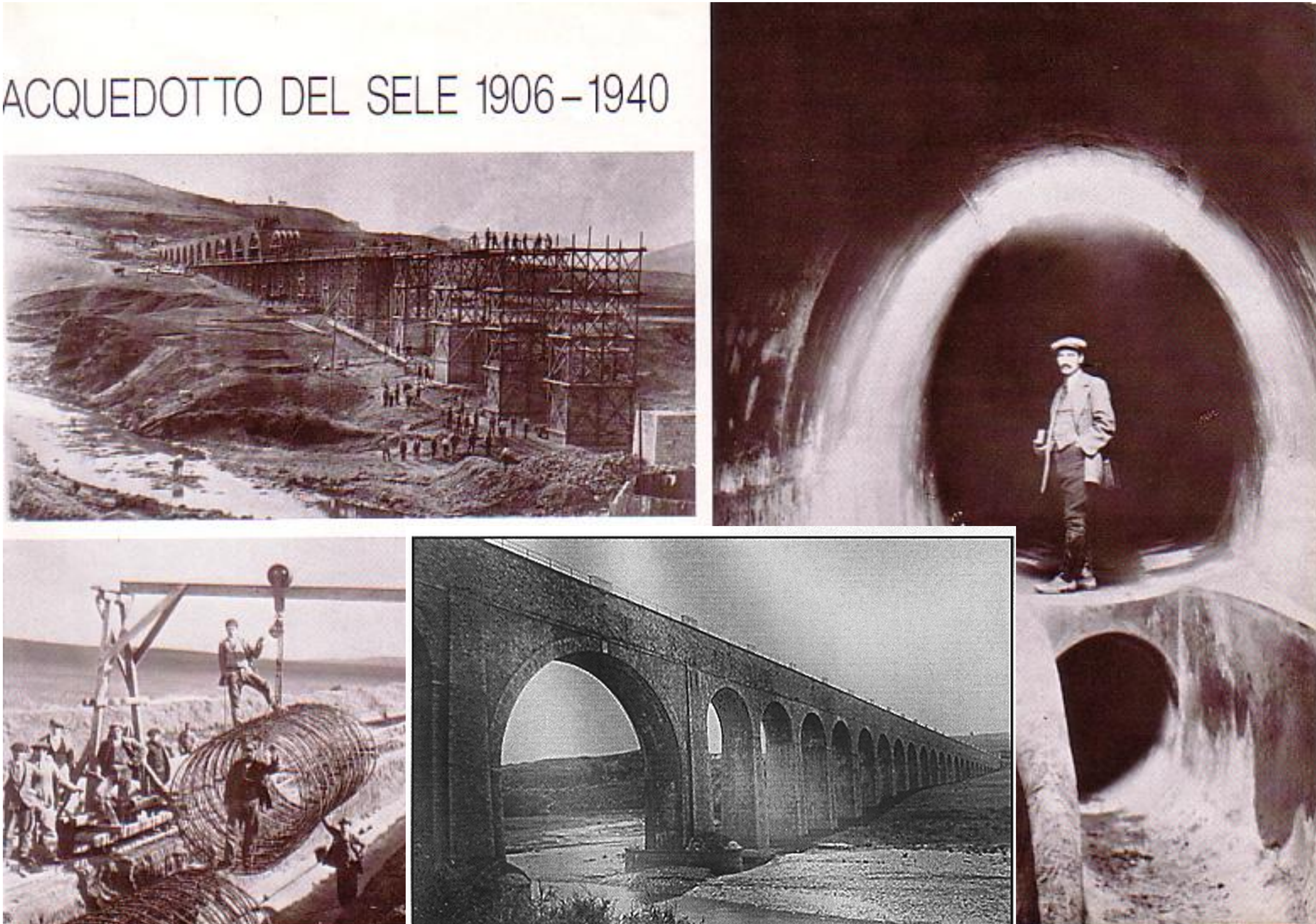
The Apulian aqueduct consists of a complex of interconnected aqueduct infrastructures.

