The ART of ITALIAN WATER ENGINEERING



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DESIGNING WATER, CONNECTING WORLDS



Maria Spena
President One Water Committee Italy

Water is the connective tissue of territories, communities and economies. It links the security of drinking-water supplies to the health of rivers and seas, the productivity of agriculture to the resilience of cities, and the reliability of infrastructure to the capacity of institutions to anticipate risk. The projects and perspectives brought together in this volume bear witness to this interdependence.

They show that the future of water cannot be addressed through isolated works or sectoral responses, but requires an integrated vision in which planning, engineering, environmental knowledge, digital tools and responsible governance reinforce one another.

This is the perspective advanced by the One Water Committee Italy. Created to strengthen Italy's contribution to the international debate on water, the Committee brings together public institutions, research bodies, universities, businesses, professional organisations and civil society around a shared objective: to treat every component of the water cycle as part of a single system. Its work promotes sustainable resource management, water security, ecosystem protection, innovation and digitalisation, risk prevention, water quality and the rational use and reuse of water.

In doing so, it turns the One Water principle from a compelling idea into a practical framework for cooperation and action.
The Committee's international network is central to this mission. By connecting Italian expertise with partners across the Mediterranean, the MENA region, the Balkans and Europe, it creates opportunities for dialogue among governments, utilities, research centres, development institutions and the private sector.

Participation in global and regional water forums, together with workshops, technical exchanges, studies and multi-stakeholder initiatives, helps compare solutions, share good practice and build common priorities.

ONE WATER: A SHARED VISION FOR A SUSTAINABLE WATER FUTURE.

The 2026 Euro-Mediterranean Water Forum in Rome is a particularly significant milestone in this process: a platform through which water can be addressed not only as a technical challenge, but also as a foundation for stability, prosperity and cooperation among countries.
Within this landscape, Italian engineering has a distinctive contribution to make. Italy combines a long tradition of hydraulic works and territorial stewardship with advanced capabilities in integrated design, monitoring, modelling, treatment, reuse, nature-based solutions and the management of complex infrastructure.

Just as importantly, Italian engineering firms are accustomed to working across disciplines, scales and cultural contexts. The experiences presented in this volume therefore represent more than individual technical achievements: taken together, they form a portfolio of knowledge that can support international partners in translating policy goals into feasible, durable and locally appropriate projects.

The value of this publication lies precisely in the bridge it creates between experience and opportunity. By making Italian competence visible, intelligible and accessible to an international audience, it contributes to a wider effort led by the One Water Committee Italy: building alliances, opening channels for scientific and industrial cooperation, and positioning Italy as a reliable partner in the global water agenda.

The ambition is not simply to export solutions, but to develop them together—combining Italian creativity and engineering rigour with the knowledge, priorities and capacities of each territory. In this spirit, the volume is both a record of what has been achieved and an invitation to collaborate on what must come next: resilient infrastructure, healthier ecosystems and water systems capable of sustaining future generations.





WATER, TERRITORY AND THE ITALIAN *INGEGNO*



Giorgio Lupoi
President OICE

There are places where engineering is born out of necessity. And then there are places like Italy, where engineering is born out of necessity but refined through beauty.
The history of our country is, in many ways, a history written by water. Water to be managed, distributed, protected and enhanced. Water that has shaped landscapes, economies, communities and cultures.

A precious resource, yet also a constant challenge. Today, the Mediterranean is one of the regions where water-related issues are most visible. Droughts and floods, coastal protection, water security, resilient infrastructure and community safety are challenges shared by countries that are diverse, yet increasingly interconnected. For Italy, however, these challenges are nothing new: they have been part of our history for centuries.

It is through this enduring relationship with water that Italian ingenuity has been shaped.
Our territory, extraordinary yet complex, has compelled generations of engineers, planners and builders to develop innovative solutions to water-related challenges, creating a body of knowledge and expertise that is now recognized around the world.

Italy is, in essence, a civilization built around water.

It is no coincidence that the great tradition of Italian engineering finds its roots in the legacy of Rome. The aqueducts, ports and hydraulic works of the Roman Empire still stand today as extraordinary examples of how technical knowledge can be transformed into development, prosperity and collective well-being.

They remind us that water management is not merely a technical matter; it is a choice of civilization.
This legacy was further enriched by the work of Leonardo da Vinci, whose studies of water, rivers and canals revealed a profound understanding of the relationship between nature, knowledge and innovation. His vision remains one of the highest expressions of Italian ingenuity: understanding natural phenomena in order to transform them into opportunities for progress and development.

“WATER IS THE DRIVING FORCE OF ALL NATURE.”

LEONARDO DA VINCI

But it has also posed continuous challenges that have fuelled research, innovation and the evolution of our expertise.

The major works of recent years, from Venice’s MOSE to the new Genoa Breakwater, demonstrate how this tradition is still alive and capable of addressing the challenges of climate change, territorial safety and infrastructure competitiveness.

It is this capacity, developed over centuries of experience, that has enabled Italian engineering companies to establish themselves among the leading players in international design, exporting expertise, innovation and a culture of design throughout the world.
The works collected in this volume tell this story.
Projects that differ in scale, geography and purpose, yet are united by the ability to transform complex needs into effective and sustainable solutions. They are not only a testament to what Italian engineering has achieved in its relationship with water; they also anticipate what dialogue and cooperation among Mediterranean countries can generate in the future.

This publication is the result of the collaboration between OICE and the One Water Committee, whom I would like to sincerely thank for the vision and commitment that made this project possible. A shared effort that demonstrates how the major challenges related to water can only be addressed through dialogue among expertise, institutions, businesses and the scientific community.

The volume was conceived on the occasion of the first European Mediterranean Water Forum, to be held in Rome with the aim of relaunching a stable process of dialogue and collaboration among Mediterranean countries.

The Mediterranean has always been a sea that unites. For centuries, people, ideas, technologies and knowledge have circulated across its shores. Today, that same spirit of cooperation is more necessary than ever.

In this context, Italian engineering can make a significant contribution, not only through the quality of the works it has delivered, but also through the experience gained in international markets. At the same time, we know that no country alone possesses all the answers to the challenges posed by water.
Each, however, holds part of the knowledge needed to address them.
For this reason, the Forum’s most important objective is to encourage the exchange of experiences, expertise and ideas, creating a collaborative network capable of transforming each country’s excellence into a shared heritage.

Water is not merely a resource to be managed. It is a heritage to be safeguarded and an element that unites territories, communities and civilisations.

This volume is not an end point. It is a starting point.

We consider it the first seed of a journey that the European Mediterranean Water Forum intends to nurture over the years.
If the experiences collected in these pages give rise to new relationships, new projects and new collaborations, we will have achieved the most important result.
Because the challenges posed by water are addressed through technology and investment, but they can only be overcome by sharing knowledge, expertise and vision

ENGINEERING
A BETTER FUTURE TOGETHER



Alfredo Ingletti
President FIDIC

In a world shaped by climate change, rapid urbanisation, growing inequalities and increasing geopolitical uncertainty, engineers are called upon to address complex global challenges and help build more inclusive, safe and sustainable societies.

Today, engineering plays a fundamental role in shaping our future and remains a key driver of human and economic progress. From ancient roads, aqueducts and enduring structures to modern transport networks, energy systems and water infrastructure, engineering has enabled societies to evolve, fostered trade and improved quality of life.

The principles of design, resilience and innovation that guided the ancients continue to inform our work today, as we develop solutions that connect communities, support economic activity, protect territories and natural systems, and contribute to public health and long-term resilience.

Our industry occupies a unique and strategic position: we turn ambition into tangible outcomes. Through our work, we create the physical and social foundations that underpin prosperity and well-being. Whether protecting communities from natural hazards, restoring rivers and ecosystems, managing water resources or developing critical infrastructure, we help societies adapt to a changing world. Meeting these challenges requires leadership and collaboration across governments, industry, financiers and other stakeholders, with trust essential to turning shared efforts into meaningful and lasting results.

By investing in capacity building and promoting strong leadership practices, we help raise standards across the industry and remain strategic partners to international organisations, advancing quality infrastructure and contributing to the achievement of the United Nations Sustainable Development Goals.

Looking ahead, we must ensure that engineering remains at the heart of a better, more connected and more resilient world — creating lasting value for generations to come.

HYDROSTRATEGY AND WATER SECURITY: WATER AND GEOPOLITICS IN THE MEDITERRANEAN



Emilio Ciarlo
CEO One Water



Filippo Maria Soccodato
Secretary General
One Water

The geoeconomic and geopolitical value of water has gained increasing importance in recent years.
In many respects, water is following the same historical trajectory that led energy, particularly after the 1973 oil crisis, to evolve from a mere commodity and input for production into an essential component of national security.
The significance of water is even greater when considering that, in addition to being essential for food production, industry and ecosystem health, water resources underpin energy production itself.

According to the UN World Water Development Report, approximately 90% of global energy production relies on processes that use water.
This growing awareness has been marked by several milestones in the international debate. In 1977, in Mar del Plata, water was addressed for the first time through a dedicated United Nations global conference. In 2015, the protection of and access to water resources were formally recognised within the international sustainable development agenda through two specific goals, concerning freshwater and the marine environment. In 2023, the United Nations convened another global conference on water after a long hiatus.

From a geoeconomic perspective, as early as 2016 the World Bank published “High and Dry: Climate Change, Water and the Economy,” warning that water scarcity, exacerbated by climate change, could lead to GDP losses of up to 6% by 2050, while also contributing to migration and increasing the risk of conflict.
Water is therefore no longer solely an environmental issue. Instead, a broader concept of water security is emerging, articulated across at least three dimensions. The first concerns water as a transport infrastructure in its own right. Like railway or motorway networks, the Suez and Panama Canals and the Straits of Hormuz, Gibraltar and the Bosporus are among the main chokepoints of global trade.
These essential waterways highlight the strategic importance of maritime security and commercial routes, bringing the concept of the maritime domain back to the forefront.

“DROUGHT, CLIMATE CHANGE AND DECLINING RIVER FLOWS ARE BECOMING MAJOR SOURCES OF ECONOMIC INSECURITY AND VULNERABILITY FOR STATES.”

Inland waters also serve as transport routes in many regions of the world. At the end of July, Germany’s river monitoring system reported extremely low water levels at 44% of monitoring stations along the Rhine and 78% of those along the Danube, two of Europe’s largest and most important rivers. The resulting restrictions on navigability affected both transport costs and delivery times.
Drought, climate change and declining river flows are therefore becoming major sources of economic insecurity and vulnerability for states, directly affecting the viability of their commercial transport routes.

A second dimension concerns shared water resources. According to the 2024 UNECE–UNESCO/UN-Water report, there are 313 transboundary river and lake basins and 468 transboundary aquifers worldwide. Yet only 43 out of 153 countries have operational arrangements covering at least 90% of their transboundary waters, while just 26 countries have operational arrangements covering all of their shared waters.

This has become a crucial geopolitical issue, particularly in relation to the regulation of watercourses shared between upstream countries, which control water before it reaches others and downstream countries, which are highly exposed to decisions taken upstream. Across the wider Mediterranean region, this natural geopolitical asymmetry affects major river basins including the Nile, Jordan, Tigris–Euphrates, Orontes, Drin and Sava.

The third dimension concerns the availability of and access to water resources, the aspect most directly connected to citizens’ security and the protection of their living conditions. New balances must now be found within territorial water budgets, increasingly challenged by demographic pressure, growing industrial water demand and a concerning mismatch between groundwater recharge periods, increasingly irregular precipitation patterns and peaks in civil, agricultural and industrial demand.

“WATER INFRASTRUCTURE FORMS THE INVISIBLE BACKBONE SUPPORTING THE ECONOMIC AND SOCIAL LIFE OF HUNDREDS OF MILLIONS OF PEOPLE.”

Integrated water management systems therefore require sustained investment and maintenance to guarantee water access, distribution and quality. This includes maintaining strategic water storage infrastructure while expanding treatment, purification and reuse facilities.

More than 500 million people depend on the Mediterranean’s major water infrastructure systems. Over 60% of available water resources on the southern and eastern shores are managed through major artificial infrastructure, including the Aswan Dam, Libya’s Great Man-Made River water transfer system, Israel’s large desalination plants, the dams of Türkiye’s GAP project and the aqueducts supplying cities such as Rome, Algiers, Tunis, Amman and Cairo.

Aqueducts, dams, desalination plants, pumping systems, distribution networks and wastewater treatment facilities now form the invisible backbone supporting the economic and social life of hundreds of millions of people.
When a power plant is hit, the energy supply is interrupted. When water infrastructure is damaged, the survival of communities themselves may be placed at risk.
The consequences can range from disruption of drinking water supplies and increased risk of epidemics and waterborne diseases to reduced water availability for agriculture, greater food insecurity, population displacement and escalating social and political tensions.

Although explicitly protected under international conventions, including the Geneva Conventions and their Additional Protocols, recent events in Gaza, Qeshm in the Gulf, Kuwait and Bemani have repeatedly shown how water infrastructure can unlawfully become a military target. Its strategic importance has also made it a target for terrorist cyberattacks, as demonstrated by the seven attacks on US water infrastructure reported by The Guardian in early summer.
Despite growing recognition of water’s strategic importance, international governance of the resource remains weak and fragmented. Water also often lacks a distinct and specific role within major international environmental summits, including the COPs.
Yet, as these developments demonstrate, water security increasingly coincides with human security.



Starting with the Mediterranean, this calls for shared maps of critical water infrastructure, dedicated civil and military protection protocols, satellite monitoring systems for strategic assets, regional cooperation mechanisms for emergency response, and international recognition of key Mediterranean water infrastructure as essential to regional stability.

A particularly significant contribution to this necessary shift in international thinking comes from the Global Commission on the Economics of Water (GCEW). In its 2024 report, “The Economics of Water: Valuing the Hydrological Cycle as a Global Common Good,” the Commission argues that blue water and green water, precipitation, soil, vegetation and atmospheric flows should be understood as components of a single interdependent system and recognised as a “global common good.”

Without taking this concept to extremes or creating categories that are compelling in theory but difficult to implement, and while fully respecting national sovereignty and local governance of water resources, it may be possible to consider the stability and integrity of the global hydrological cycle as a “common good of humanity.” Such an approach would entail shared responsibility for its protection while preserving the sovereignty of states over their own water resources.

This could provide the basis for a legal framework that does not internationalise water itself, but rather the responsibility for maintaining the stability of its cycle. Such a framework could be linked to a limited set of verifiable obligations: monitoring atmospheric flows and green water, protecting ecosystems that are critical to the hydrological cycle, assessing the transboundary hydrological impacts of major territorial transformations, financing ecosystem services and establishing an international reporting mechanism.

THE ART OF ITALIAN WATER ENGINEERING



ITALY: A COUNTRY FORGED BY WATER

by multiple authors[1]

Bounded to the north by the Alpine arc and traversed along its entire length by the Apennines., the Italian peninsula concentrates within a limited territory an extraordinary range of hydrological environments: extensive alluvial plains — the Po Valley foremost, with those of Campania, Apulia and Catania — alongside steep mountain catchments, coastal lagoons, estuaries and karst systems.

That diversity has obliged Italian communities to engage continuously with water. Across the centuries water has been both benefactor and adversary: a source of fertility, prosperity and communication, and a recurrent cause of flooding, erosion and instability. The relationship has never been passive, but a sustained effort to understand, regulate and harness a resource on which settlement, agriculture and commerce depended.

Rainfall compounds the contrast. National averages are broadly comparable with those of northern Europe, but their distribution is not: Alpine and pre-Alpine catchments may exceed 2,000 millimetres a year where parts of the south and the major islands receive under 600. The Mediterranean summer then concentrates peak demand precisely when availability is lowest — a mismatch that has required storage, conveyance and redistribution on a remarkable scale.
The hydrographic network repeats the pattern. With the exception of the Po, Italian rivers are short, with limited catchment areas, torrential behaviour and rapid hydrological response.

The Adige, Arno, Tiber, Piave, Reno, Volturno and Sele belong to a distinctly Mediterranean setting, where flood waves develop within hours and summer low flows severely constrain availability — a landscape shaped by hydrological extremes, increasingly exposed to intense rainfall and prolonged drought alike.
In such a setting hydraulic works have never been a secondary layer imposed upon the territory; they have been one of the essential conditions of its development.

[1]Prof. Eng. Maurizio Giugni - President of the Italian Hydrotechnical Association
Eng. Beatrice Majone - OICE Board Member and Vice President of the Italian Hydrotechnical Association
Eng. Angelica Catalano - Board Member of the Italian Hydrotechnical Association and General Director at MIT
Dott. Tania Tellini - Board Member of the Italian Hydrotechnical Association and Director of the Water Sector at Utilitalia
Prof. Maurizio Ferla - Board Member of the Italian Hydrotechnical Association



Cities flourished where water could be secured, marshland reclaimed, floods contained and harbours established. Agricultural productivity depended on irrigation, drainage and flood protection; industrial growth on reliable supply and hydraulic power; entire regions were transformed by canals, reservoirs, embankments and aqueducts.

The history of water in Italy is therefore the history of a continuous technique, running unbroken across the great epochs of European civilisation: from the watercourse settlements of the upper Palaeolithic and the Neolithic pile-dwellings to the hydraulic cultures of the Nuragic, Etruscan and Magna Graecia worlds; from the Roman synthesis, which brought Mediterranean hydraulic knowledge to its classical apogee, to the medieval continuity of monasteries, communes and signorie; from the Renaissance, when Leonardo, Galileo and the Italian school refounded the scientific principles of the discipline, to the reclamations, dams, regional aqueducts and hydroelectric system of the nineteenth and twentieth centuries. Across more than ten thousand years the chain has never broken.

This stratification is not a museum but an operational heritage. Roman aqueducts still feed the fountains of Rome; the Lombard navigli still irrigate the fields they have served for eight hundred years; the reclamations of the Po delta, the Maremma and the Pontine plain remain the structural backbone of the national irrigation system.
Cultural continuity has proved equally tenacious: the Italian hydraulic engineer is formed, in the engineering faculties of Milan, Padua, Bologna, Rome, Naples, Turin and Palermo, on a shared repertoire of problems, solutions and technical languages whose lineage descends through Vitruvius, Leonardo da Vinci, Benedetto Castelli, Evangelista Torricelli, Elia Lombardini and Angelo Omodeo and others into the contemporary discipline.

The Associazione Idrotecnica Italiana , founded in 1923, has taken the custody and transmission of that heritage as its mission. Its journal L'Acqua, born in the same year and never interrupted since, has documented a full century of Italian hydrotechnical knowledge.

Water civilisation finds in Italy one of its most complete and best documented cases. Not the work of isolated genius, nor the achievement of a few celebrated figures, but the patient sedimentation of a technical knowledge distributed across the centuries and across the territory, which Italian engineering culture continues to inhabit, renew and transmit.



NMC Wastewater Treatment Plant

TERRITORY AND HAZARD

Coastline	**ABOUT 8,300 Km**
Municipalities with at least one area of significant hydrogeological hazard	**94.5 per cent (ISPRA, 2025)**
Landslides catalogued in the IFFI inventory	**MORE THAN 636,000**
Cultural assets within high landslide hazard	**ABOUT 14,000**
Land of the northern Adriatic coast below 2 m elevation	**ABOUT 4,800 Km^2**

WATER RESOURCES

Mean annual renewable resource (internal flow)	**ABOUT 138 BILLION m^3; 128 IN 2025, 67 IN THE 2022 MINIMUM**
Withdrawals from groundwater (springs and wells)	**85 PER CENT OF THE TOTAL**
Share of withdrawals for agriculture	**56 PER CENT**
Irrigated area	**ABOUT 2.4 MILLION HA, ON 17 MILLION HA MANAGED BY 150 RECLAMATION CONSORTIA**

INFRASTRUCTURE

Aqueduct network	**ABOUT 485,000 KM, ALMOST 80 PER CENT GEOREFERENCED**
Sewerage network	**ABOUT 371,000 Km**
Wastewater treatment plants	**18,118**
Large dams under State supervision	**522, HOLDING +13B m^3**
Hydroelectric plants	**ABOUT 4,900; 16 PER CENT OF NATIONAL ELECTRICITY, 42 PER CENT OF RENEWABLES**

SERVICE AND ECONOMY

Integrated Water Service turnover	**ABOUT €11.5 BILLION A YEAR; THE WIDER WATER SECTOR €25–30 BILLION**
Annual investment need, Integrated Water Service	**€3–4 BILLION OVER 20–30 YEARS, PLUS ABOUT €1 BILLION FOR IRRIGATION**
NRRP allocation to the Integrated Water Service	**ABOUT €4.4 BILLION**
Network replacement rate	**0.8 PER CENT A YEAR, AGAINST A 50-YEAR SERVICE LIFE**
Reuse of treated wastewater	**ABOUT 5 PER CENT**

The same interpenetration of water and territory that supported Italian civilisation creates structural exposure. According to ISPRA's 2025 national assessment, 94.5 per cent of municipalities contain areas affected by significant landslide, flood, coastal or avalanche hazard. The IFFI inventory records more than 636,000 landslides. Flood exposure concentrates in the northern alluvial plains and major river systems; landslide exposure follows the Alpine, Apennine, Ligurian and Campanian slopes.

Climate change is sharpening both sides of the water problem. The events in the Marche, Ischia, Emilia-Romagna, Tuscany, Valle d'Aosta and Piedmont between 2022 and 2024 showed how short, intense rainfall can combine with saturated soils, sediment, urbanisation and fragile infrastructure. At the same time, drought and declining snow storage reduce the reliability of supply, irrigation and hydropower.



Piezometric Tower – Rome



First Sabo dam for debris flow control in the Belluno area

KNOWING THE EXPOSURE: MAP EXPOSURE BEFORE SELECTING WORKS.

Italian governance has progressively moved from emergency response towards shared knowledge. Seven River Basin District Authorities prepare flood-risk and water-management plans; the Hydrogeological Asset Plans regulate landslide and hydraulic constraints; IdroGEO provides a unified public cartographic interface; and ReNDiS records financed risk-reduction interventions.
The architecture is imperfect, but it establishes a common spatial language for planners, mayors, designers and citizens. The stakes are heightened by cultural heritage. Fourteen thousand cultural assets lie in areas of high or very high landslide hazard alone. Venice, Matera, Florence, the Amalfi Coast, the Cinque Terre, the Po Delta and many other protected landscapes are also water landscapes. Their loss cannot be captured adequately by conventional economic appraisal..

A TRADITION IN SERVICE

The Italian relationship with water begins before written history. Communities selected settlements according to springs, drainage, slope and the capacity of rock to collect and store water. At Matera, a connected system of roofs, channels, caves and cisterns turned scarce and irregular rainfall into an urban resource. The hydraulic intelligence lay not in a single monument but in the continuous adaptation of a settlement to its geology.

In Sardinia, Nuragic sacred wells joined water capture, stone construction, ritual and astronomical orientation. Across central Italy, Etruscan engineers drained plateaux and valleys through cuniculi: narrow underground galleries laid to controlled gradients. Their function was practical—removing water, lowering groundwater and making land cultivable—but their execution required surveying, ventilation and long-term maintenance.

Greek colonies in southern Italy brought the hydraulic knowledge of the eastern Mediterranean and adapted it to local terrain. Cisterns, fountains, drainage works and harbour structures supported dense coastal cities. Pile-dwelling settlements in the Alpine and Po regions demonstrate a different form of adaptation: building with water levels and wetlands rather than eliminating them.
These early systems established three themes that recur through the book. First, the work begins with a close reading of place. Second, storage and gravity are preferred where energy and institutional capacity are limited. Third, the infrastructure survives only when the community retains the practices needed to clean, repair and allocate it. The durable object is therefore a combined technical and social system.



