idrostudi
PART OF IWS
watercare engineering

bsi
ISO 9001 Quality Management Systems CERTIFIED
ISO 14001 Environmental Management CERTIFIED
ISO 45001 Occupational Health and Safety Management CERTIFIED

Idrostudi srl
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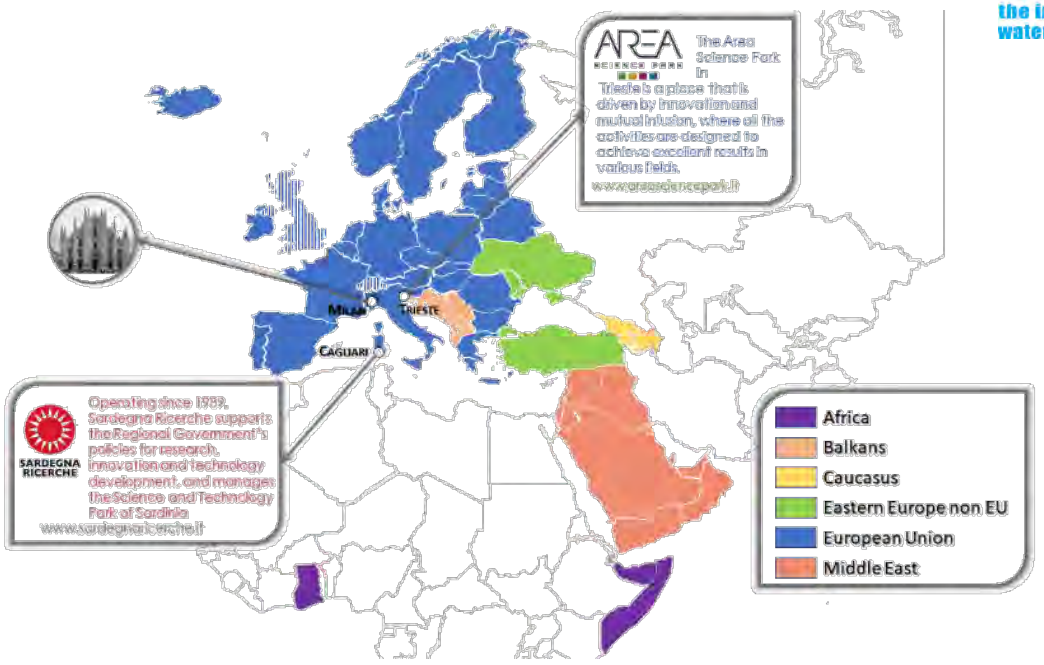
COMPANY PROFILE

Idrostudi is an European independent privately-owned consulting and engineering company. Established in **2002**, wholly owned by Italians, it is based in **ITALY** (with headquarters in Trieste and branches in Milan and Cagliari) and in **Georgia** (Tbilisi). Idrostudi is dedicated to **CIVIL ENGINEERING** related to **WATER** and **ENVIRONMENT** and propelled by international brainpower. Our ongoing commitment to **Research & Development**, carried out in close partnership with both the Italian and International academic world, has permitted us to move the Company's headquarters to the *Area Science Park* in Trieste and to the Sardegna Ricerche, multisectoral **scientific** and **technological parks** and **international research institutions**. Idrostudi has provided consulting services in the fields of hydraulic and environmental engineering and/or performed R&D activities in Italy, **EUROPE**, **BALKANS**, **EASTERN EUROPE**, **CAUCASUS** and **MIDDLE EAST**. Moreover, the staff of Idrostudi and associate consultants have supplied engineering consultancies to Clients across **AFRICA**, **LATIN AMERICA** and **FAR EAST**. **Water Utilities** and Water Authorities are the key Client.

Idrostudi is **IWA** (International Water Association) **corporate member**.



mission: to develop sustainable and reliable projects and solutions, registered and working together with the International Financial Institution (**IFIs**) and Multilateral Development Banks (**MDBs**) [EIB, EU, EBRD, UN, ADB, AfDB, WB, …], industry-specific technicians, research institutions, private companies and **local communities** in order to ensure the shared and rational use of water resources, with full respect for natural resources balance.

vision: we want a world that values the relationship between **humankind** and the **environment**; one that guarantees access to and **saving** of **natural** and **water resources** while maintaining quality over time. We want to express our vision with targeted, reliable and sustainable design strategies, in complete synergy with our customers and their needs.

key values: **constant commitment**, reduced staff turnover and internal and external relationships based on **trust**, **respect**, empowerment, dialogue, **knowledge sharing**, and **social commitment** are the engine that drives us and encourages us to improve day by day our output and results.

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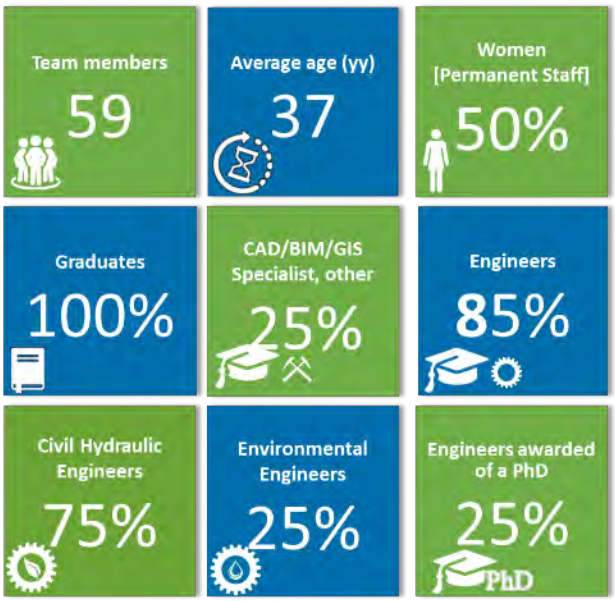
Enthusiasm and creativity, sensitivity and passion, together with the commitment of expert staff, generate a very dynamic and united team, which is able to face challenging hydraulic and environmental problems, proposing innovative and renewed approaches to manage water resources, optimizing design solutions, and requalifying the areas of intervention strictly respecting the deadlines and budgets.

The **acquisition** over the years of **outstanding expertise** in hydraulic and environmental engineering and in **highly qualified** and **specialized consulting** is undoubtedly the **strength of the company**. We study and design lasting solutions in the following sectors as well as offering project and program delivery and advisory services.

THE COMPANY IN A NUTSHELL

The always new and challenging requests of our Clients and the complexity of hydraulic and environmental issues have driven us to widen our fields of activity. Nowadays, our enterprise provides multidisciplinary advice and services to public institutions, governmental authorities, integrated urban water management multi-utility companies, and private companies.



In order to provide the market with a high-quality offer and reliable and timely services, Idrostudi has developed and constantly applies a **Quality Management System ISO 9001:2015** certified by the British Standard Institution (BSI). Idrostudi has conformed to the **Environmental Management System ISO 14001:2015** and to the **Occupational Health and Safety Management systems** (**OHS**) **ISO 45001:2018**. Furthermore, the Company has conformed with **SA8000:2014** standard encouraging organizations to develop, maintain and apply socially acceptable practices in the workplace. Idrostudi is committed continuous improvement and is thus constantly keeping the above Systems updated and fully operative.

bsi. ISO 9001 Quality Management

bsi. ISO 14001 Environmental Management

bsi. ISO 45001 Occupational Health and Safety Management

ANNUAL TURNOVER

2016	2017	2018	2019	2020	2021
2,169,000 €	2,234,000 €	2,546,000 €	3,208,000 €	4,101,000 €	4,900,000 €

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Idrostudi applies **ISO 50001 - Energy management systems**, standard aims to help organization continually reduce energy use and therefore greenhouse gas emissions, **ISO 37001 - Anti-bribery management systems**, intends to support the organization in the fight against bribery by establishing the procedures, policies and controls that help foster a culture of integrity, transparency and compliance, **ISO 27001 – Security Management System**, detailing requirements for establishing, implementing, maintaining and continually improving the information security management system making the hold information assets more secure.

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THE ENGINEERING SECTORS

Water is one of the world's most precious invaluable asset that must be protected and safeguarded. It is fundamental to survival on our planet and is under continual and growing pressures from population growth, climate change and pollution. Protecting this most precious resource is a growing concern around the world. Idrostudi understands the challenges posed to today's water environment. The Idrostudi water and wastewater team provides a full range of services to Water & Wastewater Clients, including **strategic planning**, **master planning**, **feasibility study**, **detailed design**, **construction management** and **WORKS SUPERVISION**, financial analysis and planning, Multi-Criteria Analysis (**MCA**), Cost-Benefit Analysis (**CBA**), Economic and Financial Analysis (**EFA**), Resettlement Action Plan (**RAP**), Environmental and Social Management Plans (**ESMPs**), environmental-social studies (**EIA-ESIA**), Environment Social Health and Safety (**ESHS**) safeguard provision. Furthermore, we offer a multi- disciplinary solution in that we can consult on all aspects of a project, be it Civil, Structural, Process, Mechanical, Electrical, Control & Instrumentation and/or Environmental. Operations planning and facility maintenance/management (**O&M**) requirements are fundamental aspects in maintaining infrastructure, including **CAPEX** and **OPEX** calculation. We understand that the operational requirements and the working environment have direct impacts on the lifecycle of completed projects and we address these aspects from planning and design, through to the construction phases of a project. Our design services include the preparation of **technical specifications** and **tender documentation** to the guidelines of various clients, Performance Based Contracts (**PBC**) and Public Private Partnership (**PPP**) concept development.

WSS WATER SUPPLY AND SEWERAGE

Aqueducts, Adduction, Distribution and Reticulation for Water Supply networks

Networks surveys, flow surveys, planning and execution of hydraulic monitoring campaigns and networks field test, Municipal water supply scheme design, illegal connections and unmetered connections analysis, networks hydraulic models building, model calibration with field test data, model validation against SCADA data, system performance assessment, operational model development, water audits and data validation, development of future models scenarios, leakage survey and management, water loss (technical and commercial) assessment and management, Non-Revenue Water (NRW) reduction projects, Minimum Night Flow concepts, top down and bottom up IWA water balance development, DMA (District Metered Area) design, pressure management designs, network system energy optimisation and efficiency improvement, water abstraction systems, bulk water infrastructure, Water Treatment Plants (WTPs), intermittent water supply assessment and mitigation solutions, strategies for transitioning to continuous supply.

Stormwater, Sanitary and Combined sewers

Networks and flows/levels surveys, planning and execution of Inflow/Infiltration (I/I) surveys and analysis for the identification of the Extraneous Water (EW), Municipal wastewater scheme design, **wastewater systems baseline establishment**, definition of the Combined Sewer Overflow basins (CSO basins), **networks hydraulic models building**, model calibration with field test data and model validation against SCADA data, verify the functioning of the sewage networks in dry and wet (rainy) condition, identify/verify the wastewater flow rates and pollutant loads to the treatment plants, sewerage catchment hydrological modelling, **urban drainage** and **storm water management**, Sustainable Drainage Systems (**SuDS**) and Nature Based Solutions (**NBS**) **for urban flood risk management**, wastewater systems energy optimisation and efficiency improvement, wastewater infrastructure design, improved sanitation facilities (on-site and sewered), Wastewater Treatment Plants (WWTP) including ponds and wetlands for water treatment.

IUWM INTEGRATED URBAN WATER MANAGEMENT

Utility management support, understanding the interdependencies between different urban water systems, quantifying urban water systems linkages both spatially and temporally, development of tools to optimise capital and operating expenses, minimising customer disruptions due to sewerage or stormwater flooding, rainwater tanks, stormwater harvesting and recycled water reuse, citywide inclusive approach, tariff studies, master planning and development of staged servicing strategies to service future growth, capital investment plans, infrastructure project planning and costing.

IWRM INTEGRATED WATER RESOURCES MANAGEMENT

Cross-sectoral policy approach, surface and ground water quality and quantity assessment, River Basin Management (RBM) plans, satellite-based climatological analysis, Climate Change (CC) analysis, Natural Resource Management (NRM) plans, water resources assessment, hydrological analysis, ecological flow assessment, water cycle and water balance on catchment scale.

DRR&M DISASTER RISK REDUCTION & MANAGEMENT

Hydrological modelling, satellite-based hydrological analysis, river hydraulics, Flood Risk Management (FRM), Flood Hazard and Flood Risk Assessment (FRA), Flash Flood analysis, slope stability analysis, river geomorphology studies (including sediment transport modelling), catchment protection plans, rivers and watersheds regulation, dam break analysis, dam safety assessment and dam safety programmes development, Emergency Preparedness Plans (EPPs), dam Early Warning Systems (EWS) development, dam lifespan analysis.

IRRIGATION and DRAINAGE SCHEMES

Gravity fed or pressurised irrigation systems, abstraction structures (earth dams, weirs, reservoirs) design&rehabilitation of new/existing irrigation systems, water conveyance structures (pipelines, canals systems and annexed components), irrigation demand analysis, irrigation command areas design, command area development, water reclamation networks.

CIVIL-ENVIRONMENTAL ENGINEERING

Transverse and longitudinal hydraulic structures (weirs, submerged weirs), storm drains, water intake structures for water supply purposes, artificial canals, dams, waterways design, Hydro Power Plants (HPPs), verification of hydraulic compatibility of road and railway infrastructure (including cross drainage systems, surface drainage systems, scour around bridge abutments or piers), soil bioengineering promoting environmentally friendly solutions, geology and hydrogeology, structural design, hydro-mechanical and electro-mechanical design connected to hydraulic infrastructure.

COASTAL & MARITIME ENGINEERING

Tides, surges, extreme fluvial events and flooding, sediment transport and morphological change analysis, wave impact, numerical modelling of coastal structures including seawalls, breakwaters and jetties, breakwater configurations, scour around structures, coastal geomorphology.

PHYSICAL MODELLING

Scaled-down physical models of natural environments, complex and non-standard hydraulic structures (coastal protection structures, rivers, streams and flooded areas, water and river intakes, drop structures, curved or gated weirs, outfalls, spillways, bridge piers).

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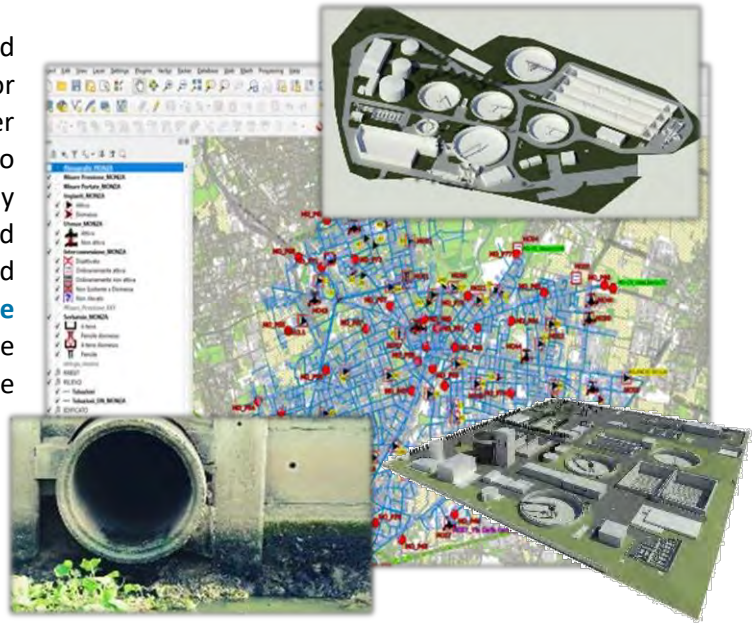
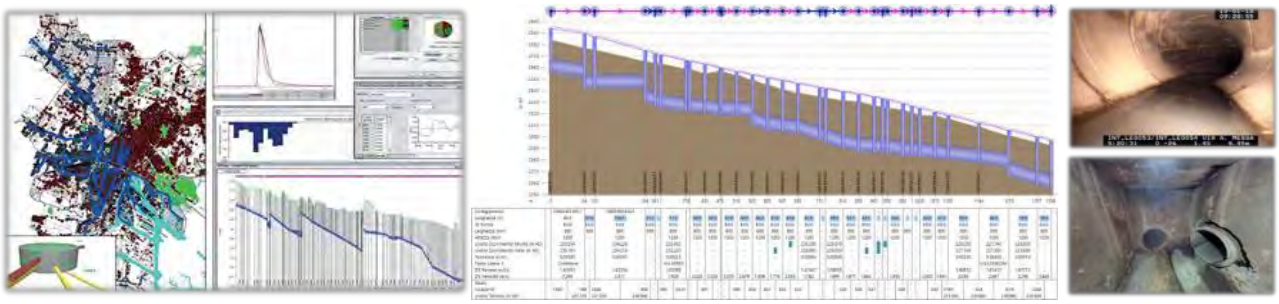
INTEGRATED AND COMPLEMENTARY SERVICES

We facilitate the work and improve the output for the Clients thanks to the following complementary services that extend our activity range.

GEOGRAPHIC INFORMATION SYSTEMS [GIS] – COMPUTER-AIDED DESIGN [CAD] BUILDING INFORMATION MODELING [BIM]



At Idrostudi we own the most advanced **technology to obtain and integrate data**, for timely information on the state of water networks. With particular regard to technological networks, the company specialises in the design, implementation and maintenance of GIS/CAD/3D-BIM systems and therefore in **integrating collected data with the customer's databases**, with full respect for the existing data structure and regulations that have already been implemented. International and national partnerships guarantee the use of our own **state-of-the-art instrumentation** in the implementation of **topographical surveys** and **flow**, **level**, **pressure measurement campaigns**.



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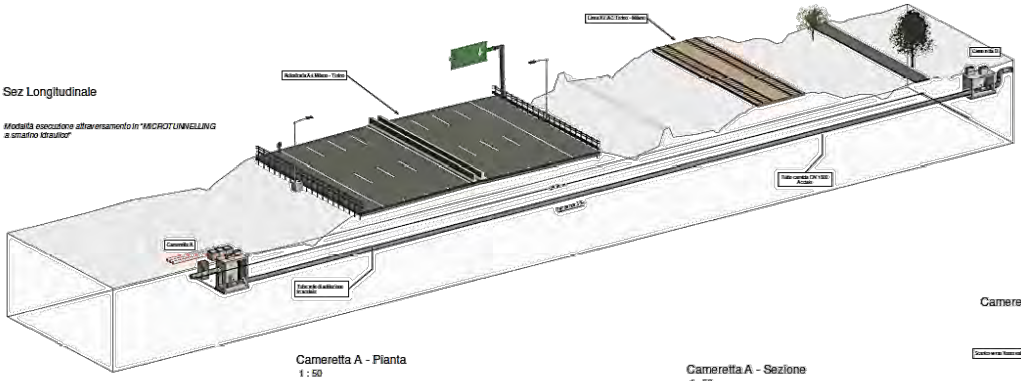
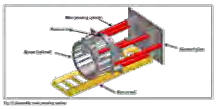


Fig. 28: Automatic bentonite lubrication station

Fig. 29: General overview bentonite lubrication system



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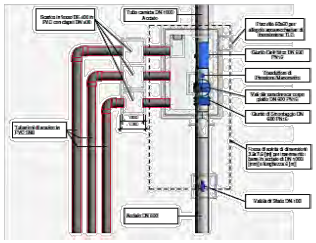

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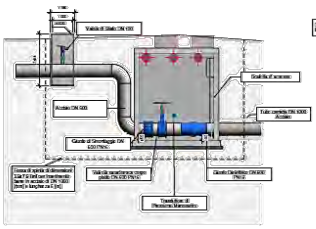

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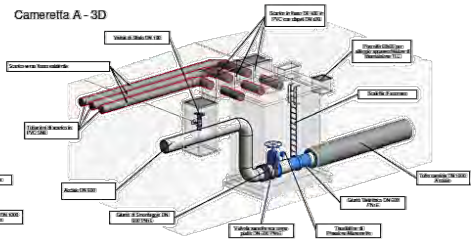

CAPACITY BUILDING – TRAINING – INSTITUTIONAL STRENGTHENING

Institutional capacity building is crucial for updating and integrating knowledge in the natural sciences, engineering, environment, economics, finance and sociology. Capacity-building of personnel and institutions engaged in water and environmental sectors is needed to ensure they can deliver what is expected from them. Where there are no clear national policies on water management, Idrostudi can policy makers and stakeholders in devising policies that clearly state the direction of water management. **Participatory planning** at the project level can result in more appropriate design and significant stakeholder contributions, leading to improved project outcomes.

Participation by stakeholders in planning and implementation of practical improvements in areas where they live and work and in local plan preparation has positive outcomes and ca n be scaled up to play a role in city-and catchment-level planning.

Idrostudi aims to **strengthen the capacities** of the Clients' staff and projects stakeholders to enable them on regularly manage, operate and maintain the water assets and to carry on and update the projects investments. Idrostudi is used to **organise a roundtable** with the staff that has to be trained **assessing** its **background knowledge and skills**, so that a **tailored training programme** can be properly developed by means of **know-how and best practices transfer**.

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HIGH SPECIALISATION ON WATER ASSET MANAGEMENT & NETWORKS

At Idrostudi we are diligent at every stage of our work, whether we are studying a network or carrying out a measurement campaign, detecting leaks or studying proposals for network optimisation. The company has set up a **DEPARTMENT** specialises in the **design** and **implementation** of **DETAILED TOPOGRAPHIC SURVEYS of wastewater, stormwater, urban drainage and water supply networks**, their special artefacts and appurtenance structures and **MONITORING - MEASUREMENT CAMPAIGNS** for water level, speed, water temperature, flow rate and pressure in both **sewer** and **water supply systems strictly in accordance with HSE** (**Health-Safety-Environment**) **regulations**. In relation to the measurements campaigns that involve staff entering in underground sewerage or tunnels, Idrostudi has conformed to the **Occupational Health** and **Safety Management** systems (**OHS**) **ISO 45001**. The surveys activities are computerized directly on-site with in-house developed web app, specifically developed for sewer and water supply flow monitoring. With our web app, it is possible to record the information of the manholes and flow rate and provide photos and videos of the pipes and instruments installation process.

Thanks to solid national and international partnerships, the group is able to guarantee the implementation of measurement campaigns with the use of **state-of-the-art instrumentation** (**ultrasonic cross-correlation flowmeters**, **transit-time flowmeters**, **magnetic** or **insertion sensors**, etc.) in order to **DETECT LEAKAGE** in the water supply systems and to asses **Inflow/Infiltration phenomena** (**EXTRANEOUS WATER analysis and management**) causing dilution in sanitary sewers thus decreasing the efficiency of treatment.

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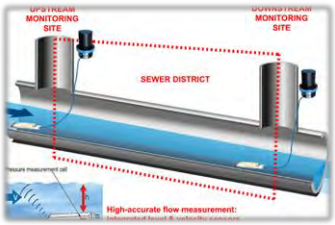
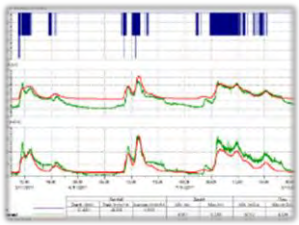
STORMWATER, SANITARY AND COMBINED SEWERS

Idrostudi designs, plans and carries out **topographical sewerage network surveys** collecting information on manholes, iron covers, cover slabs, invert levels, weirs, overflow spillways, lift stations, flood control gates, and any kind of sewerage appurtenance structures. Idrostudi provides the Clients with information concerning the location of pipe work and valves, confirmation of materials used and line and level of the pipes and sewers. **CCTV inspections** are also carried out for the **identification of sewerage defects and faults** such as cracks, displaced joints and obstructions.

One of the most promising activities offered by Idrostudi is represented by the **sewerage in situ hydrometric monitoring** for **Inflow/Infiltration (I/I) study**. The **hydrometric measuring sensors** are immersed in the wastewater in order to continuously **record** the **level** and the **speed** of the water (and consequently derive the **flow rate**), as well as the **temperature**. The analysis allows identifying a typical flow rate both in dry and wet conditions, to verify the correct functioning of the network and to quantify Inflow/Infiltration phenomena and their distribution in a sewer district.






WATER SUPPLY AND SEWERAGE SYSTEMS HYDRAULIC MODELLING

To learn more about the network and to design or modernise water networks or sections of the same, Idrostudi uses the **most well-known calculation software** to develop **numerical models** of constant and variable water flow rates. Idrostudi owns and currently runs different proprietary hydraulic and numerical models (MIKE URBAN+, InfoWorks ICM, Urbano Ultimate, MatLab) as well as license-free models (Storm Water Management Model – SWMM, EPANET) and **in-house developed tools** for **stormwater** and **urban drainage networks optimization**, water balance tools, Inflow/Infiltration analysis tools.

All the mentioned software is integrated with CAD and GIS environment (ArcGIS, QGIS, AutoCAD, Civil 3D) and are compliant with international standards/protocols. The most appropriate model is chosen for each study based on the Idrostudi wide experience in using different sewerage network models.