The first important construction, which still represents the backbone of the entire Apulian aqueduct system, is the main channel, fed by the waters of the Sele and Calore rivers, designed starting from the 1870.

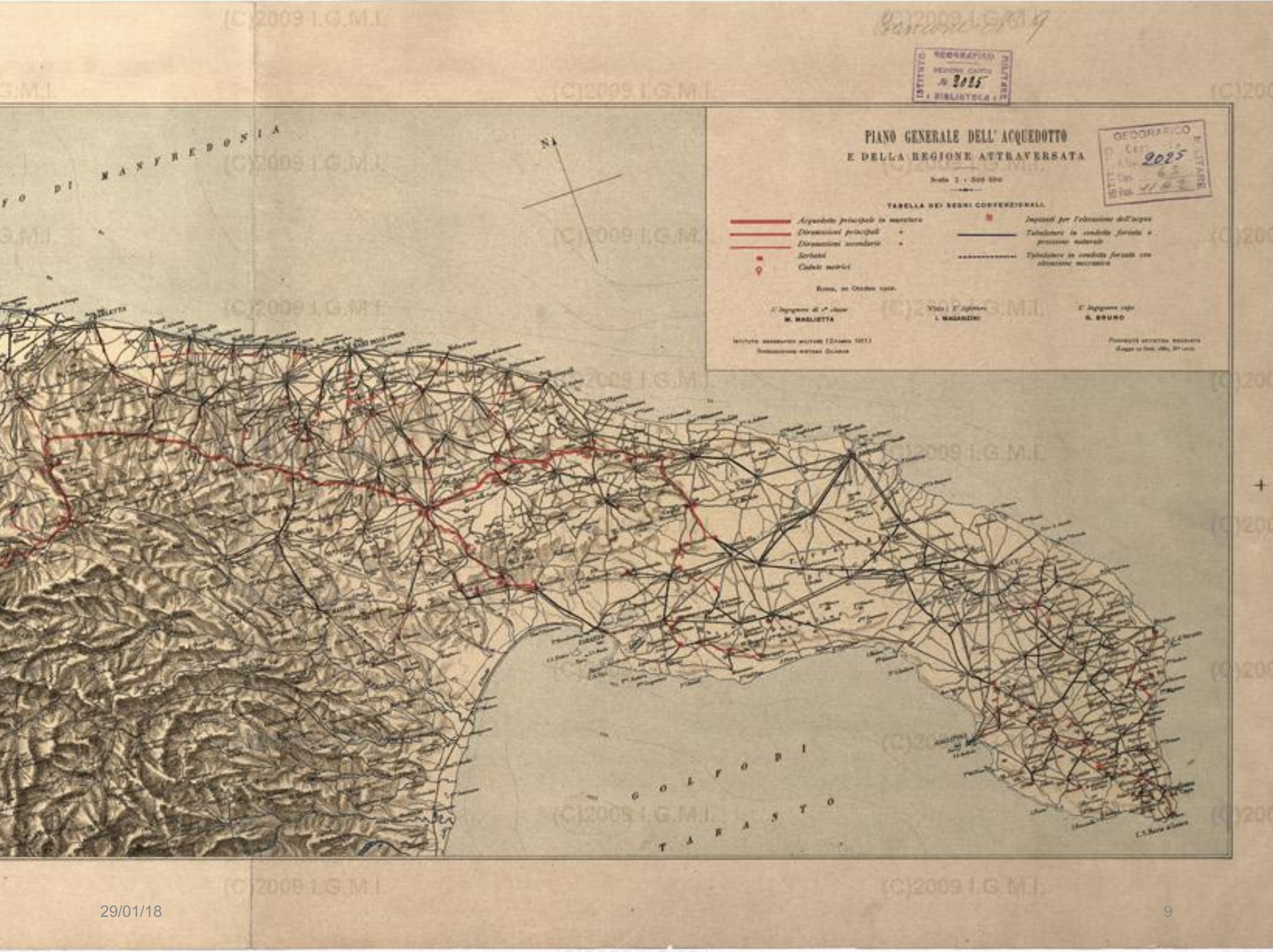


Caposele. Lavori dell'Acquedotto Pugliese. Imbocco Galleria dell'Appennino.