Castelcivita Caves



Naviglio Grande Canal

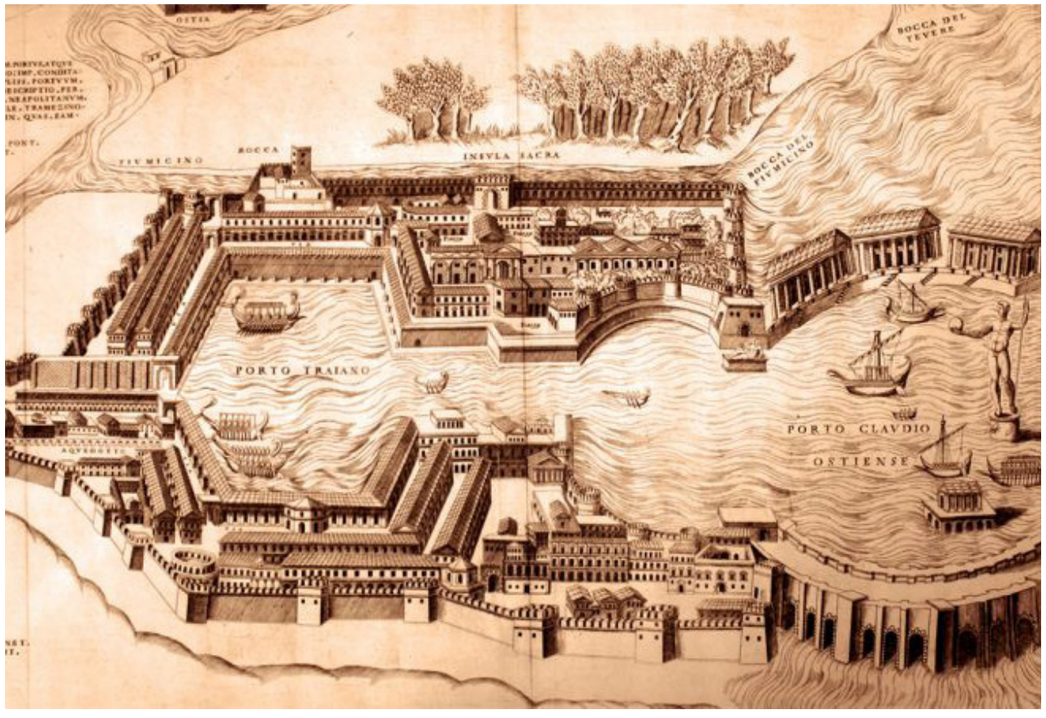
"INFRASTRUCTURE IS NOT ONLY WHAT WE BUILD, BUT HOW WE OPERATE AND MAINTAIN IT."

With Rome the Mediterranean hydraulic culture reaches its first systematic synthesis: not a sequence of masterpieces but a complete and replicable infrastructural system, governed by codified design principles, by law, by a professional culture of engineers and operators and by a maintenance organisation capable of guaranteeing service across centuries. By the second century AD the capital was supplied by eleven aqueducts delivering close to a million cubic metres a day, carried by gravity through controlled gradients, underground conduits, monumental bridges and inverted siphons; Frontinus, in De aquaeductu, describes a hierarchical distribution serving public amenities, the State and private users, and an administration — the aquarii — that made water a public institution. The Aqua Virgo of 19 BC still feeds the Trevi Fountain. The Cloaca Maxima, conceived in the sixth century BC to drain the marsh at the heart of Rome, remains partly in service within the modern drainage network; the thermae, from Agrippa to Diocletian, were the institutional declaration of a public culture of water, sized not for strict need but for a shared daily relation with the resource.

The Roman contribution to harbour engineering was a material. Lime mixed with pozzolana from the Phlegraean Fields gave a mortar that set under water, and opus caementicium could be cast directly into the sea; the ROMACONS coring campaigns have documented both the floating formwork and the export of Campanian pozzolana over two thousand kilometres to Caesarea. A harbour could now be built where the site offered no shelter at all. Portus, at the mouth of the Tiber — the Claudian basin of 150 hectares, then Trajan's inner hexagon of 33 — is the demonstration, and also the durable lesson: both basins were defeated by siltation. Wave attack is a structural problem and can be solved; the sediment budget is a systemic one, and no single structure closes it for good.



Baths of Caracalla



Port of Claudius at Ostia - Port of Trajan

Contrary to the image of decline, the Italian Middle Ages were a period of continuity and innovation. Benedictine and Cistercian monasteries preserved and extended Roman practice through irrigation, drainage and mills; Arab engineers introduced the qanat to Sicily; Siena's bottini supplied the city for six centuries under dedicated public officials, anticipating the modern utility.

In the Po Plain, between the eleventh and fourteenth centuries, communes and lordships built the navigli: the Naviglio Grande, completed in 1257 and navigable from 1272, drew the Ticino to Milan along fifty kilometres for irrigation, transport, supply and mechanical power; the Martesana followed in 1496 and the Pavese, conceived in the fifteenth century, was finished only in 1819.

The Viarenna lock of 1438–39 was the first pound lock in Europe, and the mitre gate traditionally attributed to Leonardo refined it into the standard chamber lock. At its maximum the network reached some 160 kilometres and was the principal infrastructure of European inland navigation until the early nineteenth century. Significant portions remain operational, their functions migrated from navigation to irrigation, hydropower, ecological connectivity and landscape — the Villoresi corridor is the clearest case of a historic canal reconceived as blue-green infrastructure.

Venice is a category in itself: a city built on millions of larch and oak piles driven into the silt, and a lagoon governed at territorial scale by a Republic that diverted the Brenta (1488–1507), the Sile (1664–83) and the Piave to preserve salinity and tidal exchange, and completed its defence with the murazzi of Pellestrina and the Lido (1744–82).
The Magistrato alle Acque, established in 1501, was the first specialised public water agency in modern Europe, and the engineers formed in the Venetian school worked between the sixteenth and eighteenth centuries in the Dutch Republic, France, Spain and the Ottoman Empire.
The scientific foundation came with the Italian fifteenth and sixteenth centuries. Leonardo's codices form the most extensive corpus of hydraulic studies of the

THE VALUE OF A MODEL DEPENDS ON THE QUALITY, DURATION AND GOVERNANCE OF THE RECORD THAT FEEDS IT.

Renaissance, with qualitative intuitions on continuity, on the relation between section and velocity, on friction and wave propagation that already contain the nucleus of the modern equations. Benedetto Castelli's Della misura dell'acque correnti of 1628 gave the relation between flow, section and velocity its first quantitative form, and the school that followed — Guglielmini at Bologna, Poleni at Padua — dominated European theoretical hydraulics into the eighteenth century while directing the regulation of the Reno, the Arno and the Tiber and the reclamation of the Pontine plain.



Vinciana Gate



Pollentina Spring of the Apulian Aqueduct – Cassano Irpino

WATER ENGINEERING BECAME AN INFRASTRUCTURE FOR ITALY'S TRANSFORMATION.

The nineteenth and twentieth centuries changed the scale of Italian water engineering. Integral land reclamation combined drainage, irrigation, roads, settlement and agricultural improvement. The Consorzi di Bonifica gave landowners and public authorities an enduring structure for managing shared hydraulic systems. Today roughly 150 consortia operate across about 17 million hectares, managing canals, pumping stations, irrigation and sections of the minor drainage network. Hydroelectric development harnessed Alpine and Apennine catchments through dams, tunnels, pressure shafts and power stations. Electricity supported industrialisation and urban growth; reservoirs also acquired roles in irrigation, supply and flood attenuation. Italy now has nearly 522 large dams and 5,000 hydroelectric plants with about 21.7 GW of installed capacity, while large reservoirs store more than 13 billion cubic metres.

Regional aqueducts answered the mismatch between sources and demand. Systems such as the Apulian Aqueduct, the Simbrivio and Peschiera-Capore schemes for Rome, and the networks serving Naples transferred high-quality water across basins and elevations. Their development required long tunnels, major pipelines, pumping stations, reservoirs and, crucially, arrangements for sharing a resource among territories.

Sewerage and treatment expanded later, driven by public health and environmental law. Italy now operates approximately 175,000 kilometres of sewerage and 18,118 treatment plants. Coverage and compliance have improved substantially, but infringement procedures and regional disparities show that completion of the sanitation cycle remains an unfinished national task.



Pollentina Spring of the Apulian Aqueduct – Cassano Irpino

BUILDING FOR THE MAINTAINER

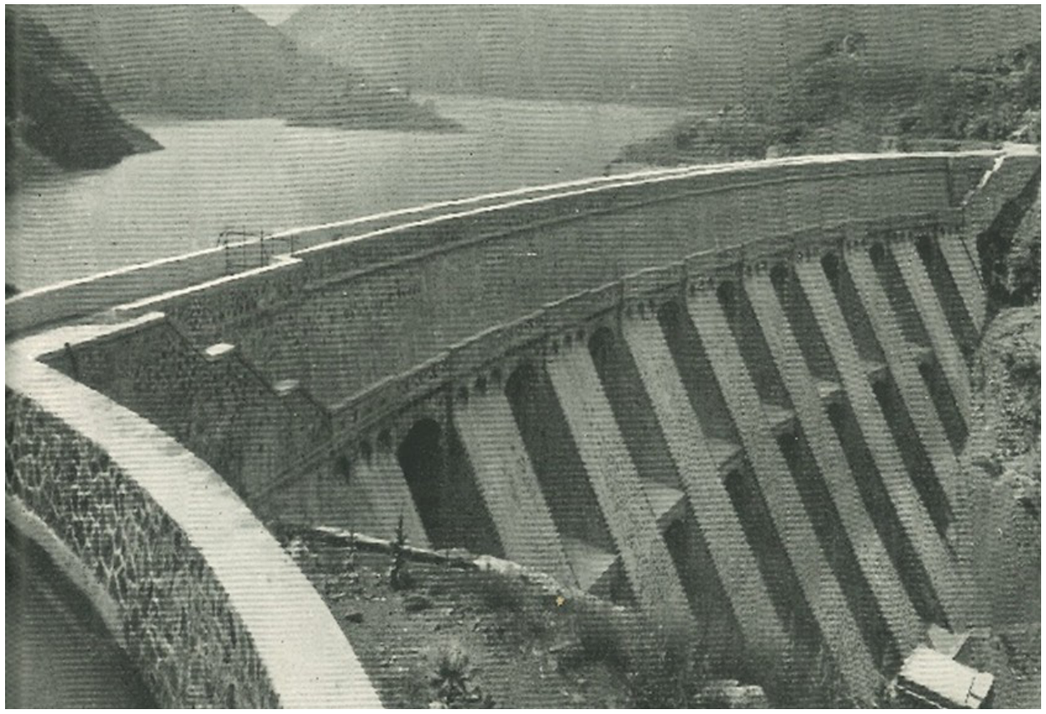
What the tradition hands the present is a stock, and the stock is the agenda: canals that must be kept in service while their functions change; reclamation districts whose pumping has to be decarbonised; dams that will be discussed in Chapter 4; regional aqueducts a century old that the replacement rate of the sector cannot renew in time; ports that have to become nodes of the electricity grid and to design for successive adaptation rather than for a single design life. None of these tasks starts from an empty site.

Little of this tradition survives because it was monumental; it survives because it could be kept in service. The Etruscan cuniculus, the Roman aqueduct, the Sardinian well-temple and the Lombard naviglio share a gravity-driven logic, an accessible fabric and, decisively, a body of rules for who inspects, who repairs and who arbitrates — the aquarii, the consortial statutes, the Magistrato alle Acque.

For an administration commissioning works today, the durable choice is generally the one a modest local capability can operate and repair for a century, in preference to the more efficient one that depends on a supply chain and a skill set the territory does not hold. The custodian must be designed together with the work: wherever the institution lapsed, the conduit silted, however well it had been built.



Lake Lavezze Dam



Orba River Basin – Province of Genoa – Gravity Dam, 1800

PROJECTS

RENATURATION OF THE PO RIVER CORRIDOR

The Po River Renaturation Project is one of the largest environmental engineering initiatives currently underway in Europe, with a total investment of €357 million financed through Italy's National Recovery and Resilience Plan (NRRP). The Italian Ministry of the Environment and Energy Security entrusted the implementation of the programme to AIPo (Interregional Agency for the Po River).

Inspired by the EU Biodiversity Strategy for 2030, the project is pioneering in Italy both for its scale and for the innovative approach adopted. Stretching over 652 km, the Po River—the longest river in Italy—has undergone profound transformations over the last century. The construction of navigation groynes progressively altered the river morphology, narrowing the active channel and disrupting the natural interaction between the river and its floodplain. These modifications have resulted in environmental degradation, the loss of riverine habitats and an increased hydraulic risk during flood events.
To address these challenges, AIPo identified 56 intervention areas distributed across four Italian regions and more than 100 municipalities.

KEY VALUES

AREAS OF INTERVENTION
56

REDUCTION OF RIVERBED ARTIFICIALITY
38 km

NEW WETLANDS
130 ha

NEW ECOLOGICAL REFORESTATION
1,800 ha

Project developed by **3TI PROGETTI** in a joint venture comprising **IN.GE.NA., HYDRO NOVA, TECNOVIA, ENGEO, STUDIO ZANZUCCHI ASSOCIATI, LAND ITALIA** and **INGENIEURE UMWELTTECHNIK GMBH.**





The programme is structured around two complementary objectives: restoring the river's morphological dynamics and promoting the ecological renaturation of riverbanks and floodplain environments.

The initiative involves more than 150 public authorities and adopts an integrated, multidisciplinary approach combining hydraulic engineering, spatial planning and natural sciences. The planned interventions aim to reduce the excessive artificialisation of the river system through morphological restoration, the creation of temporary wetlands and ecological reforestation.

The designed programme includes the morphological reactivation of 14 river reaches by selectively lowering navigation groynes and excavating new channels to reconnect abandoned side arms and oxbow lakes with the main river channel. In the Middle Po section, these interventions will significantly improve the natural hydraulic connectivity: the number of days during which water levels are expected to exceed the structural thresholds of the groynes will increase from approximately 8 to more than 100 days per year, enhancing the river's natural flood attenuation capacity while reducing hydraulic hazard during flood events.

To assess and ensure hydraulic safety, a hydraulic model covering approximately 490 km of the river was developed using state-of-the-art topographic and digital datasets. The model supports the verification of the proposed interventions while ensuring the maintenance and improvement of hydraulic safety standards throughout the project area.

To enhance biodiversity and restore natural habitats along the river corridor, the project also includes measures for the control of invasive alien species, large-scale ecological reforestation and wetland restoration across more than 2,000 hectares. Specifically, the programme provides for the excavation of more than 20 km of new channels to reactivate abandoned side arms and oxbow lakes, the ecological reforestation of approximately 1,800 hectares through the planting of more than 2 million native trees, and the control of invasive species, promoting biodiversity recovery and the re-establishment of ecological corridors along the Po River.

The completion of works in 12 intervention areas, achieved by the 31 March 2026 deadline, enabled the project to meet the NRRP target of reducing the artificialisation of the riverbed by 37 km, in line with NextGenerationEU – Mission 2 "Green Revolution and Ecological Transition", Component 4 "Investments to Address Climate Change and Hydrogeological Risk". The experience gained through this programme has represented a significant testing ground for the integrated application of multidisciplinary expertise in river renaturation, enabling the development of innovative solutions that combine hydraulic safety, ecological restoration and climate change adaptation across a large and highly complex territorial system.









NEW UPPER SECTION PESCHIERA AQUEDUCT PROJECT

The water supply system serving ATO 2, Central Lazio–Rome, relies on a complex and interconnected network of aqueducts, the most important of which is the Peschiera–Capore system. With a total conveyed average flow rate of 13.7 m^3/s, the system constitutes one of Italy's major hydraulic infrastructures and is the primary source of drinking water for the city of Rome. It can therefore be regarded as an infrastructure asset of national strategic importance.

The Peschiera springs are located in the municipalities of Castel Sant'Angelo and Cittaducale, near Rieti. The aqueduct comprises an Upper Section extending from the Peschiera springs to the Salisano junction, where the flows originating from the Capore springs also converge. Downstream of Salisano, a hydraulic flow-splitting structure, hereinafter referred to as the Bipartitore, divides the system into two conveyance branches leading towards Rome, namely the Left Lower Section and the Right Lower Section. The existing Upper Section crosses the mountainous area between the Velino and Farfa valleys, as well as the smaller topographic depressions associated with the Salto and Turano river valleys and the Tancia stream valley.

Project developed by **ACEA INFRASTRUCTURES SPA**

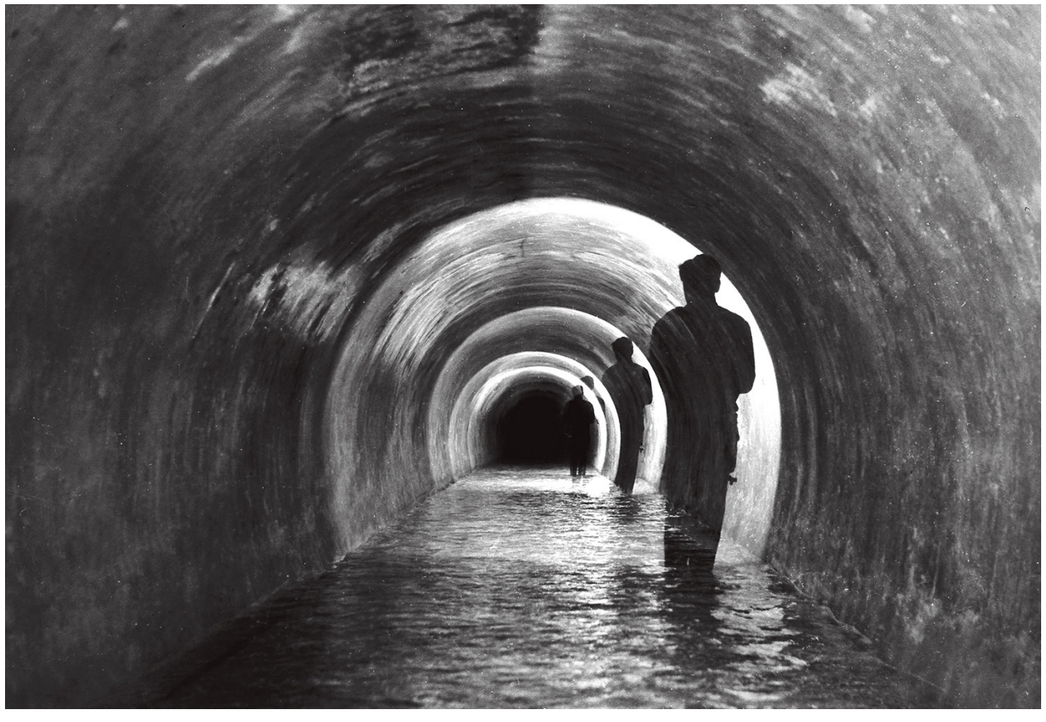
KEY VALUES

AQUEDUCT
27 km

MEDIUM FLOW RATE
10 m^3/s

MAX. TUNNEL LENGTH
13,4 km







Extending for approximately 27 km, it mainly consists of a concrete hydraulic tunnel with a polycentric cross-section operating under free-surface flow conditions. In several reaches, the tunnel lies beneath substantial overburden and has remained in continuous operation since the late 1930s. Its current configuration limits planned inspections and systematic condition assessments, as these cannot be performed without affecting water conveyance.

Furthermore, the absence of an independent bypass of the Salisano hydroelectric power plant means that continuity of the drinking water supply depends on the operational availability of both the Salisano facilities and the existing Bipartitore.

To address these constraints, a new conveyance infrastructure is planned, including a dedicated bypass of the Salisano hydroelectric power plant. The system will convey water abstracted from the Peschiera springs to Salisano while improving overall resilience and redundancy. Its main objectives are to reduce the risk of service interruption associated with the series configuration of the intake works, aqueduct and Salisano plant; convey the full licensed flow rate of 10 m^3/s towards Rome; and transfer this flow to the downstream aqueducts through an alternative alignment outside the existing Salisano node. The scheme includes a crossing beneath the San Vittorino Plain with two parallel pipelines installed by microtunnelling, with individual pipe-jacking drives ranging from 140 to 1,000 m.

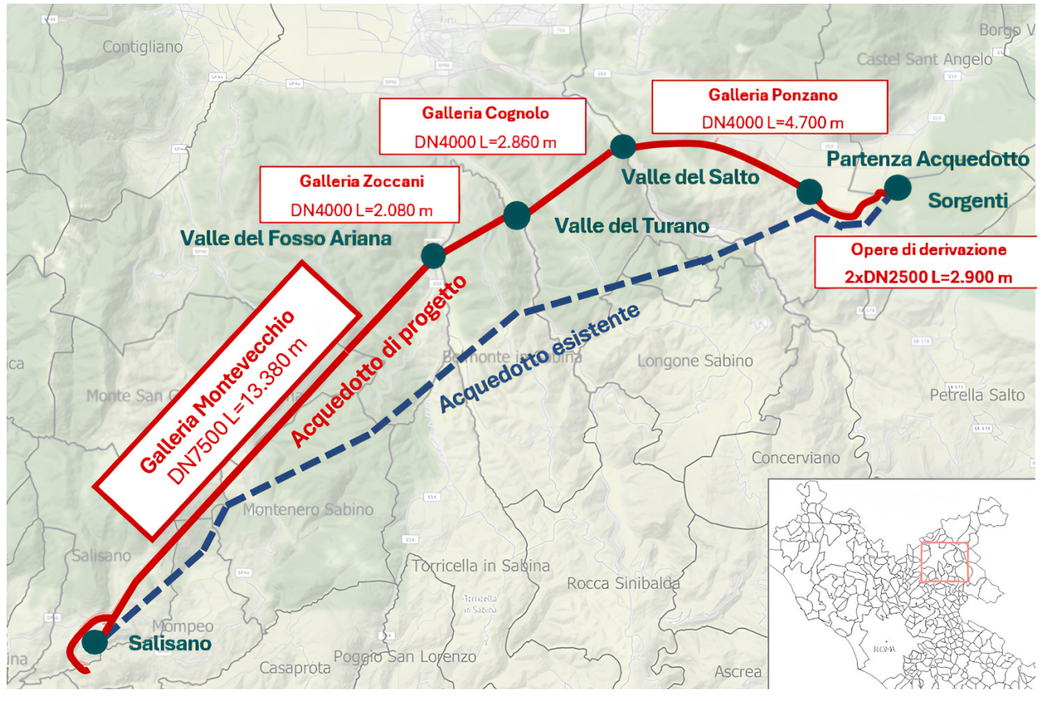
Downstream, three free-surface hydraulic tunnels with an internal diameter of 4.00 m will be arranged in series and excavated using an EPB-TBM. Their total length will be approximately 10 km: the 4,750 m Ponzano Tunnel, 2,890 m Cognolo Tunnel and 2,100 m Zoccani Tunnel. The Salto and Turano valleys will also be crossed beneath their riverbeds by two parallel pipelines installed by microtunnelling. Near the Ariana stream, in the municipality of San Giovanni Reatino, flow will transition from free-surface to pressurized conditions at the outlet of the Cognolo Tunnel. From there, the design flow will reach Salisano through a 3.40 m internal-diameter steel pipeline operating under low pressure.

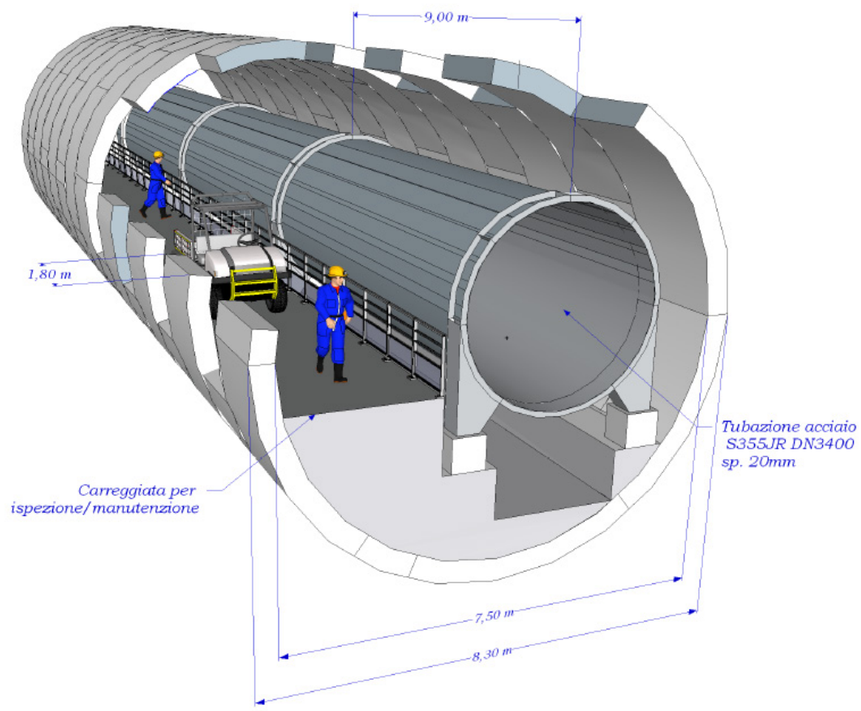
The pipeline will run within the Montevecchio Tunnel, excavated using a double-shield hard-rock TBM, with an internal diameter of 7.50 m and a length exceeding 13 km. The tunnel will discharge into a new hydraulic structure, Node S, near Salisano. Under normal conditions, Node S will direct flow to the existing forebay of the hydroelectric power plant; when bypassing the plant is required, flow will be diverted through a dedicated bypass system.

Along this route, a hydraulic head exceeding 250 m will be dissipated before discharge downstream of the Salisano node into the New Bipartitore.