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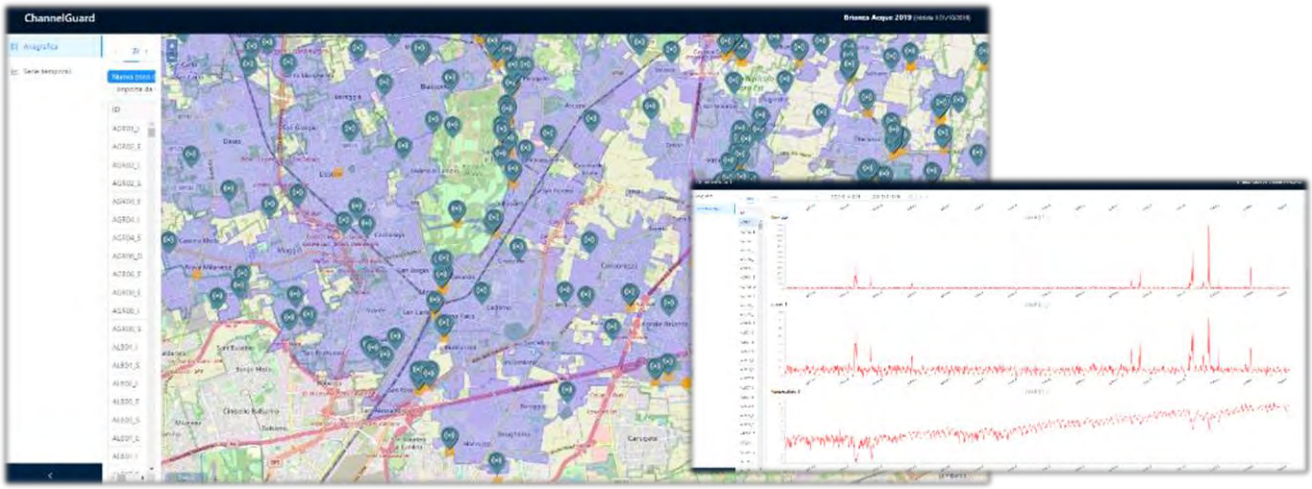
RESEARCH AND DEVELOPMENT
DRIVING NETWORK PERFORMANCE WITH SMARTER WATER

In the sector of aqueduct and sewerage networks Idrostudi provides highly specialized services focused on the improvement of their management. Over the years, the company has transferred the national and international academic knowledge on technological networks to the market and studied in depth the **water supply** and **sewerage systems** functioning on the field using advanced methodologies, quickly becoming the **first Italian reference** in the field of numerical modelling, design and optimization of water networks. Nowadays, new methodologies are having a deep impact in the engineering of water supply and distribution networks. The **traditional approach** based on numerical modelling and simulations can be **strongly enhanced through** the recent discoveries coming from **complex networks theory** and with the powerful knowledge that may be gained from several **artificial intelligence techniques**, in particular **machine learning**, for processing a large amount of field data. From the synergy of these three areas (**numerical modelling**, **complex networks**, **big data analytics**), a new paradigm emerges for the optimal planning and management of water systems. What drives real value for utilities and their communities are specific solutions to drive better capital planning and operational decision-making, save resources reducing risks, improving the environment. At Idrostudi, our vision is to help create a system in which water challenges are no longer a barrier to socio-environmental sustainability. Digital solutions are enabling financial and operation improvements through better system controls, more efficient monitoring and diagnostics.

STORMWATER, SANITARY AND COMBINED SEWERS

The tool has been set up for monitoring the sewerage networks with focus on the analysis and study of Inflow/Infiltration phenomena in the sanitary sewers (carrying household, industrial, and commercial wastewater) as well as the combined sewers. The system gathers automatically, and in real-time, the network data (velocity, level, temperature) for every single measured point. From that the system provides information on flow rates useful for the understanding of I/I sources in the sewerage networks.



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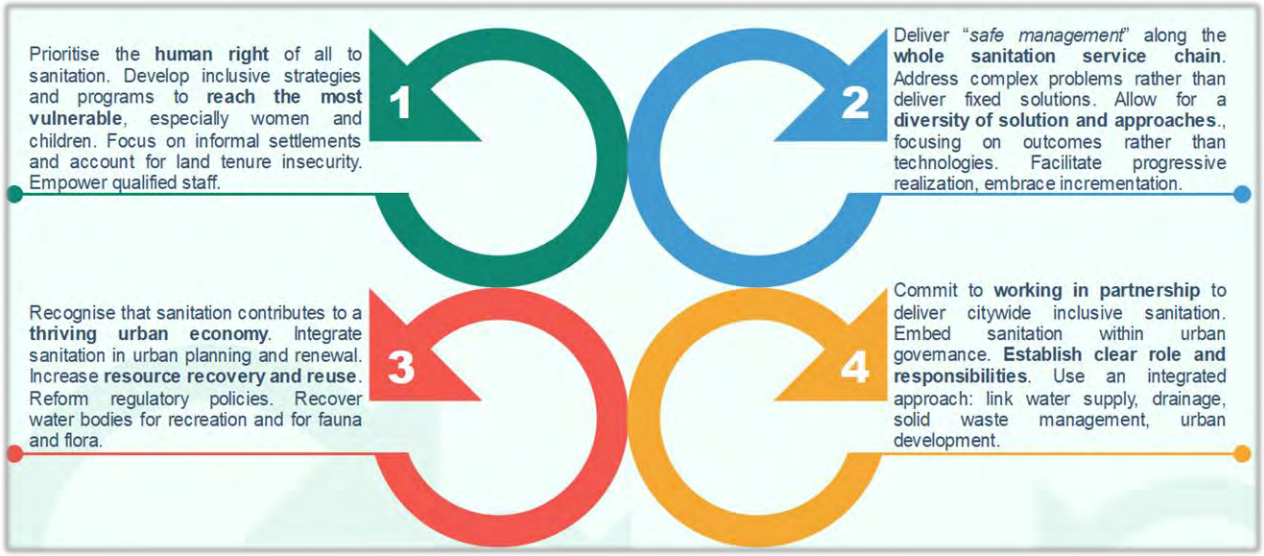
With the described instrument, our R&D department has established a new approach to water management through **Decision Support Systems** (**DSS**) tools. Latter systems are built to meet also the United Nations Sustainable Development Goals, among them SDG06 "*Clean Water and Sanitation*", SDG07 "*Affordable and Clean Energy*", SDG11 "*Sustainable cities and Communities*", SDG12 "*Responsible Consumption and Production*", and SDG13 "*Climate Action*".

The tools allow reducing systems losses, reducing Inflow/Infiltration flows therefore reducing wastewater treatment costs, proactively managing the water assets, supporting Water Safety Plans, managing the urban watershed, advancing water and sanitation equity, gaining control of data to drive better short-medium and long term decision making. The tools are an asset for supporting the implementation, transposition and harmonization into a national context of relevant **EU legislation** such as the Water Framework Directive (WFD 2000/60/EC), Urban Waste Water Directive (UWWD 91/271/EEC) and Drinking Water Directive (DWD 98/83/EC).

In order to further improve and simplify the use of the tools, they have been equipped with an advanced GIS system to geo-reference all the information concerning both the characteristics of the network and the installed equipment. Both the above tools are intended for **PLANNING AND OPERATION** (support for field operations, scheduling of activities, identification and assessment of losses, Inflow and Infiltration phenomena), **PROCESS OPTIMIZATION** (investment management, water resource management, water treatment management), **ENHANCEMENT OF KNOWLEDGE** (enhancement of information assets, improvement of the relationship with users, authority, public administrations and policy makers).

INCLUSIVE CITYWIDE WATER SUPPLY AND SANITATION APPROACH

Our Key Principles to deliver an **CITYWIDE INCLUSIVE WATER SUPPLY AND SANITATION** project are based on **COLLABORATION** between many actors, including: national, sub-national and city/municipal governments; utilities and municipal service providers; business and the private sector; civil society, local and international NGOs; donors, bilateral and multilateral agencies and private foundations; as well as academia and, importantly, households themselves. Each component is organized in a UNIQUE WAY. Local actors need to **ACKNOWLEDGE SHARED RESPONSIBILITIES** and work collaboratively to chart their own path to providing urban sanitation to all. We specifically call on all actors to work based on four interconnected principles:



Our CITYWIDE INCLUSIVE WATER SUPPLY AND SANITATION policy will include the **vision**, **missions**, and **goals** of water supply and sanitation development as well as **strategies** to meet these goals. Each strategy is then translated into indicative programmes (and **strategic action plans**). The citywide inclusive strategy will cover:

- **Technical aspects**, including strategies and programmes for the development of (a) water resource availability, (b) water supply systems, (c) sanitary sewer services, (d) stormwater sewer services, and (e) micro drainage services.
- **Non-technical aspects**, including strategies for the **development of non-physical aspects** such as (a) community awareness and participation, (b) policy and regulation, (c) institutional capacity, (d) private sector engagement, (e) NGO engagement, (f) financing and tariffs, and (g) monitoring and evaluation.

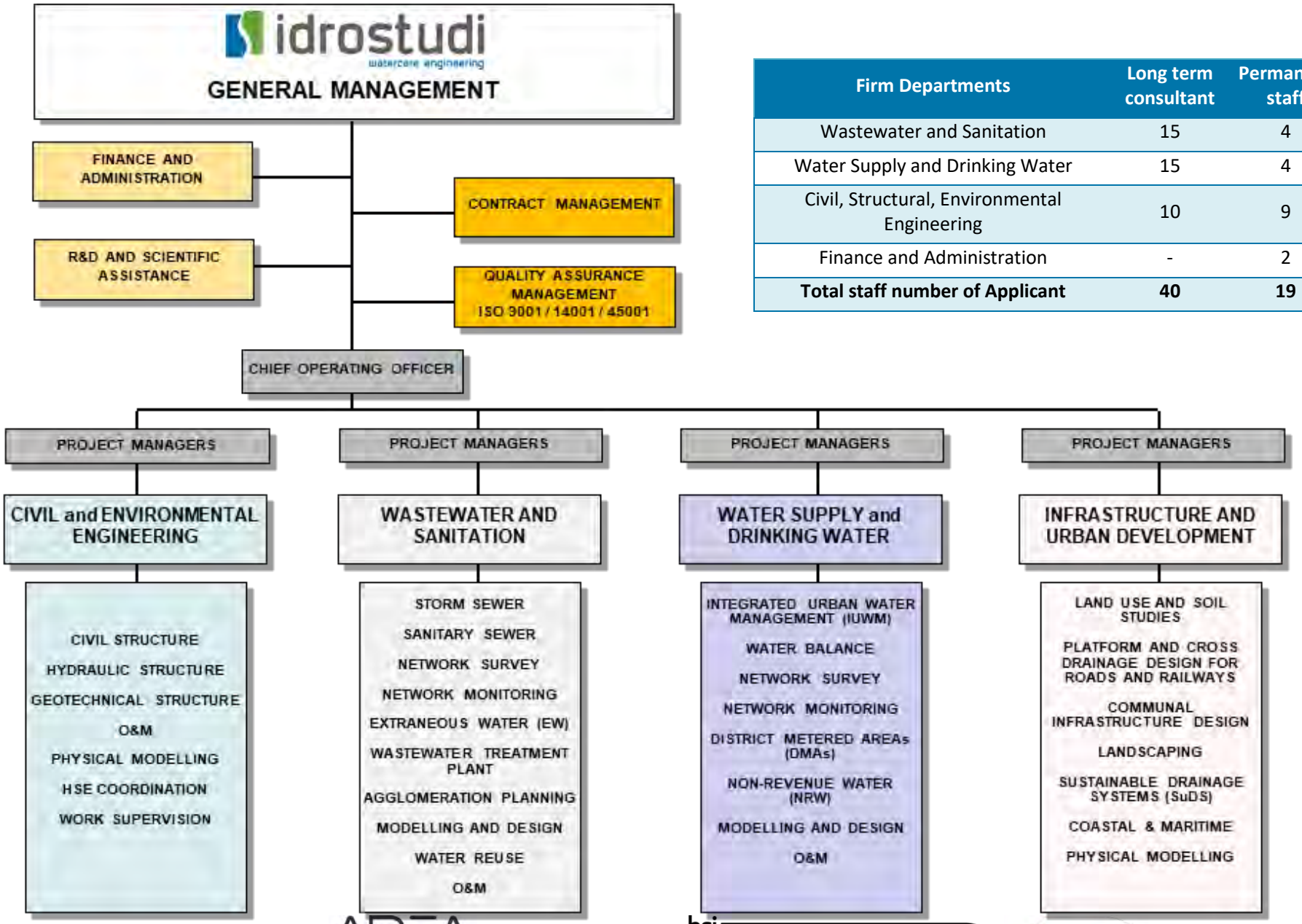
OUR TEAM

We have always believed in people and from the beginning we wanted to invest in creating a **cohesive team**; a team that would be able to synergistically combine the vertical skills of the individual in order to achieve important targets. Every day the people who work at Idrostudi use common experience to offer customers the widest range of services, which are geared towards protecting the territory's hydraulic systems and water resources management. When you work in engineering you never stop learning: for this reason, **we constantly and continuously invest in people's education,** keeping them updated on the most modern design and production techniques and technologies, on new materials, on legislation, which is increasingly more complex and stringent. We work with an extensive **network of local experts** and **recurring contributors** whom we engage according to project-specific needs.

idrostudi watercare engineering

And it is through training that we plan studies and research, in collaboration with the academic and corporate world. The result is a team that operates by becoming an interface between the working groups, offering customers an increasingly specialised service that is tailored to their needs. The team has been chosen for its **national** and **international experience**. Together our team brings a **long history** of working with **water resources environment** and **climate change**. A core staff and associate consultants supply professional services to our Clients. The majority of the staff brings a variety of educational and qualified background to the team in the fields of one-dimension and multidimensional numerical modelling, design, optimization of water supply and sewerage networks, drainage and irrigation projects, flood risk management, hydrology, geology, hydrogeology, hydraulics, reduced scale physical modelling of flow/structure interaction in rivers, information technology, GIS/CAD/BIM, works supervision, environmental and social impact studies, know-how and knowledge transfer, Occupational Health and Safety Management, and is constantly expanding their expertise.

By hiring highly educated experienced professionals Idrostudi makes sure that it provides and develops a highly valuable combination of experience and knowledge. Idrostudi team consist of performing individuals with highest academic and professional records. The team of Idrostudi includes **BSc, MSc, Ph.Ds**, **Professors** and among them **civil engineers**, **environmental engineers, hydraulic engineers and structural/geotechnical engineers**. The holders of Ph.D cover the disciplines related to **hydraulic engineering**, **environmental engineering**, **numerical modelling** and **analysis, fluvial geomorphology**. The principal organisation chart of the company is following shown.



Firm Departments	Long term consultant	Permanent staff	Total
Wastewater and Sanitation	15	4	19
Water Supply and Drinking Water	15	4	19
Civil, Structural, Environmental Engineering	10	9	19
Finance and Administration	-	2	2
Total staff number of Applicant	**40**	**19**	**59**

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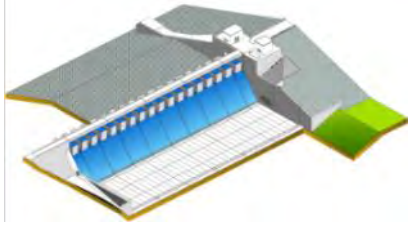
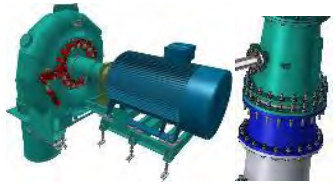
COUNTRY	SECTOR	PROJECT		SERVICES
GHANA 	CIVIL ENGINEERING DISASTER RISK REDUCTION & MANAGEMENT SANITATION	Consulting Services for the Detailed Engineering Design of Investments and Supervision of Construction Under the Flood Mitigation Component of Greater Accra Resilient and Integrated Development Project		Preliminary and Detailed Design including review of the Feasibility Study, Topographical surveys, Geotechnical survey, Hydrological and hydraulic study, Civil structure design, BoQ and cost estimates, Construction work program.
IRAQ 	DISASTER RISK REDUCTION & MANAGEMENT WATER SUPPLY	Consulting Services for feasibility study and design of Chami Rokhana, Hashazeni and Qaziawa dams		Intense droughts occurred in Northern region causing a deficiency of water supply for human and livestock needs, with significant impacts on the environment, agriculture, and economy. In order to meet water management requirements of those areas, investigations and studies started for water harvesting through the construction of dams and reservoirs everywhere possible. Water availability assessment, water balance studies, hydrological analysis and climate change projections are key activities.
SOMALILAND 	CIVIL ENGINEERING WATER SUPPLY	Consulting Services for Assessment of Ground Water Sources Potential and Possibility of Surface Water Sources for Hargeisa City		Provide a long-term planning horizon to the Hargeisa water supply system by determining and estimating the current and future demand for water supply services, assessing the capacity of existing aquifers around Hargeisa, assessing recharge improvements of the aquifers, assessing additional groundwater sources outside the existing aquifers above, assessing in detail surface and sub-surface dams' potential (hydrological and hydrogeological analysis including climate change trend), studying different water source supply options to meet the demand over the planning horizons.
ALBANIA 	WATER SUPPLY	Consulting Services for the hydraulic testing of a water supply pipe downstream Bovilla reservoir		Consulting Services for the hydraulic testing by means of hydraulic modelling of a DN900 pipe in the stretch downstream Bovilla reservoir. The hydraulic testing is required after shutdowns and repairs in order to validate that equipment will operate under desired conditions once returned to service.
ITALY 	SANITATION INFRASTRUCTURE	Consultancy Service for the Construction Supervision of wastewater networks and WWTP of Todi, Perugia		Work Supervision, contract administration, verification and approval of the constructor's health and safety provision, quantity and quality control, review and monitoring of the contractor's programme, defects liability period support

COUNTRY	SECTOR	PROJECT		SERVICES
ALBANIA 	WATER SUPPLY	Consultant service for the Construction of a water supply main from Bovilla dam to the capital of Albania - Tirana		Consulting Services for the preparation of the Technical Specifications for the hydraulic testing of a DN900 water supply pipe. The pipe section includes the stretches from Bovilla dam to the WTP (Kinostudio) and the bypass connecting the WTP with Tirana. The consultancy service includes the pressure analysis of the whole system
GEORGIA 	CIVIL ENGINEERING INFRASTRUCTURE RENEWABLE ENERGIES	Detailed design of Kasleti-1 Hydro Power Plant (Mestia, Georgia)		Detailed Design including review of the Feasibility Study, Topographical surveys, Geotechnical survey, Hydrological and Hydrogeological study, hydraulic study, Civil structure design, H&M-E&M equipment design, BoQ and cost estimates, Construction work program
ITALY 	SANITATION INFRASTRUCTURE	Consultancy Service for the Detailed Design and Construction Supervision of wastewater networks and WWTPs in the proximity of Trasimeno Lake		Detailed design, Topographical surveys, Soil investigations, Hydraulic numerical modelling of WW network, BoQ and cost estimates of the drainage structure, Work Supervision, Contract administration, Verification and approval of the construction contract and the constructor's health and safety provision, Review and monitoring of the contractor's programme, Construction monitoring including daily site diary, field reports, interim reports, executive reports, Defects liability period support
DENMARK 	URBAN DRAINAGE INFRASTRUCTURE	falster-agricultural drainage detailed design		Detailed design activities concerning urban drainage and drainage management including hydraulic and numerical modelling of the stormwater and drainage networks, networks 3D modelling, BoQ and cost estimates of the drainage structure
REPUBLIC OF MOLDOVA 	DISASTER RISK REDUCTION & MANAGEMENT	The Dniester Hydro Power Complex social and environmental impact assessment. Modelling of the Lower Dniester Wetlands		River hydraulic modelling (1D-2D), Flood hazard and Flood Risk Assessment support including understanding of flood damage assessment

COUNTRY	SECTOR	PROJECT		SERVICES
GEORGIA 	CIVIL ENGINEERING INFRASTRUCTURE RENEWABLE ENERGIES	Detailed design of Sadmeli Hydro Power Plant (Racha, Georgia)		Detailed Design including review of the Feasibility Study, Topographical surveys, Geotechnical survey, Hydrological and Hydrogeological study, hydraulic study, Civil structure design, H&M-E&M equipment design, BoQ and cost estimates, Construction work program
ALBANIA 	WATER SUPPLY AND SANITATION	Water supply, sewerage networks, and future city development: Theoretical update and on-the-job training of the UKT staff members in view of the Territorial Reform		Training on the job on water supply networks and sewer systems monitoring campaigns using measuring devices connected to SCADA, simulation of sewerage and aqueduct with hydraulic models
GEORGIA 	URBAN DRAINAGE	Consultancy Service for the analysis of runoff from Tbilisi Public Service Hall rooftop for improving the stormwater drainage system design.		Detailed Design including review of the Feasibility Study, Topographical surveys, Geotechnical survey, Hydrological and Hydrogeological study, hydraulic study, Civil structure design, H&M-E&M equipment design, BoQ and cost estimates, Construction work program.
TURKEY 	WATER SUPPLY	Malatya City Centre water supply system rehabilitation project: Master Plan		Water Supply systems Master Planning with (1,200,000 inhabitants), including network hydraulic modelling and optimization, development of District Metered Areas (DMAs), Non-Revenue Water Reduction Plan, Leakage Management Plan, design designs of priority works to be undertaken in the short period.
CHINA 	SANITATION	Sustainable programme for the rehabilitation of the Shichahai lakes in Beijing urban area. Sanitation Master Plan, Feasibility Study and Detailed Design of sanitation infrastructure.		Design and implementation of the water quality and quantity monitoring system, Development of the hydraulic modelling (1D – 2D) of the system and the water quality model for the lake, capacity building and training on the hydraulic modelling, Hydraulic modelling support to the Detailed Design of the WWTP

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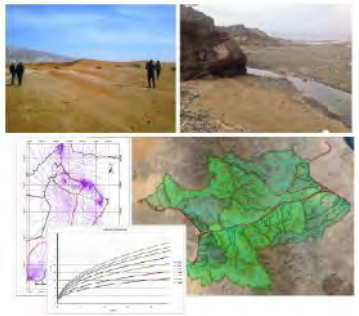
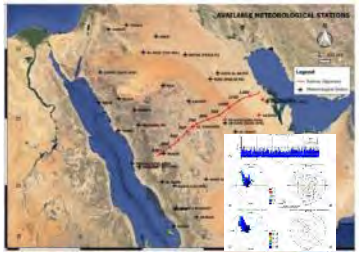
COUNTRY	SECTOR	PROJECT		SERVICES
ITALY 	SANITATION INFRASTRUCTURE	Consultancy Service for the Construction Supervision of extension and rehabilitation works of the WWTP of Trieste		Work Supervision, contract administration, verification and approval of the constructor's health and safety provision, quantity and quality control, review and monitoring of the contractor's programme, defects liability period support
ITALY 	DISASTER RISK REDUCTION & MANAGEMENT INFRASTRUCTURE	Consulting Services for hydrological-hydraulic studies, flood hazard and risk assessment for railways infrastructure and appurtenance structures, including topographical and geomorphological studies		Topographical surveys, rivers/streams/gullies cross sections surveys, geomorphological analysis of complex drainage systems for watersheds definition, hydrological modelling, hydraulic modelling (1D-2D), PFRA, railway platform cross-drainage systems assessment and improvement, flood hazard mapping, Flood Risk Assessment (FRA) and mapping, identification of structural measures to reduce flood risk and protect the railway structures, hydraulic/structural design of solutions for crossing works (ditches, culverts, pipes, ...) with rivers and channels, BoQ, cost estimates
OMAN 	DISASTER RISK REDUCTION & MANAGEMENT INFRASTRUCTURE	Hydrological study, hydrological and hydraulic design guidelines and preliminary design of the hydraulic works within the Consultancy services for preliminary design of the National Railway Project in the Sultanate of Oman		Definition of the wadi/rivers drainage systems, focused on extensive and detailed topographical surveys, the provision of the hydrological and hydrogeological modelling, the hydraulic modelling (1D-2D) and the design of the drainage system reducing the criticality.
EUROPE 	DISASTER RISK REDUCTION & MANAGEMENT	SEDITRANS / Marie Curie Actions of the 7th Framework Programme / FP7 2007-2013		Application of new techniques for catchment erosion and solid transport modelling with a specific application to the numerical simulation of gravity currents flowing over mobile bed, estimation of the capacity of gravity currents to entrain sediments and to study the influence of the entrained particles on the dynamics of the current

COUNTRY	SECTOR	PROJECT		SERVICES
KINGDOM OF SAUDI ARABIA 	INFRASTRUCTURE	Sand Mitigation Study within the Preparation of Preliminary and Detailed Engineering Design of Saudi Landbridge Project – Section 2 (from km 271 to Al Jubail/Dammam)		Field surveys, geotechnical investigations, hydrological modelling, sand erosion analysis, wind analysis, sand drift analysis, preliminary design of standard solutions for crossing works (bridges, culverts, etc.) with wadis
OMAN 	DISASTER RISK REDUCTION & MANAGEMENT INFRASTRUCTURE	Detailed design of a dam for flood protection of Quriyat City in Oman		Hydrological analysis review, hydraulic numerical modelling (1D - 2D), physical modelling (scale 1:60), hydraulic physical testing of the dam (spillway, outlets, stilling channel, stilling basin, …)
ITALY 	SANITATION	Urban StormWater & WasteWater Management Plan of the urban and peri-urban areas		Data collection and analysis, topographical surveys, stormwater and wastewater network surveys, BASELINE establishment, hydraulic monitoring campaigns and field test, Hydraulic modelling of the stormwater and wastewater network, Design of structural and non-structural measures, BoQ and cost estimates, Technical specification and Tender Documents, O&M, Knowledge Transfer
ITALY 	SANITATION	Framework Contract for the Preliminary and Detailed Design, Occupational Health and Safety management (OHS) for the works related to WTPs, WWTPs, sewerage and water supply networks		WW BASELINE establishment, definition of the Combined Sewer Overflow basins (CSO basins), hydrological modelling, hydraulic and numerical modelling of the stormwater and wastewater network, verify the functioning of the sewage networks in dry and wet (rainy) condition, identify/quantify the extraneous flows infiltrations and their distribution in the sections of the sewage, identify/verify the wastewater flow rates and pollutant loads
ITALY 	SANITATION	Consultancy services for the Integrated Water Cycle Management in the sectors of stormwater and wastewater		Data collection and analysis, topographical surveys, networks surveys, networks GIS, BASELINE establishment, Extraneous flows surveys and analysis, Hydrological modelling, Hydraulic modelling of the WW networks, Software development and testing, defining solutions to improve improve/optimize the WW networks, Knowledge Transfer.