PIANO GENERALE DELL' ACQUEDOTTO
E DELLA REGIONE ATTRAVERSATA
TABELLA DEI SEGNI CONVENZIONALI
Acquedotto principale in muratura
Diramazioni principali
Diramazioni secondarie
Serbatoi
Cadute motrici
Impianti per l'elevazione dell'acqua
M. MAGLIETTA
I. MAGANZINI
G. BRUNO
GOLFO DI MANFREDONIA
GOLFO DI TARANTO
(C)2009 I.G.M.I.



Foggia: un tratto dell'Acquedotto Pugliese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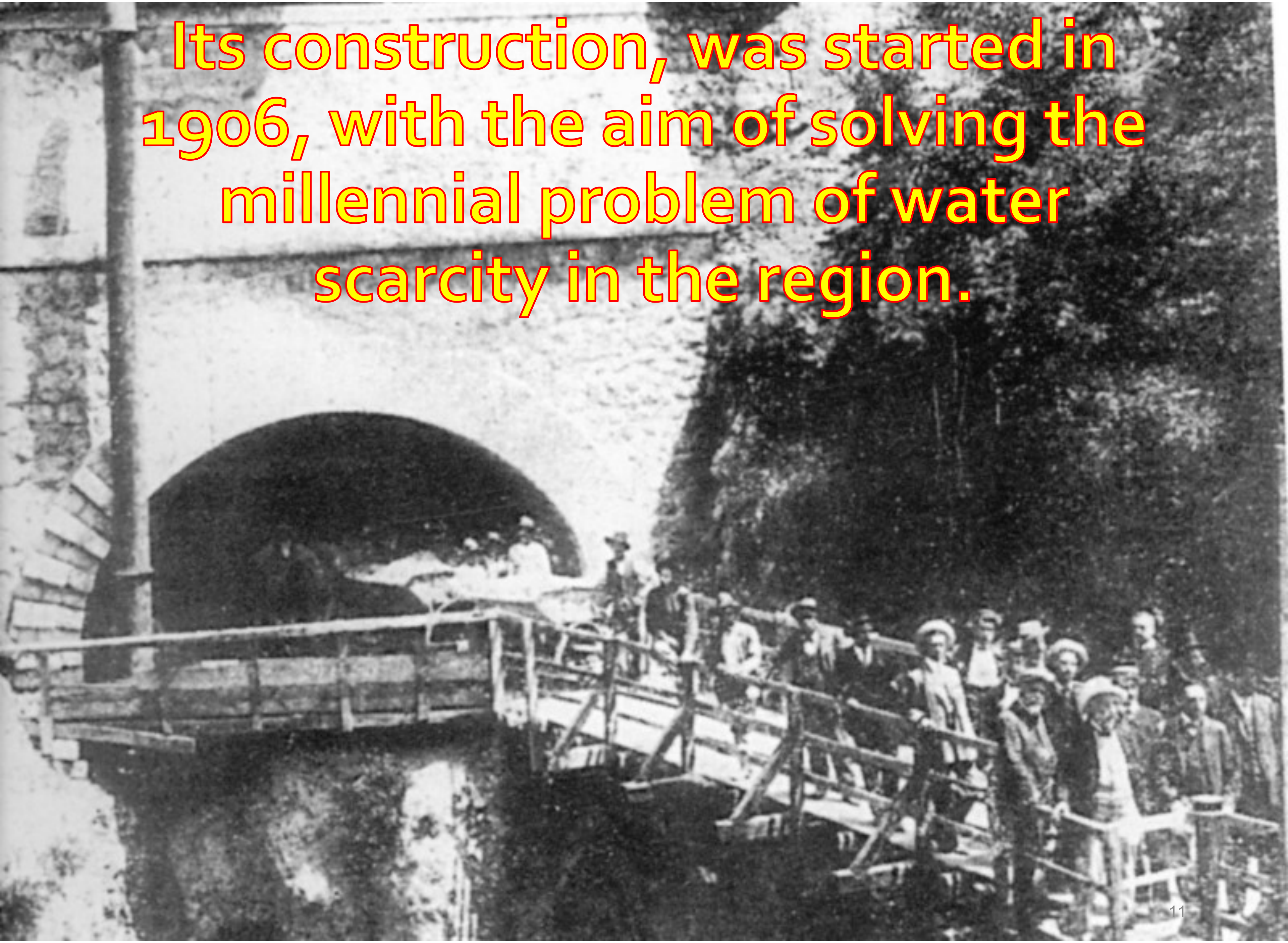
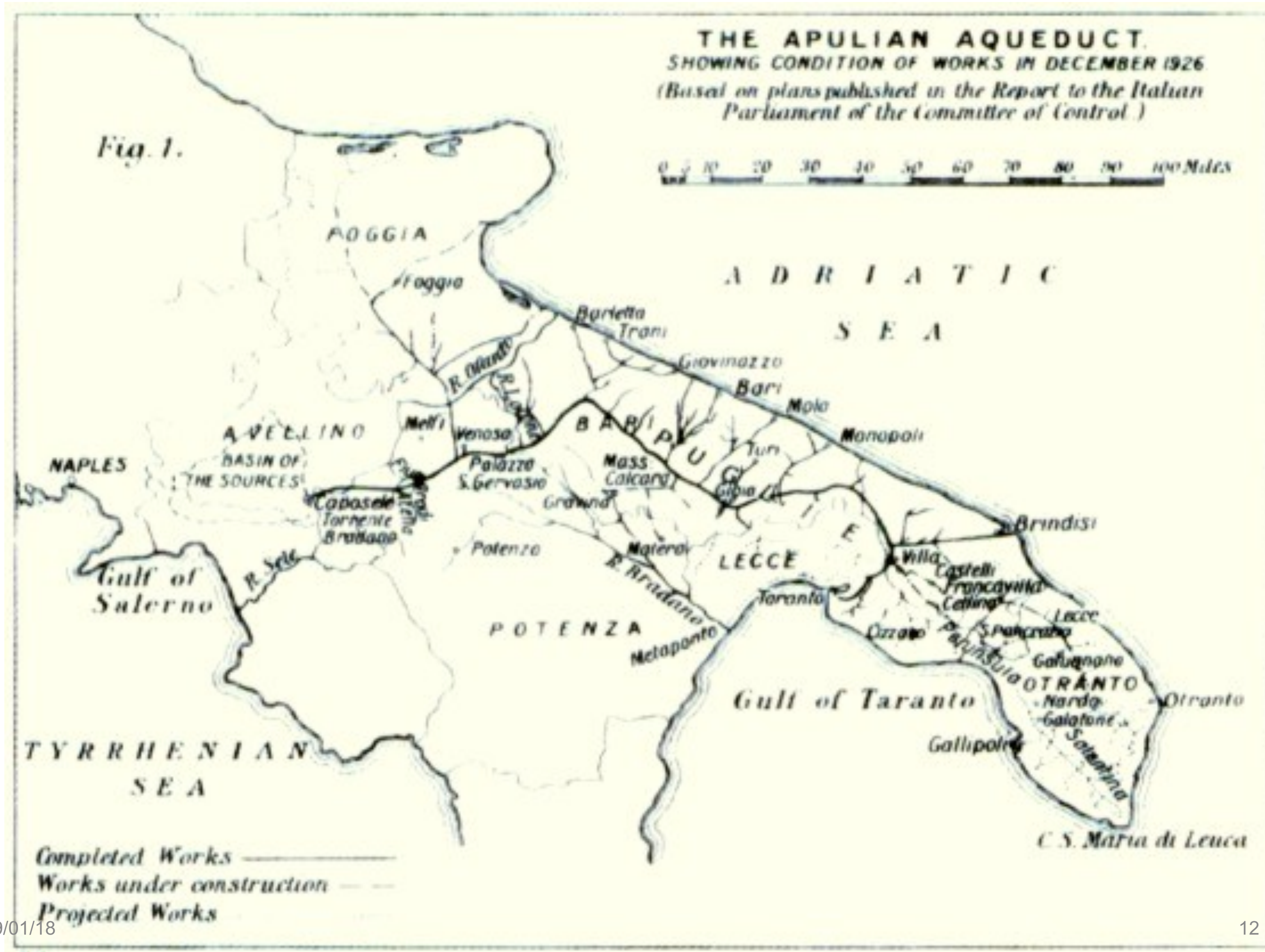
Tubolature in condotta forzata e pressione naturale
Tubolature in condotta forzata con elevazione meccanica
M. MAGLIETTA
G. BRUNO
FO DI MANFREDONIA
GOLFO DI TARANTO