Head dissipation will be achieved through two vertical shafts, approximately 100 m and 150 m deep, connected by horizontal tunnels excavated using both conventional and mechanized methods. The bypass will extend for approximately 2 km and connect to the existing Right and Left Lower Sections of the Peschiera–Capore aqueduct.

Overall, the new configuration will provide an independent route bypassing the Salisano facilities, increasing operational flexibility and reducing the vulnerability of Rome's primary drinking water supply system to individual infrastructure failures.





NEW AL FAW PORT

The New Al Faw Port is a major infrastructure development designed to create a large-scale commercial and logistics hub in Iraq. The Engineering Consultancy Services contract was signed in 2010 between the Iraqi Ministry of Transportation and the Italian Consortium IECAF (Italian Engineers and Contractors for Al Faw), of which BTP was a member.

BTP contributed to the engineering services for the development of a port designed to handle up to 25 million TEU per year and more than 50 million tonnes of dry bulk cargo, with an estimated construction value of approximately €11.7 billion.

The consultancy activities, completed in December 2022, included the Master Plan, Front End Engineering Design (FEED), preparation of tender documents, assistance during the tendering stage and supervision of breakwater construction.

KEY VALUES

TOTAL CAPACITY
25M TEU / YEAR
50M TONS
DRY BULK / YEAR

VALUE OF THE WORKS
€11.7 B

Project developed by **BTP INFRASTRUTTURE SPA,** in a joint venture with **TECHNITAL SPA** and **RSG SRL**



The project comprises an extensive system of maritime infrastructure, including 17 km of container terminal quays, 5 km of bulk terminal quays and Ro-Ro facilities designed to handle approximately 400,000 vehicles per year.

The port is protected by two major breakwaters, extending 16 km to the east and 8 km to the west, while approximately 240 million m^3 of dredging is required to provide the necessary navigation and operational conditions.

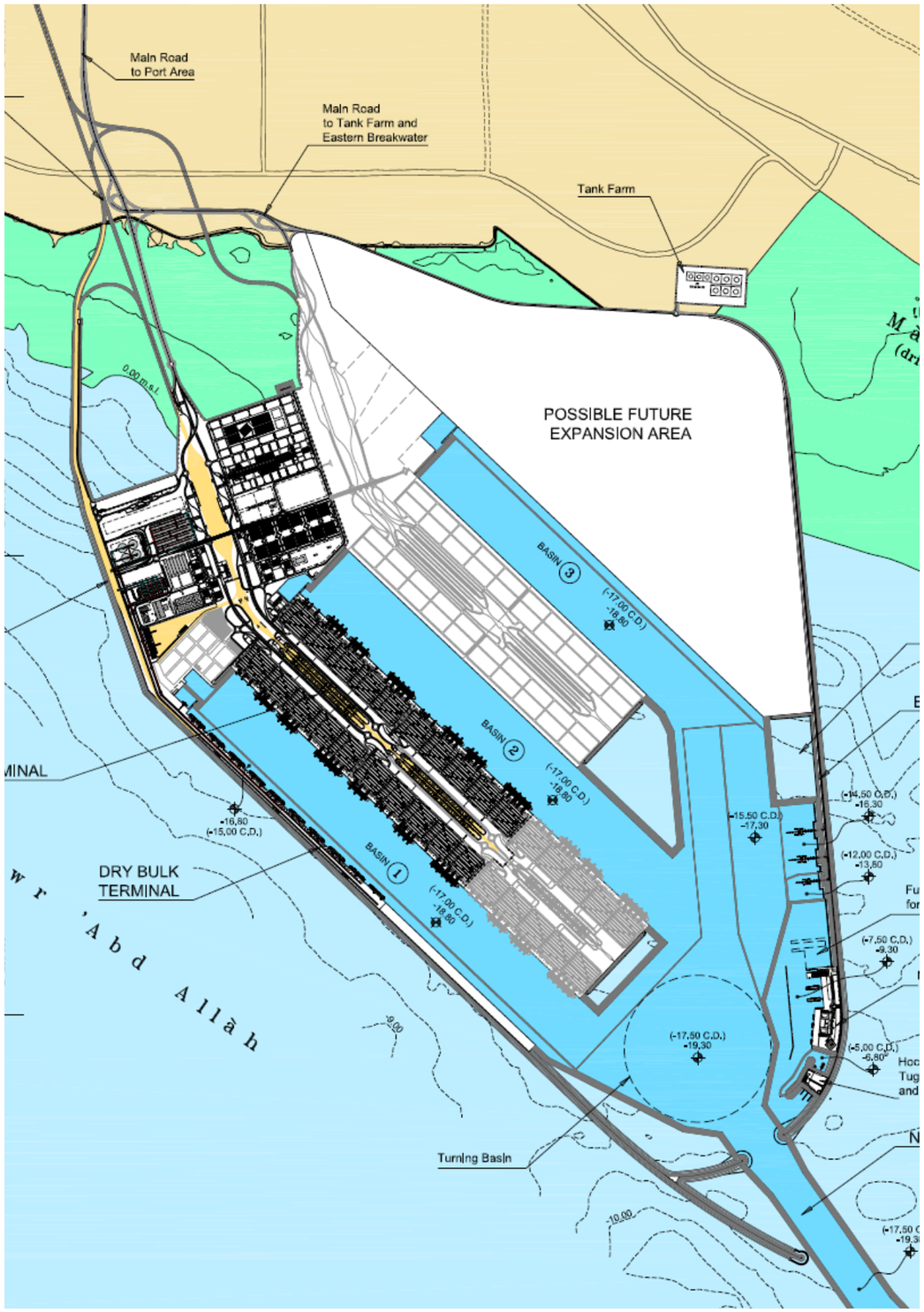
The development also includes a tank farm and oil terminal with dedicated jetties and berths, a naval base, port yards and operational areas covering approximately 2,170 hectares, as well as an extensive land infrastructure network.

This includes 61 buildings, approximately 50 km of roads, railway terminals designed to handle up to 270 trains per day, utilities and specialised hydraulic, electrical and firefighting systems.

Supporting infrastructure includes power generation, seawater intake and desalination facilities, together with fuel storage and water distribution systems.

Through the integration of maritime works, logistics, transport infrastructure, industrial facilities and utilities, the New Al Faw Port represents a highly complex multidisciplinary engineering programme conceived to support large-scale commercial operations and the development of Iraq's maritime infrastructure.





POTABLE WATER UTILIZATION FROM THE CAMPOLATTARO DAM AND UPGRADE OF DRINKING WATER SUPPLY FOR THE BENEVENTO AREA

The project consists of three lots. Lots 1 and 2 were both awarded to Campolattaro Scarl, of which AI Engineering srl, Alpina SPA, C.&S. Di Giuseppe Ingegneri Associati srl, and Studio di Ingegneria IsolaBoasso srl are the designated designers.
The project's strength lies in the productive use of one of the main reservoirs in Central and Southern Italy, originally designed by the Cassa del Mezzogiorno for irrigation purposes only, delivered in the early 1990s, and never put into operation.

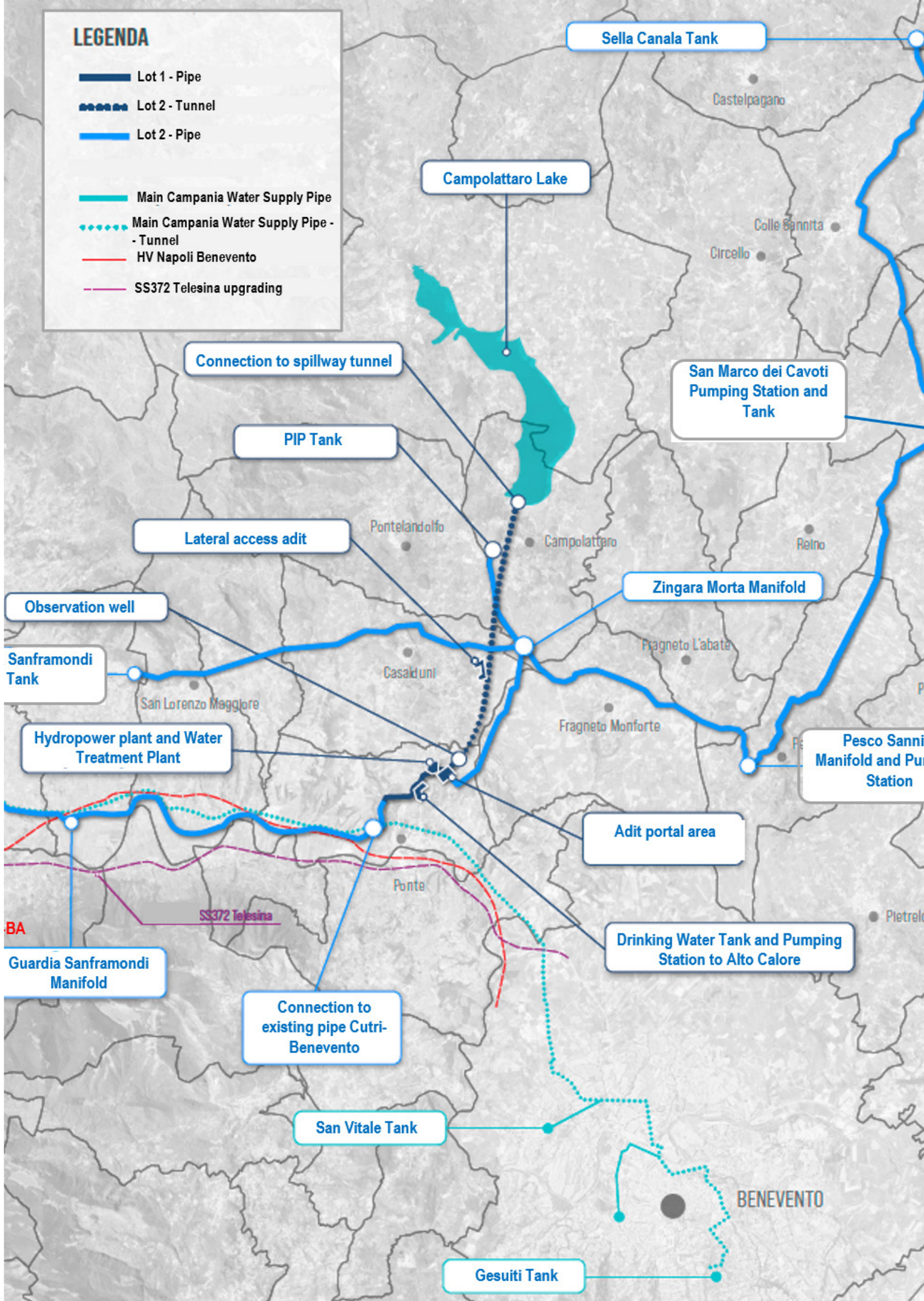
The project aims to allow the treatment and distribution of the water stored in the Campolattaro Dam reservoir, replacing less reliable and seasonal sources, which are characterized by unacceptable variations in quantity and quality. The project interconnects the existing water supply system and significantly upgrades it, resulting in a very high redistribution capacity, supplying a large catchment area for drinking water and irrigation, no longer exposed to recurring source unreliability.

KEY VALUES

MAXIMUM FLOW RATE
8 m^3/s

PIPES LENGTH/DN
100 km

SERVED POPULATION
120.000 INHABITANTS



Project developed by **C.&S. DI GIUSEPPE INGEGNERI ASSOCIATI** in a joint venture with **AI ENGINEERING SRL, ALPINA SPA, STUDI DI INGEGNERIA ISOLABOASSO SRL.**

The project, funded by the National Recovery and Resilience Plan (NRRP), will directly serve 26 municipalities with a total population of 128,000. The large water supply system as a whole will serve 2.5 million people across four provinces, while the irrigation system will serve 15,000 hectares in the Province of Benevento.

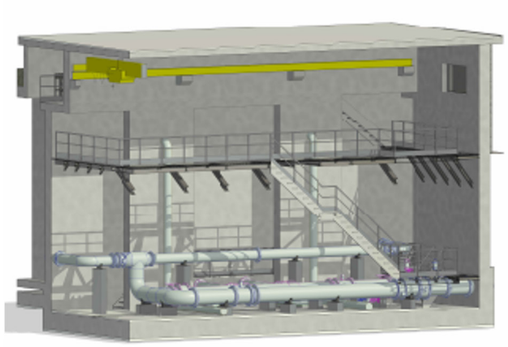
The works:
Lot 1 concerns the tunnel and facilities (water purification plant, reservoir, and hydroelectric plant):

- **Maximum flow rate from the dam:** 8 m^3/s;▪ Hydroelectric plant: Pmax: 7,200 kW - Energy: 18,000 MWh/year;
- **Diversion tunnel:** 7.5 km long, internal diameter: 4.2 m - pipeline: DN 2200 mm;▪ Over 5 km of steel pipelines: DN 800 - 1,500 - 1,800;▪ Irrigation diversion: Qmax = 5 m^3/s;▪ Water treatment plant: Qmax = 3 m^3/s;
- **Reservoir:** 30,000 m^3.

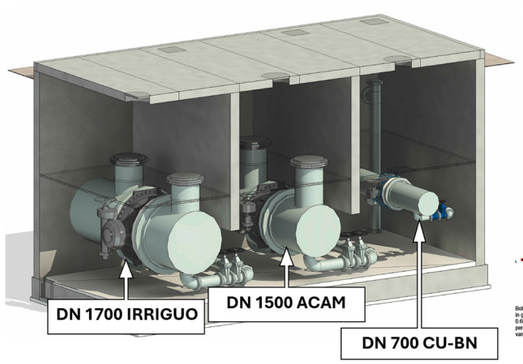
Lot 2 includes the following works:

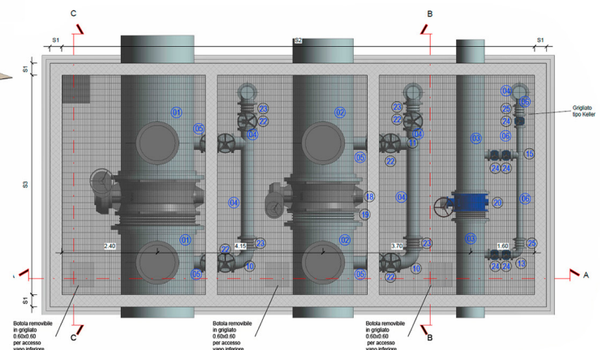
- **Approximately 100 km of steel pipelines (DN 400 to DN 1800):** Construction of a DN 1500 drinking water pipeline; Strengthening and integrating the Benevento area aqueducts through the construction of a DN 400-700 branch pipeline and line works; Construction of an irrigation pipeline DN 1800-1700-1200;
- **Point-specific works:** 2 reservoirs for a total of approximately 4,500 m^3; 4 distribution structures.

With particular reference to the crossings, the most significant in terms of construction complexity are those of the Bundle Pipe (three-pipe); among these, the crossings of the Lenta and Seneta Troughs and the Naples-Bari High-Speed Rail, the Caserta-Foggia railway line, and the SP44 are being solved using microtuning.









The works involve drawing water from the Campolattaro reservoir, generating energy, treating part of the resource for drinking water, and distributing it for civil and irrigation purposes. The favourable altitude of the source allows the larger irrigation flows to be distributed by gravity, while only part of the drinking water supply requires lifting.

Hydraulic sizing considered multiple irrigation and drinking water demand scenarios, with a maximum reservoir withdrawal of approximately 8,000 l/s: around 3,000 l/s directed to the water treatment plant and 5,000 l/s to the irrigation network. The system supplies both new and existing tanks, plants and networks, requiring a high degree of operational flexibility to accommodate multiple delivery points and interfaces with existing infrastructure.

Particular attention was given to integrating the above-ground works into the surrounding landscape. The water treatment plant is set within a green area and mitigated through natural colours, green roofs and limited waterproofed surfaces. The 30,000 m^3 tank is embedded into the hillside, reconstructing the natural slope profile and significantly reducing its visual impact, as well as noise and vibration effects.

Tanks and distribution structures feature external finishes, including stone cladding, designed to integrate with the surrounding landscape in accordance with SABAP requirements. Local tree species complete the intervention, further reducing visual impact from both elevated viewpoints and nearby roads.



CONSTRUCTION OF THE DESALINATION PLANT FOR THE SALT WATERS OF THE TARA RIVER - SITE ENVIRONMENTAL MANAGER.

The Taranto desalination plant is a strategic project of Acquedotto Pugliese (AQP), currently under construction on the banks of the Tara River.
It is the largest reverse osmosis plant for civil use in Italy. Its objective is to guarantee drinking water for 385,000 people, reducing dependence on inter-regional water supply schemes.

Project details - Technology: reverse osmosis. It treats salt waters, with a salinity of 3-4 grams per litre, drawn from the Tara River.
Capacity: it treats 1,000 litres per second, producing approximately 680 litres per second of desalinated water. At full capacity, it will produce up to 60,000 cubic metres of water per day.
Estimated cost: approximately €78.6 million, partly funded by the NRRP. Location: the site is located in the Taranto countryside, approximately one kilometre from the Tara River.
Destination: the treated drinking water is conveyed to a large 200,000-cubic-metre service reservoir and from there distributed by gravity to the Taranto area and Salento.

KEY VALUES

TOTAL INFRASTRUCTURE COST
€129.20 M

WATER SUPPLY PIPELINE LENGTH
14,09 km

DAILY WATER TREATMENT CAPACITY
~55,000 m³

Project developed by **EAMBIENTE** in a joint venture with **AI ENGINEERING S.R.L.**, **CONSORZIO UNING** and **SUEZ ITALY**



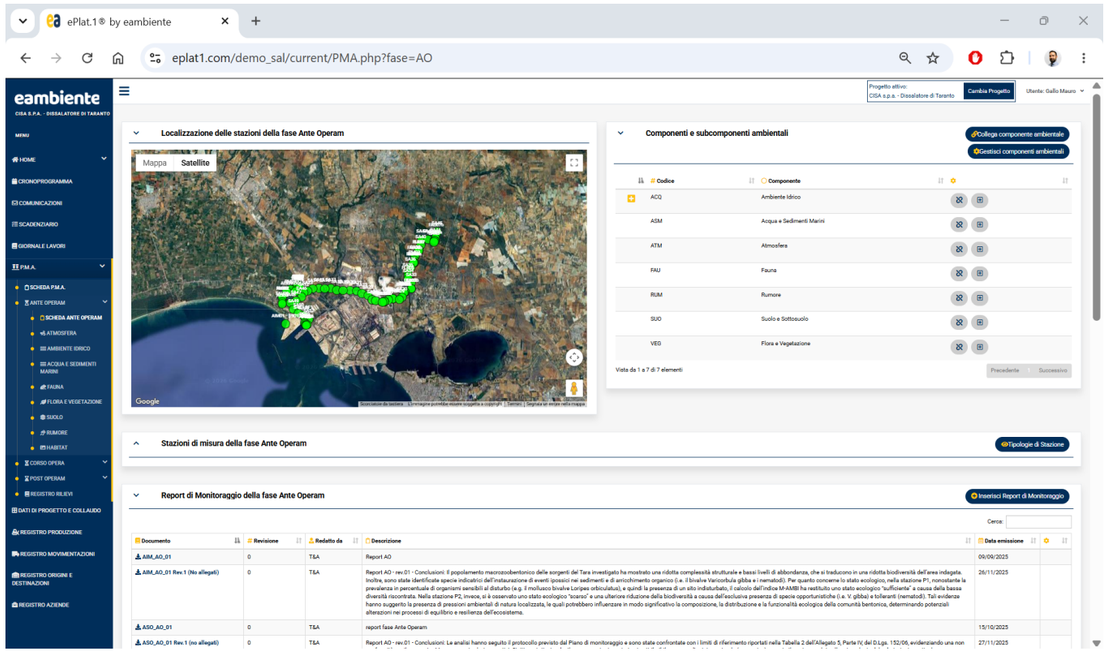
As part of the project, the ePlat1 georeferenced platform developed by eambiente was applied. It enables integrated management of operational and environmental site activities, with modules dedicated to waste production, energy and water consumption monitoring, traceability of excavated soil and rocks, and management of the Environmental Monitoring Plan. The consultation and traceability of operations.

The cloud interface is the core access layer of the integrated georeferenced platform ePlat1®, providing a secure, web-based environment for all Environmental Monitoring Plan (EMP) modules. The platform centralises environmental, technical and administrative information, integrating WebGIS maps, dashboards, datasets, documents and reporting tools, with role-based access ensuring security and full traceability.

ePlat1® enables real-time consultation and collaborative workflows among Contracting Authorities, Works Supervision teams, contractors, environmental specialists, laboratories and regulatory bodies. Configurable profiles, permissions and automated notifications improve transparency and decision-making throughout the project lifecycle.

A key feature is the Digital Twin environment, where the construction site and its environmental components are represented through a hierarchical geospatial structure.

Assets, work areas, monitoring stations and infrastructure elements can be visualised on interactive maps and linked to technical data, monitoring results, authorisations, inspections and documentation, allowing operational and environmental progress to be analysed within a complete historical record.



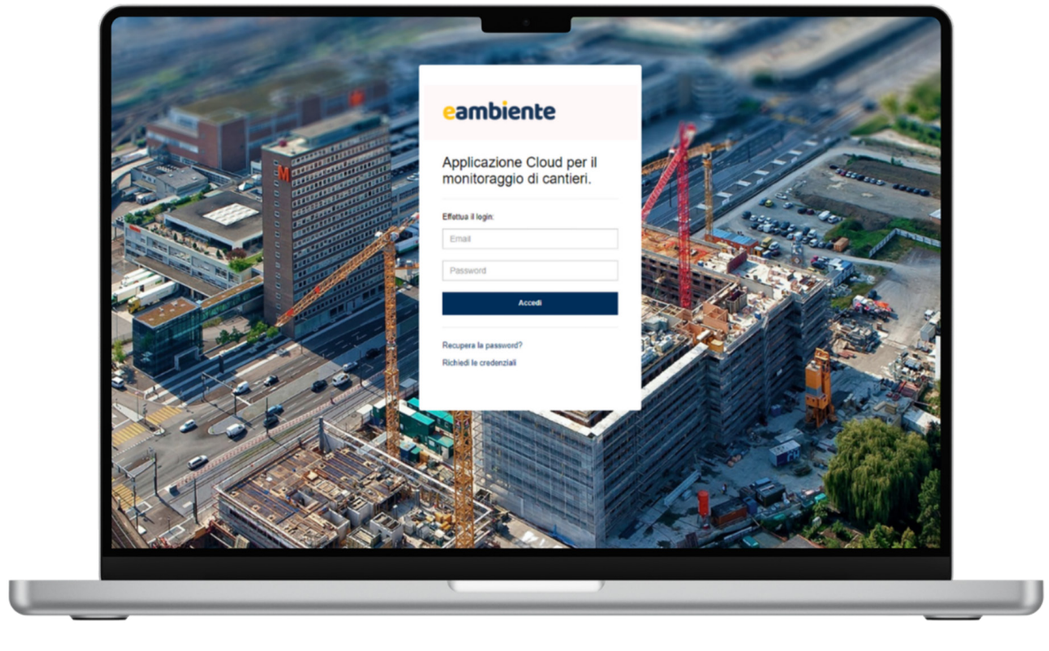
Dedicated modules support EMP management, environmental analysis, regulatory compliance, operating procedures and scheduling, generating reminders, alerts and validation workflows.
The multi-matrix environmental control system also integrates IoT technologies including air quality, noise and vibration systems, meteorological sensors, water monitoring devices, energy meters, drones and remote sensing equipment, enabling near real-time data collection and analysis.

Integrated algorithms process monitoring data, generate performance indicators, identify anomalies and trigger alerts when thresholds or regulatory limits are exceeded, supporting rapid response and proactive management of non-conformities.

ePlat1® also supports work progress, transport logistics, procurement, excavation material traceability, waste management and environmental compliance, tracking materials and waste streams from origin to reuse, recovery or final disposal.

Additional tools cover energy performance, DNSH reporting, environmental audits, compliance assessments and KPI tracking, while specialised modules integrate the management of both the Environmental Management Plan (EMP) and Site Environmental Plan (SEP).

By combining cloud technologies, geospatial intelligence, Digital Twin capabilities and real-time monitoring, ePlat1® provides an integrated framework for the efficient, transparent and sustainable management of complex infrastructure and construction projects.



UPGRADING OF THE MANTOVA WASTEWATER TREATMENT PLANT

ETC Engineering S.r.l. led the preliminary and detailed design, as well as the Construction Supervision, for the upgrading of the Mantova wastewater treatment plant (100,000 PE). The company played a strategic role in protecting a highly sensitive ecosystem: the plant effluents discharge into a lake located near Sites of Community Importance (SCI), the Po River valley system, and a UNESCO protected area. Consequently, the Province enforced compliance with stringent emission limits for capacities ≥ 100,000 PE (Regional Regulation no. 6/19), setting rigid targets on the effluent quality.