COUNTRY	SECTOR	PROJECT		SERVICES
ITALY 	SANITATION	Preliminary and Detailed Design, Occupational Health and Safety management (OHS) for the works related to WTPs, WWTPs, sewerage and water supply networks by means of common Data Sharing Environment (DSE)		Water Supply Projects: WS baseline establishment, Definition of District Metered Areas (DMAs), Pressure and flows data monitoring and collection for hydraulic model calibration, DMAs monitoring and water balance, WS network hydraulic model, analysis of optimized scenarios, design, BoQ and cost estimates. Wastewater Projects: WW baseline establishment, CSO basins definition, hydrological modelling, hydraulic modelling of the stormwater and wastewater network, hydraulic monitoring campaigns and field test, verify the functioning of the sewage networks in dry and wet (rainy) condition, identify/quantify I&I flow rates, design, BoQ and cost estimates
OMAN 	DISASTER RISK REDUCTION & MANAGEMENT	Consultancy Service for the flood protection of Quriyat City in relation to the Wadi Mailass basin		Hydrological modelling, Hydraulic modelling (1D and 2D), flood hazard mapping, Flood Risk Assessment (FRA) and mapping, river long profiles with different return periods plotted, calculation of Expected Annual flood Damages (EAD), modelling and design of structural measures for flood risk reduction, BoQ, cost estimates Cost and Benefit Analysis (CBA)

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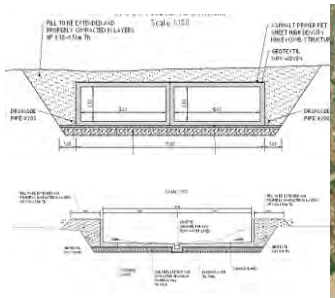
Assignment name: Greater Accra Resilient and Integrated Development Project. Consulting Services for the Detailed Engineering Design of Investments and Supervision of Construction Under the **Flood Mitigation** Component of Greater Accra **Resilient** and **Integrated Development Project**.	**Approx. value of the contract:** 430,000 USD
Country: GHANA **Location within country:** Greater Accra Region	**Duration of assignment (months):** Engineering Design Phase: 10 months Construction Supervision Stage: 18 months. Defects Liability Period: 12 months
Name of Client: A.R.S. Progetti S.P.A. **Contracting authority:** Ministry of Works and Housing International development Association (IDA – WB Funds)	**Total № of staff-months of the assignment:** 46 man-months for Engineering Design Phase
Address: HR23+746, Accra, GHANA	**Approx. value of the services provided by your firm under the contract:** 30,000 USD (Sub-Consultants)
Start date (month/year): 09/2021 **Completion date** (month/year): Expected end 02/2022	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** -
Name of joint venture partner or sub-Consultants, if any: Idrostudi as Sub-Consultant	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Davide Russo, PhD – **Urban stormwater Expert** Eng. Agostino Avanzi – **Project Manager/Hydraulic engineer** Eng. Francesca Ramazzina – **Stormwater Modeller**

Narrative description of Project:


Greater Accra is subject to **chronic flooding** (**high urban flood risk**), the impacts of which are increasing due to **climate change**, and concentration of population and assets in flood prone areas. The Government of Ghana, with financial support from the IDA is embarking on **improving critical drains** and **natural drainage channels** to **mitigate the perennial flooding in Accra** as part of the Greater Accra Resilient and Integrated Development Project. The existing storm water drainage network in Accra consists of a purely gravity system of mainly open drains and limited covered sections in the Central Business District and along the Kaneshie-Mallam road. The **floods** which usually occur in the **rainy seasons** have caused substantial **human** and **material loss** during last decades.




Poor environmental sanitation has become a significant urban challenge for the Greater Accra Region in the past decade and **contributed** to **increased flood risk**. These problems have been exacerbated by factors such as poorly managed land use, unregulated development of settlements, and inadequate municipal **solid waste management**. This engineering consultancy services assignment seeks to address the development and delivery of **detailed engineering designs**, **construction drawings**, **specifications**, **bills of quantities** which are synchronised to the construction drawings, and **engineer's cost estimates for targeted civil works construction contracts, preparation of tender documents** and other tasks and outputs related to Component 1 – **CLIMATE RESILIENT DRAINAGE AND FLOOD MITIGATION MEASURES**.

Description of actual services provided in the assignment:

Idrostudi's design has concerned **rehabilitation** and **improvements** of **major drains**, **new drains** (open channels, box and circular culverts, river and channel enlargement).

- **Data collection** and analysis; **topographical surveys** of **drainage network**;
- **Hydrological modelling**; **Hydraulic** and **numerical modelling** of the **urban drainage network**;
- Preliminary Design of **structural** and **non-structural measures** (**nature-based solutions**, **SuDS**);
- **BoQ** and **cost estimates**; **Tender Documents**, scheme management and maintenance plan (**O&M**);
- Knowledge Transfer and **Capacity Building Program**.

** Pictures taken from the project outputs delivered by Idrostudi srl*

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Assignment name: Drainage and Wastewater Management Plans, network surveys, hydraulic modelling and networks rehabilitation design.	**Approx. value of the contract:** 4,169,160.11 €
Country: ITALY **Location within country:** Lecco (LC)	**Duration of assignment (months):** 12 months
Name of Client: Lario Reti Holding S.p.A. (JSC)	**Total Nº of staff-months of the assignment:** 450
Address: Via Fiandra, 13 – 23900 Lecco (LC), ITALY	**Approx. value of the services provided by your firm under the contract:** 583,682.42 € (Partner 14%)
Start date (month/year): 09/2020 **Completion date** (month/year): 09/2021	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** 386
Name of joint venture partner or sub-Consultants, if any: Acea Engineering Laboratories Research Innovation JSC – Leader / J+S Srl (IT) – Partner / B.M. Tecnologie Industriali S.r.l. (IT) – Partner / M.P.M. Ambiente S.r.l – Partner / Datek22 S.r.l. – Partner / W.E.E. Water Environment Energy S.r.l. – Partner	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Davide Russo, PhD – **Team Leader** Eng. Mauro Castellarin, PhD – **Sewerage Expert** Eng. Christian Marson – **Sewerage Expert** Eng. Alex Stefani – **Hydraulic Modeller**

Narrative description of Project:

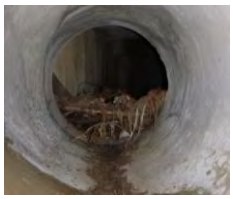
The water utility Lario Reti Holding S.p.A. (JSC) manages the **Integrated Water Service cycle** with a total of about 340.000 inhabitants served by the systems. The water distribution network is about 2,600 km, the Drainage and Wastewater network refers to a "**combined sewer**" (stormwater pipes + sanitary sewers). The water utility decided to draft the **Drainage and Wastewater Management Plans** for the entire sewerage networks of belonging, including the surface drainage networks, as the networks suffer from inefficiency, blockages, ageing and structural problems.

The project covers an area of about 800 km², **1,800 km** of **drainage** and **wastewater network** (**residential**, **commercial** and **industrial areas**) including **170 pump stations** and **420 weirs**. The wastewater is treated by 28 WWTPs.

The Idrostudi's contribution is focused on an **extensive** and **detailed networks surveys**, the provision of the **hydraulic modelling** and the **design** of **structural** and **non -structural measures** to **improve the network efficiency reducing the criticality** by **Master Planning** and outlining the networks **improvement** and **rehabilitation works** that are **economically and technically viable.**

The project concerns the analysis of the current situation of the system by means of an extensive **topographical network survey** (**sub-surface pipes**, **surface drainage network including cross sections, culverts, bridges, weirs of channels and rivers**) and **camera inspection** (**CCTV**) in order to get the proper picture of the structural problems (**blockages**, **cracks** on the pipes, etc.) affecting the network. A database in **GIS** and **CAD** has been established. Idrostudi developed the hydrological analysis (rainfall-runoff modelling) and the hydraulic modelling of the current network status in order to define the baseline condition including all the available information on sewerage flows. The Drainage and Wastewater networks are being modelled with MIKE URBAN (**integrated modelling platform** to incorporate both **urban** and **drained catchments**). With full integration of 1D and 2D **hydrodynamic simulation** techniques, both the **above- and below-ground elements** of catchments were modelled to accurately represent all flow paths. The **definition of the network geometry** modelled was performed according to the information collected with the topographical surveys. In order to **calibrate** and **validate** the hydraulic model, a monitoring campaign was carried out by means **area-velocity gauging points** within the network and **rainfall stations in the drained catchments**. By means of the monitoring campaign it has been possible to define a baseline for **estimating** the **infiltration/inflow** into the systems.

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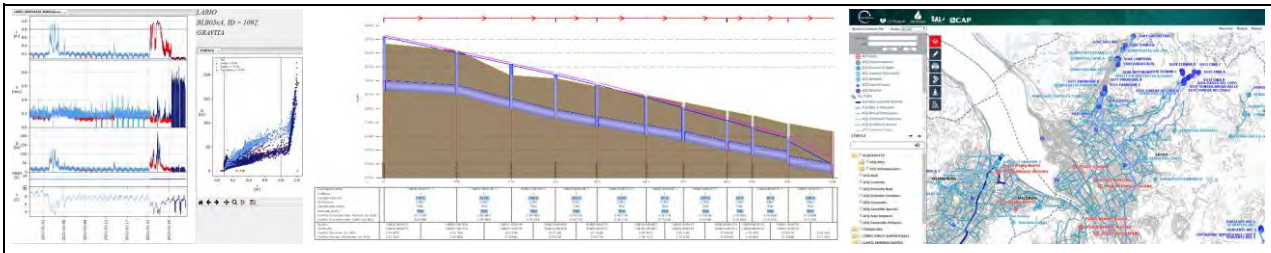

The **data collected during the monitoring campaign** were used firstly to **calibrate** and then to **validate** the **numerical model** of the drainage sewer system. The calibrated model was used to **simulate synthetic rain events (stormwater event)**, characterized by a given return time (**10**, **50**, **100 years**), in order to **identify** the **critical stretches or artefacts of the sewer system**.

The final project phase covers the study and identification of the **structural** and **non-structural measures** to **improve** and **better optimize** the **Drainage and Wastewater systems**. The measures are being studied by means of **Cost/Benefit** analyses and are being **prioritised** in order to produce a **phased investment programme** (short, medium and long term measures) for the entire network to give the overview for the necessary investment to decision makers. The method for prioritisation is taking account different aspects including the urgency of the measures and the magnitude of the hazard/risk associated with each measure. The effectiveness of the measures is being modelled and verified by means of hydraulic modelling.

Description of actual services provided in the assignment:

The Idrostudi contribution to the definition of the **Drainage and Wastewater Management Plans** is focused on the provision of the **hydraulic study** and the **design** of the **drainage and wastewater structure**. The model and design include **pumping stations**, **overflow weirs**, **non-return valves**, **new pipes** and **drainage network**, **rectangular** and **circular culverts**, etc.

- **Data collection** and analysis; **topographical surveys**, **drainage** and **wastewater network surveys**;
- **Condition Assessment** of sewerage infrastructure;
- **Stakeholder engagement/information/consultation** throughout the project;
- BASELINE establishment;
- Execution of **hydraulic monitoring campaigns** and **field test**;
- **Hydrological modelling**;
- **Hydraulic** and **numerical modelling** of the **drainage** and **wastewater network**;
- Concept **Rehabilitation/Upgrade Program** outlining **structural** and **non-structural measures (use of NBS/SUDS)**;
- **BoQ** and **cost estimates**;
- Scheme management and maintenance plan (**O&M**);
- Knowledge Transfer and **Capacity Building Program**.

** Pictures taken from the project outputs delivered by Idrostudi srl*

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Assignment name: Sustainable programme for the rehabilitation of the Shichahai lakes in Beijing urban area. **Sanitation Master Plan**, **Feasibility Study** and **Detailed Design of sanitation infrastructure.**	**Approx. value of the contract:** 2,494,193 USD
Country: CHINA / **Location within country:** Pechino	**Duration of assignment (months):** 26
Name of Client: SGI Studio Galli Ingegneria S.r.l. **Contracting authority:** Beijing Xicheng District Bureau of Environmental Protection.	**Total № of staff-months of the assignment:** 166
Address: n. 20 Nanxiaojje. Xizhimen Xicheng District – Beijing PRC (PEOPLE'S REPUBLIC OF CHINA)	**Approx. value of the services provided by your firm under the contract:** 45,000.00 €
Start date (month/year): 01/2006 **Completion date** (month/year): 03/2009	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** 150
Name of joint venture partner or sub-Consultants, if any: N/A	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Davide Russo, PhD – **Project Manager** Eng. Christian Marson, PhD – **Hydraulic expert** Eng. Luca falcomer, PhD – **Sanitation expert**

Narrative description of Project:

The overall objective of the study is the **sustainable improvement** of **life** and **sanitary conditions** of the Shichahai lakes in Beijing urban area through a **SANITATION PLAN**. The Sanitation Plan covers stormwater drainage, wastewater collection and treatment. The study is part of a wider project aiming at understanding the causes of **water quality deterioration** in the Shichahai Lakes which surround the Forbidden city in Beijing. Through **field investigation** and **water quality model building** the consultant has identified the main reasons of lake **pollution** and has produced **different scenarios** that **mitigate the problems**, analysing the **environmental impact** in terms of **physical**, **chemical**, **biological components**. Each **scenario** has been analysed in terms of **costs** and **benefits** (CBA) in order to provide a valuable decision support tool for the identification of the best solution. The Beijing Environmental Protection Bureau (EPB) agreed to proceed with the implementation of the solutions identified at Master Plan and Feasibility Study levels and implement a pilot project consisting of the **detailed design** and **construction** of a **WWTP** positioned in Qianhai lake. The WWTP was built in the typical style of the old Beijing constructions. The construction of the works has been supported by a monitoring campaign that consented to evaluate the physical and chemical processes in the lakes throughout the year and provide the basis for the optimization of the newly installed treatment works and the evaluation of the costs and benefits of the rehabilitation of the whole lakes system. The tools developed throughout the project, namely the mathematical model, database and monitoring network, has been supplied to Beijing EPB and **training courses** has been held with the relevant local experts to make sure they are autonomous in the application of these instruments following project's completion.

Description of actual services provided in the assignment:

- Site visits, **data collection** and analysis; Water quality survey and assessment;
- Design and implementation of the water quality and quantity monitoring system;
- Development of the **hydraulic modelling** (1D – 2D) of the system and the **water quality model** for the lake;
- Capacity building and training on the hydraulic modelling;
- **Master Plan** and **Feasibility Study** of the possible water treatment facilities/technologies; Hydraulic modelling support to the **Detailed Design** of the **WWTP**; Hydraulic modelling support to the Plant Operation and Monitoring.

** Pictures taken from the project outputs delivered by Idrostudi srl*

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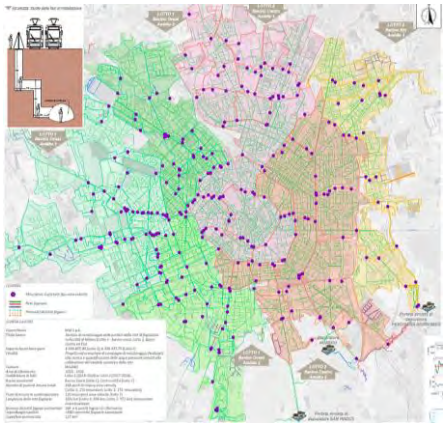
34149 Trieste (TS) – ITALY - P.IVA 01039560329

Assignment name: Framework Agreement: Consultancy services for the **Integrated Water Cycle Management** in the sectors of **stormwater** and **wastewater**.	**Approx. value of the contract:** 1,346,800.00 €
Country: ITALY **Location within country:** Whole Country	**Duration of assignment (months):** 36
Name of Client: BM Tecnologie Industriali S.r.l.	**Total Nº of staff-months of the assignment:** 125 staff-months
Address: Via Dell'Industria 12 - 35030 RUBANO (PD), ITALY	**Approx. value of the services provided by your firm under the contract:** 1,346,800.00 €
Start date (month/year): 01/2017 **Completion date** (month/year): 12/2019	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** N/A
Name of joint venture partner or sub-Consultants, if any: N/A	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Luca Falcomer, PhD – **Project Manager** Eng. Mauro Castellarin, PhD – **Hydraulic Engineer** Eng. Davide Russo, PhD – **Hydraulic Engineer** Eng. Fabiana Cavazzon – **Hydraulic Engineer** Eng. Francesca Zanello, PhD – **Environmental Engineer** Eng. Gianfranco Tamburi – **Hydraulic Modeller** Eng. Enrico Murari, PhD – **Hydraulic Modeller**

Narrative description of Project:



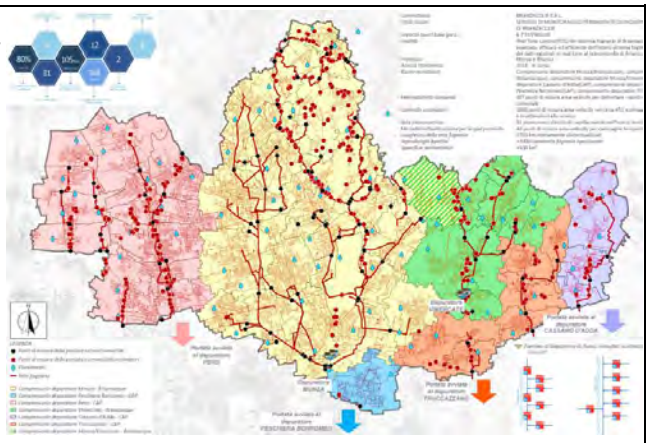
STORM SEWER. Urbanisation is clearly underway in the Italian peninsula, and human settlement patterns are becoming more complex and more interconnected. Where **rainfall intensity** and **flooding increase**, **climate change** will impose additional costs on **stormwater drains**, dams, and levees, and may render certain areas uninhabitable. **Flooding may damage sewers**. In cities with combined stormwater and sewage systems, flooding may overwhelm treatment facilities and create public health risks. **Recurring floods** and the **lack of proper drainage** systems is **increasing the damage to physical assets** as well as the **number of people affected**. Cities located near water bodies may be at risk of climate change-related disasters (e.g. Venice concerning the exceptional tide peaks that occur periodically in the northern Adriatic Sea).

SANITARY SEWER. Urban wastewater represents a significant **pollution load**. Where **sanitation facilities** are **inadequate** or **absent**, all available channels become a means for wastewater disposal. Urban wastewater becomes particularly **hazardous** when **mixed with untreated industrial waste**, a common but dangerous practice in some parts of the peninsula. In some settlements greywater – water from bathing, laundry, washing, which might be reused without treatment for some purposes – is channelled into drains, where it **mixes with polluted stormwater**, solid wastes before entering natural water bodies. Additional problem refers to groundwater, illegally discharged drainage water, or rainwater flowing into a sanitary sewage causing additional costs in treatment (the so-called **extraneous water**).

In response to such threats, **Water Utility Industry** is revisiting conventional practices as it searches for efficient ways to ensure human wellbeing while safeguarding the integrity of the resource base as well as the **ecosystem** and **environment**. The answer is changing the approach toward an Integrated Urban Water Management (**IUWM**). The Italian Water Utility Industry calls for the alignment of urban development and basin management to achieve **sustainable economic**, **social**, and **environmental goals**.

The industrial Client (BM Tecnologie Industriali) supports the Italian Water Utility Industry by **developing** and **providing software** and **gauging/monitoring devices** to **improve** the **water collection** and **treatment**. BM has been looking for an experienced consulting engineer specialized in the **sanitation sectors** with skills in the field of IUWM. Idrostudi has been engaged by BM within a **FRAMEWORK AGREEMENT** in order to **create a robust knowledge base** to assist municipal actors in **addressing wastewater** and **stormwater challenges**. The

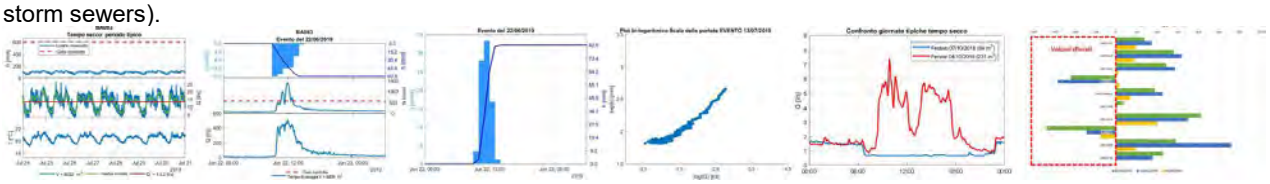
activities performed by Idrostudi supported the Client, thus the Water Utility Industry, to **improve the resilience** of **existing networks** and the **design** of **new** and **expansion networks** by means of **IUWM approaches**.



One of the main outcomes of the Framework Agreement was the development of a dashboard for managing and monitoring the sewage networks called **CHANNELGUARD** with the strong involvement of the R&D Department of Idrostudi. The latter is a tool, directly **developed by Idrostudi**, for the **management of monitoring systems** and the **assessment of the sewage network.** The software is capable to manage both the **sanitary sewers** (carrying **household**, **industrial**, and **commercial wastewater**) and the **storm sewers** (carrying **runoff** from **rain** or **snow)** as well as the combined sewers (carrying both kinds of water).
The Technology readiness level (TRL) representing the software maturity refers to a level 7 out of 9.

CHANNELGUARD provides comprehensive engine for modelling complex hydrology, advanced hydraulics in both open and closed conduits for urban drainage systems, storm water sewers and sanitary sewers. It includes **geo-spatial data access**, **visualization**, **interrogation** and **analysis**. The web-based software gathers **automatically**, and in **real-time**, the network data (pressure and levels) by the SCADA systems connected with a server via GSM-GPRS.

By means of internationally recognized algorithms, the software provides in real-time information on the network to monitor/managing the **behaviour** and the **working status** of a **sewage network in continuous** (**RTC** – Real Time Control). The software is supported by a GIS system that allows easy management of cartographic elements displaying the network data where enquired. The software can provide the **flow rates** and **volumes** for every single measured point within a sewage network delivering water balances considering different concentration times. The software is capable to manage **data** coming from **rain gauges** in order to **correlate rainfall events with flooding** that could take place in the sewer networks. The software features full hydraulic modelling capabilities including modelling of sewer pipes and canals, pumps, pump stations, trunks, weirs, orifices, valves in order to study: the **return periods** for **overloading** of various parts of an existing sewer system / the **main causes** of the overloading (insufficient local pipe capacity, backwater, cracks, …) / the impact of by **changing the operational sewerage strategy /** definition of the investment priority (**network rehabilitation**, **renewal or expansion**, …).
Additionally, in the stormwater and sanitary water networks analysed by BM with their installed instruments and devices, Idrostudi performed **hydrological calculation** on basin catchments, carried out **hydraulic modelling** to study the **behaviour** of the **storm and sanitary networks**, calibrates the network **gauging stations**, performs **field tests** on the networks, defined baselines study for the networks, defined the geographic areas served by a common sewer and stormwater system (**CSO basin definition**), estimated the Combined Sewer Overflows (**CSO estimation**), defined the **design storm event**, assessed the flows of **extraneous water** into a wastewater conveyance system from sources other than a sanitary sewer connections (such as roof leaders, basement drains, manhole covers, and cross-connections from storm sewers).



Description of actual services provided in the assignment:

- **Data collection** and analysis; **topographical surveys**, **networks surveys**; networks **GIS**;
- BASELINE establishment;
- **Extraneous flows surveys** and **analysis**;
- **Hydrological modelling;**
- **Hydraulic modelling** of the WW networks; **Software** development and testing;
- Defining solutions to improve **improve/optimize** the **WW networks (use of NBS)**;
- Training and **capacity building** through close involvement with water utilities and specialists during system development, and through training and legacy systems.