Terminal column of AQP in S. Maria di Leuca - 1938

Santa Maria di Leuca, Acquedotto Pugliese, Colonna Terminale, *1938 ca*

Its construction, was started in 1906, with the aim of solving the millennial problem of water scarcity in the region.




THE APULIAN AQUEDUCT.
SHOWING CONDITION OF WORKS IN DECEMBER 1926
(Based on plans published in the Report to the Italian Parliament of the Committee of Control.)
Fig. 1.
0 5 10 20 30 40 50 60 70 80 90 100 Miles
FOGGIA
Foggia
ADRIATIC
SEA
Barletta
Trani
Giovinazzo
Bari
Molo
Monopoli
AVELLINO
BASIN OF THE SOURCES
NAPLES
Melfi
Venosa
Palazzo S.Gervasio
Mass. Calcara
Turi
Gioia
Caposele
Gravina
Brindisi
Potenza
Matera
LECCE
Villa
Castelli
Francavilla
Gulf of Salerno
R. Sele
R. Bradano
Taranto
Lecce
POTENZA
Metaponto
S.Pancrazio
Galugnano
OTRANTO
Nardo
Galatone
Otranto
Gulf of Taranto
Gallipoli
TYRRHENIAN SEA
C.S. Maria di Leuca
Completed Works
Works under construction
Projected Works

The tunnel of the Apennine mountain pass, from Caposele to Conza was completed in 1914. It has the name of Galleria Pavoncelli. Its length, at the time of construction was 12,750 m.

In the same year 1914 some countries of Puglia were already fed with his water.

Watch the video of the history of the Apulian Acqueduct (45 m)

- https://youtu.be/1Hpx7-MX4bw

In Bari the first fountain was inaugurated in Piazza Umberto on 24 April 1915, a few days before the outbreak of the First World War.

Only after the end of the war, the works were resumed and the aqueduct reached the areas of Brindisi, Taranto, Lecce and, with the construction of the primary branch for the Capitanata, also Foggia.

During the years all structures of the aqueduct became old with necessity of maintenance to avoid loss of water

piping distribution installation with loss of water

"There is no water-supply in which some unnecessary waste does not exist and there are few supplies, if any, in which the saving of a substantial proportion of that waste would not bring pecuniary advantage to the Water Authority"

William Hope, 1892

From the year 2007 AQP Spa planned a reduction in water losses to 43.7%, of which 32.6% for real losses and 11.1% for apparent losses.

The achievement of this objective required the optimal management of the infrastructures.