KEY VALUES

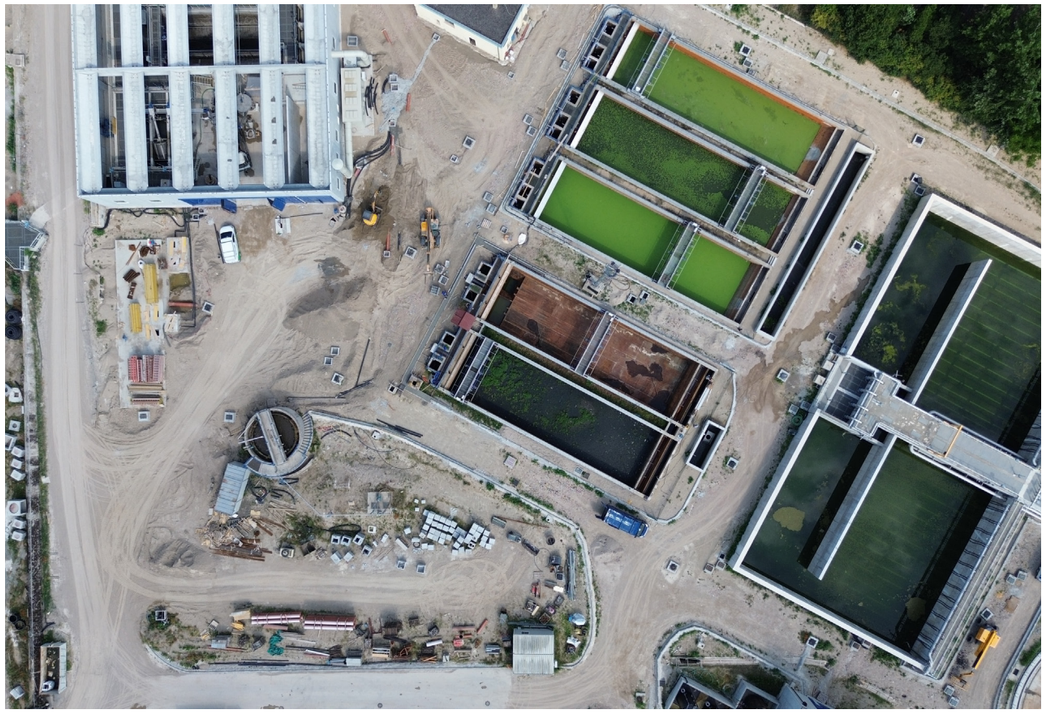
VOLUMES AND FOOTPRINT
12.400 m^3

POPULATION EQUIVALENT (PE)
100.000AE

AVERAGE DRY WEATHER FLOW
24.000 m^3/day

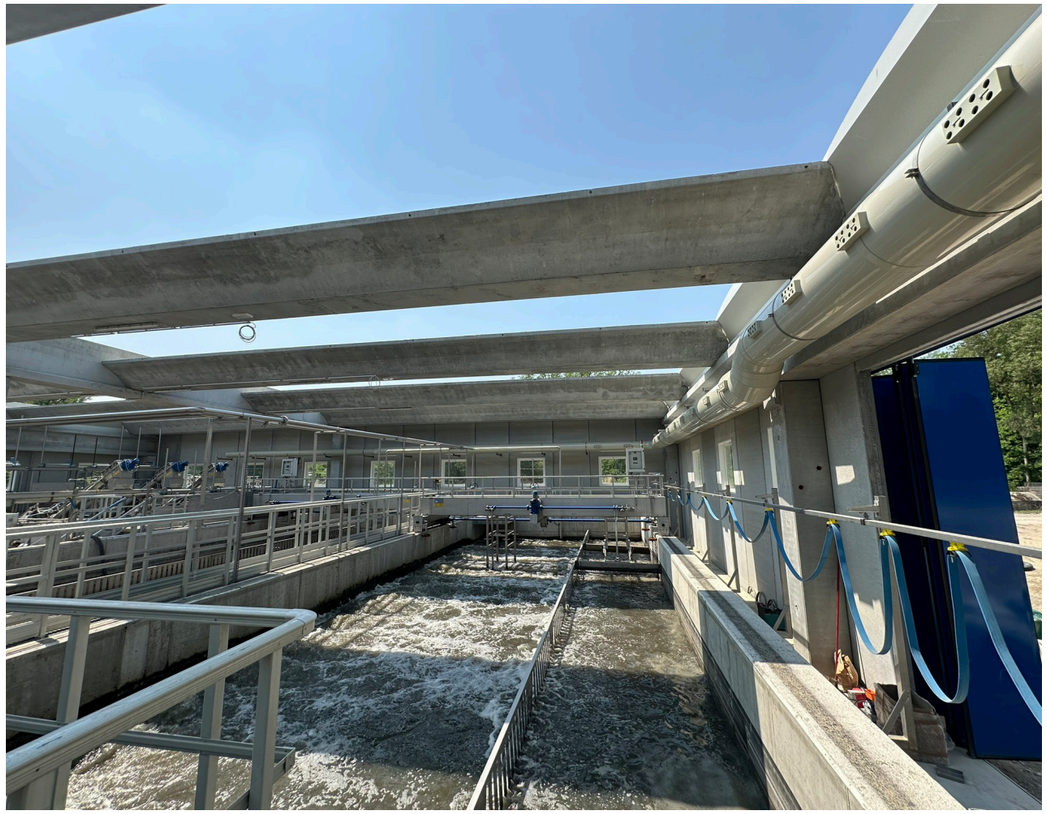
Project developed by **ETC ENGINEERING** in a joint venture with **APL ENGINEERING SRL, SG STUDIO ASSOCIATO FOR THE CONSTRUCION SUPERVISION.**





Implemented Design Solutions

- **Intermittent aeration biological process:** This process is managed by the OSCAR controller with external carbon dosing (acetic acid) to maximize nitrogen and phosphorus removal while optimizing blower energy consumption.
- **Volume retrofitting:** Conversion of the former equalization tank into a new pre-denitrification section to increase biological volume and ensure gravity-driven flow.
- **Screening and grit removal:** Three new fine screening channels (6 mm) to manage wet weather flows up to 4,167 m^3/h, along with new rectangular grit and grease removal channels.
- **Tertiary treatment and polishing:** Three new rectangular secondary clarifiers, filtration of the clarified effluent, and a UV disinfection system for stormwater flows.
- **Digital Twin modeling:** Application of WEST® software for dynamic calibration and validation of the biological process, and EPANET to minimize hydraulic losses in the pumping systems.





ANTIFRAGILE LANDSCAPE
GORO WATERFRONT PLAN

The intervention interprets the coastal landscape as an antifragile system, able not only to resist climate transformations but also to evolving and strengthening through them. In a fragile context such as the Goro shoreline, characterized by erosion, saltwater intrusion, and climate pressures, the project imagines the landscape as an active ecological infrastructure, integrating territorial protection, biodiversity and public space.

The methodological solutions adopted are based on a multidisciplinary approach that integrates landscape, geomorphological, environmental, and infrastructural analyses through GIS tools, georeferenced data, and climate assessments. The environmental restoration strategy follows an evolutionary and incremental logic, supporting the natural processes of the territory rather than replacing them with rigid systems.

The project includes light morphological interventions, dune systems, native vegetation, and devices designed to slow wind and water flows, promoting sediment accumulation, natural soil stabilization, and increased biodiversity.

KEY VALUES

COASTAL LANDSCAPE
7,5 km

AREA DEDICATED TO ECOLOGICAL RESTORATION
>95%

ACCESSIBLE AND RECREATIONAL SHORELINE
160 m

ACCESSIBLE WALKWAY
5,8 km

Project developed by **FLO** in a joint venture with **AMBIENTE SPA**



The work organization was developed through continuous interdisciplinary coordination among urban planning, environmental and landscape design expertise, progressively integrating technical evaluations and local territorial needs.

The experience has demonstrated how an antifragile approach enables the creation of adaptive and resilient territorial systems capable of improving their ecological and environmental performance over time through lightweight, reversible strategies that are fully integrated with the natural processes of the coastal landscape.
A further dimension of the project concerns the relationship between environmental restoration and the experience of the landscape.

Rather than treating accessibility and tourism as separate from ecological protection, the intervention integrates them into a gradual, site-specific system. The two main areas of the shoreline are approached differently according to their environmental conditions: more accessible areas accommodate public, recreational and educational activities, while the most sensitive portions of the scanno are primarily devoted to habitat restoration and biodiversity protection.

This differentiation allows human presence to become part of the landscape strategy without compromising the processes that sustain it.
The project therefore proposes a form of slow and conscious tourism, recognising the coastal landscape as an experience rather than simply a destination.



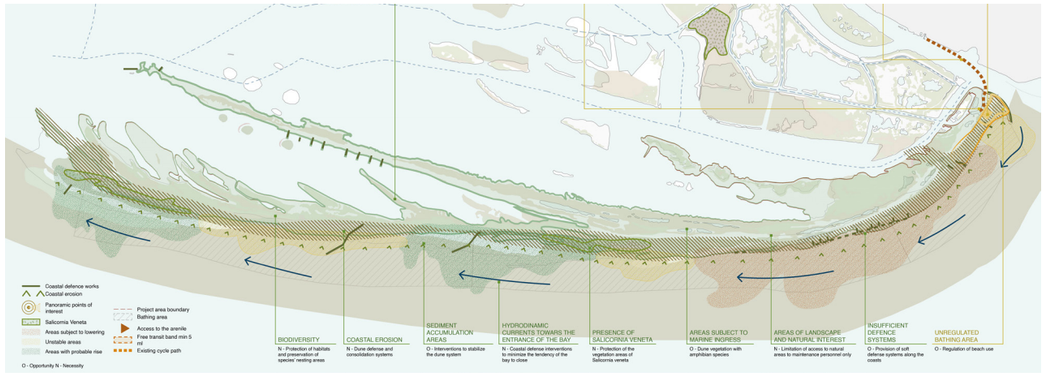
Walking and cycling connections, observation points, naturalistic routes and spaces for environmental interpretation bring people closer to the landscape while increasing awareness of its ecological value. Accessibility is understood not only as a technical requirement, but as a means of enabling a wider range of users to experience and understand the territory.

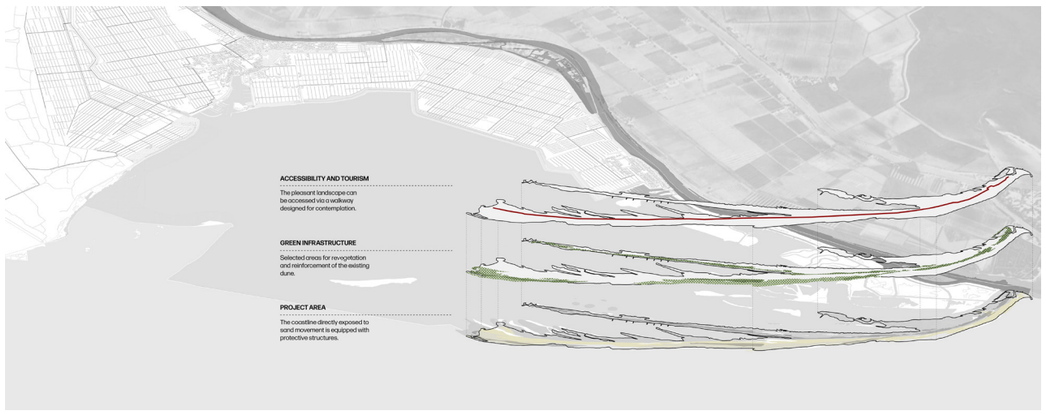
The distinction between areas of active use and restricted access also reinforces the evolutionary character of the intervention. In the most sensitive parts of the scanno, public access is initially limited to allow vegetation and habitats to recover, while future naturalistic routes are envisaged once ecological conditions have consolidated.

The landscape is therefore not considered a fixed final configuration, but a system whose forms of use can change according to its capacity to recover and evolve.

Ultimately, the project suggests that coastal adaptation can be pursued not only through defensive infrastructure, but through the progressive rebalancing of natural dynamics and human activities.

By combining ecological restoration, public accessibility and low-impact tourism, the shoreline becomes an evolving landscape infrastructure in which protection and use are no longer opposing objectives, but mutually reinforcing components of a long-term territorial strategy.





HYDRAULIC IMPROVEMENT WORKS ON THE BIFERNO RIVER REACH

The study topic concerns the hydraulic arrangement works for the Biferno River in the reach between the Liscione Dam and the river mouth, aimed at mitigating hydrogeological flood risk. The definition and verification of all works required to regulate peak flood discharges in the terminal section of the Biferno River, downstream of the Ponte Liscione artificial reservoir, are envisaged.

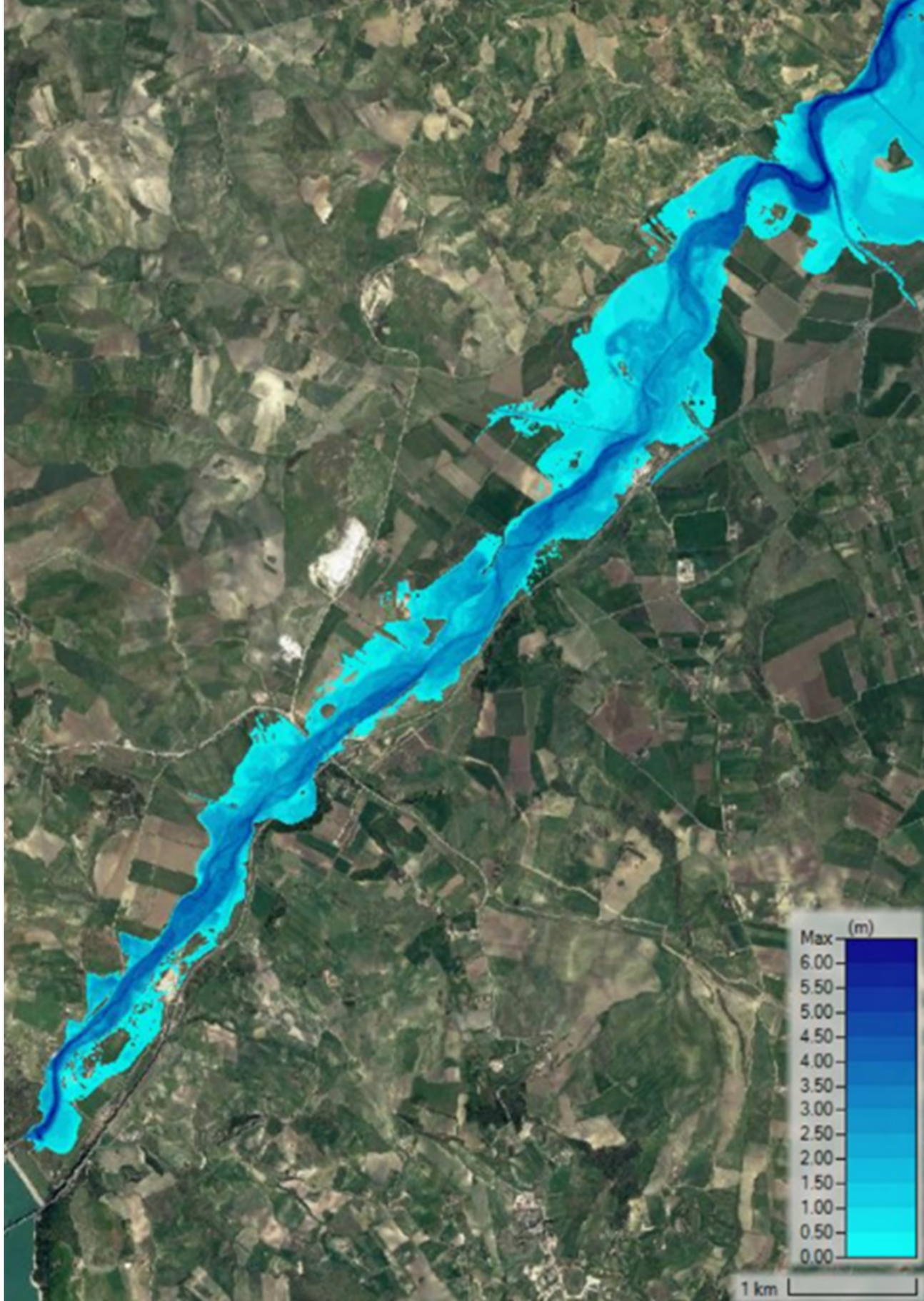
The works include the construction of 12 offline flood storage basins, the upgrading of about 18 km of existing embankments, the construction of new embankment fills and levees, gated outlets, ditches for regulating and conveying surface waters, riverbed excavation works, and verification of the hydraulic compatibility of existing structures, together with the related upgrading and adaptation works.

KEY VALUES

CONSTRUCTION AMOUNT
€210 M

FLOOD RETENTION VOLUME
13,5 X 10^6 m^3

RETURN PERIOD
TR 200 YEARS



Project developed by **FILOS** in a joint venture with **TECHNITAL SPA, STUDIO TECNICO ING. MAURIZIO DE VINCENZI,DOTT. PIERPAOLO IANNITELLI**

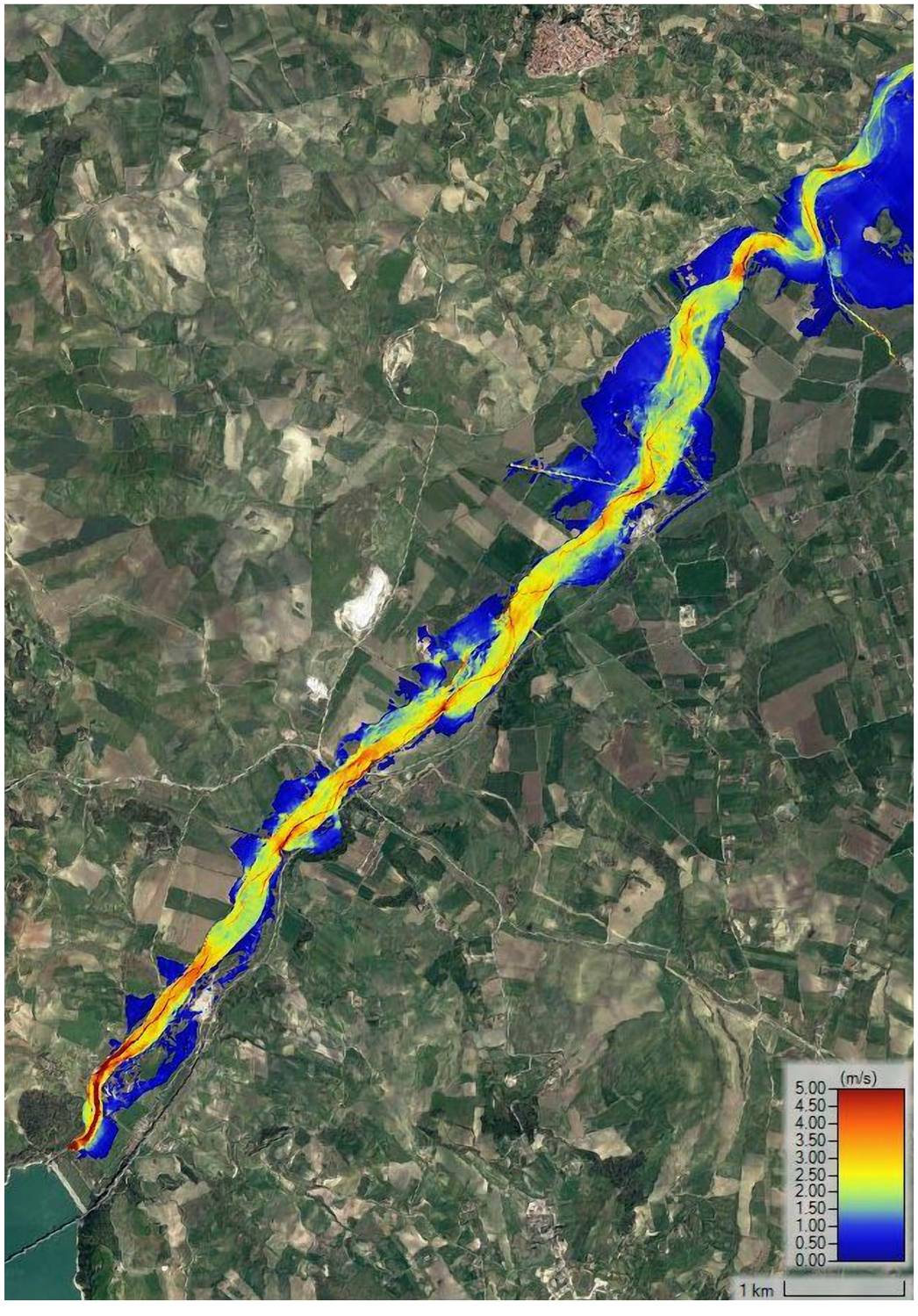
The activity was developed using BIM methodology and an integrated multidisciplinary approach, supported by topographic surveys, hydrological and hydraulic studies, geological, geotechnical and environmental investigations, structural checks and specialist modelling aimed at optimizing the works and reducing interference with the surrounding territorial and environmental context.

The result achieved is a coordinated system of hydraulic works capable of increasing territorial safety and improving the attenuation and flood storage capacity for peak discharges, with important mitigation of hydraulic risk in downstream areas and, in particular, in inhabited centres and their associated industrial zones

To promote greater environmental sustainability in the planned project, the works have been designed to achieve a “zero soil balance”—meaning that all excavated material is to be reused within the construction site itself. Specifically, as previously noted, the material required for all planned embankment structures will be sourced from river-reprofiling excavations and excavations within the various basins. Furthermore, the excavation work will be preceded by the recovery of the topsoil layer, allowing the organic soil component to be reused to create a seedbed for native plant species, in compliance with CAM criterion 2.5.3 (“environmental performance”).

This approach prioritizes the reuse of natural materials, thereby minimizing the need to source material from borrow pits and reducing the depletion of natural resources.





HYDRAULIC RISK IN THE DIGITAL ERA: DESIGNING TERRITORIAL SAFETY FOR THE BOLOGNA-CASTEL BOLOGNESE QUADRUPLING PROJECT

Developed at Technical and Economic Feasibility Design (PFTE) level, the project involves the quadrupling of the Bologna–Castel Bolognese railway section to high-speed/high-capacity standards, increasing capacity and improving integration with the existing network. It includes approximately 50 km of new double track, partly alongside the existing line and partly on a new alignment, as well as two interconnections with the existing routes towards Rimini and Ravenna.

From a hydraulic perspective, the alignment crosses numerous elements of the primary and secondary drainage network within the Reno River basin, under the jurisdiction of the Regional Agency for Territorial Safety and Civil Protection of Emilia-Romagna.
The main watercourses include the Savena, Idice, Quaderna, Gaiana, Sillaro, Santerno and Senio, together with several reclamation canals managed by the Renana Land Reclamation Consortium and the Western Romagna Land Reclamation Consortium.