** Pictures taken from the project outputs delivered by Idrostudi srl*

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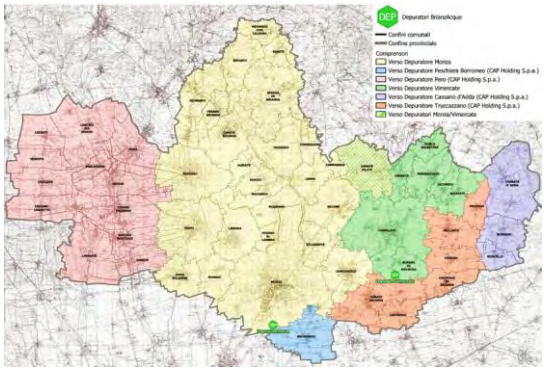
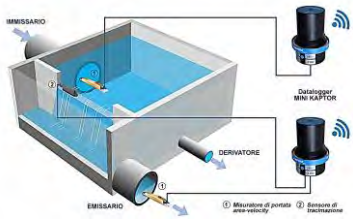
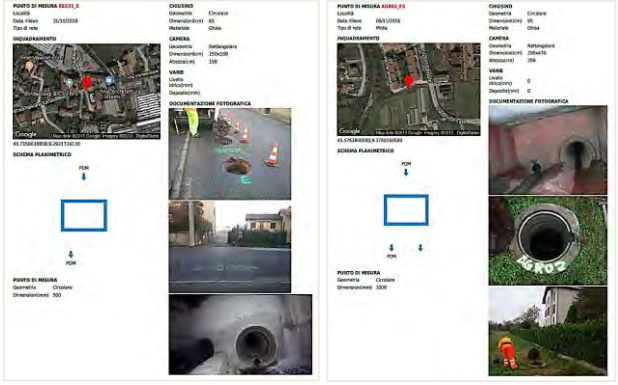
Assignment name: Consultant Service for the **continuous monitoring** of the whole **sewerage networks** managed by BrianzaAcque srl	**Approx. value of the contract:** 6,851,194.68 €
Country: ITALY **Location within country:** Milan (MI), Monza-Brianza (MB)	**Duration of assignment (months):** **1st Phase (Survey+Modelling):** 13 months **2nd Phase (Monitoring):** 60 months
Name of Client: BrianzaAcque srl.	**Total Nº of staff-months of the assignment:** 738
Address: via Enrico Fermi n. 105 – 20900 Monza (MB), ITALY	**Approx. value of the services provided by your firm under the contract:** 706,000.00 € (Partner 10.30%)
Start date (month/year): **1st Phase (Survey + Modelling):** 11/2018 **2nd Phase (Monitoring):** 12/2019 **Completion date** (month/year): **1st Phase (Survey + Modelling):** 12/2019 **2nd Phase (Monitoring):** Expected end 12/2024	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** 662 person-months
Name of joint venture partner or sub-Consultants, if any: BM Tecnologie Industriali Srl (IT) – Supplier of the instruments for monitoring.	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Mauro Castellarin, PhD – **Project Manager** Eng. Davide Russo, PhD – **Team Leader** Eng. Alex Stefani – **Hydraulic Modeller** Eng. Marco Simon Ostan – **Hydraulic Modeller** Eng. Gianfranco Tamburi – **Hydraulic Modeller** Eng. Fabiana Cavazzon – **Hydraulic Engineer**

Narrative description of Project:



The province of Monza and Brianza is an administrative province of Lombardy region in North Italy. The water utilities BrianzaAcque srl manages the **Integrated Water Service cycle** covering a total of 56 Communes of the province for a total of about **879.200 inhabitants** served. The Drainage and WasteWater network of the communes refers to a "**combined sewer**" (stormwater pipes + sanitary sewers). The water utility decided to plan **strategic** and **real-time control** of the **entire sewage networks** infrastructure in order to overcome inefficiency, blockages, ageing and structural problems.





The project covers **2,760 km** of **sewerage network** (**residential**, **commercial** and **industrial areas**). The Idrostudi's contribution was focused on **extensive** and **detailed networks surveys**, the provision of the **hydraulic modelling** and the **design** of the **monitoring systems** to **improve the network efficiency reducing the criticality**. The project is divided into 2 phases.

The first one refers to the **analysis** of the **current situation** of the system by means of an extensive **topographical survey** of the **entire network:**

- survey of **4,165 weirs**;
- survey of **26,000 manholes**;
- **video inspection** (**>150km**) in order to get the proper picture of the collecting system;
- more than **1,000 sewage measurement points** have been installed;
- **123 pluviometers** installed (1 station / 5km²);
- n°**155 flow measurements** carried out.

All data collected are managed by a **web-based platform**. A database in **GIS** and **CAD** has been established. The phase also concerned the collection of data in relation to the drainage catchments including **rainfall distribution data**.

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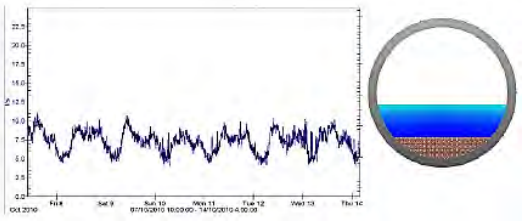
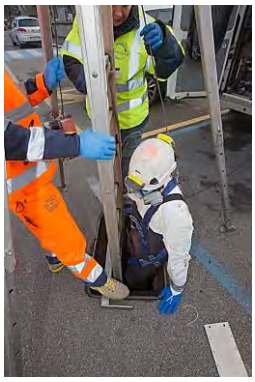
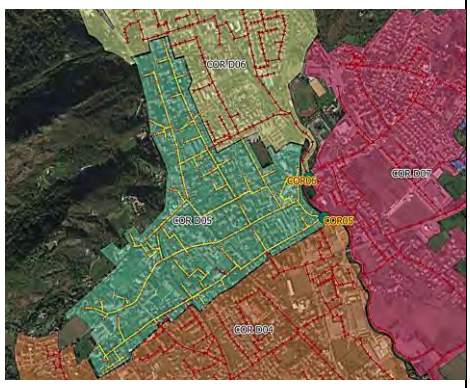
Within the first phase Idrostudi developed the **hydrological analysis** (rainfall-runoff modelling) and the **hydraulic modelling** of the current network status in order to define the baseline condition. The **definition of the geometry of the network** modelled was performed according to the information collected with the above surveys and information.



The hydraulic modelling carried out evaluated the following:

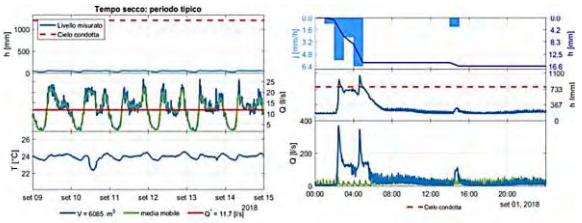
- the average, min and max **non-storm flow** over 24 hours during the **dry months** of the year. It is composed of the average sewage flow and the average dry weather inflow/infiltration
- the average, min and max **flow** over 24 hours during the **wet months** of the year on days when no rainfall occurred on that or the preceding day;
- functional analysis of the sewerage weirs;
- the **base flow**. Wastewater flow (including a reasonable amount of inflow and infiltration) originating from residential, commercial and industrial sources;
- presence of sediment in the pipes.





Additional analysis carried out by Idrostudi refers to groundwater, illegally discharged drainage water, or rainwater flowing into a sanitary sewage causing additional costs in treatment (the so-called **extraneous water**). In order to identify the extraneous flows in the sewer systems and define the necessary operations for their control and reduction, the realization of a measurement campaign of the flows in the sewer network has been designed and arranged by Idrostudi.

The first phase involved also the installation of the designed monitoring system provided by the Lead partner (BM Tecnologie Industriali Srl (IT).



The second phase covers the monitoring of the network by providing quarterly reports on the network behaviour based on the information collected from the installed instruments.

Description of actual services provided in the assignment:

- **Data collection** and analysis;
- **Topographical surveys**, **drainage** and **wastewater network surveys**;
- **Stakeholder engagement/information/consultation** throughout the project;
- **Extraneous flows detection**;
- BASELINE establishment;
- web-based platform design;
- **GIS** database;
- CAD implementation;
- **Hydrological modelling**;
- **Hydraulic** and **numerical modelling** of the **stormwater** and **wastewater network**;
- Continuous monitoring system design;
- Execution of **hydraulic monitoring campaigns** and **field test**;
- Knowledge Transfer and **Capacity Building Program**.

** Pictures taken from the project outputs delivered by Idrostudi srl*

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Assignment name: **Urban StormWater & WasteWater Management Plans** of municipalities of Mantova province (IT).	**Approx. value of the contract:** 1,434,764.00 €
Country: ITALY **Location within country:** Mantova (MN)	**Duration of assignment (months):** 24
Name of Client: Tea Acque s.r.l. & AqA Mantova S.r.l.	**Total Nº of staff-months of the assignment:** 154
Address: via Taliercio 3, 46100 Mantova (MN), ITALY	**Approx. value of the services provided by your firm under the contract:** 864,047.91 € (Leader 60,22%)
Start date (month/year): 09/2018 **Completion date** (month/year): 09/2020	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** 61 person-months
Name of joint venture partner or sub-Consultants, if any: Datek22 Srl (IT) – Partner Geocomp Srl (IT) – Partner	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Mauro Castellarin, PhD – **Project Manager** Eng. Christian Marson, PhD – **Team Leader** Eng. Davide Russo, PhD – **Hydraulic Expert** Eng. Marco Simon Ostan – **Hydraulic Modeller**

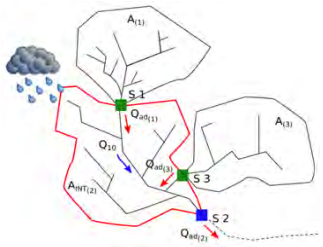
Narrative description of Project:

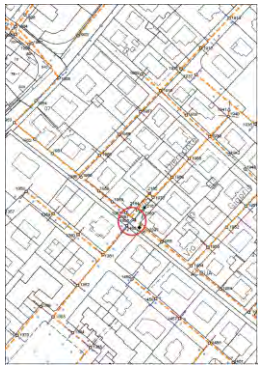
The water utilities Tea Acque s.r.l. & AqA Mantova S.r.l., part of TEA Group, manages the **Integrated Water Service cycle** of Mantova and 41 communes of the province for a total of about **274,700 inhabitants served**. Tea Acque s.r.l. & AqA Mantova S.r.l. guarantee the supply of water and the entire range of services regarding water treatment for potable water (WTP), wastewater collection and related treatment (WWTP). The system includes **40 treatment plants** and **363 pumping stations** for the **urban drainage** and **wastewater management**.

Due to rapid urbanization and increase in-built up areas some parts of the networks are inadequate. Additionally, no proper and time-sensitive maintenance are leading to no plans and designed system alleviation measures that consider fast urbanization trend.

The Group intends to **improve** the **management** of the **urban drainage** and **wastewater network systems** by adopting comprehensive **Management Plans** to **better manage urban drainage** and **wastewater collection** with aim **of protecting infrastructure, preventing economic losses, improving local environment and public health,** supporting the **economic development** of the **industrial areas**.

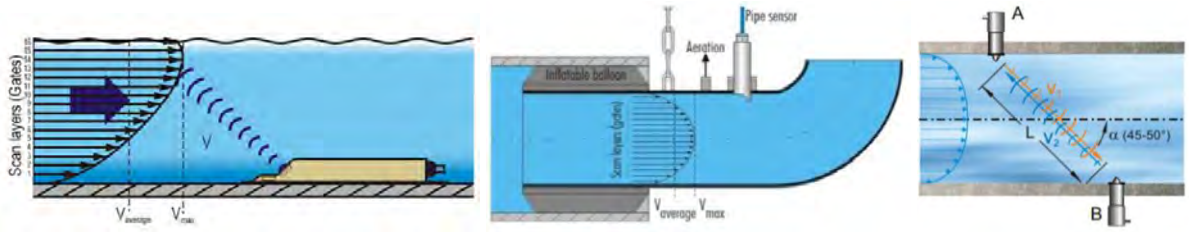
The Idrostudi's contribution to the definition of the **Urban StormWater & WasteWater Management Plans** is focused on **extensive** and **detailed networks surveys**, the provision of the **hydraulic modelling** and the **design** of **structural** and **non-structural measures** to **improve the network efficiency reducing the criticality**.





The StormWater & WasteWater network of the municipalities refers to a "**combined sewer**" (storm water pipes + sanitary sewers). Idrostudi is surveying/modelling a total extension of about **750 km of pipes**, **21,290** among **manholes** and **manhole inverts**, **790 sewer weirs**, **305 pumping stations**. Istrostudi is performing a hydrological analysis (rainfall-runoff modelling) using SWMM (Storm Water Management Model). The StormWater & WasteWater networks are then being modelled with InfoWorks ICM (**integrated modelling platform** to incorporate both **urban** and **drained catchments**). With full integration of 1D and 2D **hydrodynamic simulation** techniques, both the **above-and below-ground elements** of catchments are being modelled to accurately represent all flow paths. The **definition of the geometry of the network** modelled is performed according to the information collected with the above surveys.

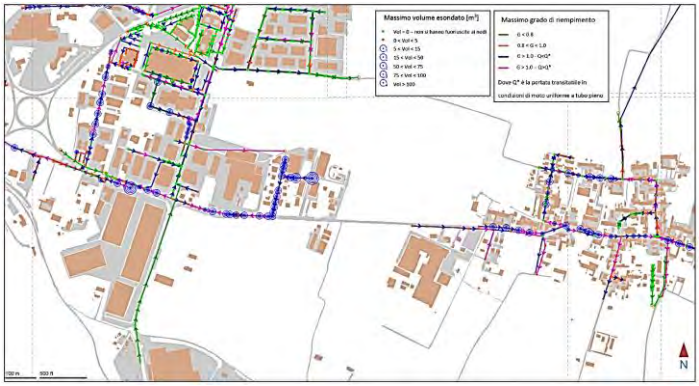
In order to calibrate properly the hydraulic model, a monitoring campaign is being carried out by means of **11 area-velocity gauging points** within the network and **3 rainfall stations in the drained catchments**. The **data collected during the monitoring campaign** is being used first to **calibrate** and then to **validate** the **numerical model** of the sewer system. The calibrated model is being used to **simulate synthetic rain events (stormwater event)**, characterized by a given return time, in order to **identify** the **critical stretches or artefacts of the sewer system** and identify/**design the solutions** that can possibly **reduce the risk of overflow hence increase the sewer system environmental sustainability.**



Description of actual services provided in the assignment:

The Idrostudi's contribution to the definition of the **Urban StormWater & WasteWater Management Plan** was focused on **extensive** and **detailed networks surveys**, the provision of the **hydraulic modelling** and the **design structural** and **non-structural measures** to **improve the network efficiency reducing the criticality**.

- **Data collection** and analysis; **topographical surveys**, **stormwater** and **wastewater network surveys**;
- **Stakeholder engagement/information/consultation** throughout the project;
- BASELINE establishment;
- Execution of **hydraulic monitoring campaigns** and **field test**;
- **Hydrological modelling**;
- **Hydraulic** and **numerical modelling** of the **stormwater** and **wastewater network**;
- **Design** of **structural** and **non-structural measures (use of NBS/SUDS)**;
- **BoQ** and **cost estimates**;
- **Technical specification** and **Tender Documents**;
- Scheme management and maintenance plan (**O&M**);
- Knowledge Transfer and **Capacity Building Program**.



** Pictures taken from the project outputs delivered by Idrostudi srl*

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Assignment name: Framework Contract: Consulting Services for hydrological-hydraulic studies, flood hazard and risk assessment for railways infrastructure and appurtenance structures, including topographical and geomorphological studies – Lot 7, Lot 8 and 10	**Approx. value of the contract:** 1,920,000.00 €
Country: ITALY **Location within country:** Bologna, Florence, Milan	**Duration of assignment (months):** 24
Name of Client: RFI S.p.A. – Italian State Railways Group	**Total № of staff-months of the assignment:** 210
Address: Piazza della Croce Rossa, 1 - Roma (ITALY)	**Approx. value of the services provided by your firm under the contract:** 864,000.00 € (Leader JV 45%)
Start date (month/year): 01/2020 **Completion date** (month/year): Expected end 01/2022	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** 114
Name of joint venture partner or sub-Consultants, if any: Techproject S.r.l. (IT) – Partner I.T. S.r.l. – Partner E.T.S. S.r.l. – Partner	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Luca Falcomer, PhD – **Team Leader** / **Project Manager** Eng. Christian Marson, PhD – **Hydraulic constructions** Eng. Davide Russo, PhD – **Hydraulic expert** Eng. Francesca Zanello, PhD – **Hydrological expert** Eng. Marco Simon Ostan – **Hydraulic Modeller**

Narrative description of Project:

RFI – Rete Ferroviaria Italiana, a company belonging to the Italian State Railways Group – has the public role of Infrastructure Manager, responsible for management and for safety of the rail traffic on the whole national network, track, stations and installations. In its role of Infrastructure Manager, RFI allows the access to the railway network to Railway Undertakings (RU), performs the maintenance, manages the investments for the upgrading of railway lines (High Speed and Conventional) and the technological development. On the international side, RFI promotes the integration of the Italian infrastructure in the European railway network and cooperates with other European Infrastructure Managers. At January 2015, operational lines are more than 16,700 km long; more than 11,900 km of it are electrified and over 7,500 km are double track. Stations active for customer service are almost 2,100 km.

In this context Idrostudi's has been awarded a **Framework Contract** covering the major Italian railways lines in Bologna, Florence and Milan in order to carry out **hydrological-hydraulic analysis** and **design hydraulic infrastructure serving** and **protecting** the lines. Railways affect the natural surface and subsurface drainage pattern of a watershed or individual hill slope. Idrostudi is in charge for **studying** and **designing solutions** for the **reduction** and/or **elimination** of **energy generated by flowing water**, **improving** the **drainage** and **removing** the **risk of floods** caused by the rail lines.

Idrostudi is carrying out **topographical** rivers/channels **surveys**, hydraulic structures **census**, elaboration of **hydrological-hydraulic analysis** and **modelling** (including **climate change projection analysis**) of river catchments by means of **rainfall-runoff modelling** for the **definition** of the **areas prone to flooding** for different return periods (30, 100, 200, and 500-year), **flood hazard analysis** and **flood risk assessment** (FRA) and **mapping**. The 1D-2D hydraulic modelling is being carried out by means of numerical modelling with and without flood mitigation measures in place in order to study the **effectiveness** of the **measures for flood risk reduction**.

Additionally, Idrostudi is carrying out evaluations relating to the **fluvial dynamics** by studying the **trend** of **riverbed evolution by** the **geomorphological** point of view. The activity comprises: riverbed grain size assessment, **geomorphological modelling**, suspended sediment and bedload transport analysis. The outcomes of the latter activities are also being used to estimate the piers, piles and abutments **scour** of bridges or river-transversal structure.

The Framework Contract additionally asks to develop a proper design of the catchment drainage systems involving rivers and channels networks as well. The **drainage schemes** involve the design of **inlets** for **stormwater collection**, **storm sewers**, **open channels** (trapezoidal or V-shaped ditches), reinforced concrete **culverts**, rivers and channels **slopes improvement, thalweg lowering, rivers cross-sections enlargement and improvement, bridge pier/abutment scour evaluation and protection.**

Description of actual services provided in the assignment:

- Project management, coordination and collaboration with Ministries and subordinated agencies involved;
- **Stakeholder information** and **consultation** throughout the project;
- Institutional and Legal framework assessment (relating to the flood risk management) pertinent case by case;
- **Data collection** and analysis (previous or existing hydrologic studies, historical data, collection of rainfall depth data at several rain gauge stations, collection of water levels and flows (where available) of the existing rivers/channels crossed by the rail lines, …);
- **Topographical surveys**, **bathymetric surveys, river cross sections surveys**;
- **Remote sensing** analyses by means of airborne LiDAR surveys to obtain DTM, DSM;
- **GIS-CAD design**;
- **Soil investigations** (riverbed sediment sampling and determination of the physical-chemical characteristics of the soil);
- **Geomorphological analysis** of complex drainage systems for **watersheds definition**;
- **Sediment transport** analysis;
- **Historical flood** data analysis (Preliminary Flood Risk Assessment - **PFRA**);
- **Hydrological modelling**; **Peak flow estimation** for **different period of occurrence**;
- **Hydraulic modelling (1D-2D);**
- Railway platform cross-drainage systems assessment and improvement;
- **Flood hazard mapping;**
- **Flood Risk Assessment** (**FRA**) and **mapping;**
- River long profiles with different return periods plotted;
- Calculation of Expected Annual flood Damages (**EAD**) for the appraisal of flood risk management options;
- Identification of **structural measures** to reduce flood risk and protect the railway structures;
- **Hydraulic** and **structural design** of standard solutions for crossing works (ditches, culverts, pipes, ...) with rivers and channels;
- **BoQ** and **cost estimates**;
- **Technical specification**.

** Pictures taken from the project outputs delivered by Idrostudi srl*

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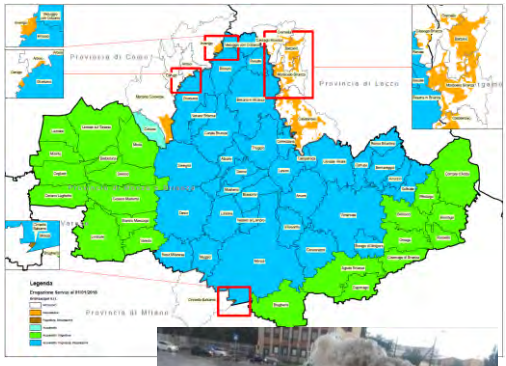
Area Science Park, Padriciano 99
34149 Trieste (TS) – ITALY - P.IVA 01039560329

Assignment name: **Drainage and Wastewater Management Plans** for 41 communes managed by BrianzaAcque srl by means of hydraulic modelling.	**Approx. value of the contract:** 830,566.43 €
Country: ITALY **Location within country:** Milan (MI), Monza-Brianza (MB)	**Duration of assignment (months):** **1st Phase:** 18 months **2nd Phase:** 30 months
Name of Client: BrianzaAcque srl.	**Total Nº of staff-months of the assignment:** 89
Address: via Enrico Fermi n. 105 – 20900 Monza (MB), ITALY	**Approx. value of the services provided by your firm under the contract:** 250,000.00 € (Partner 30%)
Start date (month/year): **1st Phase:** 10/2016 **2nd Phase:** 11/2018 **Completion date** (month/year): **1st Phase:** 12/2017 **2nd Phase:** Expected end 04/2021	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** 63
Name of joint venture partner or sub-Consultants, if any: J+S Srl (IT) – Leader Studio SPS Srl (IT) – Partner Ingegnerie Toscane Srl (IT) – Partner	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Mauro Castellarin, PhD – **Project Manager** Eng. Davide Russo, PhD – **Team Leader** Eng. Alex Stefani – **Hydraulic Modeller**

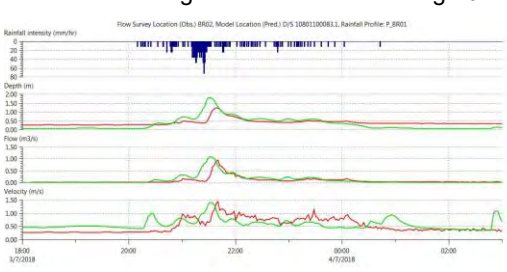
Narrative description of Project:



The province of Monza and Brianza is an administrative province of Lombardy region in North Italy. The water utilities BrianzaAcque srl manages the **Integrated Water Service cycle** covering a total of 56 Communes of the province for a total of about 879.200 inhabitants served. The Drainage and WasteWater network of the communes refers to a "**combined sewer**" (stormwater pipes + sanitary sewers). The water utility decided to draft the **Drainage and Wastewater Management Plans** for the entire sewerage networks of belonging, including the surface drainage networks, as the networks suffer from inefficiency, blockages, ageing and structural problems. Additionally, some **areas are still not served** by the system of drainage and wastewater collection.

The project cover **41 communes** for a total of **848,200 people served**, a catchment area of 405 km² and **2,760 km** of **drainage** and **wastewater network** (**residential**, **commercial** and **industrial areas**). The Idrostudi's contribution to the definition of the **Drainage and Wastewater Management Plans** was focused on **extensive** and **detailed networks surveys**, the provision of the **hydraulic modelling** and the **design** of **structural** and **non-structural measures** to **improve the network efficiency reducing the criticality** by **Master Planning** the interventions that are **environmentally sustainable.** The project is divided into 2 phases.