One of the key point was the perfect knowledge of the actual situation, characteristics and locations of all infrastructure. In few words a complete **georeferenced survey** realized with **geomatic** tools in a Geographic Information System.

It was an important reference point for urban water distribution networks.

Modelling aqueduct in a GIS environment

Water. It's an essential part of our everyday lives that we often take for granted. Behind the scenes there are many people working to ensure that we have a clean, safe, reliable water supply; that wastewater is safely routed, treated, and eventually released; and that stormwater drainage systems protect human lives, property, and the natural environment.

Modelling aqueduct in a GIS environment

Beginning around the time of the industrial revolution, the advent of standards in water, wastewater, and stormwater utility management led to standardized construction and water treatment practices. This has resulted in the ability to service many millions of people in urban centers without the historical health and pollution complications of preindustrial society.

But while we can now support large urban population centers unlike anything seen in human history, many of these water and sewer systems around the world are reaching the end of their planned life spans.

Today’s challenges involve optimizing the use of existing resources and effectively managing capital improvement budgets to ensure sustainable service quality.

Today’s water and wastewater utilities are realizing the benefits of geographic information system (GIS) technology for engineering, construction, and operations purposes.

The typical requirements of these utilities needs to:

- Update GIS databases with as-built data
- Produce standard and custom map products
- Integrate computer-aided design (CAD) drawings into the GIS environment
- Integrate with other enterprise systems, such as work management systems (WMSs), document management systems (DMSs), infrastructure management systems (IMSs), materials management systems (MMSs), and customer information systems (CISs)
- Analyze installed network for capacity planning and capital improvement projects
- Manage operations activities, such as leaks, repairs, and inspections

The case of ArcGIS Esri

The Esri ArcGIS Water Utilities Data Model is designed for water, wastewater, and stormwater utilities that manage these complex systems.

By providing a geographically oriented view of water network systems, ArcGIS Water aids in visualizing and understanding real-world engineering and business problems.

Built using object– component technology, ArcGIS Water provides a platform for water utility solutions.

Modeling water and wastewater networks

The object technology combines data and application behavior modeling.

As a result, the model not only includes an essential set of water object classes and properties, it also includes rules and relationships that define object behaviors.

The core object technology and applied Water model result in significantly less configuration and customization effort for overall implementation per site.

In addition, the object model is readily extensible, allowing developers to extend the model, behavior, and user interface of the system with minimal effort.

Transmission systems

Around the world, the water that we consume for residential, commercial, and industrial purposes originates from a source, usually in the form of a lake, river, or underground aquifer.

For communities that do not have a local water supply, a transmission network is built to transport the water from the source to the destination communities.

Transmission systems are typically composed of aqueducts, tunnels, connecting devices, and pumping facilities.

In a transmission system, all of the pipes, devices, and pumping facilities tend to be large

the network system is relatively simple

and the networks can span hundreds of miles as they push water over continental divides, under ocean channels, and across deserts to population centers.

As the transmission system delivers water to a community, the transmission system connects with the local water distribution system.

Usually, there are treatment plants that ensure water quality and control the flow of water into the distribution system.

Many treatment plants also have adjacent storage basins and enclosed storage facilities to provide adequate flow when water demand exceeds the capacity of the transmission system.

Typical devices include pumps, chemical injectors, aerators, motors, and generators

Water modeling requires consideration of facilities as assets

One benefit of GIS technology is that utilities can track their assets by geographic location.

Network assets, like most other infrastructure owned by businesses, can be depreciated for tax accounting purposes.