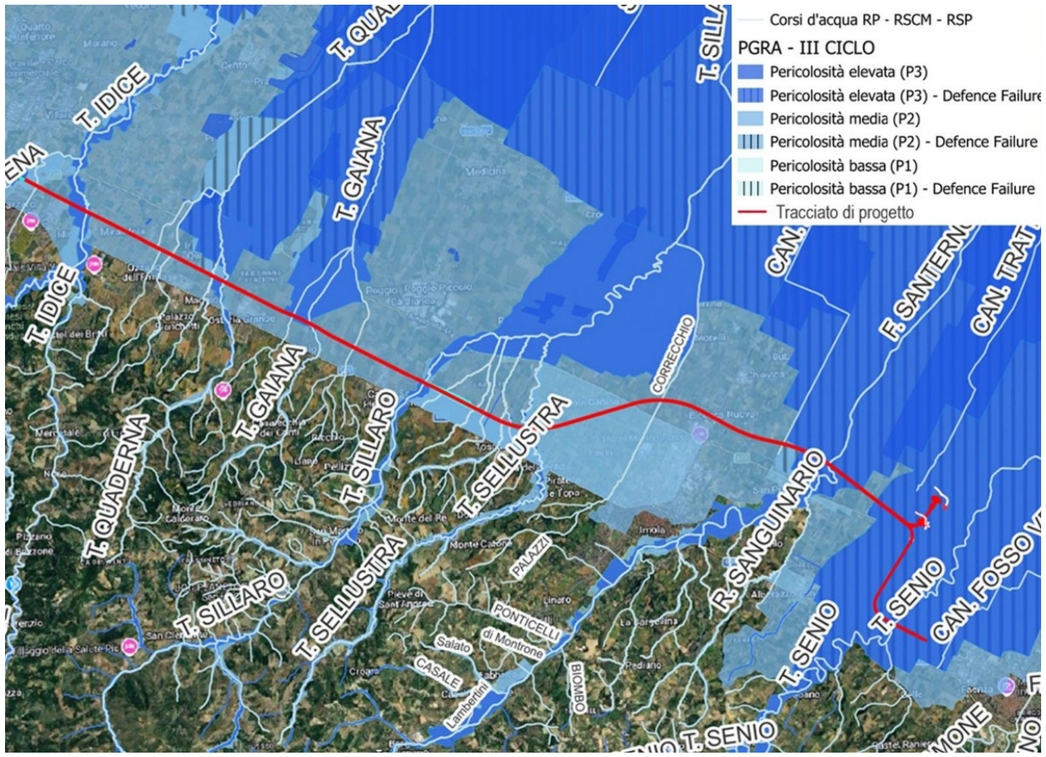
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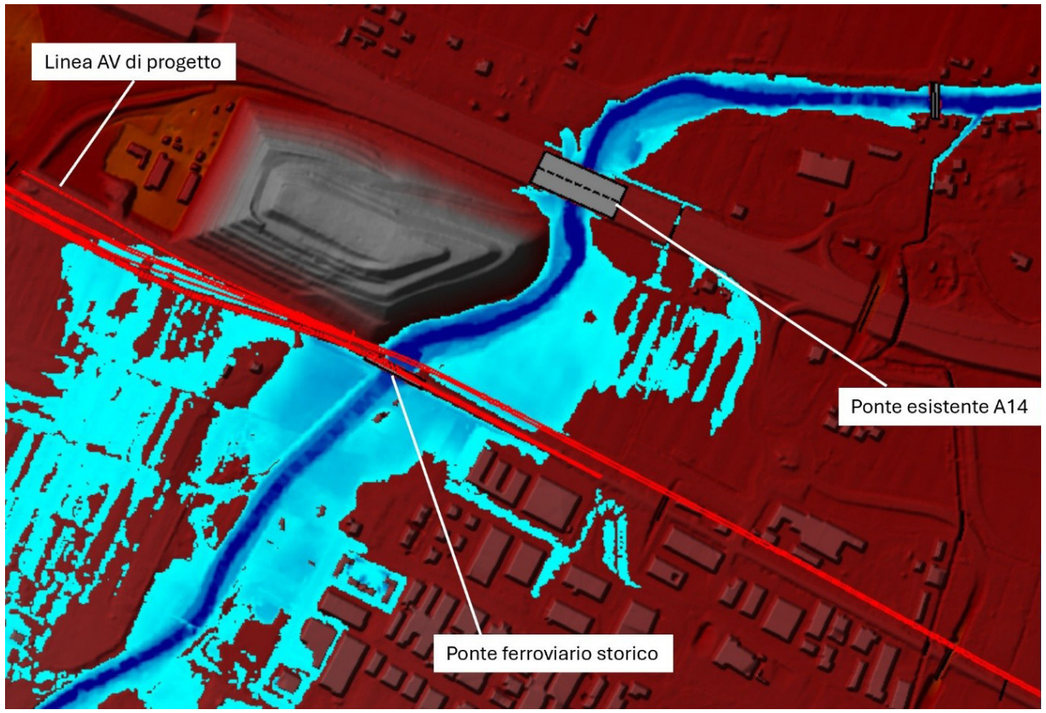
WATERCOURSES INTERFERED
+50

CULVERTS AND HYDRAULIC WORKS
+100

DETENTION BASINS
+50

Project developed by **FS ENGINEERING**





The competent hydraulic authority is the Po River Basin Authority. The design was therefore developed in accordance with the hydraulic hazard maps of the third management cycle of the Flood Risk Management Plan (PGRA) for the Po District, Reno basin, revised in December 2025 and including levee breach scenarios. The entire project corridor is classified as subject to medium (M-P2) and high (H-P3) hydraulic hazard. These scenarios incorporate the flood events of May 2023 and September–October 2024, which significantly updated the knowledge framework concerning overflow dynamics and embankment vulnerability.

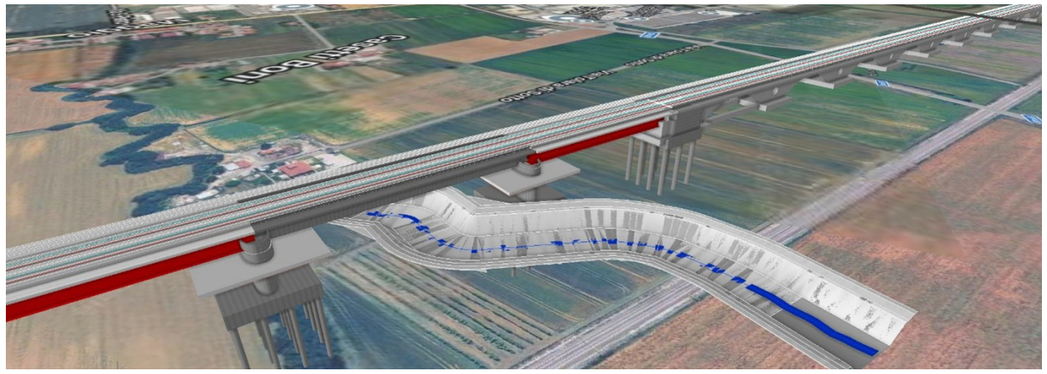
Within this complex hydrogeological context, the infrastructure is designed to contribute to hydraulic and geomorphological hazard mitigation and risk management. To minimise interference with potentially flood-prone areas, the alignment is predominantly developed on elevated structures, including approximately 37 km of viaducts and 21 km of hydraulically transparent embankments. Equipped with box culverts, the embankments facilitate water flow from southwest to northeast, maintaining hydraulic and morphological continuity and reducing the barrier effect.
The viaducts allow the railway to cross the flood-prone areas of the main watercourses in compliance with NTC 2018 and Royal Decree No. 523/1904.

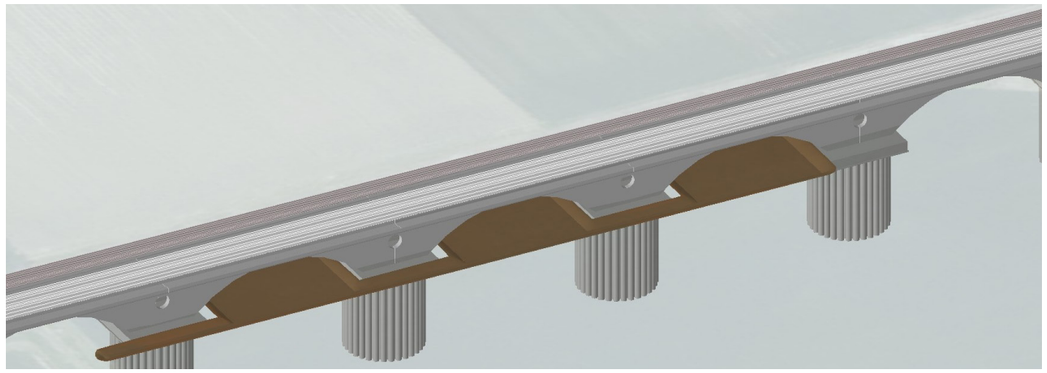
At watercourse crossings, the design preserves flow conditions and ensures integration with existing works through targeted hydraulic protection measures. Where required, these include grade-control structures and hydraulic works to stabilise riverbeds and control morphological evolution, as well as solutions to maintain the functionality of irrigation channels and compatibility with operational and maintenance requirements.

Digital design within a BIM environment supported the process by integrating GIS analyses, topographic surveys and discipline-specific models, improving coordination between the railway alignment, structures and hydraulic components.

One-dimensional and two-dimensional hydraulic modelling using HEC-RAS supported hazard assessment and the definition of appropriate solutions, enabling comparison between alternatives and more effective management of hydraulic interactions.

Particular attention was also given to hydraulic invariance, with dedicated works designed to compensate for the effects of new impermeable surfaces and regulate stormwater runoff, mitigating peak flows discharged into the drainage network.
Overall, the project prioritises hydraulic transparency and integration with the natural and artificial drainage networks. Technical consultation with the competent authorities supported the definition of the solutions, ensuring consistency between railway and hydraulic works. The integration of hydraulic analyses, design choices and targeted mitigation measures enables effective management of the corridor's hydraulic interactions, reducing exposure to flood scenarios and strengthening the safety and resilience of both the infrastructure and the surrounding territory.







COASTAL PROTECTION DESIGN AT ODAW RIVER OUTLET - WACA PROJECT

Commissioned by Ghana's Ministry of Works and Housing and financed by the World Bank under the West Africa Coastal Areas (WACA) Resilience Investment Program, the project focused on improving the hydraulic performance, safety and long-term climate resilience of the Odaw River outlet in Greater Accra. Located at the interface between the river, lagoon and sea, the area is influenced by urban runoff, tides, waves and sediment transport, contributing to flooding, coastal erosion, sediment accumulation and changes in the river channel.

We contributed to the project through an integrated programme of morphological studies, field investigations, numerical modelling and engineering design.

KEY VALUES

RIVER · LAGOON · SEA
3 SYSTEMS

DESIGN SERVICE LIFE
5 YEARS

TIDAL & WAVE EVENT
RETURN PERIOD
100 YEARS

Project developed by **IDROSTUDI** in a joint venture with **A.R.S. PROGETTI SPA**



Available metocean, hydrological, tidal, wave and sediment transport data were complemented by bathymetric and topographic surveys to define the river channel, seabed and adjacent coastal area, as well as geotechnical investigations to assess soil characteristics and ground stability.

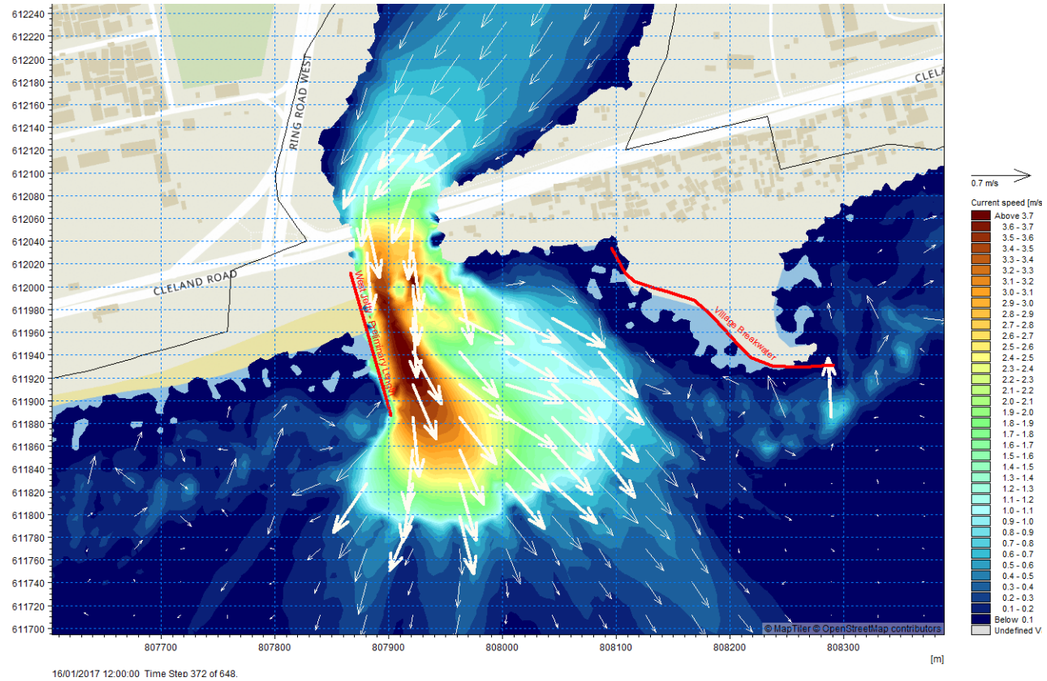
Existing coastal protection structures were also examined to evaluate their condition and influence on local hydrodynamics, sediment movement and shoreline evolution.

The resulting dataset supported the development and calibration of hydrodynamic, wave, sediment transport and morphological models.

These were used to reproduce the existing behaviour of the river outlet and coastal system and evaluate alternative design scenarios, considering sedimentation patterns, shoreline change, tidal exchange, climate change and extreme events.

The analyses provided the technical basis for solutions aimed at improving water conveyance, limiting erosion and managing sediment more effectively.

Preliminary and detailed designs were developed for a coordinated system of coastal and river protection measures, including breakwaters, revetments, channel embankments, scour protection systems and improvements to the river cross-section.



The solutions were designed to facilitate sediment transport, improve hydraulic efficiency, reduce flood and erosion risks, and preserve tidal exchange and navigability.

A 50-year service life was adopted, accounting for severe environmental conditions, including 1-in-100-year tidal and wave events.
The assignment included the complete technical documentation required for implementation, including design reports, drawings, construction details, bills of quantities, technical specifications, tender documents and bidding packages prepared in accordance with applicable donor requirements.
An operation and maintenance manual, supported by cost estimates, was also developed to guide future infrastructure management.

Technical activities were accompanied by consultation with institutions, stakeholders and project-affected communities, integrating engineering requirements with local priorities and environmental and social considerations. Capacity-building activities and training modules were also developed for Ghanaian government staff, covering morphological modelling, coastal infrastructure operation and maintenance, and resilience planning.

By combining field investigations, advanced modelling and multidisciplinary engineering design, the project provides a comprehensive framework for the sustainable management of the Odaw River outlet, strengthening the resilience of Greater Accra's coastal and urban environment and reducing exposure to flooding and erosion.





HYDRAULIC HAZARD MITIGATION ALONG THE MARINELLA STREAM

Technical and Economic Feasibility Project for the mitigation of hydraulic hazard along the Marinella Stream, within the municipalities of Calenzano and Prato commissioned by Consorzio di Bonifica 3 Medio Valdarno: the assignment combined hydrological studies, hydraulic modelling and the assessment of a coordinated system of works involving both the main watercourse and the Fosso Pagnelle, one of its left-bank tributaries.

The project was conceived as an integrated response to the area's flood risk. It includes the upgrading of the three existing flood storage basins at Pizzidimonte, the construction of an in-line flood storage basin along the Fosso Pagnelle and the strengthening of selected sections of the Marinella's left bank. Rather than treating each critical point separately, the design considers the behaviour of the catchment as a whole, with the aim of improving storage performance, attenuating peak discharges and reducing the extent and consequences of flooding during severe events.

Project developed by **INGEGNERI RIUNITI**

KEY VALUES

IMPOUNDED VOLUME
511.000 m^3

FLOOD RETENTION
3 BASINS

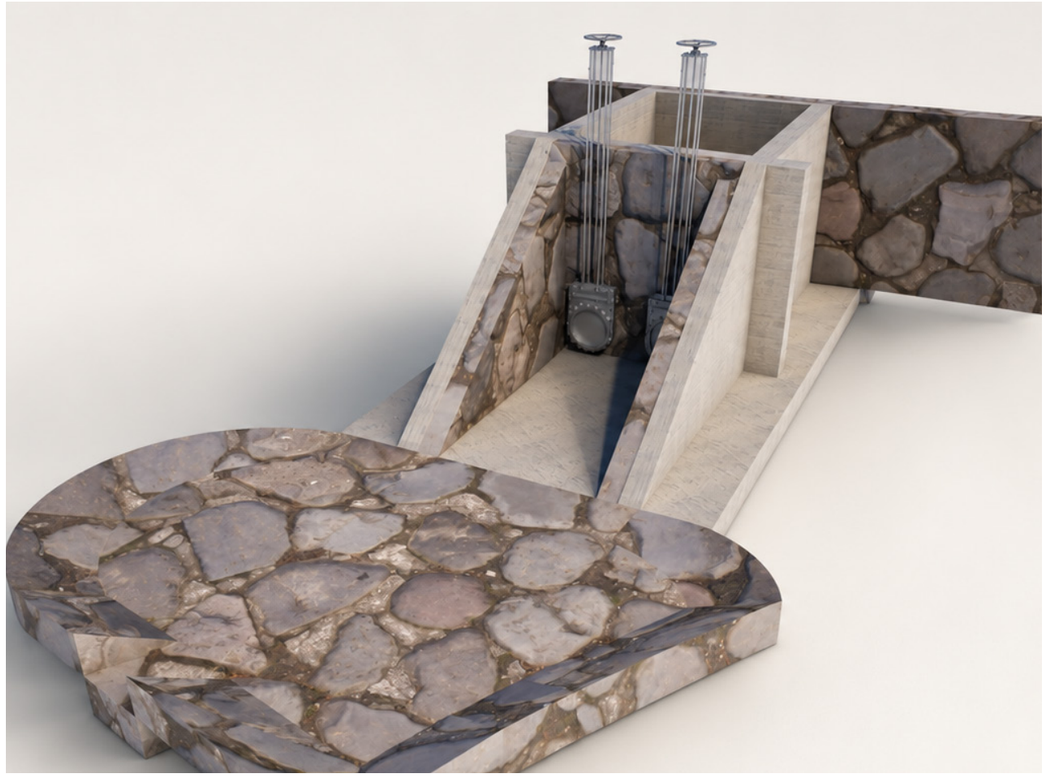
PEAK FLOW RATE
37,90 m^3/s



At Pizzidimonte, the proposed works are designed to increase both the efficiency and the available storage volume of the three basins. They include changes to the elevations of the intake structures, upgrades to the existing intake and return works, new intake and outlet structures, additional emergency overflow weirs and local regrading of the basin floors. Together, these measures optimise the way in which floodwater enters, is retained within and is released from the system, while making fuller use of the available storage capacity.

In-line flood storage basin whose function is to attenuate the peak flow and temporarily retain the volumes generated when the stream overtops.

The embankment is to be enlarged in order to increase storage capacity and limit the flooded areas identified through the simulated design scenarios. Further downstream, along the left bank of the Marinella, additional embankment raising and widening works extend from below the third Pizzidimonte basin to the Florence-Viareggio railway embankment near Via Pratese. Reinforced-soil solutions were selected for these sections to provide greater stability and reduce the risk of embankment failure under exceptional hydraulic loading.
The proposed works were defined through a structured analytical process. The hydrological study first characterised the morphology of the relevant catchments and examined rainfall data to reconstruct depth-duration-frequency relationships for the selected return periods.



Design hydrographs were then generated using HEC-HMS. A 200-year return period and different storm durations were considered so that the most demanding combinations of peak discharge and flood volume could be identified for each watercourse.

The hydraulic behaviour of the Marinella Stream and the Fosso Pagnelle was subsequently analysed through unsteady-flow simulations developed in HEC-RAS.

The 1D-2D modelling framework combined one-dimensional representation of flow within the channels with two-dimensional simulation of water spreading across the surrounding floodplain.

Existing and proposed conditions were compared to evaluate how the planned interventions would alter the areas exposed to flooding and to test the effectiveness of the overall mitigation strategy.

By integrating catchment-scale hydrology, detailed hydraulic modelling and the design of complementary storage and embankment works, Ingegneri Riuniti we translated complex flood dynamics into a coherent and technically verifiable set of measures. The project establishes a robust basis for the subsequent design stages and supports a more resilient relationship between the watercourses, the surrounding land and the infrastructure crossing the area.



EXPANSION AND UPGRADE OF THE SECCHIA RIVER FLOOD DETENTION BASIN-MUNICIPALITY OF RUBIERA

The expansion of the flood retention basin addresses the hydraulic criticalities of the area through interventions on the existing basin located near the Municipality of Rubiera. Its current storage capacity is insufficient to provide adequate flood attenuation for events with a return period of T=200 years.

The project includes the upgrade of the regulation and diversion structures of the Secchia River flood expansion basin, the adaptation and elevation adjustment of the existing embankments, and expansion works aimed at increasing the overall capacity and efficiency of the flood retention system. The works are being implemented progressively according to technical requirements and available funding, with part of the project currently under construction. The project involves an existing hydraulic system and introduces new works that, through dedicated control equipment, ensure optimal attenuation of the flood hydrograph. Its complexity required a multidisciplinary approach encompassing geological and geotechnical analyses of soils and embankments, seismic and tectonic studies, reinforced concrete seismic structures, electromechanical systems, environmental and landscape aspects, and hydrogeological issues. Particular attention was given to the presence of one of the area's most important drinking water supply well fields immediately downstream of the basin.

Project developed by **MAJONE PARTNER**



Hydrological and hydraulic modelling supported the design process. The upstream catchment analysis was based on the calibration of hydrological parameters using rainfall data and water level measurements recorded at Castellarano rather than Rubiera. A 1D unsteady flow hydraulic model was therefore developed to accurately define the flood wave entering the basin.

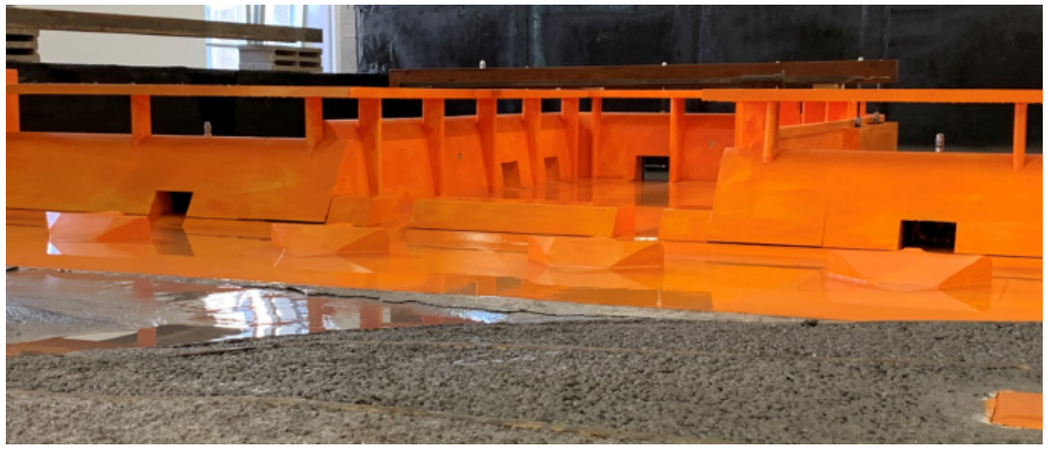
The basin area was also analysed through a 2D unsteady flow model covering the river reach between the Rubiera weir and the section immediately downstream of the regulation structure, extending beyond the motorway bridge.
The upgrade of the weir and regulation structure includes the refurbishment of the existing weir, the construction of a new structure connected to the existing one and incorporating flow regulation elements, and the construction of a service bridge.

The diversion structure within the lateral basin is also upgraded through the partial demolition of the existing threshold and the construction of a new one. Excavation and reshaping works within the in-line basin provide the earthworks required to ensure the construction and functionality of these structures.
The weir and regulation structure, together with the in-line embankments, are subject to supervision by the competent national authority (D.G.D.).

Nine typical cross-sections were defined for the embankments to address different homogeneous sections according to geotechnical conditions, basin and floodplain configuration, and existing geometry. Deep diaphragm walls were designed to prevent seepage and piping phenomena.

The seismic design of the structures was supported by a dedicated seismotectonic study based on geological literature data, aimed at identifying seismogenic sources, active and capable faults, the seismic history of the site, and site-specific seismic hazard.

The project is integrated within a landscape shaped by the interaction between the river's morphological evolution, past anthropogenic interventions and periodic maintenance activities aimed at preserving hydraulic functionality.









PLATFORM DRAINAGE AND HYDRAULIC SYSTEM

The project concerns the hydraulic sizing and verification of all facilities dedicated to the collection, conveyance, and treatment of platform and slope rainwater for the 4-lane upgrading of S.S. 223 "di Paganico" (Lot 9, from km 41+600 to km 53+400).

To protect the vulnerability of receiving water bodies, a closed drainage system is employed along approximately 90% of the route. This system intercepts platform runoff and conveys it to dedicated treatment plants and basins before discharging into final physical receivers (ditches and natural watercourses).

For the remaining 10% of the sections (at bridge crossings over ditches), an open drainage system is adopted (with chutes/gutters and concrete-lined ditches); this avoids the installation of collectors beneath

KEY VALUES

TOTAL FIRST-FLUSH WATER VOLUME TREATED

~610 m^3/EVENT

TOTAL SEDIMENTATION VOLUME AVAILABLE

~200 m^3

MAXIMUM FIRST-FLUSH FLOW RATE TREATED

~354 l/s

Project developed by **OFFTEC**



the bridge decks, which would otherwise reduce the safety clearance required for flood events with a 200-year return period.