The first one refers to the analysis of the current situation of the system by means of an extensive **topographical survey** of the **entire network** (**sub-surface pipes**, **surface drainage network including cross sections, culverts, bridges, weirs of channels and rivers**) and **video inspection** in order to get the proper picture of the structural problems (**blockages**, **cracks** on the pipes, etc.) affecting the network. A database in **GIS** and **CAD** has been established. The phase also concerned the data collection of information related to the drainage catchments including **rainfall data**, **DTM**, **LiDAR survey**, land use, soil type. Within the first phase Idrostudi developed the hydrological analysis (rainfall-runoff modelling) and the hydraulic modelling of the current network status in order to define the baseline condition. The Drainage and



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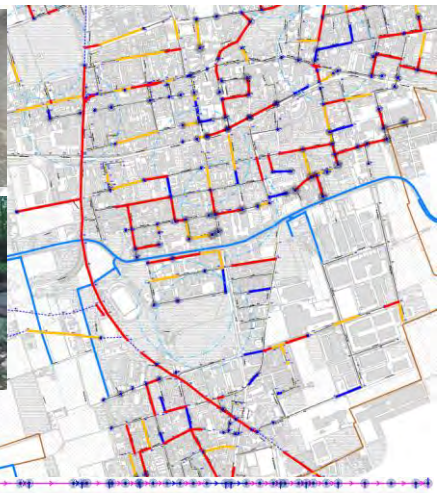
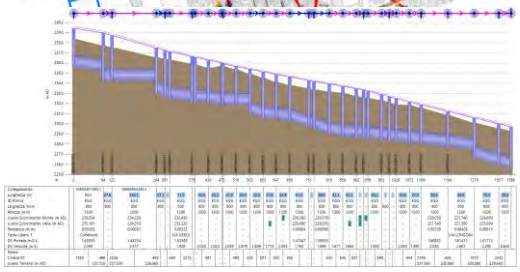


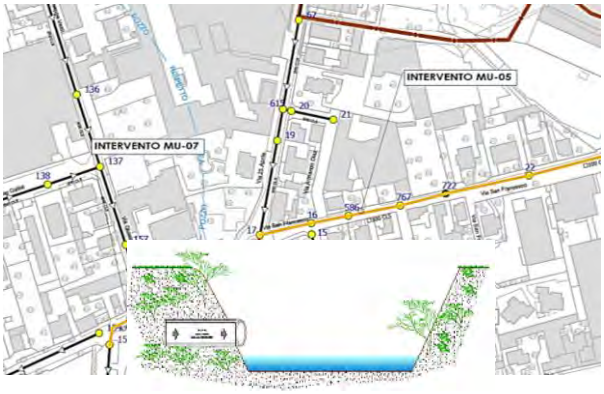
Wastewater networks have been modelled with InfoWorks ICM (**integrated modelling platform** to incorporate both **urban** and **drained catchments**). With full integration of 1D and 2D **hydrodynamic simulation** techniques, both the **above-and below-ground elements** of catchments were modelled to accurately represent all flow paths. The **definition of the geometry of the network** modelled was performed according to the information collected with the above surveys and information. In order to **calibrate** and **validate** properly the hydraulic model, a monitoring campaign was carried out by means of **11 area-velocity gauging points** within the network and **3 rainfall stations in the drained catchments**. The **data collected during the monitoring campaign** were used firstly to **calibrate** and then to **validate** the **numerical model** of the drainage sewer system. The calibrated model was used to **simulate synthetic rain events (stormwater event)**, characterized by a given return time (**10**, **50**, **100 years**), in order to **identify** the **critical stretches or artefacts of the sewer system**.



The second phase covers the study and identification of the **structural** and **non-structural measures** to **improve** and **better optimize** the **Drainage and Wastewater systems**. The measures are being studied by means of **Cost/Benefit** analyses and are being **prioritised** in order to produce a **phased investment programme** (short, medium and long term measures) for the entire network to give the overview for the necessary investment to decision makers. The method for prioritisation is taking account different aspects including the urgency of the measures and the magnitude of the hazard/risk associated with each measure. The effectiveness of the measures is being modelled and verified by means of hydraulic modelling.

It worth to mention that all the modelling and design is being carried out in strong relationship with the current **Urban Plans** and future projections of the 41 Communes. Only in this way is possible to obtain Drainage and Wastewater Management Plans **integrated** at **catchment level**.

Description of actual services provided in the assignment:



The Idrostudi contribution to the definition of the **Drainage and Wastewater Management Plans** is focused on the provision of the **hydraulic study** and the **design of the drainage and wastewater structure**. The model and design include **pumping stations**, **overflow weirs**, **non-return valves**, **new pipes** and **drainage network**, **rectangular** and **circular culverts**, etc.

- **Data collection** and analysis; **topographical surveys**, **drainage** and **wastewater network surveys**;
- **Stakeholder engagement/information/consultation** throughout the project;
- BASELINE establishment;
- Execution of **hydraulic monitoring campaigns** and **field test**;
- **Hydrological modelling**;
- **Hydraulic** and **numerical modelling** of the **drainage** and **wastewater network**;
- **Design** of **structural** and **non-structural measures (use of NBS/SUDS)**;
- **BoQ** and **cost estimates**;
- **Technical specification** and **Tender Documents**; Scheme management and maintenance plan (**O&M**);
- Knowledge Transfer and **Capacity Building Program**.

** Pictures taken from the project outputs delivered by Idrostudi srl*

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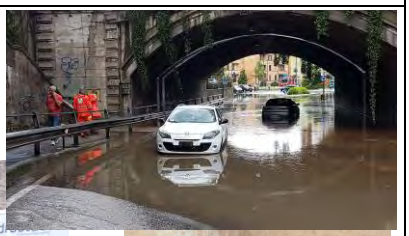
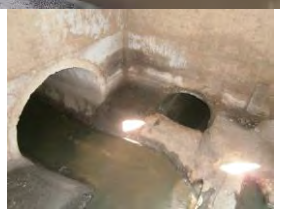
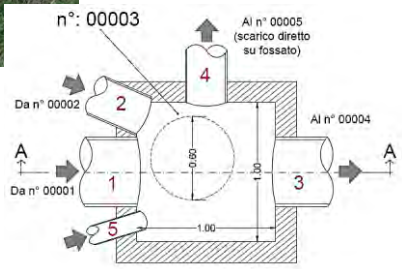
34149 Trieste (TS) – ITALY - P.IVA 01039560329

Assignment name: **Urban StormWater & WasteWater Management Plan** of Cremona (IT).	**Approx. value of the contract:** 1,530,261.81 €
Country: ITALY **Location within country:** Cremona (CR)	**Duration of assignment (months):** 12
Name of Client: Padania Acque S.p.A.	**Total Nº of staff-months of the assignment:** 165
Address: via del Macello n. 14 – 26100 Cremona (CR), ITALY	**Approx. value of the services provided by your firm under the contract:** 540,182.42 € (Leader 35.30%)
Start date (month/year): 07/2017 **Completion date** (month/year): 06/2018	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** 107
Name of joint venture partner or sub-Consultants, if any: BM Tecnologie Industriali Srl (IT) – Partner Datek22 Srl (IT) – Partner J+S Srl (IT) – Partner Geocomp Srl (IT) – Partner	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Mauro Castellarin, PhD – **Project Manager** Eng. Christian Marson, PhD – **Team Leader** Eng. Davide Russo, PhD – **Hydraulic Expert** Eng. Marco Simon Ostan – **Hydraulic Modeller**

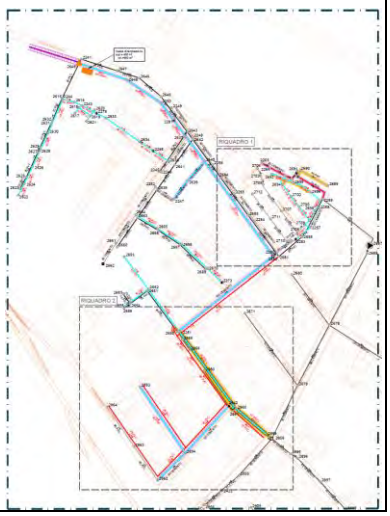
Narrative description of Project:







Cremona is one of the economic and political cities of north Italy with a total population of **360,000 inhabitants**. The rainfall regime is bimodal, with seasonal convective rainfall occurring mainly during the months of March – May (main rainy season) and October – December (secondary rainy season). Typical rainfall events are characterised by high intensities of short duration and high temporal and spatial variability which leads to pluvial flooding. Over the last 10 years there has been an **increase** in the **frequency**, **magnitude** and **duration** of **urban flash flooding** incidences in Cremona during or after occurrence of extreme convective rainfall events. This has been mainly attributed to a multiplicity of factors that include among others: (a) Impacts of **climate change** and **variability on urban rainfall patterns**; (b) Rapid **urban development** leading to very high increase urban imperviousness levels. The reduced capacity of **storm water channels** results in **frequent flooding** and loss of goods and assets. Padania Acque S.p.A. decided to draft the **Urban StormWater & WasteWater Management Plan** of Cremona, the document that summarizes the current hydraulic issues of the sewer system that collects the wastewater of Cremona and in which the **rehabilitation intervention for increasing the sewer system** resilience and performance are identified.

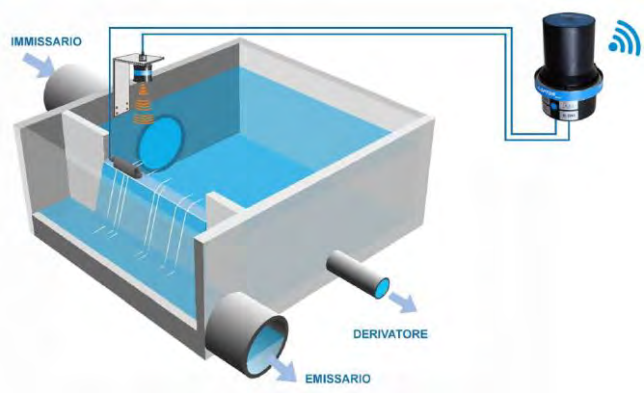


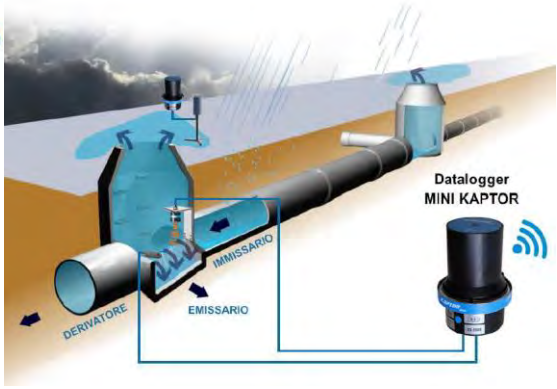
The Idrostudi's contribution to the definition of the **Urban StormWater & WasteWater Management Plan** was focused on **extensive** and **detailed networks surveys**, the provision of the **hydraulic modelling** and the **design** of **structural** and **non-structural measures** to **improve the network efficiency reducing the criticality**.

The StormWater & WasteWater network of Cremona refers to a "**combined sewer**" (storm water pipes + sanitary sewers). Idrostudi surveyed/modelled a total extension of about **750 km of pipes**, **21,290** among **manholes** and **manhole inverts**, **790 sewer weirs**, **305 pumping stations**. Istrostudi performed a hydrological analysis (rainfall-runoff modelling) using SWMM (Storm Water Management Model). The StormWater & WasteWater networks have then been modelled with InfoWorks ICM (**integrated modelling platform** to incorporate both **urban** and **drained catchments**). With full integration of 1D and 2D **hydrodynamic simulation** techniques, both the **above-and below-ground elements** of catchments were modelled to accurately represent all flow paths. The **definition of the geometry of the network** modelled

was performed according to the information collected with the above surveys.

In order to calibrate properly the hydraulic model, a monitoring campaign was carried out by means of **11 area-velocity gauging points** within the network and **3 rainfall stations in the drained catchments**. The **data collected during the monitoring campaign** were used first to **calibrate** and then to **validate** the **numerical model** of the sewer system. The calibrated model was used to **simulate synthetic rain events (stormwater event)**, characterized by a given return time, in order to **identify** the **critical stretches or artefacts of the sewer system** and identify/**design the solutions** that can possibly **reduce the risk of overflow hence increase the sewer system environmental sustainability.**

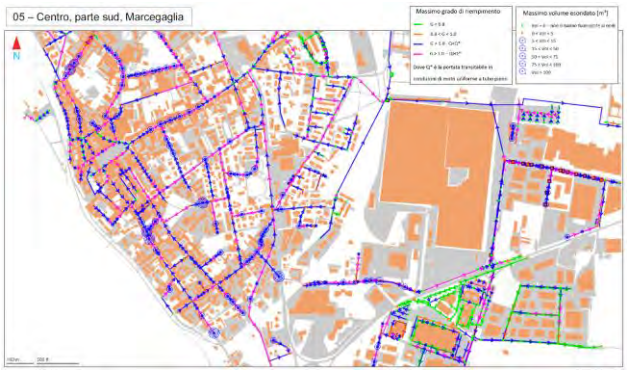




Description of actual services provided in the assignment:

The Idrostudi contribution to the definition of the **Urban StormWater & WasteWater Management Plan** was focused on the provision of the **hydraulic study** and the **design of the wastewater structure**. The model includes **pumping stations**, **overflow weirs**, **non-return valves**, etc.

The selected structural and non-structural measures that shall lead to an improvement in the sewer system performance were **modelled** and their **effectiveness** was tested. The **numerical simulations** confirm the efficiency of the **designed solutions.**



- **Data collection** and analysis; **topographical surveys**, **stormwater** and **wastewater network surveys**;
- **Stakeholder engagement/information/consultation** throughout the project;
- BASELINE establishment;
- Execution of **hydraulic monitoring campaigns** and **field test**;
- **Hydrological modelling**;
- **Hydraulic** and **numerical modelling** of the **stormwater** and **wastewater network**;
- **Design** of **structural** and **non-structural measures**;
- **BoQ** and **cost estimates**;
- **Technical specification** and **Tender Documents**;
- Scheme management and maintenance plan (**O&M**);
- Knowledge Transfer and **Capacity Building Program**.

** Pictures taken from the project outputs delivered by Idrostudi srl*

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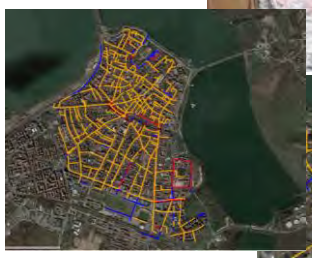
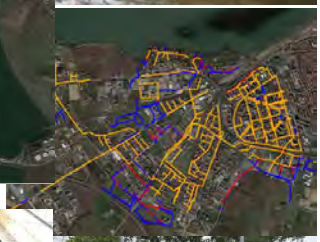
Assignment name: **Urban StormWater & WasteWater Management Plan** of the urban and peri-urban areas of Mantova (IT).	**Approx. value of the contract:** 64,780.00 €
Country: ITALY **Location within country:** Mantova (MN)	**Duration of assignment (months):** 17
Name of Client: Tea Acque s.r.l.	**Total № of staff-months of the assignment:** 10
Address: via Taliercio 3, 46100 Mantova (MN), ITALY	**Approx. value of the services provided by your firm under the contract:** 64,780.00 €
Start date (month/year): 07/2017 **Completion date** (month/year): 12/2018	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** N/A
Name of joint venture partner or sub-Consultants, if any: N/A	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Luca Falcomer, PhD – **Project Manager – Hydraulic Expert** Eng. Davide Russo, PhD – **Hydraulic design Team Leader** Eng. Marco Simon Ostan – **Numerical model team leader**

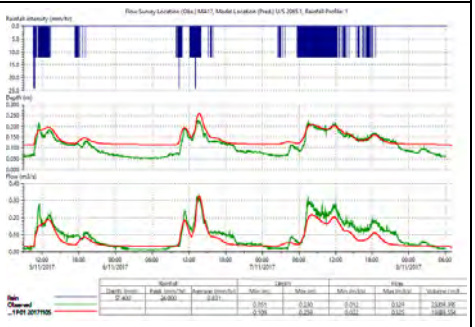
Narrative description of Project:





Mantova is a medium size city in the North West of Italy of about **122,300 inhabitants** (**urban** and **peri-urban areas**). The **wastewater network** has a total extension of about 190 km, divided in 114 km of **combined sewer**, 51 km of **storm water pipes**, and 25 km of **sanitary sewer**, whereas the drainage basin covers an area of about 10 km2. In 2017, Tea Acque srl decided to draft the **Urban StormWater & WasteWater Management Plans** of Mantova, the document that summarizes the current hydraulic issues of the sewer system that collects the wastewater of Mantova and in which the **rehabilitation intervention for increasing the sewer system** resilience and performance are identified. For this aim, the water company performed a **LIDAR survey** of the territory in order to obtain a very high resolution DTM (Digital Terrain Model) of the territory. The activities of the project included also a **monitoring campaign of the discharges collected by the sewerage system** and the contemporary **recording of the main precipitation events**. The data collected were used to calibrate and validate the **numerical model** that was designed and built during the second stage of the project. Finally, the calibrated hydraulic simulator was used to perform **scenario analysis** including the as built scenario, identifying the critical issues/portions and to understand in depth the **impact of the designed solutions aimed at augmenting the infrastructure resilience to extreme events**. In the last stage of the project, together with the Tea Acque staff, the interventions aimed at **improving the current state of the sewerage system** were identified and their effect on the whole system functioning checked via numerical simulation.

Description of actual services provided in the assignment:

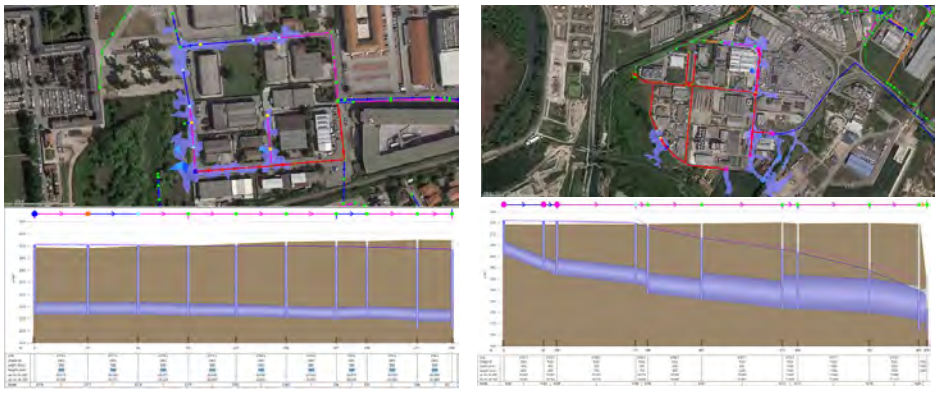


The Idrostudi contribution to the definition of the **Urban StormWater & WasteWater Management Plans** was focused on the provision of the **hydraulic study** and the **design of the wastewater structure**. The study included the **numerical modelling of the sewer system** and the **functional analysis of the network** with the identification **of the rehabilitation interventions** aimed at solving the hydraulic issues. The numerical modelling of the sewerage system of Mantova was performed using the software InfoWorks ICM 6.5 by Innovyze Ltd., the first truly **integrated modelling platform** to incorporate both **urban and river catchments**. Full two-dimensional (2D) **surface flood modeling** was employed across both the **wastewater** and **river components** of the model, providing more precise modelling of flows through complex geometries. With full integration of 1D and 2D **hydrodynamic simulation** techniques, both the **above- and below-ground elements** of catchments were modelled to accurately represent all flow paths. InfoWorks ICM enables the hydraulics and hydrology of natural and man made environments to be incorporated into a single model. The linking

of 1D river channels and 2D floodplain is carried out by means of lateral banks. The flow can pass between these two components at any location along the river, allowing real life conditions to be more accurately modelled.
The **definition of the geometry of the network** modelled was performed according to the information collected within a **detailed survey campaign** that covered **the whole sewer system**. The resulting geometry of the sewer network numerical model is characterized by a total pipe length of 190 km and 5350 junctions. The drained area has an extension of about 1000 ha, subdivided in pervious and mainly impervious areas. The model includes also **pumping stations**, **overflow weirs**, **non-return valves**, etc. The two-dimensional numerical model that represents the territory along the sewer network is based on a polygonal mesh, a mathematical representation of the soil surface. The description of the ground surface is very accurate since it is based on the detailed DTM that covers the whole simulation domain.

The **data collected during the monitoring campaign** were used first to **calibrate** and then to **validate** the **numerical simulator** of the sewer system and the eventual **overflows on the urban territory**.

The calibrated model was also used to **simulate synthetic rain events (stormwater event)**, characterized by a given return time, in order to **identify** the **critical stretches or artefacts of the sewer system** and identify/**design the solutions** that can possibly **reduce the risk of overflow hence increase the sewer system environmental sustainability**



The selected intervention that shall lead to an improvement in the sewer system performance were modelled and their effectiveness was tested. The **numerical simulations** confirm the effectiveness of the **designed solutions.**

- **Data collection** and analysis; **topographical surveys**, **StormWater** & **WasteWater networks surveys**;
- **Stakeholder engagement/information/consultation** throughout the project;
- **Hydrological modelling**;
- **Hydraulic** and **numerical modelling** of the **rivers system** combined with the **stormwater** and **wastewater network**;
- **Detailed designs** of priority works to be undertaken to **reduce the risk of urban and peri-urban overflow**;
- **BoQ** and **cost estimates**; Economic and Financial analysis (**EFA**);
- Development of Environmental and Social Impact Assessment (**ESIA**) and Right of Way (**RoW**) definition;
- **Technical specification** and **Tender Documents**;
- Scheme management and maintenance plan (**O&M**);
- Knowledge Transfer and **Capacity Building Program**.

** Pictures taken from the project outputs delivered by Idrostudi srl*

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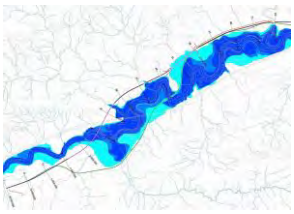
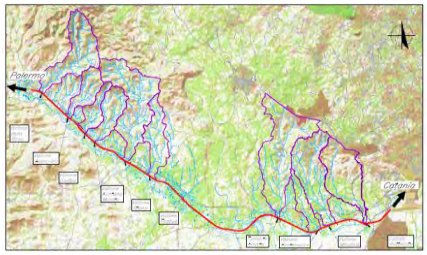
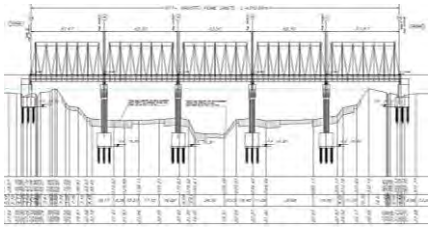
34149 Trieste (TS) – ITALY - P.IVA 01039560329

Assignment name: Framework Contract: Consulting Services for Feasibility Studies, Preliminary Designs and Detailed Designs of railways and roads infrastructure in relation to hydrology and hydraulic constructions.	**Approx. value of the contract:** 100,000.00 €
Country: ITALY **Location within country:** Whole Country	**Duration of assignment (months):** 24
Name of Client: ITALFERR S.p.A. - Italian State Railways Group	**Total № of staff-months of the assignment:** 12
Address: Via V. G. Galati, 71, 00155 Roma (ITALY)	**Approx. value of the services provided by your firm under the contract:** 100,000.00 €
Start date (month/year): 11/2015 **Completion date** (month/year): 11/2017	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** N/A
Name of joint venture partner or sub-Consultants, if any: N/A	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Davide Russo, PhD – **Team Leader** / **Project Manager** Eng. Christian Marson, PhD – **Hydraulic constructions** Eng. Luca Falcomer, PhD – **Hydraulic expert** Eng. Francesco Peratoner – **Hydrological expert** Eng. Marco Simon Ostan – **Hydraulic Modeller**

Narrative description of Project:







ITALFERR S.p.A. – a company belonging to the Italian State Railways Group – operates throughout Italy and abroad, providing engineering services in the field of conventional and high speed railways and other transport infrastructure projects, such as metropolitan railways, tram transport systems, roads, intermodal and port transportation systems. The core operations include feasibility studies, detailed design, tendering & contract management, work supervision, acceptance testing and commissioning of infrastructure subsystems (civil works and conventional and innovative technology systems). Italferr has made a substantial contribution to Italy's national railway infrastructure, designing, supervising, building, upgrading, modernising rail lines. In this context Idrostudi's has been awarded a **Framework Contract** covering the major Italian railways lines in order to carry out **hydrological-hydraulic analysis** and **design hydraulic infrastructure serving** and **protecting** the lines. Railways affect the natural surface and subsurface drainage pattern of a watershed or individual hill slope. Idrostudi was in charge for **studying** and **designing solutions** for the **reduction** and/or **elimination** of **energy generated by flowing water**, **improving** the **drainage** and **removing** the **risk of floods** caused by the rail lines. The designer imposed that water must not be allowed to develop sufficient volume or velocity so as to cause excessive wear along ditches, below culverts, or along exposed running surfaces, cuts, or fills. Idrostudi, after carrying out a robust **hydrological-hydraulic analysis** of the catchments involved by the rail lines included in the Framework Contract, developed a proper design of the catchment drainage systems involving rivers and channels networks as well. The **drainage schemes** involved the design of **inlets** for **stormwater collection**, **storm sewers**, **open channels** (trapezoidal or V-shaped ditches), reinforced concrete **culverts**, rivers and channels **slopes improvement, thalweg lowering, rivers cross-sections enlargement and improvement, bridge pier/abutment scour evaluation and protection.**

Description of actual services provided in the assignment:

- **Data collection** and analysis; **topographical surveys**, **bathymetric surveys**; (LiDAR remote sensing, DTM)
- Collection of rainfall depth data at several rain gauge stations; GIS-CAD design;
- Collection of water levels and flows (where available) of the existing rivers/channels crossed by the rail lines;
- Geomorphological analysis of complex drainage systems; **watersheds definition**;
- **Hydrological modelling**; **Peak flow estimation** for **different period of occurrence**;
- **Hydraulic modelling (1D-2D);** Identification of flood hazard and flood risk (**FRA**) and mapping; **Platform drainage**;
- **Hydraulic** and **structural design** of standard solutions for crossing works (ditches, culverts, pipes, ...) with rivers and channels; **BoQ** and **cost estimates**; **Technical specification**.