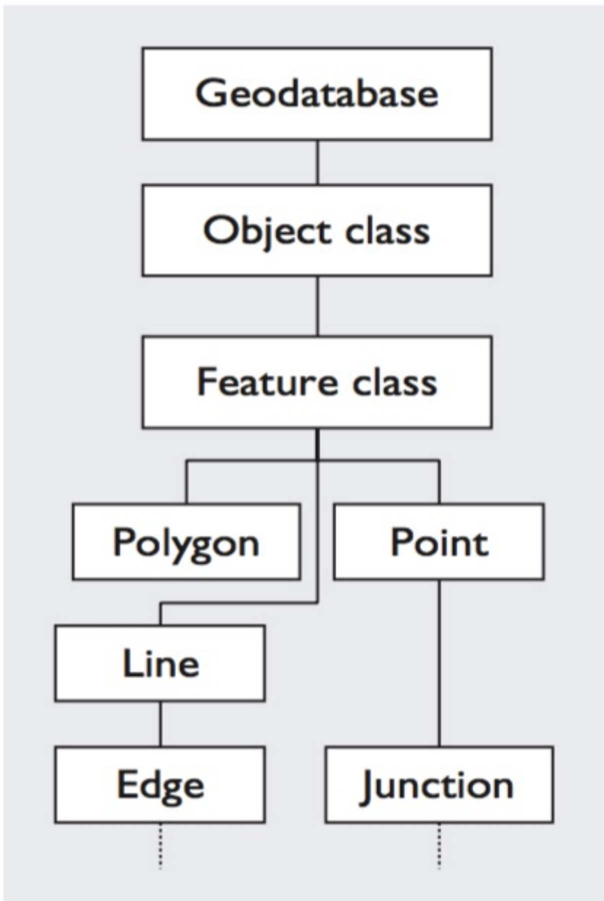
The specific amount of depreciation allowed depends on the original value of the equipment, how long the facilities have been in the ground, and the tax boundary area that the facilities are located in.

Having an accurate record of facilities managed with a GIS provides a more accurate inventory of existing facilities and an automated way to maintain these records as a by-product of map maintenance activities.

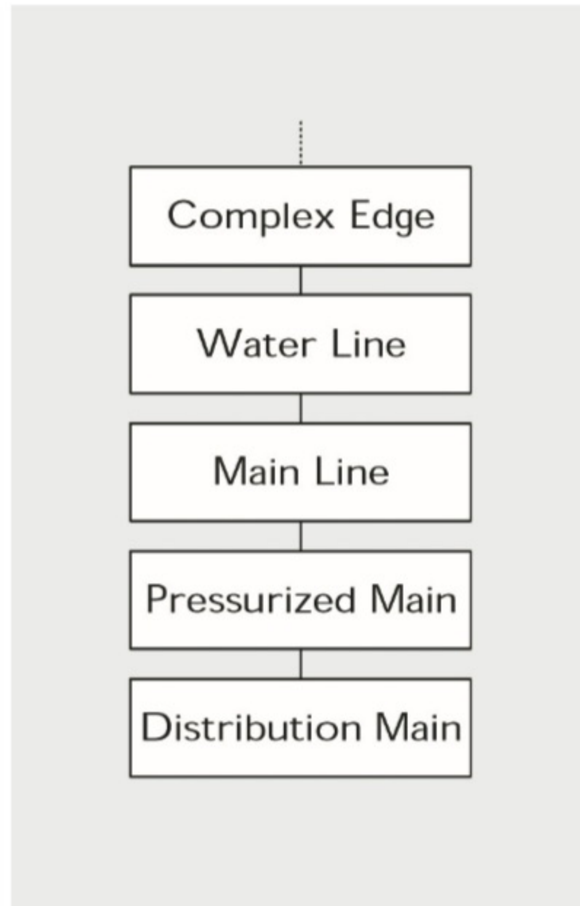
From a GIS system design standpoint, it is important to understand how the exact same piece of physical equipment (i.e., the same 10" valve) can be considered differently from an asset management standpoint, depending on if the valve is used as a normal mainline valve or as a hydrant valve.

Creating a geodatabase

The geodatabase model is a generic model for geographic information that supports a wide variety of object relationships and behavior.



Geodatabase data model



ArcGIS Water data model