The hydraulic sizing of the drainage system covers several key structural elements. Prefabricated 40x40 channels, located along embankments and cut sections, handle a contributing width of 11 meters and operate up to a 67% fill ratio, discharging int o underlying collectors through grated manholes spaced every 25 meters.

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Buried HDPE collectors range in diameter from 315 to 800 mm, adhering to a maximum fill ratio of 67%, which is reduced to 50% for pipes 400 mm or smaller.
On viaduct decks like Merse and Ornate, water is gathered by gullies with cast iron grates every 8 meters, feeding 125 mm outlets that operate under hydraulic head with a capacity of up to 9.0 liters per second, which then drain into longitudinal steel collectors bracketed beneath the deck.

To intercept runoff upstream of cut slopes, concrete catch ditches with a minimum section of 50x50 cm are sized for a 50-year return period event over an average 100-meter contributing strip.

Runoff intercepted by the closed drainage system is directed to First-Flush Storage Tanks (VPP) to mitigate pollution from vehicular traffic.

These units utilize sand traps for solid sedimentation and oil separators to remove hydrocarbons, with storage capacities calculated from the total impervious surface area and design rainfall depth to ensure controlled discharge into final receiving waterbodies.

Finally, the design extends drainage continuity and flood protection to complementary works, including underpasses, slip roads, and roundabouts across the secondary road network.





MARINA DI CARRARA WATERFRONT PROMENADE ON THE WEST PIER

At Marina di Carrara the outer pier has long served as an informal seafront walk, yet the beach at its root had decayed and lacked safe, protected access. The project reworks the port-city interface as Zone 4 of the waterfront regeneration masterplan developed by Policreo, screening the degraded port areas while opening the main views towards the open sea and the harbour.

The scheme is an exercise in integrated architectural and engineering design. On land, a naturalistic system of paths reinterprets the vegetated dunes of the historic Tuscan coast, while the routes along the pier evoke the territory's marble-transport tradition.

From the root of the pier outward, the design unfolds in four architectural steps, beginning with an ascent through a play of gentle, constant ramps that recall the marble blocks of the Apuan quarries.

Project developed by **PROGER** and **DINAMICA**

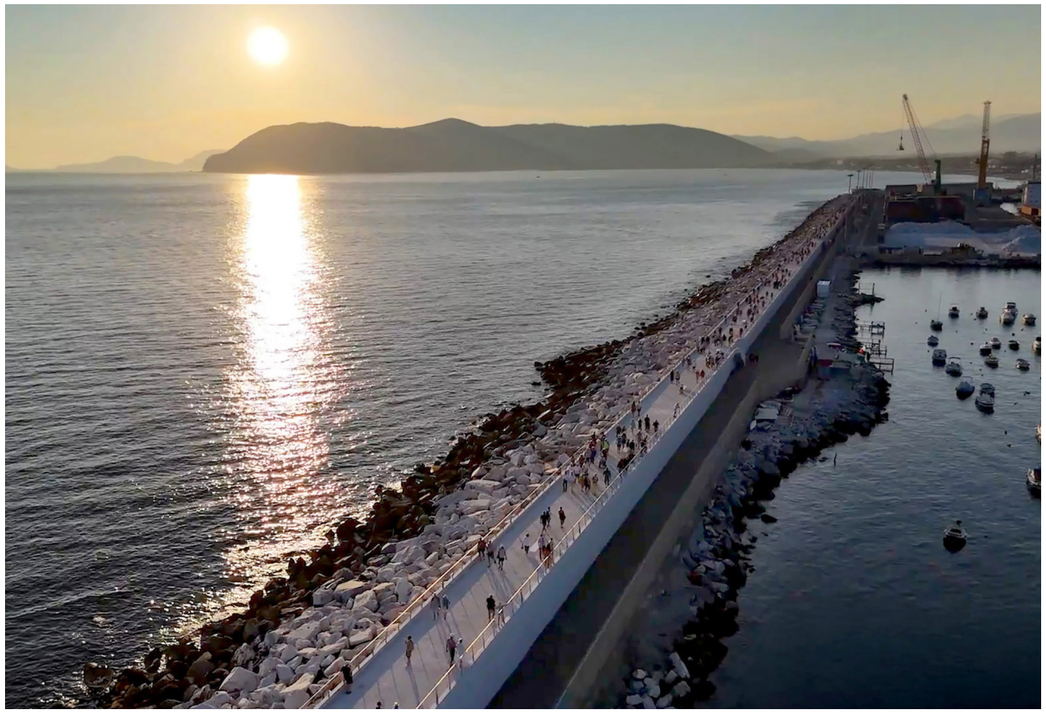
KEY VALUES

NEW SEAFRONT ROUTE
1200 m

PANORAMIC PROMENADE
870 m

TOTAL INFRASTRUCTURE COST
€13 M

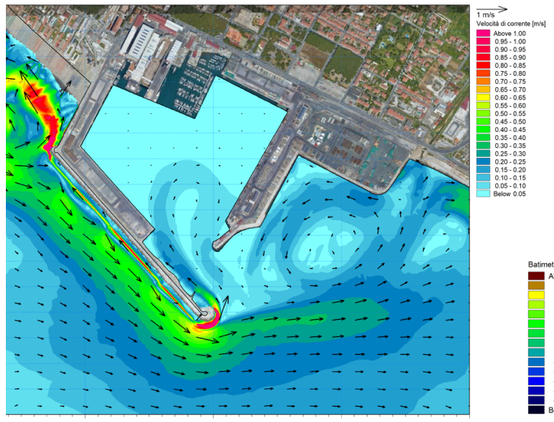


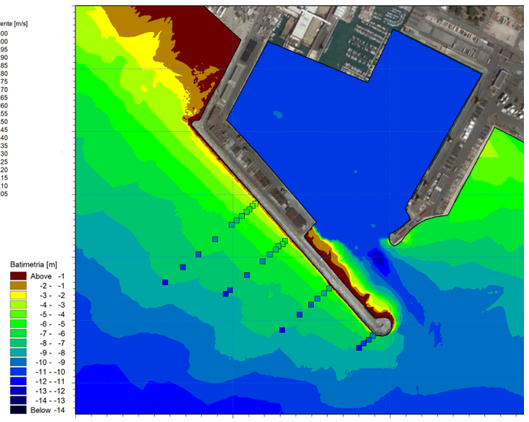


A new route leads from the 'ground-level square' and the beach up to the bend of the outer pier; a new 'sea square' opens onto the water; the long panoramic promenade runs atop the wave wall, 870 metres long and 5 metres wide, and forms the most significant part of the project; and the sequence ends in a new, wide sea terrace at the pier head, completing a seafront path 1,200 metres long in all.

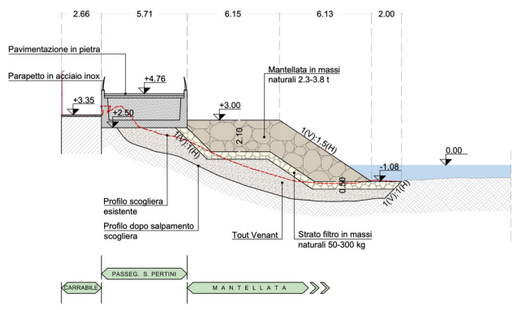
On the engineering side, highly detailed topo-bathymetric surveys enabled a three-dimensional reconstruction of the existing site, both above and below the waterline.

In-depth maritime-hydraulics studies were then carried out through numerical modelling. These covered the offshore meteo-marine climate; the nearshore propagation of significant storms; the extraction of local wave-model results along cross-sections of the pier to obtain the data for overtopping checks; and the hydrodynamic conditions around the works, verifying the continuity of current flows and the bypass of littoral sediment transport (sand in transit under storm conditions) in the downdrift areas. The typical construction sections of the 'evocative promenade', the sea square and the 'panoramic promenade' were designed as a function of the incident wave motion, with particular attention both to the hydraulic stability of the armour layers and to the control of wave run-up and overtopping, to guarantee full public use of the works for most of the year.

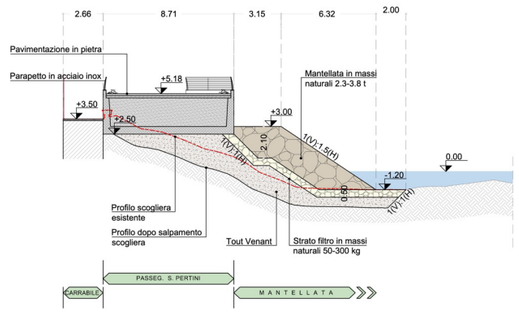


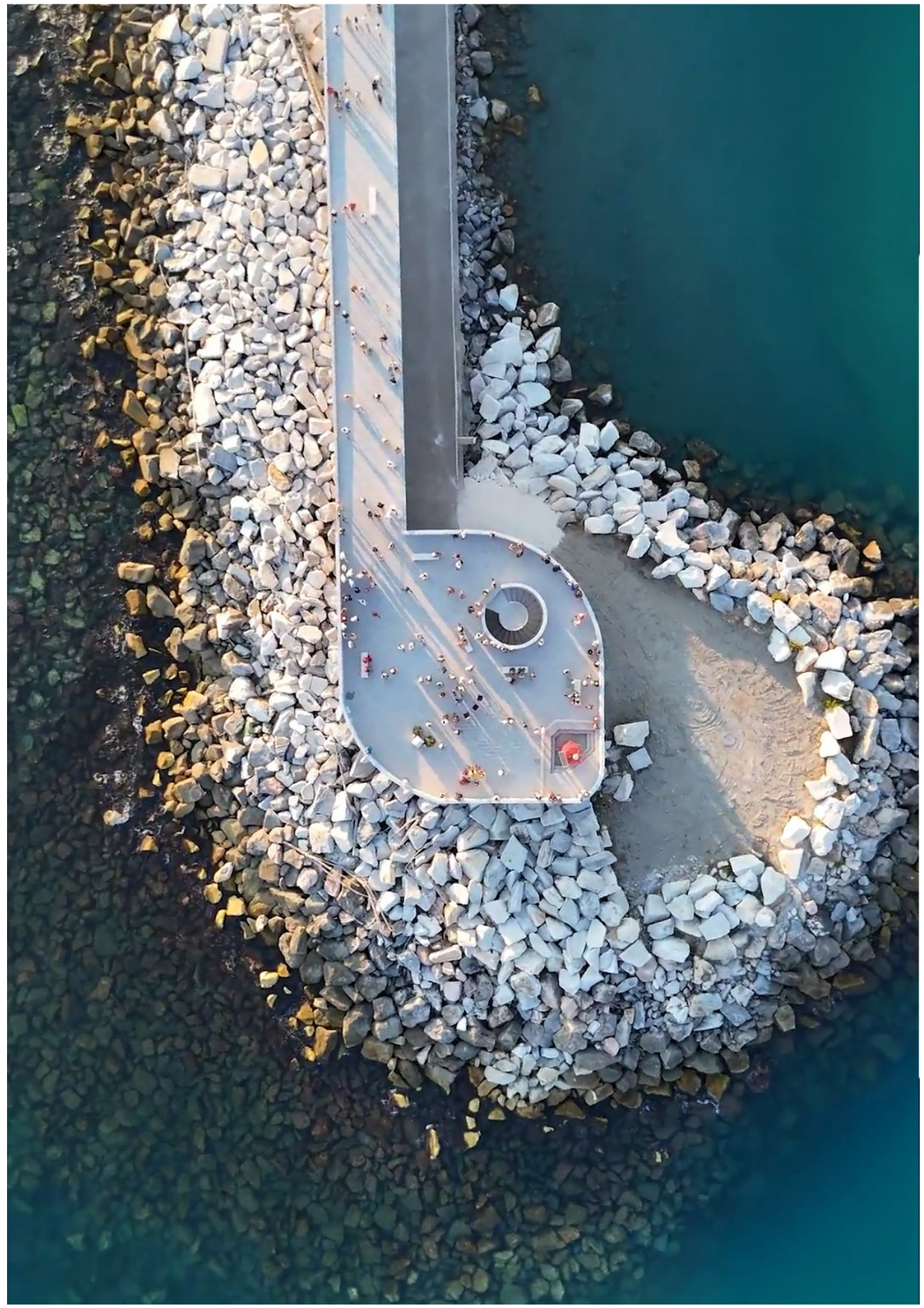


SEZIONE G-G'



SEZIONE H-H'





TERRITORIAL WATER SUSTAINABILITY STRATEGIES

Across Italy, civil, agricultural, industrial and energy users compete for the same water, and climate change is turning that rivalry into conflict.
Proger developed an integrated water sustainability and resilience model operating at both territorial and industrial scale. It replaces competitive allocation with a circular approach of recovery, reuse, storage and efficiency, so that water is used in a “cascading” sequence rather than contested at each stage.

The model is applied to concrete case studies through a replicable workflow, from diagnosis to volumetric balance and ESG assessment. At territorial scale, the Trecate-Cerano case in Piedmont combines treated-wastewater reuse, buffer basins in disused quarries and flow diversion during periods of abundance, converting underused volumes into a reliable water source, strengthening irrigation security and reducing pressure on aquifers. At Lake Penne, treated effluent from the wastewater treatment facility, currently discharged downstream, is rerouted to replenish a strategic reservoir, reinforcing water security across more than 4,700 hectares of farmland in the Tavo Valley.

At industrial scale, two cases in Abruzzo target water-intensive cycles. In a textile plant, recovery of effluent from its own treatment system reintroduces up to 90% of treated volumes into production, cutting groundwater abstraction.

At a polypropylene film plant, a rainwater scheme with first-flush management, filtration, oil separation, storage and automatic pumping meets 17.5% of demand, improving resilience to drought, restrictions and tariff shocks.

Project developed by **PROGER**





SEA SMART EYE (S2E)

SEA SMART EYE (S2E) is a Research, Development and Innovation project promoted by SPERI and developed between 2023 and 2026 with the support of the Puglia Region.

With a total investment exceeding €3 million, the project applies advanced technologies to the planning, design and management of maritime infrastructure, combining numerical modelling, marine observation, data assimilation, Artificial Intelligence and specialised maritime engineering expertise. Its primary objective is to provide reliable metocean data and forecasts to improve safety and support the management of coastal areas and infrastructure.

At the core of S2E is a cloud-based Web-GIS platform developed to generate, process and provide access to metocean data, forecasts and information in support of the Blue Economy.

The platform brings together historical data and evolving scenarios within a single digital environment, using Artificial Intelligence, Machine Learning and dedicated processing tools to transform large volumes of data into operational information for engineering, planning, risk management and decision-making.

Project developed by **SPERI SPA**

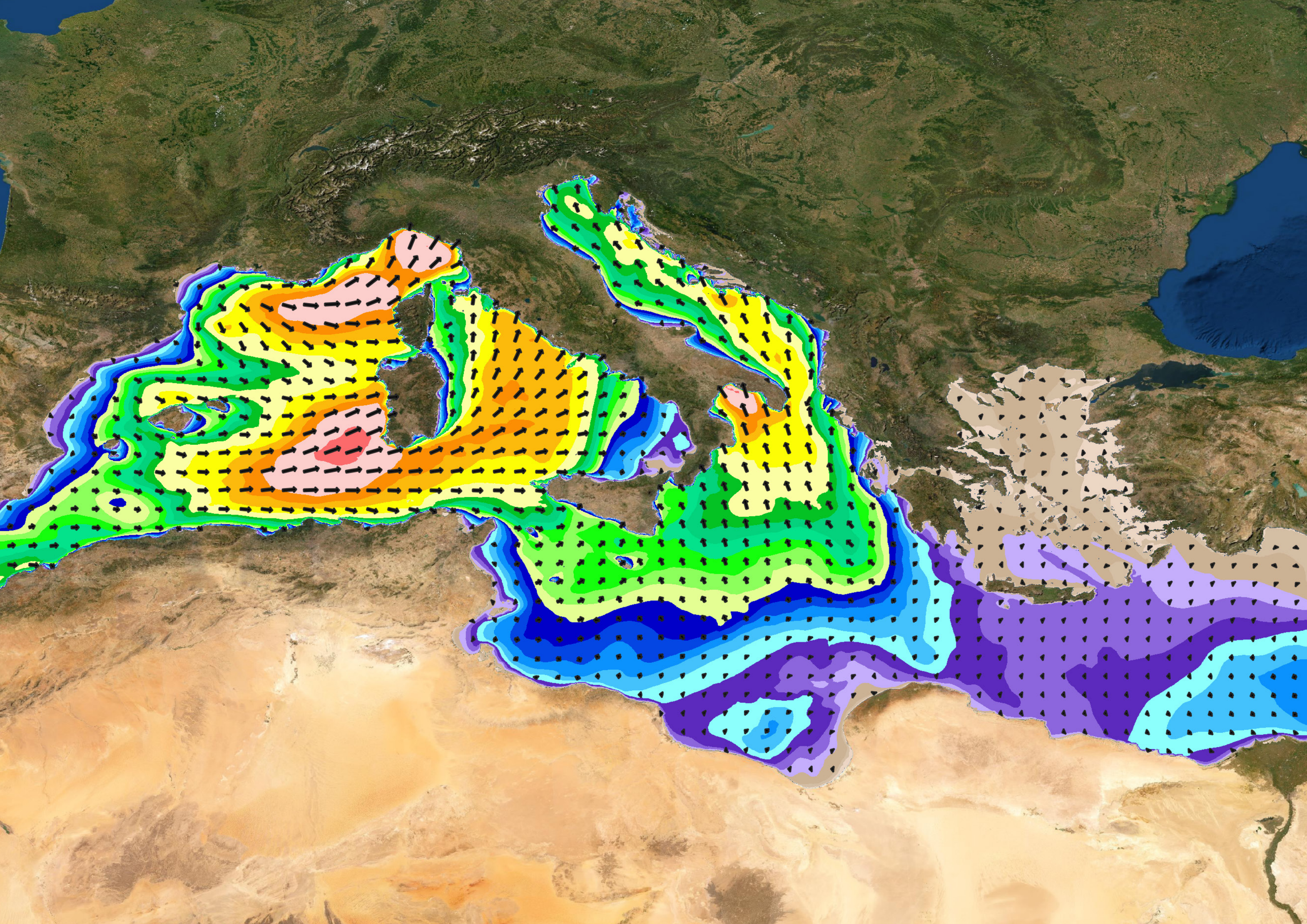
KEY VALUES

GLOBAL MODEL
AVERAGE RESOLUTION
10 km

MEDITERRANEAN REGIONAL MODEL
AVERAGE RESOLUTION
2 K m

PROJECT VALUE
€3.5 M





Data from third-party sources, proprietary forecasting and hindcasting models, in-situ sensors, direct surveys, wave buoys and marine drones are integrated and processed within the platform. A major technological component is the development of a high-fidelity, coupled global three-dimensional model capable of representing key metocean processes across different spatial and temporal scales.

Waves, currents, tides, storm surges, temperature and salinity can be simulated to produce forecasts, hindcasts, historical datasets and reanalyses.

By operating at a global scale, the system can also help address the limitations of field measurements in regions where historical datasets are absent, discontinuous or insufficient.

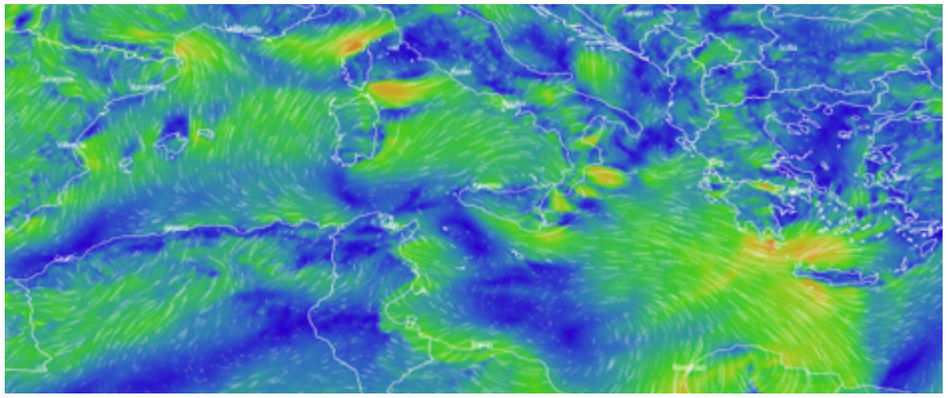
The digital infrastructure is complemented by dedicated monitoring technologies, including remotely operated Uncrewed Surface Vehicles (USVs) and wave buoys. Their development integrates mechanical, electronic, sensor, geomatics and data-processing expertise, allowing direct measurements to be combined with numerical modelling, validation and visualisation. This integrated approach creates a continuous workflow from observation of marine conditions to engineering analysis and decision support.

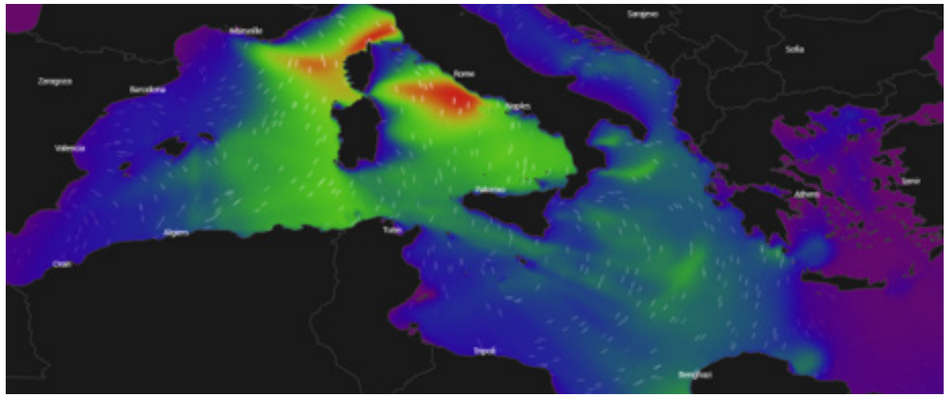
The technologies developed through S2E have already been applied to real-world contexts. At the Port of Monopoli, historical data processing supported the design of port infrastructure interventions, while a USV prototype was used for survey and data-integration activities. At the Port of Palermo, a Decision Support System was applied to assess and forecast safety conditions within port areas and at berths serving cargo vessels, ferries and cruise ships. USV-based survey technologies were also used in Bari to identify shallow waters and support the safe use of areas dedicated to water sports.

Beyond its technological dimension, S2E contributes to safer and more informed management of marine activities. Its forecasting and hindcasting capabilities, together with the integration of third-party data and proprietary models, can support public administrations, Port System Authorities, infrastructure managers, regulatory bodies and Blue Economy operators in risk management, coastal protection and infrastructure planning. In the context of climate change and increasingly intense metocean events, forecasts, hindcasts, reanalyses and evolving scenarios can improve risk awareness and strengthen the resilience of vulnerable coastal communities and infrastructure.

Operating from global to local scale, SEA SMART EYE integrates advanced metocean modelling, Big Data, Artificial Intelligence, Machine Learning, marine monitoring systems and decision-support tools within a single framework. In doing so, the project combines the Italian tradition of water engineering with digital innovation, transforming knowledge of physical phenomena into more informed decisions, safer infrastructure and sustainable strategies for coastal and marine environments.







SEISMIC ASSESSMENT AND REHABILITATION OF THE KEY ITALIAN DAMS

In the first half of the twentieth century, Italy strongly developed hydropower to compensate for the lack of fossil resources. Today, hydroelectric sources produce about 20% of the country's gross power and approximately 40% of its renewable power. The exploitation of water resources, together with agricultural and potable water demands, led to the construction of about 530 large dams. Their average service life is almost 70 years, with around 200 dams more than 80 years old and one or two reaching their centenary every year.

These structures are ageing in one of the Mediterranean countries with the highest seismic risk. The CPTI15 catalogue reports 61 earthquakes with Mw ≥ 5.5 over the last 100 years, reflecting Italy's location at the convergence of the Eurasian and African tectonic plates.

Most dams retain large reservoirs and represent strategic assets for energy production, water management and flood protection. Many are located in moderate-to-high seismic hazard zones and were built when earthquake risk was not yet considered in design. Italian dam regulations began in 1923, following the Gleno Dam disaster, when about 100 dams had already been built or were under construction without specific seismic provisions or dedicated dam guidelines.

Project developed by **SPERI SPA**

KEY VALUES

TOTAL LARGE DAMS IN ITALY
528

LARGE DAMS IN SEISMIC ZONES 1 AND 2
195

TOTAL DAMS ANALYSED IN THE STUDY
53





Seismic actions were formally introduced into dam standards only in 1982. Increasing knowledge of national seismic hazard, together with evidence from dam behaviour during earthquakes worldwide, raised questions about the resilience of ageing structures originally designed mainly for static loading. The 2014 New Italian Technical Standard for the Design and Construction of Dams and the complementary 2019 guidelines therefore place strong emphasis on the seismic vulnerability assessment of existing dams.