** Pictures taken from the project outputs delivered by Idrostudi srl [AQ n° 200000985]*

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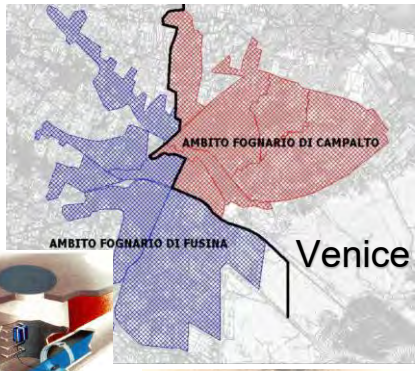
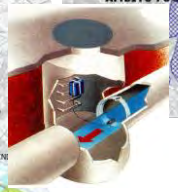
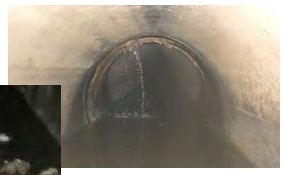
Idrostudi srl
Area Science Park, Padriciano 99
34149 Trieste (TS) – ITALY - P.IVA 01039560329

Assignment name: **WasteWater Management Plans** related to the **extraneous water** flowing into the sewer network system leading to the **Waste Water Treatment Plant** of Venice mainland – Fusina Municipality (VE).	**Approx. value of the contract:** 599,985.25 € **Approx. Construction cost:** 2,100,000.00 €
Country: ITALY **Location within country:** Venice (VE)	**Duration of assignment (months):** 32
Name of Client: VERITAS SPA	**Total № of staff-months of the assignment:** 65
Address: Santa Croce, 489 – 350135 Venice (VE), ITALY	**Approx. value of the services provided by your firm under the contract:** 269,993.25 € (Partner 45%)
Start date of the Framework Contract: 04/2011 **Completion date** of the Framework Contract: 06/2014	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** 36 person-months
Name of joint venture partner or sub-Consultants, if any: N/A BM Tecnologie Industriali Srl (IT) – Leader SGI Studio Galli Ingegneria spa (IT) – Partner	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Mauro Castellarin, PhD – **Project Manager** Eng. Christian Marson, PhD – **Team Leader** Eng. Davide Russo, PhD – **Hydraulic Expert**

Narrative description of Project:

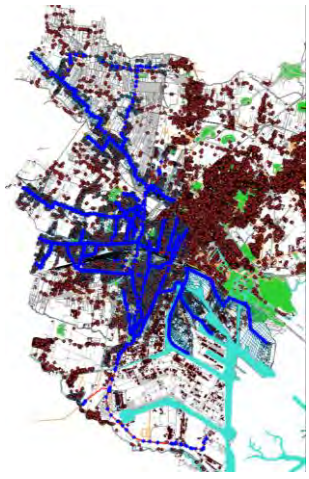






The **Stormwater** and **Wastewater networks** systems of Venice mainland were built 60 years ago in 1961. Only on 1983 (Campalto) and 1985 (Fusina), two **WWTPs** were built for treating properly the wastewater of the Venice mainland system.

The system is today made by a **series** of **adjacent catchments**, each one collecting and conveying the water in its own barycentric point and then conveying the flows, in some cases by pumping, to the following basin until reaching the WWTPs. The system covers **176,000** inhabitants by means of **hundreds of kilometres of pipes**. The existing sewage systems of the studied areas (Zelarino, Gazzera, Chirignago, Malcontenta, Marghera, Porto Marghera, Mestre Sud, Fusina) are formed by a **separate network** (**sanitary sewer** and **storm sewer** are separated) or by a **single combined network** (**sanitary sewer** + **storm sewer**). In the case of intense rainy events the storm water is discharged into the **urban drainage channels**. The water remained into the storm sewer pipes reaches directly the two WWTPs to be treated and then released into the Venice lagoon. Heavy rains result in frequent floods, to which a great part of the settled areas is exposed. The **urban drainage** for **storm water is inadequate**. The catchments are densely populated and most severe flooding takes place and puts residents and critic al infrastructure assets at **risk**. The networks suffer also from inefficiency, **blockages**, **ageing** and **structural problems**. Additionally, some **areas are still not served** by the system of drainage and wastewater collection.



With an **in-depth analysis**, the **sewer network** has been **surveyed** and divided in sewer basins on which, through the **installation** of a certain number **of flow rate measure instruments**, the **hydraulic balance** has been **evaluated** in order **to determine** the **inflow/outflow discharges** in the sewer system. The scope of the consultancy included also the analysis of the **extraneous flows**.

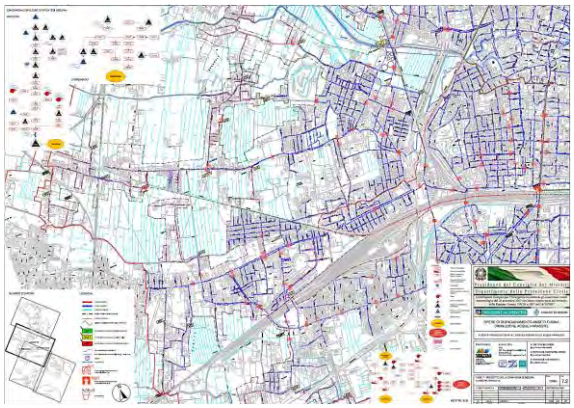
With the implementation of a **numerical model** and its **output**, the **design** of the **structural measures** and **non-structural measures** have been finally defined in order to **optimize the operation of the sewer system** with a **considerable reduction of the energy consumptions**.

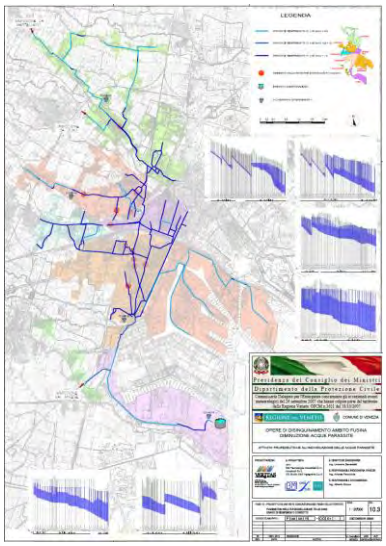
Specifically, among the different phases that characterize the implementation of the operation, a range of preliminary

activities are planned for the removal of the extraneous water divided in:

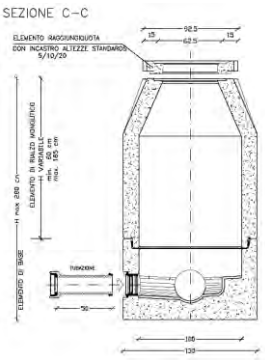
- **detailed construction of the knowledge base** consisting in the collection and classification of the available documents, analysis/consistency status/topographical survey of the sewer system, feasibility and cartographic tracing of the **urban drainage network**;
- **measurement campaigns**, **hydraulic modelling** and **analysis**, **design** of **sewer basins**, **new urban drainage**, **pumping stations**, **flow measurements** and design of the rehabilitative operations of the network.

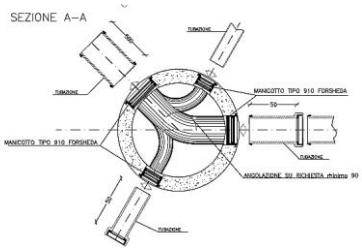
Description of actual services provided in the assignment:





A consistent **measurement campaign of the flows in the sewer network** has been designed and arranged with the Client in order to establish the initial baseline. All the sewer areas involved in the study have been divided in segmentations where every measurement point represents the closure section for the upstream catchment and the inlet one for the downstream catchment. Once detected the causes of the entering in the network of extraneous flows and the causes of the **urban flooding**, the **design** of the **structural** (**pumping stations**, **overflow weirs**, **non-return valves**, **new pipes** and **drainage network**, **rectangular** and **circular culverts**, etc) and **non-structural measure** (waste water network **operating rules**) has been carried out in order to improve the network systems.
By means of the numerical model, conveniently calibrated with the measurements realized, the most critical points in the network have been finally highlighted, and so defined the structural operations needed in order to optimize its functioning.





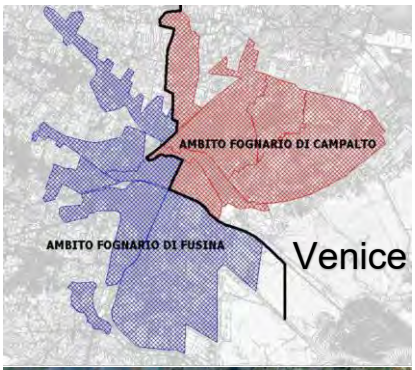
- **Data collection** and analysis; **topographical surveys**, **stormwater** and **wastewater network surveys**;
- **Stakeholder engagement/information/consultation** throughout the project;
- BASELINE establishment
- **Hydrological modelling**;
- **Hydraulic** and **numerical modelling** of the **stormwater** and **wastewater network**;
- **Design** of **structural** and **non-structural measures**;
- **BoQ** and **cost estimates**;
- **Technical specification** and **Tender Documents**;
- **Extraneous flows Management Plans**;
- Scheme management and maintenance plan (**O&M**);
- Knowledge Transfer and **Capacity Building Program**.

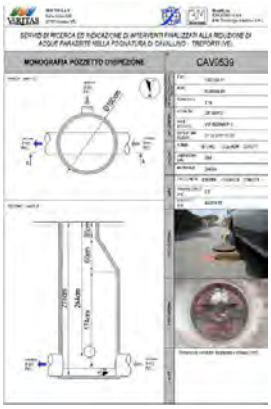
** Pictures taken from the project outputs delivered by Idrostudi srl*

Idrostudi srl
Area Science Park, Padriciano 99
34149 Trieste (TS) – ITALY - P.IVA 01039560329

Assignment name: **WasteWater Management Plans** related to the **extraneous water** flowing into the sewer network system leading to the **Waste Water Treatment Plant** of Venice mainland – Cavallino-Treporti Municipalities (VE).	**Approx. value of the contract:** 349,950.00 € **Approx. Construction cost:** 856,694.00 €
Country: ITALY **Location within country:** Venice (VE)	**Duration of assignment (months):** 21
Name of Client: VERITAS SPA	**Total Nº of staff-months of the assignment:** 38
Address: Santa Croce, 489 – 350135 Venice (VE), ITALY	**Approx. value of the services provided by your firm under the contract:** 209,970.00 € (Leader 60%)
Start date of the Framework Contract: 05/2010 **Completion date** of the Framework Contract: 02/2012	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** 15
Name of joint venture partner or sub-Consultants, if any: N/A BM Tecnologie Industriali Srl (IT) – Partner	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Mauro Castellarin, PhD – **Project Manager** Eng. Christian Marson, PhD – **Team Leader** Eng. Davide Russo, PhD – **Hydraulic Expert**

Narrative description of Project:



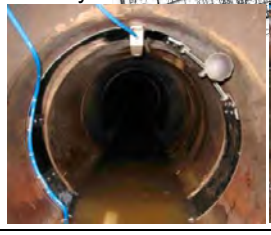


The **Stormwater** and **Wastewater networks** systems of Venice mainland were built 60 years ago in 1961. Only on 1983 (Campalto) and 1985 (Fusina), two **WWTPs** were built for treating properly the wastewater of the Venice mainland system.

The system is today made by a **series** of **adjacent catchments**, each one collecting and conveying the water in its own barycentric point and then conveying the flows, in some cases by pumping, to the following basin until reaching the WWTPs. The system covers **176,000** inhabitants by means of **hundreds of kilometres of pipes**. The existing sewage system of Cavallino-Treporti Municipalities is formed by a **separate network** (**sanitary sewer** and **storm sewer** are separated). In the case of intense rainy events the storm water is discharged into the **urban drainage channels**. The water remained into the storm sewer pipes reaches directly the two WWTPs to be treated and then released into the Venice lagoon. Heavy rains result in frequent floods, to which a great part of the settled areas is exposed. The **urban drainage** for **storm water is inadequate**. The catchments are densely populated and most severe flooding takes place and puts residents and critic al infrastructure assets at **risk**.

With an **in-depth analysis**, the **sewer network** has been **surveyed** and divided in sewer basins on which, through the **installation** of a certain number **of flow rate measure instruments**, the **hydraulic balance** has been **evaluated** in order **to determine** the **inflow/outflow discharges** in the sewer system. The scope of the consultancy included also the analysis of the **extraneous flows**.

With the implementation of a **numerical model** and its **output**, the **design** of the **structural measures** and **non-structural measures** have been finally defined in order to **optimize the operation of the sewer system** with a **considerable reduction of the energy consumptions**.



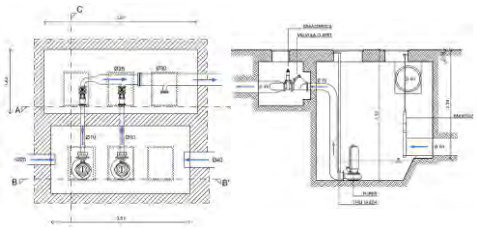
Specifically, among the different phases that characterize the implementation of the operation, a range of preliminary activities are planned for the removal of the extraneous water divided in:

- **detailed construction of the knowledge base** consisting in the collection and classification of the available documents,

analysis/consistency status/topographical survey of the sewer system, feasibility and cartographic tracing of the **urban drainage network**;

- **measurement campaigns**, **hydraulic modelling** and **analysis**, **design** of **sewer basins**, **new urban drainage**, **pumping stations**, **flow measurements** and design of the rehabilitative operations of the network.

Description of actual services provided in the assignment:



A consistent **measurement campaign of the flows in the sewer network** has been designed and arranged with the Client in order to establish the initial baseline. All the sewer areas involved in the study have been divided in segmentations where every measurement point represents the closure section for the upstream catchment and the inlet one for the downstream catchment. Once detected the causes of the entering in the network of extraneous flows and the causes of the **urban flooding**, the **design** of the **structural** (**pumping stations**, **overflow weirs**, **non-return valves**, **new pipes** and **drainage network**, **rectangular** and **circular culverts**, etc) and **non-structural measure** (waste water network **operating rules**) has been carried out in order to improve the network systems.
By means of the numerical model, conveniently calibrated with the measurements realized, the most critical points in the network have been finally highlighted, and so defined the structural operations needed in order to optimize its functioning.

- **Data collection** and analysis; **topographical surveys**, **stormwater** and **wastewater network surveys**;
- **Stakeholder engagement/information/consultation** throughout the project;
- BASELINE establishment
- **Hydrological modelling**;
- **Hydraulic** and **numerical modelling** of the **stormwater** and **wastewater network**;
- **Design** of **structural** and **non-structural measures**;
- **BoQ** and **cost estimates**;
- **Technical specification** and **Tender Documents**;
- **Extraneous flows Management Plans**; (estimated saving of 1,330,000 €/year);
- Scheme management and maintenance plan (**O&M**);
- Knowledge Transfer and **Capacity Building Program**.

** Pictures taken from the project outputs delivered by Idrostudi srl*

Idrostudi srl
Area Science Park, Padriciano 99
34149 Trieste (TS) – ITALY - P.IVA 01039560329

Assignment name: **WasteWater Management Plan** related to the **extraneous water** flowing into the sewer network system leading to the **Waste Water Treatment Plant** of Venice mainland – Campalto Municipality (VE).	**Approx. value of the contract:** 304,619.32 € **Approx. Construction cost:** 2,196,029.32 €
Country: ITALY **Location within country:** Venice (VE)	**Duration of assignment (months):** 20
Name of Client: VERITAS SPA	**Total № of staff-months of the assignment:** 33
Address: Santa Croce, 489 – 350135 Venice (VE), ITALY	**Approx. value of the services provided by your firm under the contract:** 137,078.55 € (Partner 45%)
Start date (month/year): 11/2009 **Completion date** (month/year): 07/2011	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** 18 person-months
Name of joint venture partner or sub-Consultants, if any: BM Idrodata Srl (IT) – Leader BM Tecnologie Industriali Srl (IT) – Partner	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Mauro Castellarin, PhD – **Project Manager** Eng. Christian Marson, PhD – **Team Leader** Eng. Davide Russo, PhD – **Hydraulic Expert**

Narrative description of Project:

The infiltration and exfiltration phenomena in the sewer network contribute directly and indirectly the **contamination** of the **urban water environment** both **superficial** and **deep**, as well as **management problems of sewer network** and of the **WWTP**. The most important causes of leakages in the conduits are the **breakage of conduits in the networks** and in the transport systems and the **damage of joints between the conduits** or between the conduits and the parts that constitute the **sewer and the combined system**, the **irregular operation of the overflow spillway**, etc. It is highlighted that the control of the sewer system can't require the same care and attention as the one for the aqueduct, mainly because of the greater complexity in the assessment of the flow rates. However, the control is necessary for the importance that the **wastewater leakages** can have, regarding the **pollution** and the **environmental protection**. In order to ensure a better and more precise awareness of the magnitude of the wastewater leakages and their distribution over the network, the sewer system has to be conveniently divided in components and areas, considering the distribution of the expectable closure section of a catchment.

With an **in-depth analysis**, the **sewer network** has been **surveyed** and divided in sewer basins on which, through the **installation** of a certain number **of flow rate measure instruments**, the **hydraulic balance** has been **evaluated** in order **to determine** the **inflow/outflow discharges** in the sewer system. Inflow/outflow discharges are meant as extraneous flows: they are otherwise **clean storm water** or **groundwater getting into the sanitary sewer system**.

With the implementation of a **numerical model** and its **output**, the **design** of the **structural measures** has been finally defined in order to **reduce** the **extraneous flows** and **optimize the operation of the sewer system** with a **considerable reduction of the energy consumptions**.

Specifically, among the different phases that characterize the implementation of the operation, a range of preliminary activities are planned for the removal of the extraneous water divided in:

- **detailed construction of the knowledge base** consisting in the collection and classification of the available documents, analysis/consistency status/topographical survey of the sewer system, feasibility and cartographic tracing of the **urban drainage network**;
- **measurement campaigns**, **hydraulic modelling** and **analysis**, **design** of **sewer basins**, **new urban drainage**, **pumping stations**, **flow measurements** and design of the rehabilitative operations of the network.

The study covers the **entire sewer network** leading to the **WWTP** of Campalto (VE), **241 km** of sewer pipes and about **120,000 inhabitants**.

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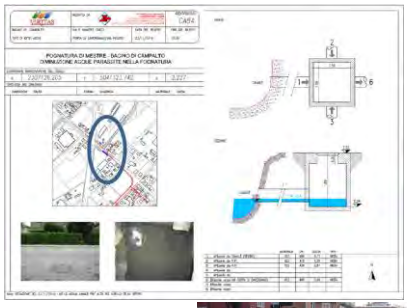
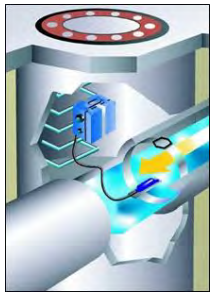
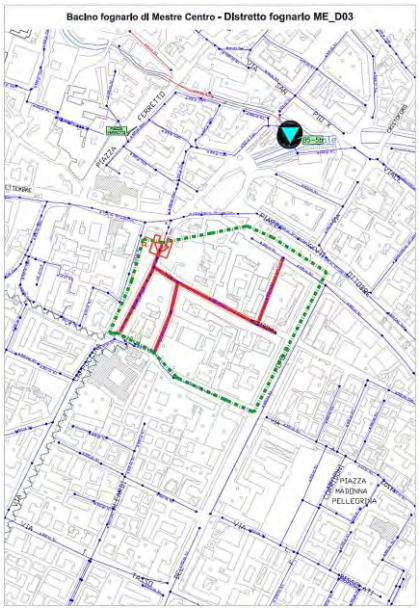
Description of actual services provided in the assignment:

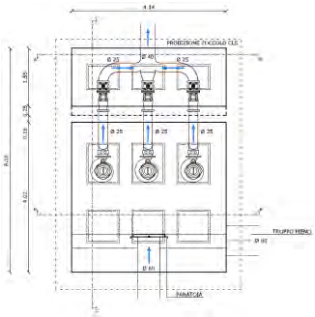




In order to identify the extraneous flows in the sewer systems and define the necessary operations for their control and reduction, the realization of a **measurement campaign of the flows in the sewer network** has been designed and arranged with the technicians of the multiutility VERITAS S.p.A, including the installation of 140 (one hundred forty) measurement points thanks to the laying in the pipeline of instruments as area-velocity, able to evaluate the waste water flow by the integration, on the geometry of the flow area detected, of the velocity field measured. Simultaneously the **flow measurements** in the **delivery conduits** of the **pump stations** SM3, SM4 and B43 have been carried out by 8 (eight) instruments with time transit **flow meter**. All the sewer areas involved in the study have been divided in segmentations where every measurement point represents the closure section for the upstream catchment and the inlet one for the downstream catchment. The division in segmentation has been developed after a detailed functional analysis of the network, supported also by the **numerical modelling**.

The **total extraneous flows** detected was resulted equal to 151.7 l/s (546.1 m3/h), equal to about **30%** of the total flow in the network of Campalto Municipality, flows that are pumped and led to the WWTP. So, once detected the causes of the entering in the network of extraneous flows, the **design** of the **structural** (**pumping stations**, **overflow weirs**, **non-return valves**, **new pipes** and **drainage network**, **rectangular** and **circular culverts**, etc) and **non-structural measure** (waste water network **operating rules**) has been carried out in order to **reduce the extraneous flows** and aim to a **significant system energy saving**.





By means of the numerical model, conveniently calibrated with the measurements realized, the most critical points in the network have been finally highlighted, and so defined the structural operations needed in order to optimize its functioning

- **Data collection** and analysis; **topographical surveys**, **stormwater** and **wastewater network surveys**;
- **Stakeholder engagement/information/consultation** throughout the project;
- BASELINE establishment
- **Hydrological modelling**;
- **Hydraulic** and **numerical modelling** of the **stormwater** and **wastewater network**;
- **Design** of **structural** and **non-structural measures** to reduce the extraneous flows and aim to a significant system energy saving.
- **BoQ** and **cost estimates**;
- **Technical specification** and **Tender Documents**;
- **Extraneous flows Management Plans**;
- Scheme management and maintenance plan (**O&M**);
- Knowledge Transfer and **Capacity Building Program**.

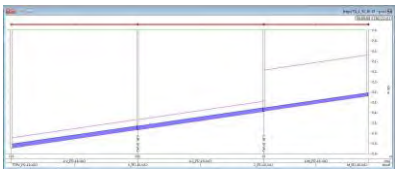
** Pictures taken from the project outputs delivered by Idrostudi srl*

Idrostudi srl
Area Science Park, Padriciano 99
34149 Trieste (TS) – ITALY - P.IVA 01039560329

Assignment name: Consulting Service for the study of the hydraulic functionality for sewerage weirs of mixed **sewerage networks** and for the outfalls drains of **stormwater** networks managed by BrianzaAcque srl.	**Approx. value of the contract:** 103,787.80 €
Country: ITALY **Location within country:** Milan (MI), Monza-Brianza (MB)	**Duration of assignment (months):** 16
Name of Client: BrianzaAcque srl.	**Total № of staff-months of the assignment:** 12
Address: via Enrico Fermi n. 105 – 20900 Monza (MB), ITALY	**Approx. value of the services provided by your firm under the contract:** 103,787.80 €
Start date (month/year): 11/2013 **Completion date** (month/year): 04/2015	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** N/A
Name of joint venture partner or sub-Consultants, if any: N/A	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Mauro Castellarin, PhD – **Project Manager** Eng. Davide Russo, PhD – **Team Leader** Eng. Alex Stefani – **Hydraulic Modeller**

Narrative description of Project:

The province of Monza and Brianza is an administrative province of Lombardy region in North Italy. The water utilities BrianzaAcque srl manages the **Integrated Water Service cycle** covering a total of 56 Communes of the province for a total of about 879.200 inhabitants served. The Drainage and WasteWater network of the communes refers to a "**combined sewer**" (stormwater pipes + sanitary sewers). The water utility decided to improve the sewerage network knowledge by means of surveys and network modelling. The Idrostudi's contribution was focused on **extensive** and **detailed networks surveys** and the provision of the **hydraulic modelling** to **improve the network efficiency reducing the criticality** on 18 communes for a total population of 151,900 inhabitants. The first step referred to the analysis of the current situation of the system by means of an extensive **topographical survey** of the **network** in order to get the proper picture of the structural problems (**blockages**, **cracks** on the pipes, etc.) affecting the network. A database in **GIS** and **CAD** has been established with focus on the position of the sewerage weirs, outfalls drains and pump stations of stormwater networks.