This regulatory update triggered the reassessment of many large dams currently in operation. Within this framework, SPERI was engaged by ENEL and other local public water operators to develop a methodology for the seismic assessment of more than 50 existing dams of different ages and typologies, distributed from the Alps through the Apennines to Sicily. These include concrete gravity and masonry dams, embankments and zoned or upstream-faced structures, built with materials ranging from granular fills and dry masonry to cyclopean and conventional concrete.

The methodology begins with an accurate database for each dam, combining historical research, Ministry archives and geological and geotechnical investigations to characterise dam materials and foundations. Seismic input is defined using Italian hazard maps and, in many cases, site-specific probabilistic studies. Monitoring data are also interpreted to reconstruct each dam's behaviour under operating conditions and provide the basis for calibrating numerical models.



Analyses range from 2D pseudo-static models with linear material behaviour to advanced 3D time-history analyses using site-specific natural accelerograms, non-linear materials and joint modelling. Unlike standard engineering design, where verification procedures are largely prescribed by regulations, the assessment of existing dams relies more heavily on engineering judgement. National regulations establish required performance and limit states, while professionals retain considerable responsibility for demonstrating compliance.

The results of this extensive programme are encouraging. Despite their age, original design based mainly on static loads and natural material ageing, most assessed dams comply with national standards and show satisfactory predicted behaviour under seismic conditions. This indicates significant safety reserves, partly related to the conservative design approaches adopted at the time of construction and to the relationship between the principal water and earthquake loads.

Only a few cases required interventions to improve performance, including structural reinforcement of the Fontanaluccia multiple-arch masonry dam, while Collemezzo Dam required a full retrofit design of the embankment. Considering the age of these structures and Italy's seismic risk, the results indicate that, when properly maintained and continuously monitored, existing dams can retain a long residual service life and continue to provide significant benefits to the countr

Their reliability depends on engineering expertise and continuous monitoring.



HYDRAULIC CONTAINMENT WORKS AND TERRITORIAL RESILIENCE IN THE MISA VALLEY

The Misa river basin is among the most flood-exposed areas of the central Adriatic coast. The flood events of 2014 and September 2022 caused extensive inundation, disrupted strategic infrastructure, and inflicted significant damage on the valley's settlements and productive fabric.

In response, the Marche Region, supported by the special commissioner structure and by Sogesid S.p.A., launched a programme of works to secure the river basin, with a total investment of €105 million, funded under Article 12-bis of Decree-Law 176/2022 (converted into Law 6/2023) and Article 1(730) of Law 197/2022, with completion targeted for 2029.

The programme covers a river stretch of approximately 21 km and a catchment of 103 km^2, protecting the municipality of Senigallia and a population of around 47,000 inhabitants.
Its central component is a system of flood expansion and retention basins, complemented by hydraulic regulation works, channel-section upgrades, and interventions on crossing structures.

Project developed by **SOGESID SPA**

KEY VALUES

PROTECTED AREA
103 km ²

FLOOD PEAK REDUCTION
46%
(FROM 650 TO 350 m^3/s)

INVESTMENT
€105 M



The system is designed to attenuate flood peaks and reduce discharges reaching Senigallia from a current flow of approximately 650 m^3/s to a design flow of 350 m^3/s, cutting the probability of flooding for events with a 200-year return period.
The design was developed through a multidisciplinary approach combining hydraulic engineering, basin-scale hydrological and hydraulic modelling, spatial planning, and environmental assessment.

Design choices were verified using a hydraulic model built on topographic surveys and digital datasets covering the entire basin, enabling comparison of alternative works configurations and optimisation of their location and sizing according to the expected hydraulic benefit downstream.
The works are conceived not as an emergency response but as permanent climate-adaptation infrastructure.

Their configuration accounts for integration within the valley's agricultural and landscape context and compatibility with existing land uses, providing for approximately 200 hectares of mixed-use areas, available for ordinary use and designed to flood under high-water conditions.

The initiative fits within the European policy framework for climate change adaptation and flood risk management set out by Directive 2007/60/EC and addresses a challenge — the increasing frequency and intensity of extreme rainfall — common to the wider Mediterranean basin.

The experience gained on the Misa, combining basin-scale hydraulic modelling, distributed retention works and territorial integration, offers a transferable methodological reference for other Mediterranean river contexts with comparable exposure.







E6 RENTVANNSTUNNEL (VAV)

The E6 project is a key component of the Oslo City Municipality's extensive efforts to ensure a stable water supply by constructing a new water tunnel from Holsfjord, situated to the west of the city, and an underground water treatment facility at Huseby. Currently, the capital's water needs are met by a single source and one treatment facility, which together provide approximately 90% of the water supply.

The E6 Project includes the following elements:

- A tunnel stretching 11 kilometers from Stubberud to Huseby, which will be built using a Tunnel Boring Machine (TBM);
- A 7-kilometer Drill and Blast tunnel that will connect to the existing water treatment plant at Maridalsvannet;
- 6 large underground chambers;
- 6 niches and 4 vertical shafts that will serve as intermediate water distribution points.

KEY VALUES

TBM WATER TUNNEL
11 km

MAXIMUM OVERBURDEN
130 m

LARGE CAVERNS
6

Project developed by **SYSTRA** and **SWECO NORGE.**



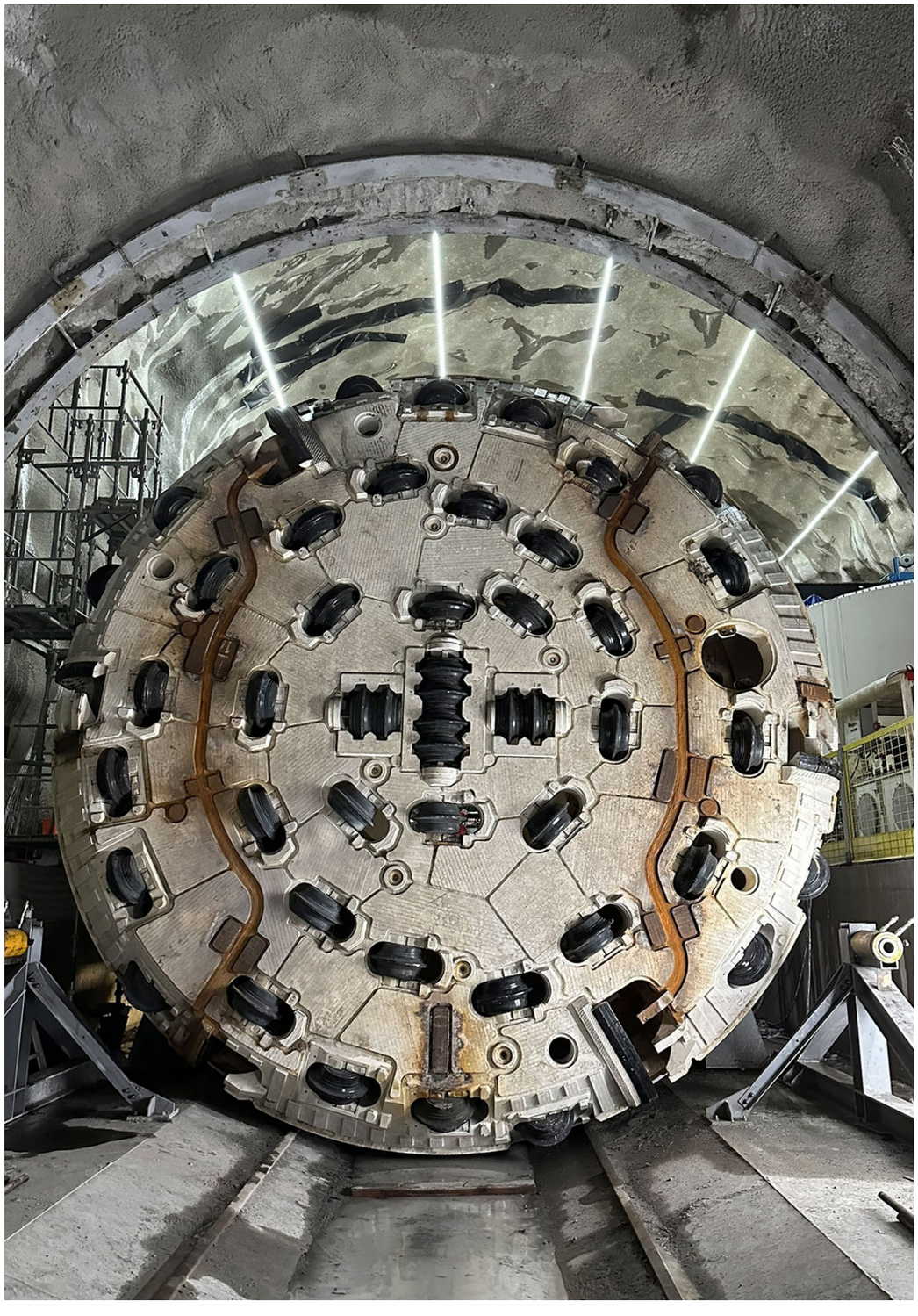
The civil engineering design for the main tunnel, which will house the water distribution system's pipes and electromechanical components, as well as a railway for inspection and maintenance, has been entrusted to the design consortium of SWECO Norge and Systra, specializing in tunnel design.

The main tunnel's excavation will be performed using a double shield TBM with a nominal excavation diameter of 7.08 meters. The tunnel will be reinforced with a waterproof precast concrete lining. This lining consists of a 6+0 universal ring system, 30 centimeters thick with an internal diameter of 6.10 meters. The segments are uniquely reinforced with a combination of a welded steel rebar cage and steel fibers.

Additionally, a specialized ring featuring an inflatable "o-ring" system on the outer side will be installed approximately every 200 meters, as well as before and after the openings to the tunnel recesses, to significantly minimize water flow within the annular space, which will be filled with a two-component backfilling grout.

The depth of the earth above the tunnel ranges from 40 to 130 meters, and the water table is at the surface level. The TBM will cut through three primary geological formations: gneiss, Cambro-Silurian sedimentary rocks, and shale with limestone lenses. The excavation will intersect six geological faults, including the significant regional fault known as the "Ekeberg Fault."





MOSE MOBILE FLOOD BARRIERS FOR THE PROTECTION OF THE VENICE LAGOON

The Venice Project is a comprehensive programme of works covering the entire Venice Lagoon. Its purpose is to protect the settlements located within the lagoon (Venice, Chioggia, Burano, Murano, Sant'Erasmo and the other islands) from high-water events, while restoring the lagoon environment from a morphological and ecosystem perspective.

To implement the overall programme of works, in 1984 the Italian State enacted the Special Law for Venice, which assigned the respective roles of the various authorities (the Venice Water Authority, the Veneto Region and the Municipality of Venice) in achieving the objective of safeguarding the lagoon and its settlements. MOSE system (Modulo Sperimentale Elettromeccanico, or Experimental Electromechanical Module), comprising a set of mobile barriers installed at the lagoon inlets of Chioggia, Malamocco and Lido, which connect the lagoon to the sea. The barriers are designed to hydraulically separate the lagoon from the sea during meteorological events in which sea levels may cause water levels in the lagoon to exceed the safeguard level, set at 110 cm above the datum of the Punta della Salute tide gauge.

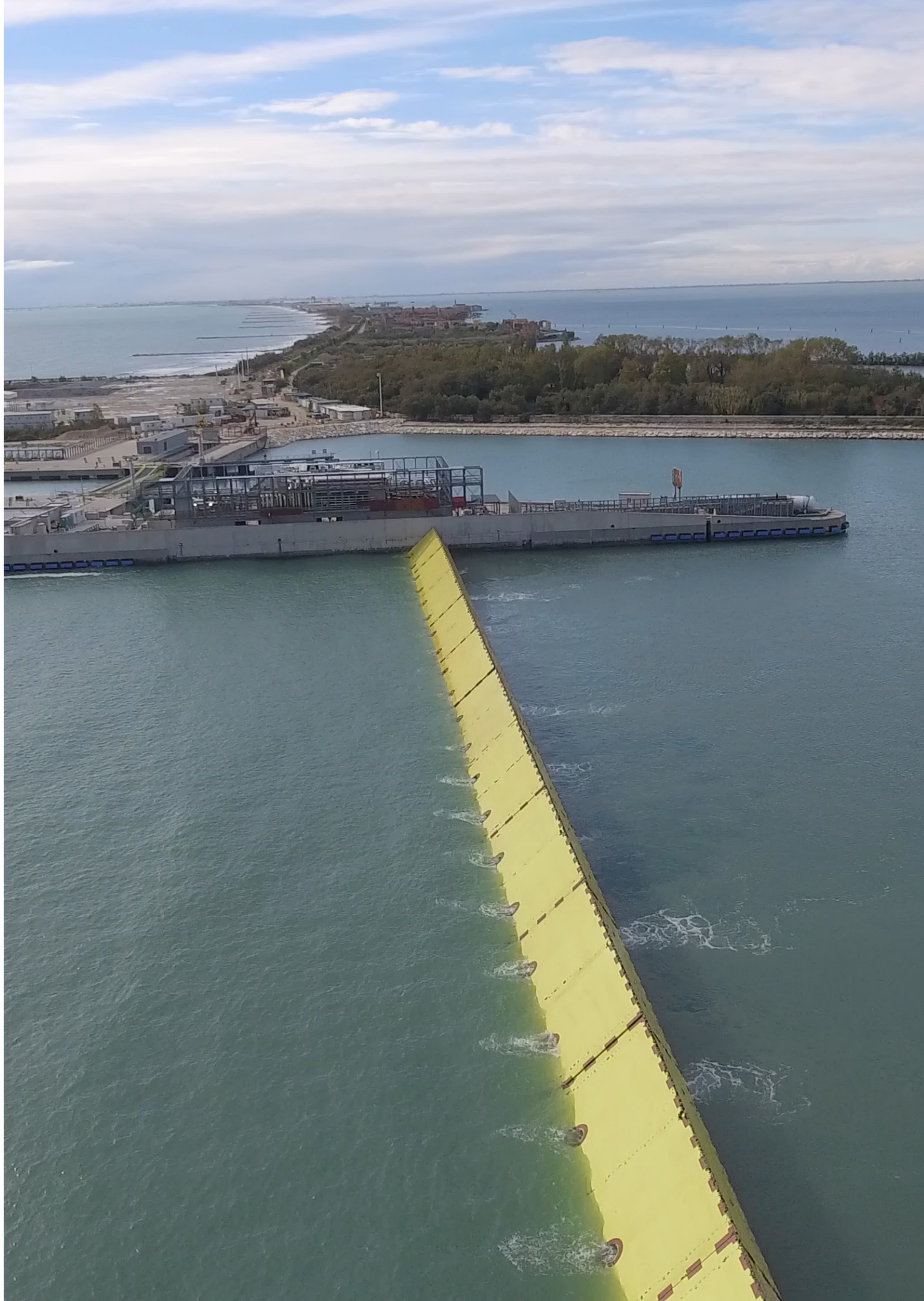
Project developed by **TECHNITAL SPA**

KEY VALUES

MOBILE GATES
78

MOBILE BARRIERS
1,6 km

TOTAL WORKS VALUE
3.16 B€





MOSE is unique worldwide among flood-defence barriers because, under normal sea-level conditions, it is completely invisible, with the gates resting on the seabed. Only during extreme events are the gates raised by injecting air into them; their upper edges then emerge just over 1 m above sea level for the duration of the event.

The functional core of MOSE consists of four mobile barriers, formed by flap gates hinged to the seabed. The design solution is based on the temporary isolation of the Venice Lagoon from the Adriatic Sea by raising mobile gates installed at the lagoon inlets. Under normal conditions, the gates remain housed in foundation caissons on the seabed and allow the normal exchange of water between the sea and the lagoon. When forecasts indicate tidal levels that may cause flooding, water is expelled from the gates by pumping in compressed air, making them buoyant; the gates rotate about their hinge axes and move into the operating position, temporarily interrupting the tidal flow into the lagoon through the inlets when the reference threshold for raising the gates (the safeguard level), set at +110 cm above the datum of the Punta della Salute tide gauge, is expected to be exceeded. From a hydraulic and functional perspective, the inlets may be regarded as watercourses subject to an oscillating tidal regime, with bidirectional currents, water-level variations and continuous interaction between seawater and the inland water system.

The MOSE plant systems enable the coordinated raising, lowering and control of the gates. Movement is achieved by injecting compressed air, supplied by three compressors per gate with 100% redundancy, thereby expelling the water contained in each gate.



The compressed air reaches the gates through a network of pipelines and changes the gate's attitude: by reducing the apparent weight of the steel element, it increases buoyancy, causing the gate to rotate upwards about its base restraint (the connector-hinge assembly that anchors the gate to the foundation).
The electrical power supply is also redundant and includes medium-voltage networks, transformers, dedicated switchboards and emergency generators. For MOSE, navigation represented a fundamental design constraint. The works were integrated with navigation locks and refuge harbours, shown in Figure 6, enabling the passage, even while the barriers are in operation, of emergency craft, small vessels and, at the Malamocco inlet, ships bound for the commercial and industrial port system.
The design of MOSE required a sound knowledge of the regulatory and authorisation framework governing major hydraulic-maritime, environmental, plant-engineering and safety works. The approval process involved the Ministry of Infrastructure and Transport, the Interregional Public Works Authority, Consorzio Venezia Nuova as the single concessionaire, and the competent supervisory and approving bodies. The service included the direct management of relations with more than 20 supervisory authorities and all the approving bodies, as well as assistance during the approval and construction phases, helping to streamline the authorisation timetable.

The complexity of the project required the coordination of a permanent multidisciplinary team comprising approximately 300 specialists across four offices, with expertise in hydraulics, maritime engineering, structures, geotechnics, mechanics, electrical systems, the environment, automation and safety.





SAFETY UPGRADE AND MODERNIZATION OF THE PESCHIERA WATER SUPPLY SYSTEM IN ROME

The “Ottavia–Trionfale Transmission Main” is part of the National Recovery and Resilience Plan (NRRP), Mission M2C4 – Investment 4.1, and forms part of the programme for upgrading and securing the water supply system of the Metropolitan City of Rome.

The project addresses the vulnerability of the existing transmission system connecting the Ottavia Water Supply Centre to the Trionfale Node. The current pipelines, constructed in the 1950s using prestressed reinforced concrete (CAP) and Bonna reinforced concrete, are now over 60 years old and difficult to repair following failures.

The new infrastructure will increase conveyance capacity, ensure supply reliability, and provide redundancy for both the transmission system and the Trionfale Node. The scheme consists of a new transmission main connecting the Ottavia Water Supply Centre to a new facility at Pineta Sacchetti, creating a bypass of the existing Trionfale water supply centre.

KEY VALUES

NEW PIPELINE
~5,2

SERVICE PROVIDED
~1M PEOPLE

INCREASE IN THE FLOW RATE
25%

NRRP FUNDING INVESTMENT
€109.97 M

Project developed by **VDP SRL**



The works include a steel pipeline from Ottavia to the Casale del Marmo structure, designed to remain compatible with the future refurbishment of the Ottavia Water Supply Centre. From Casale del Marmo, a DN2500 steel pipeline extends to the Monte Mario railway station, where a new distribution chamber will connect a DN2000 pipeline to the Pineta Sacchetti Water Supply Centre and a DN800 pipeline to the existing DN700 main towards Ponte Galeria.

The total length of the new infrastructure is approximately 5.2 km.
The Environmental Impact Assessment (EIA), initiated in May 2022, was successfully completed in March 2023, and the project is currently under construction.
The design included the preparation of a Preliminary Archaeological Assessment, Geological, Hydrological and Hydraulic Reports, and a Project Sustainability Report. As part of the EIA process, additional studies comprised the Environmental Impact Assessment and Non-Technical Summary, Landscape Integration and Green Works Design, Environmental Monitoring Plan, Noise Impact Assessment, Landscape Architecture and Rendering, and Biodiversity Survey.

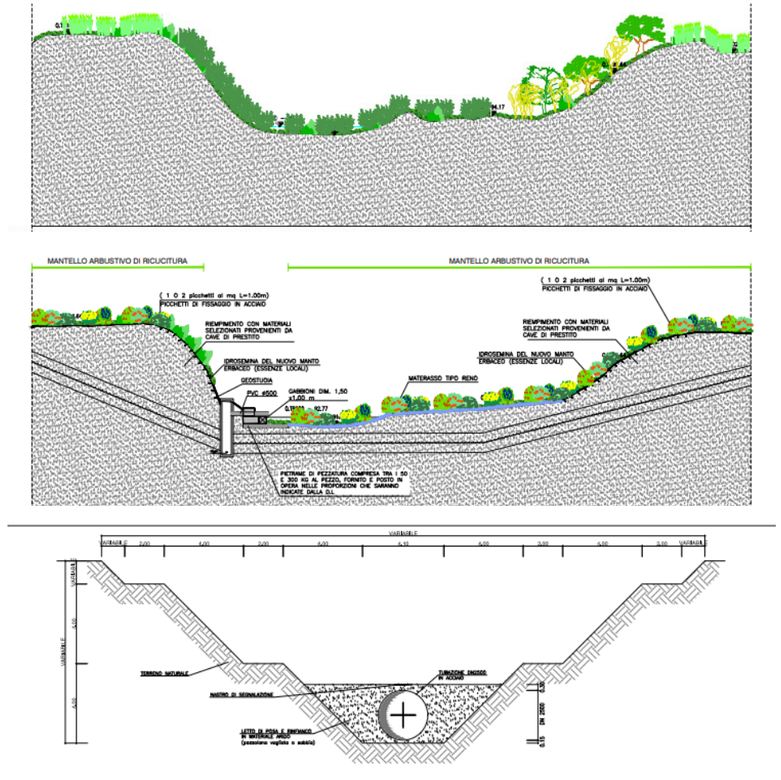
The Environmental Impact Assessment addressed the integration of a major water infrastructure within a highly sensitive setting characterised by densely urbanised areas and valuable natural landscapes of the Agro Romano. Key analyses included acoustic modelling using CadnaA software, vibration assessments associated with microtunnelling operations, hydrogeological investigations, air quality modelling, and biodiversity assessments focused on the nearby Insugherata Nature Reserve.



Air quality modelling identified the need for dust suppression measures, including continuous wetting capable of reducing particulate emissions by up to 75%. A comprehensive environmental monitoring programme was developed to minimise impacts throughout construction.

One of the project's principal engineering challenges was the adoption of microtunnelling technology to cross beneath the Rome–Viterbo railway and Via Trionfale without open-cut excavation, thereby limiting disruption to existing infrastructure and reducing environmental impacts.
Landscape integration formed a key component of the design.
The new Pineta Sacchetti Water Supply Centre features an architectural concept with perforated expanded-metal cladding whose variable geometry recalls the movement of water while blending with the surrounding urban environment. Environmental mitigation measures include the restoration of vegetation using native species, such as elm and broom, together with the reinstatement of existing road pavements.

These measures ensure that, despite a construction period of approximately 27 months, the project will not generate significant long-term environmental impacts or adversely affect the surrounding communities, while substantially improving the resilience and reliability of the Peschiera aqueduct system.





TEN LESSONS FROM ITALIAN WATER ENGINEERING FOR THE WORLD

by the OICE Water Task Group

The lessons below are drawn from the chapters of this volume and from the closing boxes that accompany them. They are stated as propositions because they are meant to be argued with:

1. **Map before building.**
   Italy's national hazard inventories show that common spatial knowledge is the first risk-reduction infrastructure. A partial inventory that the responsible institution can maintain is more useful than a perfect inventory purchased once.
2. **Protect first what cannot be rebuilt.**
   Cultural landscapes and historic water systems require appraisal methods that recognise irreversible loss, not only replacement cost. Priority should make that correction explicit.
3. **Design the custodian with the work.**
   A commissioning decision is incomplete until it identifies who will inspect, operate, repair, finance and arbitrate throughout the asset life.
4. **Know the network before digitising it.**
   Survey, geolocation and topology precede modelling; calibrated modelling precedes large-scale instrumentation; instrumentation precedes automation.
5. **Treat the existing stock as the first investment.**
   In mature systems, rehabilitation, loss reduction, restored storage and safer operation often produce more value, sooner, than an equivalent programme of new construction.
6. **Grade supervision by risk, and risk by evidence.**
   Consequence, condition and behaviour must guide attention. Classification without monitoring and operating history is not a safety system.
7. **Treat adaptation as a pathway.**
   Define thresholds, preserve options and identify the lead time for the next stage. The right question is often which values can be held, for how long, under which scenario.
8. **No coastal city adapts alone.**
   Sediment, ports, ecosystems, tides and protective works interact along a coast. Local defence must sit within regional strategy.
9. **Build the regulator before the programme.**
   Predictable rules, transparent performance and territorial aggregation are what make sustained investment possible and accountable.
10. **Efficiency and reuse are the least costly new water.**
    Reducing avoidable loss and using treated water can expand available resources with lower impact than new supply, provided sanitary, tariff and operating frameworks are established.