The Drainage and Wastewater networks have been then modelled with InfoWorks ICM (**integrated modelling platform**). The **definition of the geometry of the network** modelled was performed according to the information collected with the above surveys and information. In order to **calibrate** and **validate** properly the hydraulic model, a monitoring campaign was carried out by means of **area-velocity gauging points** within the network and **rainfall stations in the drained catchments**. The **data collected during the monitoring campaign** were used firstly to **calibrate** and then to **validate** the **numerical model** of the sewer system. Important outcome was the calculation of the "Overflows", during wet weather, of combined wastewater and stormwater. **Combined Sewer Overflows** (**CSOs**) happen when flows in the wastewater collection system exceed the capacity of that system.

Description of actual services provided in the assignment:

- **Data collection** and analysis; **topographical surveys of** sewerage weirs and outfalls drains of stormwater networks;.**Stakeholder engagement/information/consultation** throughout the project;
- BASELINE establishment;
- Execution of **hydraulic monitoring campaigns**; **Hydrological modelling**;
- **Hydraulic** and **numerical modelling** of the **network**;
- Knowledge Transfer and **Capacity Building Program**.

** Pictures taken from the project outputs delivered by Idrostudi srl*

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Area Science Park, Padriciano 99
34149 Trieste (TS) – ITALY - P.IVA 01039560329

Assignment name: The Dniester Hydro Power Complex social and environmental impact assessment. Modelling of the Lower Dniester Wetlands.	**Approx. value of the contract:** 341,046.00 USD
Country: REPUBLIC OF MOLDOVA **Location within country:** River Dniester between Moldovan-Ukrainian border	**Duration of assignment (months):** 12
Name of Client: JBA Consulting Engineers and Scientists Limited **Contracting authority:** United Nation Development Programme (UNDP Moldova)	**Total № of staff-months of the assignment:** 34
Address: Unit 24, Grove Island, Corbally, Limerick, V94 312N – IRELAND	**Approx. value of the services provided by your firm under the contract:** 16,000.00 €
Start date (month/year): 08/2020 **Completion date** (month/year): 11/2020	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** 30
Name of joint venture partner or sub-Consultants, if any:	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Davide Russo, PhD – **Scientific supervisor** Eng. Agostino Avanzi – **Project Manager/Hydraulic expert** Eng. Marco Simon Ostan – **Hydraulic modeller expert**

Narrative description of Project:

The Dniester River is the ninth largest river in Europe with total length of 1,350 km and basin area of more than 72,000 km². Approximately 8.5 million people (5.5 in Ukraine and 2.7 in Moldova) live in the river basin. In addition to the Moldovan users of the Dniester water, including capital city of Chișinău, the river is used as a source for drinking water for about 3,5 million peoples in cities, situated out of the Dniester River basin - Chyrnivtsy and Odesa (both, in Ukraine).

The first Hydro Power Station on the Dniester River was built in Moldova in the Dubasari town in 1954. Starting 1973, Ukraine is continuously constructing on the river the second hydropower facility, known as Dniester Hydro Power Complex (HPC). The initial design of the HPC was modified in 2000's in terms of increasing the electricity generation capacity thus changing of the initial role of the water accumulation reservoir, constructed in the riverbed. Another construction (Dniester PSP) began in 1988. The Dniester PSP is expected to become after finalization the largest pumped-storage HPP in Europe with 2,268 MW in the upper Dniester (envisaged in the Ukrainian National Program on Hydropower Development until 2026, approved in 2017).

The Dniester HPC is functioning for many years and various negative environmental impacts and other consequences of its operation were registered by State Hydrometeorological Service (Moldova) in the Dniester River downstream. Generally, the critical pressures are well known: hydropeaking, altered water flow and fluctuating water level, sharp decrease of the natural water temperature values in the downstream river stretch which can be traced up to the Dubăsari water reservoir, non-typical high transparency of water and reduced self-purification capacity of the river, drastic slow up of the gravel and sand sediments movement, extensive growth of aquatic vegetation in some river stretches, loss of valuable fish biodiversity and decline of fish population due to both blockage of migratory pattern, and changed features and loss of aquatic habitats, etc. Joint Dniester Expeditions have also indicated severe water quality problems, declining biodiversity and deteriorating ecosystems along the river.

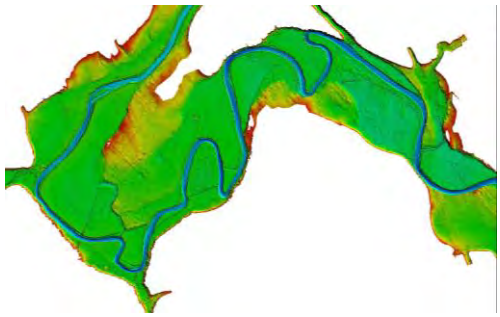
To address cooperation on the hydro-energetics issues, currently, the Agreement on functioning of the Dniester HPC is being developed and negotiated between the Governments of Moldova and Ukraine. It aims to provide the legal

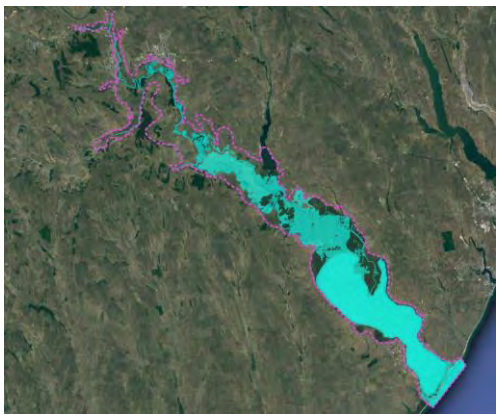
background for functioning of Dniester HPC and it further upgrading for full scale operation, as well as to establish responsibilities of both contracting parties in terms of ensuring safety of the HPC functioning, parties' rights, use of properties, leasing of land, etc. The negotiation process on the Agreement was accelerated and in 2017 the parties came up with a revised draft of the Agreement, where some articles, addressing environmental issues still is a main obstacle for its signing.

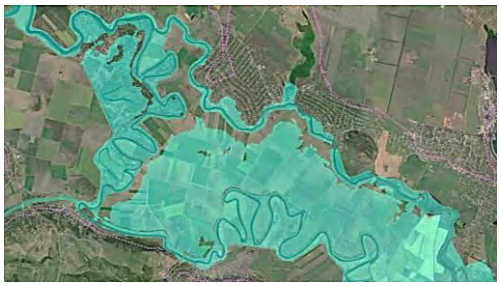
In order to understand the implications of the further development of the Dniester HPC on ecosystems and the population of Moldova, as well as to ensure that the position of the Moldovan negotiation team is based on scientific evidence, the Ministry of Agriculture, Regional Development and Environment of the Republic of Moldova requested support in elaboration of a study on the current and potential impacts of the functioning of the Dniester HPC on the territory of Moldova.

The overall scope of the project was to support sustainable management and protection of the Dniester River. A comprehensive study covering a wide range of issues linked to the hydropower has been carried out. The Study provided both the Government and broad public with scientifically based assessments and data to be used for negotiation of the Agreement, particularly, addressing environmental, social and legal implications of such an Agreement.

Idrostudi has been involved in evaluating the impacts resulting from (1) upgrading of the Dniester HPC and (2) planned construction of 6 new Hydro Power Complexes in the upper stretch of the Dniester River. Idrostudi involvement concerned the river hydrology and river morphology, with particular focus on Dniester wetland, covering:







a. Historical overview of the Dniester hydrological regime on the territory of Moldova before and after construction of the Dniester HPC;
b. Comparison of the hydrological regime before and after construction in typical years of the different water probability;
c. determination the effects of permanent downstream river flow modification (e.g., daily flow changes from peaking releases, seasonal flow changes, etc.) as a result of the existing infrastructure operation, its extension and planned new hydropower plants;
d. evaluation of significance and magnitude of the hydrological regime alteration in different river stretches and identification the most affected (critical) stretches from the point of view of the river functions and services provided to Moldova;
e. identification of major hydro-morphological impacts generated by the altered hydrological regime (e.g., bank erosion, transport of sediments, substrates deposition/siltation of riverbed, etc.), their description and mapping;
f. revealing the dependence of hydrological parameters downstream on the operation patterns of the Dniester HPC (hydro peaking, seasonal flow, etc.);
g. evaluation of potential hydrological and morphological impacts due to planned upgrade of the Dniester HPC and construction of new hydro-power generation facilities.

Description of actual services provided in the assignment:

- **Hydraulic modelling** (1D-2D);
- Explaining and detailing how the model simulates the **inundation processes** at the lower order events;
- **Understating flows** split in the **channels**, **floodplains**, **impact** of the main **crossing bridges**;
- Modelling of before/post dam spring flood flow hydrographs;
- Modelling of release patterns of different durations and peak flow
- **Flood hazard** and **Flood Risk Assessment** support including understanding of **flood damage assessment**;
- River Cross Sections and River long profiles with different flows plotted;
- Depth maps, flow and velocity vectors in exported in GIS;
- **Animation of flooding propagation**.

** Pictures taken from the project outputs delivered by Idrostudi srl*

Idrostudi srl
Area Science Park, Padriciano 99
34149 Trieste (TS) – ITALY - P.IVA 01039560329

Assignment name: **Numerical** and **physical hydraulic modelling** of Tagliamento River close to A4 international motorway.	**Approx. value of the contract:** 98,000.00 €
Country: ITALY **Location within country:** Friuli Venezia Giulia Region	**Duration of assignment (months):** 10
Name of Client: Tiliaventum s.c.ar.l.	**Total № of staff-months of the assignment:** 12
Address: Via Buttrio, 35050 Pozzuolo del Friuli (UD) – ITALY	**Approx. value of the services provided by your firm under the contract:** 98,000.00 €
Start date (month/year): 10/2012 **Completion date** (month/year): 08/2013	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** N/A
Name of joint venture partner or sub-Consultants, if any:	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Christian Marson, PhD – **Team Leader** Eng. Davide Russo, PhD – **Hydrological Expert** Eng. Luca Falcomer, PhD – **Hydraulic/Modeller expert**

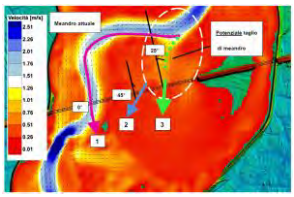
Narrative description of Project:

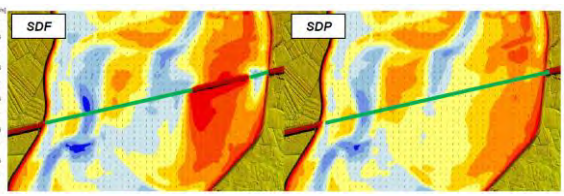
The **Tagliamento** is a **braided river** in north-east Italy, flowing from the Alps to the Adriatic Sea at a point between Trieste and Venice. The watershed covers an area of **2,916 square kilometres**. The **river passes through very important urbanized and industrial areas that need protection**. The **river length** is about **180 km**. The Autostrada A4, or "Serenissima", is a motorway which connects Turin and Trieste via Milan and Venice. It runs through the whole Pianura Padana, which is a densely populated and highly industrialized area, A4 is one of the most trafficked motorways of Italy. A4 is a dual-carriageway, six-lane motorway for most of its length. The stretch from Venice to Trieste is instead a four-lane motorway but it is being upgraded to six lanes. The total motorway length is 517 km. The motorway **crosses the Tagliamento River in a crucial position** of the river valley.

The aim of this study was to **study** the **impact of the motorway** on the Tagliamento river. If there are important **changes in levels and flows regime** in the Tagliamento River this may **impact** the planned urban and industrial development of the adjacent areas **causing flooding**.

Idrostudi carried out the **flood hazard** and **risk assessment** of the **areas involved** by the **floods** of the Tagliamento River. As the **river is braided**, it was therefore necessary to assess the impact of the Tagliamento River **avulsion** impacting the neighbouring developed areas and the motorway piers, piles and abutments laying in the riverbed. One of the objectives of the assignment was, in fact, to undertake a **comprehensive diagnostic assessment** of the impact of the **river avulsion** and to undertake design/sizing of the **mitigation measures** and the key hydraulic structures.

Idrostudi carried out **hydrological** and **hydraulic modelling** (**1D-2D modelling**) defining the areas prone to flooding for different return periods (20, 50, 100, 200, 500-year). The flood simulation models modelled the behaviour of the river in order to define the flood hazard and to assess the flood risk. Once defined the behaviour of the river, Idrostudi carried out the analysis and modelling of **structural measures** in order to **protect the motorway appurtenance structure and the areas prone to flooding** where requested.



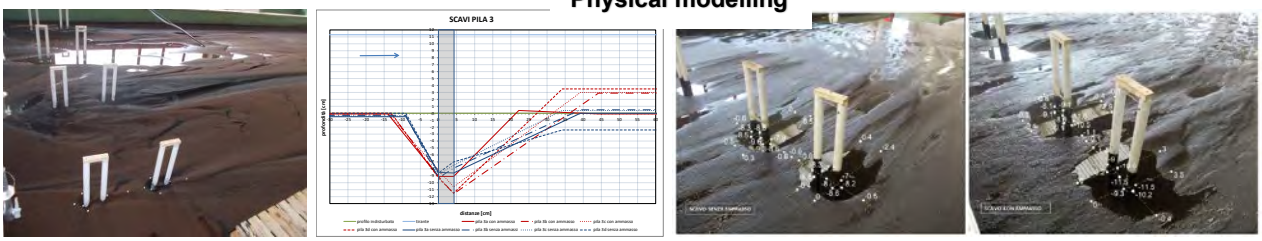


Due to the complexity of the river system, Idrostudi built a **physical model** of Tagliamento river. The physical modelling remains the most reliable way of investigating the interaction between river-structures of complex and non-standard constructions. The physical model **confirmed** the **outcomes** of the **hydraulic numerical modelling**. The physical model

was implemented by means of **mobile-bed modelling** (thus **including sediment transport**) with **exact geometric similitude** (model scale 1:60).

Additionally, the purpose of the physical model was to study the **effects** related to the **three-dimensionality** of the **river flow field** to better understand the dynamics triggering piers/piles scour and failure mechanisms and local pier scour dynamics was carried out. The physical model evaluated the maximum excavation, considering the possible accumulation of **floating material** carried by the river flow.

Physical modelling



Description of actual services provided in the assignment:

- **Data collection** and analysis; **topographical surveys**;
- **Bathymetric** cross sections **survey**;
- **Remote sensing** analyses by means of airborne **LiDAR survey**;
- **Soil investigations** (for sediment transport analysis);
- **Historical flood data analysis**;
- **Hydrological modelling** (intensity-duration-frequency curve (IDF) and Depth-Duration-Frequency Curves (DDF));
- **Hydraulic modelling** (**1D** and **2D** with triangular mesh);
- **Flood hazard** mapping; **Flood Risk Assessment** (**FRA**) and mapping;
- River long profiles with different return periods plotted;
- **Geomorphological analysis**: sinuosity, flow depth, river width, river and valley slope, flow velocity, discharge, stream power, suspended sediment and bedload analysis;
- **Physical modelling** (scale 1:60);
- Piers, piles and abutments scour evaluation;
- Identification of **structural measures** to reduce flood risk and protect the motorway structures.

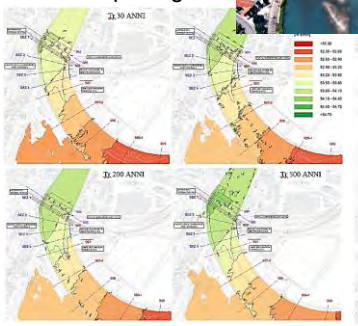
** Pictures taken from the project outputs delivered by Idrostudi srl*

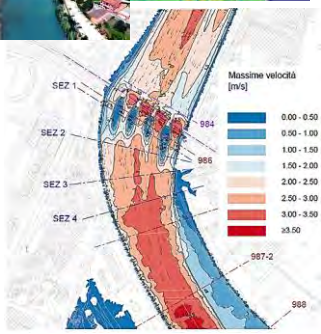
Idrostudi srl
Area Science Park, Padriciano 99
34149 Trieste (TS) – ITALY - P.IVA 01039560329

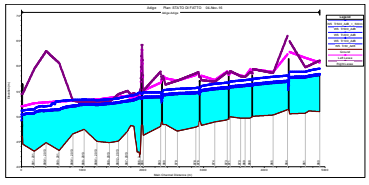
Assignment name: Hydraulic study of the Adige River in Verona.	**Approx. value of the contract:** 100,000.00 €
Country: ITALY **Location within country:** Veneto Region	**Duration of assignment (months):** 24
Name of Client: ITALFERR S.p.A.	**Total Nº of staff-months of the assignment:** 12
Address: Via V. G. Galati, 71, 00155 Roma (ITALY)	**Approx. value of the services provided by your firm under the contract:** 100,000.00 €
Start date (month/year): 01/2016 **Completion date** (month/year): 01/2018	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** N/A
Name of joint venture partner or sub-Consultants, if any: N/A	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Christian Marson, PhD – **Project Manager** Eng. Francesco Peratoner – **Hydrological expert** Eng. Marco Simon Ostan – **Hydraulic Modeller**

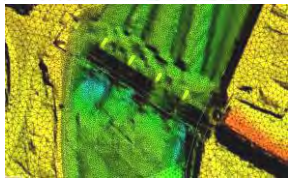
Narrative description of Project:

The **Adige river** is the **second longest river in Italy** after the Po, rising in the Alps in the province of South Tyrol near the Italian border with Austria and Switzerland, flowing 410 kilometres through most of North-East Italy to the Adriatic Sea. The basin size is about 12,100 km² with an average flow of about 235 m³/s. The river flows through Verona, an UNESCO World Heritage Centre of about 260,000 inhabitants. The anthropic interventions of the last centuries, such as the construction of dikes and built-up areas (urban and industrial) have severely **reduced the river's space**, causing **highly critical hydraulic conditions** exposing the areas to frequent flooding. ITALFERR S.p.A. – a company belonging to the Italian State Railways Group – operates throughout Italy and abroad, providing engineering services in the field of conventional and high speed railways and other transport infrastructure projects, such as metropolitan railways, tram transport systems, roads, intermodal and port transportation systems. Italferr intends to build a new railway bridge crossing the river Adige in Verona.



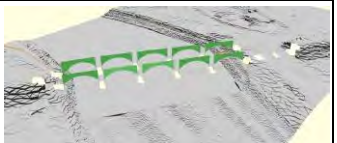


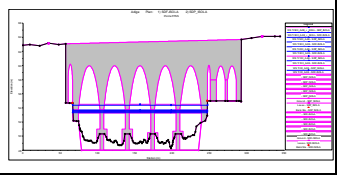




In this context Idrostudi has been awarded of the **hydraulic study** of the **Adige River** in order to carry out **hydrological-hydraulic analysis** to understand the interaction between the new bridge and the river system in Verona. If there are important **changes in levels and flows regime** in the Adige River this may **impact** the UNESCO World Heritage site **causing flooding**. Idrostudi carried out **hydrological** and **hydraulic modelling** (**1D-2D modelling**) defining the areas prone to flooding for different return periods (30, 100, 200 and 500-year) in the current situation and in the future situation (with the designed bridge in place). The flow dynamic close to the bridge's piers/piles and abutments were also analysed and modelled. Finally, Idrostudi carried out the **verification** of **structural measures** to reduce the risk of probable flooding such as **slopes improvement, thalweg lowering, rivers cross-sections enlargement and improvement, bridge pier/abutment scour protection.**

Description of actual services provided in the assignment:





- **Data collection** and analysis; **topographical surveys**, **bathymetric cross sections surveys**; LiDAR remote sensing acquisition for DTM and DSM analysis;
- **Soil investigations** (for bridge pier/abutment scour assessment);
- **Historical flood data analysis**; **Hydrological modelling**; **Peak flow estimation** for **different period of occurrence**; **Hydraulic modelling** (**1D** and **2D** with triangular mesh); **Flood hazard** mapping; **Flood Risk Assessment** (**FRA**) and mapping; River long profiles with different return periods plotted;
- Piers, piles and abutments scour evaluation;
- Testing of **structural measures** to reduce flood risk.

** Pictures taken from the project outputs delivered by Idrostudi srl [AQ n° 200000991]*

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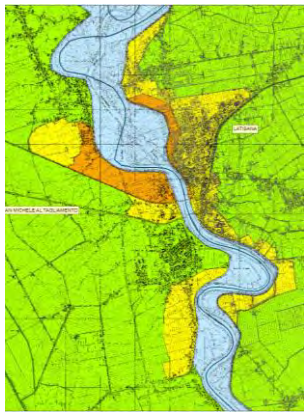
Area Science Park, Padriciano 99
34149 Trieste (TS) – ITALY - P.IVA 01039560329

Assignment name: **Numerical** and **physical hydraulic modelling** of Tagliamento River in Latisana stretch.	**Approx. value of the contract:** 120,000.00 €
Country: ITALY **Location within country:** Friuli Venezia Giulia Region	**Duration of assignment (months):** 12
Name of Client: Regione autonoma Friuli Venezia Giulia, Latisana Commune	**Total № of staff-months of the assignment:** 12
Address: Piazza Indipendenza 74, 33053 Latisana (UD) – ITALY	**Approx. value of the services provided by your firm under the contract:** 120,000.00 €
Start date (month/year): 01/2005 **Completion date** (month/year): 12/2005	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** N/A
Name of joint venture partner or sub-Consultants, if any:	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Mauro Castellarin, PhD – **Team Leader** Eng. Davide Russo, PhD – **Hydrological Expert** Eng. Luca Falcomer, PhD – **Hydraulic/Modeller expert**

Narrative description of Project:

Flooding damage caused by the Tagliamento River has been reported since historical times. Tagliamento River is a **braided river** in north-east Italy, flowing from the Alps to the Adriatic Sea at a point between Trieste and Venice. The watershed covers an area of **2,916 square kilometres**, including 60 cities with a population of approximately 165,000. The **river passes through very important urbanized** and **industrial areas that need protection**. The river length is about **180 km**. The entire Tagliamento river basin is running to be an **UNESCO** heritage site. Meteorology, a large area of the upper catchment and steep slopes confer to the river a torrential regime that generates **flash flood events** of **considerable size** in the alluvial plain. Furthermore, the **anthropogenic interventions** of the last centuries, such as the construction of dikes and draining of existing wetland sin the lower lands, have severely **reduced the river's space**, causing highly critical hydraulic conditions in the lower part of the floodplain.



The city of Latisana (a Roman post station) is located approximately where the river changes from braiding to meandering. During the 20th century Latisana suffered **heavy damage**, especially **caused by the floods** of the Tagliamento in 1965 and 1966. The town of Latisana has to be seen one of the major stakeholders and at the most vulnerable position of the river valley

The objective of the assignment was to undertake a comprehensive **hydraulic modelling** of Tagliamento River by means of **numerical modelling** and **physical modelling** in order to **estimate** the **max river flows passing safely** through Latisana and with a **reliable freeboard under** the **motorway** and **railway bridges**.

Historical documents were used to reconstruct and map the evolution of the Tagliamento during the past centuries in order to understand better the fluvial dynamic. Of particular interest was to analyse the location and area of the floodplain, the flood and sediment regime to define fluvial corridors for a better **hazard mapping**.

If the numerical modelling covered a longer river stretch, the physical model was mainly focused on the river stretch upstream and downstream the city of Latisana, involving the motorway and railway bridges. Idrostudi carried out **hydrological** and **hydraulic modelling** (**1D-2D modelling**) defining the areas prone to flooding for different flows (1,500 m³/s, 3,000 m³/s and 4,500 m³/s – the latter corresponding to 100-year return period) in Latisana.

The physical model was implemented by means of **mobile-bed modelling** (thus **including sediment transport**) with **exact geometric similitude** (model scale 1:35). The model was built directly over the Tagliamento riverbank.

The physical model on the one hand **confirmed** the **outcomes** of the **hydraulic numerical modelling** and on the other hand gave important information on the **freeboard parameter** and **evidence** of the **structural measures to be implemented to solve the problem of flooding** (dykes rising, piers/piles protection, slope protection, …).

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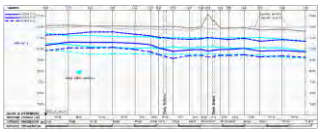
Construction of the physical hydraulic model

Tagliamento flooding in the reality

Tagliamento flooding in the model

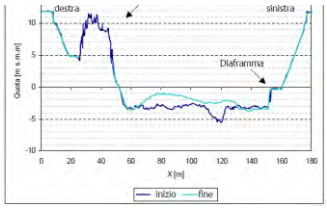
Additionally, the purpose of the physical model was to study the **effects** related to the **three-dimensionality** of the **river flow field** to better understand the dynamics triggering piers/piles and slope scour and failure mechanisms. The physical model evaluated the maximum excavation, considering the possible accumulation of **floating material** carried by the river flow.

Description of actual services provided in the assignment:



- **Data collection** and analysis; **topographical surveys**;
- **Bathymetric** cross sections **survey**;
- **Remote sensing** analyses by means of terrestrial **LiDAR survey**;
- **Soil investigations** (for **sediment transport analysis**);
- **Historical flood data analysis**;
- **Hydrological modelling** (intensity-duration-frequency curve (IDF) and Depth-Duration-Frequency Curves (DDF));
- **Hydraulic modelling** (**1D** and **2D**);
- **Flood hazard** mapping; **Flood Risk Assessment** (**FRA**) and mapping;
- River long profiles with different return periods plotted;
- Piers, piles and abutments scour evaluation;
- **Physical modelling** (scale 1:35);
- Testing of **structural measures** to reduce flood risk.