Behind all ten stands one principle: the work is not complete when construction ends. It becomes infrastructure only when a capable institution can operate, finance, learn from and adapt it to unforeseen conditions.

COMPANIES

3TI PROGETTI

3TI Progetti is an independent, fully employee-owned engineering and consultancy company founded in Rome in 1997. For nearly 30 years, we have been providing integrated services covering the entire project lifecycle, from planning and design to project and construction management, technical assistance and works supervision, supporting the development of complex projects in Italy and worldwide.

With over 3,000 projects delivered in more than 70 countries, 3TI has worked with over 1,200 public and private clients and established partnerships with more than 100 companies. Its multidisciplinary expertise encompasses transport infrastructure, including airports, railways, metros, ports, roads and highways, and complex buildings such as hospitals, schools and cultural centre, as well as industrial, residential and sports facilities, environmental engineering and landscape projects. Since 2015, 3TI has been included in the ENR Top 225 International Design Firms, reflecting its established presence in the international engineering. Operating across Italian and international markets, 3TI combines technical expertise with experience gained in diverse geographical and operational contexts, fostering collaboration among leading Italian players and supporting the development of integrated international design and build activities.

Sustainability is an integral part of our approach to engineering and design, guiding the development of solutions that promote energy efficiency, the green transition and responsible resource management. 3TI Progetti has been a member of Green Building Council Italia since 2023, is an Envision Supporter, and has been a supporter of the UN Global Compact since 2025. Through its projects and partnerships, 3TI contributes to more resilient infrastructure and sustainable urban transformation, creating lasting value for people, communities and territories.

acea infrastructure

Acea Infrastructure is the Acea Group company specialized in the development, design and delivery of complex infrastructure across the water, environmental and energy sectors. As the Group's integrated engineering hub, it supports the entire asset lifecycle, from strategic planning and feasibility studies to design, construction, commissioning, testing and certification. Through a multidisciplinary approach, Acea Infrastructure combines civil, hydraulic, environmental, geotechnical, structural, mechanical and electrical engineering with EPC services, project and construction management, supervision, testing, independent project verification, laboratory services and applied research. This enables the company to deliver integrated solutions with high technical standards, operational efficiency and effective risk management.

The company contributes to major investment programs in water supply, wastewater treatment, environmental protection, circular economy, renewable energy and strategic utility infrastructure, serving both Acea Group companies and external public and private clients. Innovation is central to its approach, with BIM, Digital Twin technologies, hydraulic and geotechnical modelling, and data-driven monitoring systems supporting project quality, sustainability and infrastructure resilience.

Its portfolio includes aqueducts, water and sewer networks, drinking water and wastewater treatment plants, environmental facilities, energy infrastructure and industrial plants. By combining engineering, construction and scientific expertise, Acea Infrastructure supports complex infrastructure projects from concept through operation.

BTP INFRASTRUTTURE

BTP INFRASTRUTTURE S.p.A. is an Italian Engineering Company with an experience of more than fifty years in the Design, Construction Supervision and Project & Construction Management services for the Infrastructure, Industrial and Renewable Energy sectors.
BTP INFRASTRUTTURE comes from the demerging of the Italian Company PROGETTI EUROPA & GLOBAL S.p.A. (shortly called **PEG**) which **was founded in 1970** and has always operated in two main sectors: "Oil & Gas Plants" (on EPC basis) and "Major Infrastructures", boasting over 50 years' experience of major projects successfully executed. On May 26th 2021, in consideration of the exponential growth of both sectors in Italy and abroad, **PEG** took the decision to demerge into two different Companies, one dedicated to the development of the "Oil & Gas Division" (briefly called **"PEG Oil & Gas"**) and another one dedicated to the "Infrastructure & Renewable Energies Division" (called **"PEG INFRASTRUTTURE"**).

All the staff, financial assets, experience, know-how and references gained by PEG in the Oil & Gas and Infrastructure sectors converged into the demerged Companies.On 29 March 2022 PEG Infrastrutture S.p.A. changed its name and became BTP Infrastrutture S.p.A. **Transportation Engineering:** Design and implementation of advanced, smart, flexible, and resilient transportation systems to enhance connectivity and efficiency. Expertise spans railways, ports, roads, highways, metros, and airports.
Civil Engineering: Integrated civil engineering solutions, including urban planning, structural design and construction management. Robust and sustainable infrastructures tailored to meet the demands of modern society. **Renewable Energie & Green Hydrogen:** BTP Insfrastrutture S.p.A. is an EPC contractor, driving the energy transition by developing renewable energy projects and pioneering green hydrogen technologies. **Industrial & Treatment Plants:** Design and construction of state-of-the-art industrial facilities and treatment plants, ensuring optimized performance and compliance with environmental standards.

C.& S. Di Giuseppe Ingegneri Associati Srl

C.&S. Di Giuseppe Ingegneri Associati Srl is an engineering company specialising in hydraulic and environmental infrastructure, with over 40 years of experience in the water sector. Founded in the 1980s by Eng. Sante Di Giuseppe, the company has progressively expanded its expensive and international presence (especially in Balkans area), combining traditional hydraulic engineeering knowledge with advanced digital technologies.
Its multidisciplinary approach covers the entire lifecycle of water infrastructure, from feasibility studies and hydraulic modelling to detailed design, authorisation procedures and asset management. The company operates across water and sewer networks, water and wastewater treatment plants, reservoirs, dams and flood protection systems, integrating BIM methodologies, predictive modelling and lifecycle analyses to develop resilient, efficient and sustainable solutions.

Through its #watercare approach, C.&S. addresses the challenges of the water transition by combining engineering expertise, digitalisation and environmental responsibility. Its experience in last 10 years includes more than 1,000 km of new pipelines, over 500 km of networks optimised for district metering and water-loss reduction, and treatment plants designed to serve more than 3 million population equivalent. This technical expertise is supported by an integrated management model focused on quality, environmental performance, safety, social responsibility and inclusion.

Supported by a multidisciplinary team and a consolidated network of professionals, the company has the technical and operational capacity to manage highly complex projects. Its approach combines innovation and specialised expertise to support the development of safer, more resilient and future-ready water infrastructure.

eambiente Srl is an engineering and consulting company with over twenty years of experience in the environmental, sustainability, and energy sectors.
It operates throughout Italy through an interdisciplinary team of over 50 specialized professionals, capable of developing innovative and tailored solutions to meet clients' technical and regulatory requirements. The company also collaborates with universities, research centers, and strategic partners to develop advanced methodologies and tools in the fields of sustainability and energy. The organizational structure is based on a multidisciplinary approach that brings together engineers, environmental scientists, geologists, modelers, acoustic technicians, and legal professionals, who work synergistically to manage complex projects in the environmental and energy sectors.

Activities are organized into five Service Lines: Engineering & Monitoring, Permitting, Auditing & Sustainability, Remediation, Energy Consulting.

ETC Engineering was founded in Trento in 2008 with the vision of combining engineering, research and technological innovation to deliver smarter and more sustainable solutions for the water sector. It brought together its founders' experience in civil, hydraulic and environmental engineering since 2003 with the scientific expertise of professionals from the Environmental and Sanitary Engineering Laboratory of the University of Trento.

Today, ETC operates across Italy through four local offices, working with leading water utilities from planning and design to construction supervision and project delivery. Its expertise covers drinking water and wastewater treatment, water reuse, resource recovery, energy efficiency and the upgrading of existing plants to meet new environmental and regulatory requirements.

ETC combines multidisciplinary engineering, advanced process modelling, automation, digital tools and applied research to optimise plant performance, reduce energy and resource consumption, and develop more efficient, resilient and sustainable water systems. Strong links with universities and research institutions help transform scientific knowledge into practical, full-scale solutions.

As part of AXEYA, ETC contributes its specialist expertise in water and wastewater treatment to an engineering ecosystem covering the entire integrated water cycle. For ETC, engineering water goes beyond infrastructure: it means protecting a vital resource, recovering value from it and designing a more sustainable future.

FIL.OS is an independent engineering company operating in Italy in the field of engineering services, in an organised corporate form since 2012 and as a technical practice since 1980. It has developed multidisciplinary expertise spanning the fields of river hydraulic engineering, maritime engineering, geotechnical engineering applied to infrastructure, soil defence works and the Integrated Water Cycle. It is involved in projects concerning large multi-purpose water supply networks, dams, port works, and hydraulic and geotechnical works aimed at soil defence (hydraulic risk and landslide risk).

Within the framework of the First Strategic Infrastructure Programme, pursuant to the so-called Legge Obiettivo (Law 443/2001), it independently conceived and developed, anticipating recent issues related to the water crisis, the ambitious interregional hydraulic interconnection project, for multi-purpose use, between the Biferno and Fortore river basins, the first intervention of which is currently at an advanced stage of implementation. Over the last five years, it has developed specific projects in the field of hydraulic engineering (dams, hydraulic works and maritime works), applying the BIM methodology to the “Water” sector in an innovative manner. The company is able to develop projects with specialist expertise, while at the same time ensuring an overall vision and general coordination in line with clients’ expectations.

It operates under ISO 9001:2015, UNI 11337-7:2018, UNI/PdR 78:2020, UNI EN ISO 45001:2023 and UNI PdR 125:2022 certifications.

FLO was born in a time of transition, shaped by profound climatic and social changes that offer opportunities to experiment with new design approaches, from disrupting established systems to responding to emerging human behaviours. The studio’s research responds to a constantly evolving environment, understanding innovation as a process of continuous experimentation. We push the boundaries between disciplines, focusing on compromised ecosystems and pursuing antifragility as a guiding objective. We consider the criticalities associated with technological development as opportunities for transformation, generating functional, environmental, cultural and social value.

FLO brings together complementary expertise spanning architecture, landscape, planning, environmental studies, sociology and visual arts. FLO is made up of very curious people, all under 35, and speaks Arabic, English, Italian, Polish, Portuguese and Spanish. We believe in an ecological approach to the relationship between human and natural actors. In line with neo-Anthropocene thinking, we consider the psychophysical perception of space as a combination of architectural, climatic and digital factors. We aim to create flexible, incremental spaces capable of responding to future transformations.

The design process begins with an in-depth critical analysis of human and natural factors, establishing a matrix to define possible and predictive scenarios. We translate these scenarios into options aligned with the objectives of the brief, observing dynamics from a lateral perspective capable of generating innovative strategies. Our method develops models consistent with the identities and aspirations of both our team and clients, fostering a collaborative, dynamic and creative environment. Our objectives are to create effective and sustainable models for the development and improvement of the real estate sector, reduce the resources required to manage existing assets, and introduce augmented reality as a new layer of the urban landscape.

FS Engineering, the engineering company of the Italian State Railways Group, with over 40 years of experience, has established itself as a center of excellence in integrated high-tech engineering. It combines solid technical expertise, digital innovation, sustainability, and an interdisciplinary vision, including activities in scientific research for emerging technologies, to drive the digital and smart transformation of infrastructure. By integrating engineering capabilities, digital innovation, and sustainability, both in Italy and internationally, FS Engineering aims to create long-term value for territories and communities.
FS Engineering is positioned as a partner capable of integrating engineering expertise, data, and advanced digital platforms to design, monitor, and manage complex infrastructure throughout its entire lifecycle. In this model, digitalization is not only an enabling factor but also a distinctive element of its offering as a true “center of excellence.”

Through advanced BIM, artificial intelligence, cutting-edge monitoring systems, and digital twin technologies, the company develops solutions that support informed decision-making and improve the performance, safety, and sustainability of assets.

The new innovative operations rooms represent the core of this approach, acting as integrated platforms for control, collaborative management of critical issues, simulation, and real-time operations.
These platforms are capable of connecting design, construction, and operations.
This model, developed within one of the most complex infrastructure systems in Europe, is now being enhanced and replicated across international markets, strengthening FS Engineering’s role as a digital center of excellence for engineering at both European and global level, with more than 15 overseas offices across five continents

Idrostudi is one of Europe’s most innovative engineering companies specialising in the sustainable management of water and natural resources. For over twenty years, it has combined engineering expertise, applied research and technological innovation to improve the efficiency, safety and resilience of water infrastructure. Operating across the water cycle, Idrostudi supports utilities, public authorities and companies in planning, designing and optimising complex water systems. Its expertise includes water supply and sewer networks, hydraulic safety, environmental engineering, water resources management and digital infrastructure.

With more than 70 engineers specialised in physical and numerical modelling, monitoring, data science, BIM and Digital Twins, Idrostudi combines technical expertise and digital capabilities to analyse complex systems, identify critical issues and support informed decisions. Innovation is central to its approach. Idrostudi develops proprietary platforms, technologies and monitoring devices, integrating engineering models, digital tools and field data to improve network performance, operational control and investment planning.

Its expertise ranges from existing network assessment to new infrastructure design, hydraulic risk analysis, monitoring and performance optimisation, helping organisations address challenges such as climate change, water scarcity and the responsible use of water resources.

Idrostudi is part of AXEYA, an independent engineering group that includes ETS, Overgrid and ETC Engineering. ETC’s expertise in water and wastewater treatment, water reuse, energy efficiency and resource recovery further strengthens the group’s capabilities.

Founded in Modena in 1965, Ingegneri Riuniti S.p.A. is an established Italian integrated design firm providing architecture and engineering services to public and private clients. For over 60 years, it has combined local roots with a forward-looking vision, transforming complex ideas into functional, safe and sustainable places, infrastructure and urban environments.

Its multidisciplinary team of over 50 professionals combines expertise in architecture and urban planning, structural and geotechnical engineering, energy and building systems, hydrology and hydraulics, infrastructure and mobility and urban development. This breadth of knowledge allows each project to be approached as a coordinated whole, balancing technical precision, architectural quality, environmental performance and the needs of clients, users and communities.
The company operates throughout the project lifecycle, from feasibility studies, planning and integrated design to works supervision, safety coordination, project and construction management. Its services also include technological systems and infrastructure, tender and competition support, technical consultancy, Value Engineering and independent design verification for validation purposes.
BIM, digital innovation, research and artificial intelligence are integral to the company's approach.

These tools improve interdisciplinary coordination, support informed decisions and help optimise overall quality, costs, timelines and performance. Technology remains part of a broader human-centred vision: every solution is designed to generate lasting value and respond responsibly to the needs of society and the environment. With more than 2,000 projects completed, Ingegneri Riuniti continues to unite experience, creativity and innovation. Its goal is not simply to design buildings and infrastructure, but to shape resilient spaces and connections that improve quality of life and contribute to the responsible development of territories for future generations.

Sixty Years of Water Engineering: Knowledge, Research and Innovation
Italy has shaped water for more than two thousand years. Majone & Partners belongs to this tradition. The firm draws on sixty years of experience rooted in the scientific and professional work of Professor Majone, and on a conviction inherited from it: good engineering begins with understanding. Established in its present corporate form in 2009, the company counts with 30 highly specialized hydraulic engineers and provides integrated engineering services in Italy and internationally to public authorities, water utilities and private organisations. Its work spans the water cycle: supply and distribution, water-loss management, sewerage, drinking-water and wastewater treatment, pumping stations, urban drainage and irrigation. It extends to dams and hydraulic structures, river and coastal engineering, flood and hydrogeological risk mitigation, slope stabilisation and territorial planning, and to the roads, railways, ports, airports, bridges and tunnels where water decides safety and durability.
Method is what sets the firm apart. Numerical modelling, BIM, GIS, digital technologies and monitoring are instruments of knowledge, not ends in themselves. Every solution is tested against evidence before it is built. Close cooperation with universities and research institutions brings research into practice and returns field experience to research.
Climate change, ageing networks and growing demand make water the defining infrastructure challenge of our time. Majone & Partners meets it with scientific rigour, technical imagination and a sense of public responsibility, delivering solutions that are reliable, sustainable and resilient.
Experience. Knowledge. Research. Innovation. **Engineering for the future of water.**

OFFTEC is a multidisciplinary architecture and engineering company founded in 2015, with offices in Benevento, Milan and Catania. The firm operates in Italy and abroad, providing integrated design and consultancy services for public and private clients across architecture, civil engineering, infrastructure, urban regeneration, landscape, education, healthcare, culture, sport and mixed-use development.

OFFTEC's approach is based on the belief that architecture, engineering and landscape should not be treated as separate disciplines, but as interconnected parts of a single design vision. Every project begins with a careful analysis of context. From this understanding, the firm develops solutions that combine identity and innovation, spatial quality and technical performance, ambition and feasibility.
The company brings together managers, architects, engineers, BIM specialists and young professionals within a collaborative and coordinated environment. Building Information Modelling and digital information management are central to the design process, improving multidisciplinary coordination, quality control, interoperability and efficiency throughout the project life cycle.

Over the years, OFFTEC has developed more than 300 projects and coordinated programmes with an overall value of approximately €3.3 billion. Its portfolio includes schools, universities, hospitals, cultural buildings, sports facilities, offices, public spaces, transport infrastructure and large-scale urban regeneration projects.
Sustainability, resilience, accessibility and long-term adaptability are key principles in the firm's work. OFFTEC transforms technical complexity into clear, efficient and meaningful design, creating places that improve everyday life, strengthen communities and generate lasting value. Through research, innovation and interdisciplinary collaboration, the company continues to explore new ways of shaping a more responsible, inclusive and sustainable built environment.

Proger is Italy's leading independent engineering company, consistently ranked in the ENR Top 225 International Design Firms. With more than 700 professionals and offices across Europe, Africa, the Middle East and Central Asia, it draws on 70 years of experience to manage and deliver large-scale multidisciplinary projects in Infrastructure and Major Works, Building, Healthcare, Green Energy and Oil and Gas, Environmental Sustainability, Art and Culture, and Integrated Security.
Sustainability is one of Proger's five strategic pillars. Responsible resource use and lower environmental impact shape how it designs and runs its projects. At the core of its approach lies a clear idea: adaptation is the foundation of a new engineering that serves the territories. It is captured in a single claim, "monitor to predict and predict to prevent".

This vision shapes all of its work, whether inspecting and monitoring thousands of bridges, viaducts and tunnels across Italy's motorway network or designing many of the country's largest works, from high-speed railways and hospitals to renewable and waste-to-energy plants.

This vision finds its clearest expression in water, a vital resource increasingly affected by climate change whose efficient management requires both a multidisciplinary approach and sensitivity to local contexts. Through its Observatory, Proger has placed water at the centre of the national debate with the Water Economy and Water Intelligence studies, presented at the Italian Parliament. Through its technical skills, spanning hydraulic, maritime and environmental engineering, Proger both designs large treatment and distribution infrastructure and develops replicable water management models that can be adapted to different territorial contexts: from AWARE, its water and energy project for off-grid African villages, to the "Territorial Water Sustainability Strategy", a circular approach based on the recovery, reuse and storage, now being put into practice through several projects in Italy.

SPERI is a multidisciplinary design and engineering company where architects, designers, engineers and scientists work together to shape what lies ahead. Founded in 1974, the company brings over fifty years of experience in architecture, civil engineering and environmental engineering, combining technical rigor, creativity and innovation. Active worldwide alongside global firms, public authorities and research institutions, SPERI supports clients throughout the entire project lifecycle, from design to construction and beyond.

More than 500 professionals integrate complementary expertise to deliver solutions where performance, quality and environmental responsibility coexist. This experience is reflected in over 300 delivered projects, more than 100 active construction sites, a total project value exceeding €5 billion, over €100 million in turnover in the last three years and more than 120 satisfied clients worldwide.

SPERI's approach is founded on excellence, partnership, reliability, sustainability, innovation, imagination, multidisciplinarity, inclusivity and humanity. ISO-certified processes, digital innovation and a commitment to the UN Sustainable Development Goals support the company in managing complexity and creating long-term value.
At the heart of SPERI are its people, whose expertise and different perspectives drive every project forward. Through collaboration, analytical rigor and creative vision, the company develops reliable and sustainable solutions that contribute to the evolution of the built environment while respecting its natural and urban contexts.

Sogesid S.p.A. is the in-house engineering company wholly owned by the Italian Ministry of Economy and Finance, established in 1994 and operating on behalf of the Ministry of Infrastructure and Transport (MIT) and the Ministry of Environment and Energy Security (MASE). For over 30 years, Sogesid has provided technical and specialist support throughout the project lifecycle, from strategic planning and feasibility studies to design, contracting authority functions, construction management and works supervision.

Operating across all Italian regions, Sogesid supports public investment programmes in water resources and integrated water services, environmental remediation, hydrogeological risk mitigation, waste management, and port and transport infrastructure. As of April 2026, it manages active agreements worth approximately €1.18 billion, alongside technical assistance to central administrations and international cooperation. The company also supports Special Commissioners and public administrations, including programmes funded under the National Recovery and Resilience Plan (NRRP) and EU cohesion policy.

Under its 2026-2028 industrial plan, Sogesid's production value is projected to grow from €155 million to €289 million, while its workforce is expected to increase from around 580 to 610 professionals, supported by partnerships with 20 Italian universities.

Sogesid contributes to strengthening Italy's environmental, territorial and infrastructure resilience through climate adaptation, water security, land and sea remediation, and sustainable infrastructure. Its activities also include port system planning across the Adriatic and Tyrrhenian coasts, urban regeneration of public assets, and international cooperation on water, remediation and waste management projects in the Mediterranean and Africa.

SYSTRA is a leading engineering company, with 12000 people world wide in 80 countries specialising in the design and PMC of complex infrastructures. The company supports clients in developing challenging projects, transforming ambitious ideas into efficient and sustainable solutions that contribute to more resilient territories and mobility systems. SYSTRA combines decades of experience, specialist know-how and an international presence.

Operating worldwide through the SYSTRA Group network, the company provides engineering, design, consultancy, and risk management services for major infrastructure projects, working alongside leading contractors and clients, including on complex Design & Build projects. SYSTRA has extensive experience in the water and hydropower sectors, covering dams, hydropower plants, hydraulic tunnels and underground water infrastructure. Its expertise ranges from feasibility studies and detailed design to construction support, rehabilitation and safety assessment of existing assets.

The company applies advanced capabilities in geotechnical engineering, BIM, risk assessment and value engineering to develop reliable and sustainable solutions for complex hydraulic infrastructure. Innovation is a key driver of SYSTRA's development. Its R&D activities explore Artificial Intelligence, IoT and data-driven technologies applied to engineering and construction processes, alongside a strong commitment to sustainability, technical quality and continuous improvement. SYSTRA's greatest strength is its people. By investing in training, research, collaboration with universities and knowledge sharing, and by connecting expertise across the SYSTRA Group, the company delivers innovative and forward-looking solutions to complex infrastructure challenges worldwide.

Founded in Verona in 1964, Technital is one of Italy's longest-established engineering firms, with over 60 years of international experience.
Today, more than 500 professionals with specialised expertise in different engineering disciplines work together to address complex challenges through a multidisciplinary and integrated approach.
Through more than 3,000 projects worldwide, this expertise has contributed to landmark developments such as Al Faw Grand Port in Iraq, MOSE in Venice and Konza Technopolis in Kenya.

From one of the world's largest ports, to the protection of Venice from high tides, to a new city rising in the heart of the African savannah, Technital engineers where the world needs next.

VDP is an engineering company that develops studies and multidisciplinary projects in the field of environmental sustainability. Established in 1991, VDP provides highly professional consultancy services in sustainable development, energy, and hydraulic infrastructure, ensuring appropriate solutions to meet the different needs of its clients.
The activities, carried out through specific assignments or integrated projects, include:
Environmental Studies and Permitting, Environmental Monitoring, Environmental Design.
The Company, based in Rome, employs qualified project managers and highly specialized professionals with many years of experience in various fields of environmental design. The company, which has experienced a steady growth with more than 1000 projects developed, is today one of the largest Italian companies in the sector and counts among its clients Public Institutions and key players in the infrastructure, ports, hydraulic infrastructure, transport, energy and oil & gas sectors.
VDP's mission, based on the in-depth analysis and assessment of socio-economic and environmental contexts, is to contribute to the development of projects in which technology and progress are compatible with the need to safeguard and conserve the environment, in line with international standards.
Since 2004, VDP has adopted a Quality Management System in accordance with the requirements of UNI EN ISO 9001:2015, covering environmental impact studies, monitoring and environmental design.Over the course of its activity, the company has also obtained the following certifications:

- ISO 14001:2015 - Environmental Management System Certification
- ISO 45001:2018 - Occupational Health and Safety Management System Certification
- ISO 37001:2016 - Anti-Bribery Management System Certification
- UNI/PdR 125:2022 - Gender Equality Management System Certification

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