Sediment transport in the physical hydraulic model



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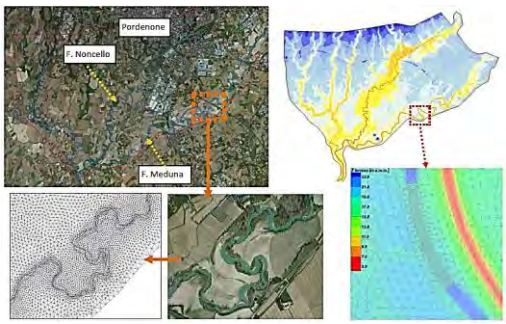
Assignment name: **Flood Risk Management** for Meduna River in Pordenone Commune (IT).	**Approx. value of the contract:** 100,000.00 €
Country: ITALY **Location within country:** Friuli Venezia Giulia Region	**Duration of assignment (months):** 12
Name of Client: University of Trieste - Prof. Eng. E. Caroni	**Total № of staff-months of the assignment:** 12
Address: Piazzale Europa n.1, 34127 Trieste – ITALY	**Approx. value of the services provided by your firm under the contract:** 100,000.00 €
Start date (month/year): 01/2011 **Completion date** (month/year): 12/2011	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** N/A
Name of joint venture partner or sub-Consultants, if any:	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Christian Marson, PhD – **Team Leader** Eng. Davide Russo, PhD – **Hydrological Expert** Eng. Luca Falcomer, PhD – **Hydraulic/Modeller expert**

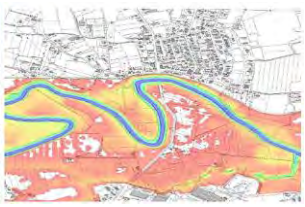
Narrative description of Project:

It is generally accepted that flood risk has been increasing in Europe in the last decades. Accordingly, it becomes a priority to better understand its drivers and mechanisms. Flood risk is evaluated on the basis of three factors: hazard, exposure and vulnerability. In the past 50 years Pordenone (city in north-east Italy) has suffered **several heavy floods**, the **disastrous consequences** of which demonstrated the **vulnerability of the areas** (**2,300 km²**). In 2010 thousands of residents were evacuated from their houses.

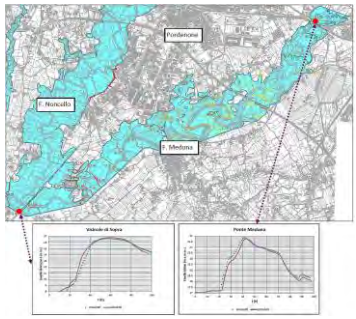


Idrostudi was commissioned to carry out a **flood hazard** and risk **assessment** of the areas involved by the river Meduna and Noncello in Pordenone Commune. Results of the consultancy confirmed that the main driving force of increased flood risk is found in new urban developments in flood-prone areas. Idrostudi carried out **hydrological** and **hydraulic modelling** (**1D-2D modelling**) defining the areas prone to flooding for different return periods (20, 50, 100, 200-year). The flood simulation models modelled the behaviour of flood occurrences in order to define the flood hazard and to assess the flood risk. Once defined the objects to be protected against floods, Idrostudi carried out the analysis and modelling of **structural** (flood storage areas, dykes,…) and **non-structural measures** (change in land use, early warning system,..) in order to **reduce the risk of flooding** where requested.

Description of actual services provided in the assignment:



- **Data collection** and analysis; **topographical surveys**; **bathymetric** cross sections **survey**;
- Support the process of stakeholder information and consultation throughout the project;
- **Historical flood data analysis**, Preliminary Flood Risk Assessment (**PFRA**);
- **Hydrological modelling** (intensity-duration-frequency curve (IDF) and Depth-Duration-Frequency Curves (DDF));
- **Hydraulic modelling (1D-2D)**;
- **Flood hazard** mapping; **Flood Risk Assessment** (**FRA**) and mapping;
- River long profiles with different return periods plotted;
- **Calculation** of **Expected Annual flood Damages** (**EAD**) for the appraisal of flood risk management options;
- Identification of **structural** (grey and green structures) and **non-structural measures** to reduce flood risk;
- Estimation of measures' **costs and benefits** (**CBA**);
- Prioritisation of measures and **development of a phased investment programme**.



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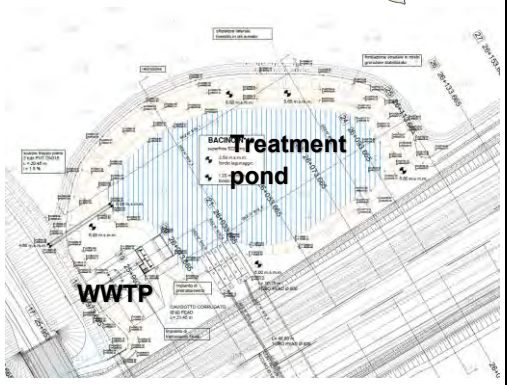
Assignment name: Detailed Design and works construction for the extension of A4 motorway, route Quarto d'Altino – San Donà (IT).	**Approx. value of the contract:** 124,500.00 € **Approx. Construction cost:** 162,500,000 €
Country: ITALY **Location within country:** Veneto Region	**Duration of assignment (months):** 6
Name of Client: 3TI ITALIA spa **Contracting authority client:** Salini Impregilo – Scott Wilson Ltd	**Total Nº of staff-months of the assignment:** 15
Address: Via del Fornetto 85, 00149 Roma – ITALY	**Approx. value of the services provided by your firm under the contract:** 124,500.00 €
Start date (month/year): 02/2012 **Completion date** (month/year): 08/2012	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** N/A
Name of joint venture partner or sub-Consultants, if any:	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Davide Russo, PhD – **Team Leader** / **Project Manager** Eng. Christian Marson, PhD – **Drainage Expert** Eng. Francesco Peratoner – **Hydrological expert** Eng. Fabio D'Alessandro – **Hydraulic Modeller**

Narrative description of Project:

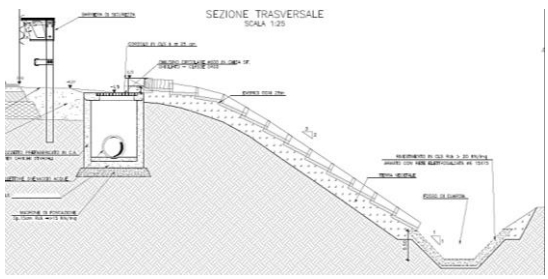
The Autostrada A4, or "Serenissima", is a motorway which connects Turin and Trieste via Milan and Venice. It runs through the whole Pianura Padana, which is a densely populated and highly industrialized area, A4 is one of the most trafficked motorways of Italy. A4 is a dual-carriageway, six-lane motorway for most of its length. The stretch from Venice to Trieste is instead a four-lane motorway but it is being upgraded to six lanes. The total motorway length is 517 km.

Proper drainage is a very important consideration in design of a motorway. The general function of a **motorway surface drainage system** is to remove rainwater from the road and water from the motorway right-of-way. It is known that motorway surface run-off can contain a cocktail of potential pollutant and the impact of the latter in adjacent watercourses, including groundwater, ca be very site specific and environmentally dangerous.



The motorway affects also the natural surface and subsurface drainage pattern of a watershed. The motorway A4 has to be aligned often as to cross natural drainage channels, streams and major rivers. The A4 alignment crosses man-made channels like those for irrigation. In such cases, the need for constructing **cross drainage system** arises to ensure that the water flows beneath the road without causing any inconvenience or instability to the highway structure.

Idrostudi was in charge for the **hydraulic modelling** and the **detailed design** of the motorway surface drainage system. The **patterns formed** by existing **cross drainage system** such as **natural streams**, **rivers**, **irrigation/drainage channels** in the **drainage basin** were **studied** as well by means of extensive hydrological and hydraulic modelling in order to understand the impact of different drainage solutions in the behaviour of the motorway. The **intensity** of **rainfall**, **frequency** and **duration** which contribute to surface **run-off** were properly study. The scope of the consultancy service was the detailed design of: **lagooning areas**, **WWTPs** (grease trap), inlets for stormwater collection, **storm pipes**, **longitudinal drains** (open, trapezoidal, rectangular), **chutes**, **toe drains**, **ditches**, open channels (trapezoidal or V-shaped ditches), **pump stations** for covering differences in altitude, reinforced concrete **culverts** (slab culverts, masonry arch culverts, pipe culverts, R.C.C. box culverts), **rivers** and **channels slopes improvement**, thalweg lowering, **rivers cross-sections enlargement** and improvement, bridge pier/abutment scour evaluation and protection.



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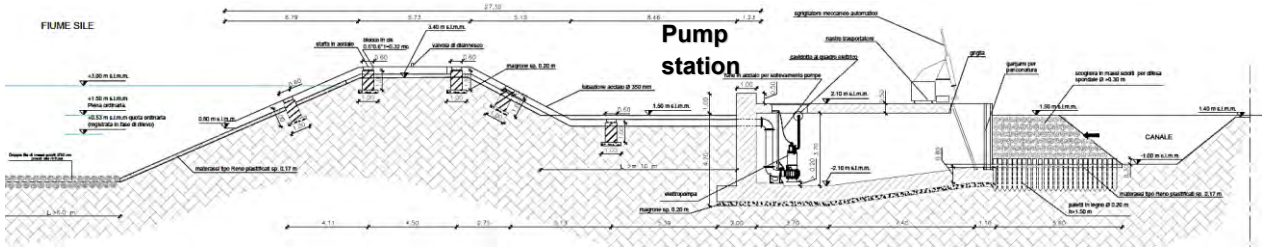
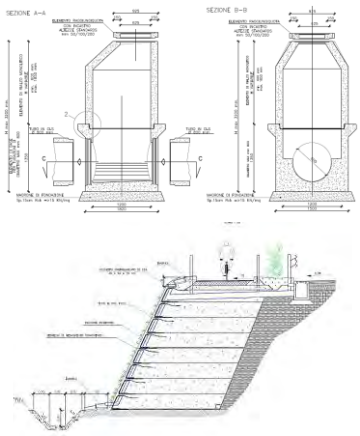
It is important to mention that the first 5 mm of run-off on the motorway surface were collected and treated by **WWTPs** (**lagooning areas, soakaways, ponds)** in order to **clean the water** from oil and other pollutants left on the surface from the vehicles during the dry period and washed away during a single storm event.



Description of actual services provided in the assignment:

- **Data collection** and analysis; **topographical surveys**;
- Hydrogeological analysis of the drainage system; **watersheds definition**;
- **Hydrological modelling; Peak flow estimation**;
- **Hydraulic modelling** of **streams**, **rivers**, **irrigation channels** in the drainage basin;
- **Analysis** of the **hydraulic interaction** between the **drainage patterns** and the **motorway alignment;**
- **Hazard** and **risk mapping;**
- **Hydraulic modelling** of the **motorway surface;**
- **Detailed design** of the **drainage systems (surface drainage and cross drainage systems)**;
- Use of Sustainable drainage systems (**SuDS**);
- **BoQ** and **cost estimates**; **Technical specification**.



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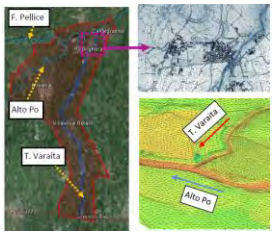
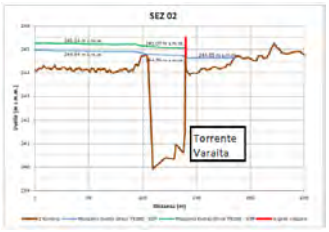
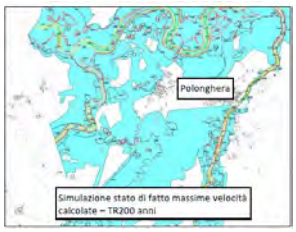
Assignment name: **2D Hydraulic modelling** of the Varaita-Po confluence in the stretch Brossasco - Polonghera (IT).	**Approx. value of the contract:** 100,000.00 €
Country: ITALY **Location within country:** Piemonte Region	**Duration of assignment (months):** 12
Name of Client: University of Trieste – Civil Engineering and Architecture Department	**Total Nº of staff-months of the assignment:** 12
Address: Piazzale Europa n.1, 34127 Trieste – ITALY	**Approx. value of the services provided by your firm under the contract:** 100,000.00 €
Start date (month/year): 01/2013 **Completion date** (month/year): 12/2013	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** N/A
Name of joint venture partner or sub-Consultants, if any:	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Christian Marson, PhD – **Team Leader** Eng. Davide Russo, PhD – **Hydrological Expert** Eng. Luca Falcomer, PhD – **Hydraulic/Modeller expert**

Narrative description of Project:





Flooding, as a major natural disaster, affects many parts of the world including developed countries. Due to this natural disaster, billions of euro in infrastructure and property damages and hundreds of human lives are lost each year. The **Po** is a river that flows eastward across northern Italy. The Po flows **682 km**. The **Po is the longest river in Italy**; at its widest point its width is 503 m. The Po ends at a delta projecting into the Adriatic Sea near Venice. It has a **drainage area** of **74,000 km²**. The river is subject to heavy flooding. Consequently, over half its length is controlled with dikes. The river flows through many important Italian cities, urbanised areas, industrial areas and agricultural areas. The aim of the study was to investigate, through **2D numerical modelling**, the hydrodynamic conditions of the river Varaita that arise near the confluence with the Po river when flood events occur, in order to **assess** the **adequacy** of the **existing flood defences** or possible need to adapt them or build new ones to make the territory safe against flooding. Idrostudi carried out **hydrological** (rainfa-runoff) and **hydraulic modelling** (**2D modelling**) defining the areas prone to flooding for different return periods (20, 200, 500-year). Idrostudi carried out its activities in accordance to the **EU Flood Directive** (2007/60/EC). First, topographical data were digitized, and digital elevation model (DTM) was prepared using GIS by means of an existing **LiDAR survey** provided the Italian Ministry of Environment. Then, flood flows of different return periods were simulated using a hydraulic model. The calibration of the rainfall-runoff and hydraulic models has been done on the base of the data collected during an historical flood (2000). Finally, flood risk maps were obtained by integrating the results of GIS and the hydraulic modelling. **Flood risk analyses** were guided by the national legislation for Flood Risk Management that complies with the requirements, methodologies and objectives as those defined in the **EU Floods Directive**. A **plan of structural and non-structural measures** was prepared, defining long, medium and short-term investment programmes for flood prevention and protection. The plan was founded on the principle of sustainability so that **measures were conceived to be technically realizable, economically justifiable, ecologically sustainable, and socially shareable**. The results have been disseminated through workshops and meetings with the stakeholders.



Description of actual services provided in the assignment:

- **Data collection** and analysis; **topographical surveys**; **bathymetric** cross sections **survey**; Use of remote sensing technologies (satellite imagery, LiDAR, DEM, DSM, DTM); Support the process of stakeholder information and consultation throughout the project;
- **Historical flood data analysis**, Preliminary Flood Risk Assessment (**PFRA**);
- **Hydrological modelling**; **Hydraulic modelling (1D-2D)**;
- **Flood hazard** mapping; **Flood Risk Assessment** (**FRA**) and mapping;
- River long profiles with different return periods plotted; **Calculation** of **Expected Annual flood Damages** (**EAD**);
- Identification of **structural** and **non-structural measures** to reduce flood risk.

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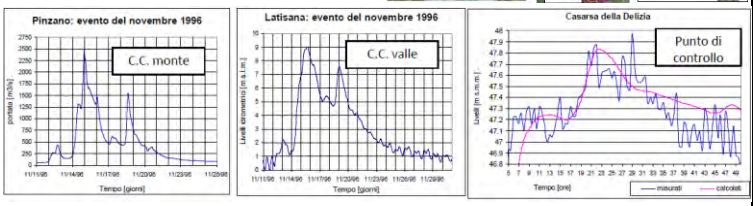
Assignment name: **Flood Risk Management Plan** for Tagliamento River in the stretch Pinzano - Ronchis (IT).	**Approx. value of the contract:** 100,000.00 €
Country: ITALY **Location within country:** Friuli Venezia Giulia Region	**Duration of assignment (months):** 12
Name of Client: University of Trieste – Civil Engineering and Architecture Department	**Total № of staff-months of the assignment:** 12
Address: Piazzale Europa n.1, 34127 Trieste – ITALY	**Approx. value of the services provided by your firm under the contract:** 100,000.00 €
Start date (month/year): 01/2005 **Completion date** (month/year): 01/2006	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** N/A
Name of joint venture partner or sub-Consultants, if any:	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Christian Marson, PhD – **Team Leader** Eng. Davide Russo, PhD – **Hydrological Expert** Eng. Luca Falcomer, PhD – **Hydraulic/Modeller expert**

Narrative description of Project:

Several factors contribute to the occurrence of **flood disasters**. One is the natural event of **extreme precipitation** and consequently excessive river discharge and flood water levels. The second aspect is represented by **human interventions** that play a relevant role in the occurrence of flood disasters. Idrostudi was commissioned to carry out a **flood hazard** and **risk assessment** of the areas involved by the river Fella (tributary of Tagliamento river) and river Tagliamento in the stretch Pinzano – Ronchis. The comprehensive flood risk study considered a number of anthropogenic factors that could increase exposure and vulnerability to floods.

The Tagliamento is a **braided river** in north-east Italy, flowing from the Alps to the Adriatic Sea at a point between Trieste and Venice. The watershed covers an area of **2,916 square kilometres**. The **river passes through very important urbanized and industrial areas that need protection**. The river length is about **180 km**. If there are important **changes in flow regime** in the Tagliamento River this may impact the planned urban and industrial development of the adjacent areas.



The aim of this study was to obtain flood hazard and risk maps. Idrostudi carried out **hydrological** (rainfa-runoff) and **hydraulic modelling** (**1D-2D modelling**) defining the areas prone to flooding for different return periods (10, 50, 200-year). First, topographical data were digitized, and digital elevation model was prepared using GIS. Then, flood flows of different return periods were simulated using a hydraulic model. Finally, flood risk maps were obtained by integrating the results of GIS and the hydraulic modelling. The calibration of the rainfall-runoff and hydraulic models has been done on the base of the data collected during an historical flood (1996).

Description of actual services provided in the assignment:

- **Data collection** and analysis; **topographical surveys**; **bathymetric** cross sections **survey**;
- Support the process of stakeholder information and consultation throughout the project;
- **Historical flood data analysis**, Preliminary Flood Risk Assessment (**PFRA**);
- **Hydrological modelling** (intensity-duration-frequency curve (IDF) and Depth-Duration-Frequency Curves (DDF));
- **Hydraulic modelling (1D-2D)**;
- **Flood hazard** mapping; **Flood Risk Assessment** (**FRA**) and mapping;
- River long profiles with different return periods plotted;
- **Calculation** of **Expected Annual flood Damages** (**EAD**);
- Identification of **structural** and **non-structural measures** to reduce flood risk.

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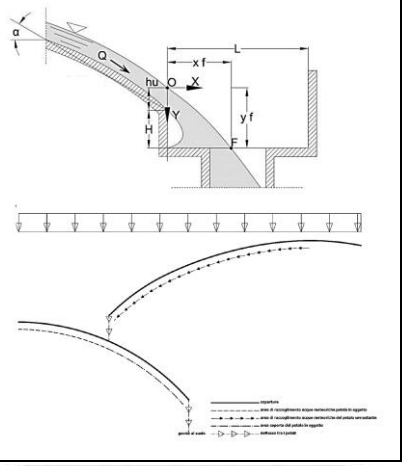
Assignment name: Consultancy Service for the analysis of runoff from Tbilisi Public Service Hall rooftop for improving the **stormwater drainage system design.**	**Approx. value of the contract:** 32,000.00 €
Country: GEORGIA **Location within country:** Tbilisi	**Duration of assignment (months):** 2
Name of Client: Permasteelisa Spa (Joint Stock Company) **Contracting authority:** LEPL Civil Registry Agency / LEPL National Public Registry Agency.	**Total № of staff-months of the assignment:** 3
Address: via E. Mattei 21/23, 31029 Vittorio Veneto (TV), (ITALY)	**Approx. value of the services provided by your firm under the contract:** 32,000.00 €
Start date (month/year): 04/2012 **Completion date** (month/year): 06/2012	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** N/A
Name of joint venture partner or sub-Consultants, if any: N/A	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Davide Russo, PhD – **Project Manager** / Eng. Christian Marson – **Stormwater expert** / Eng. Giorgio D'Orlando – **Hydrological expert and Hydraulic Modeller**

Narrative description of Project:

Cities are seen as both the source of and solution to today's economic, environmental and social challenges. The urban areas are the engines of the global economy and act as catalysts for creativity and innovation throughout the World. It is an example the **Tbilisi Public Service Hall**, designed by Massimiliano and Doriana Fuksas. It is situated in the central area of the city and it overlooks the Kura (Mtkvari) river. The Tbilisi Public Service Hall was inaugurated on September 2012. The building houses the National Bank of Georgia, the Minister of Energy, and the Civil and National Registry in a 42,000 m² building composed of seven volumes. The public service building is situated in a central area of the ceiling where it overlooks the Kura River. The seven volumes that make up the building contain offices for the different public agencies housed inside.

The roofing is made up of a system of 11 elements situated at different heights and characterized by a mainly convex surface. These eleven rooftops, described as "petals", are independent – formally and structurally – from the building. The petals, different for their geometry and dimension, reaches almost 35 meters and they are supported by a structure of steel pillars with a tree shape, visible, as well as the petals, externally and internally from the building. The structure gives the impression of being in a overgrown mushroom forest or in the midst of ancient towering trees. These isolated forms are perceived from both the exterior and interior of the building.

Idrostudi was entrusted with the **study of the effects of rainfall** on the roofing and the **design of the roof stormwater collection systems**.



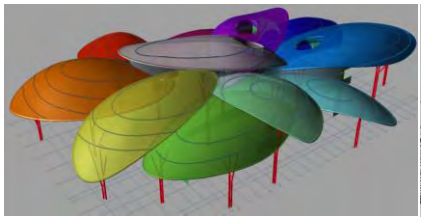
The study was essentially divided in two parts: (1) **Analysis** of the **rainfall-runoff** on the petals in order to identify the critical points where said flow is concentrated; (2) Analysis of drainage of rainfall that inflows in the structure, to identify the points where there is water accumulation and to **design** the **stormwater collection system**.

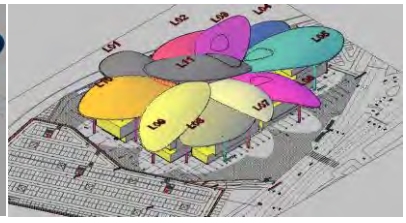
The rooftop must be seen as an artificial surface that is designed to drain rapidly and completely. Waterproof-coated or concrete surface building roofs have almost ideal runoff conditions in a hydrologic runoff analysis. The runoff flow follows the rainfall intensity pattern with time. In this study, Idrostudi assumed that a rooftop surface was a perfect drain area without any loss.

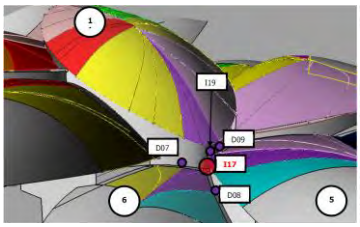
The runoff along the surface of the petal was obtained and calculated by rebuilding the steepest slope curves. The envisaged method split the surface of the petal in smaller areas (roofing stripes). Interestingly, some sections of the area are not affected directly by rainfall as they are covered by overlapping petals.

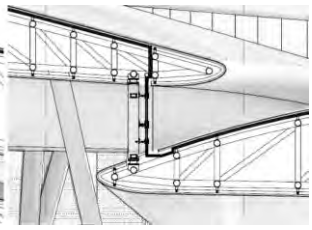
The roofing surface in this case is affected by the flow, but it is not a gathering surface directly exposed to rainfall.

To properly characterize the draining phenomenon, a series of physical laboratory tests were carried out on a gutter 0,5 m wide, while varying the flow.









Design and testing of the drainage systems

Construction site (2012)

Description of actual services provided in the assignment:

- **Data collection** (hydrological data and records) and analysis;
- Rainfall statistical analysis;
- **Hydrological modelling**;
- **3D modelling** of the rooftop covering;
- **Rainfall-runoff analysis** on the rooftop;
- **Hydraulic modelling** of the runoff on the rooftop;
- Numerical modelling and design of structural measures for stormwater rooftop drainage systems;
- **Physical modelling** and **testing** of the **stormwater drainage systems**;
- **BoQ** and **cost estimates** of the drainage structure.

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Assignment name: Consultant Service for the **wastewater flows monitoring campaigns** of the whole **sewerage networks** managed by CAP Group 2019-2026	**Approx. value of the contract:** 8,758,962.49 €
Country: ITALY **Location within country:** Milan (MI)	**Duration of assignment (months):** 90
Name of Client: CAP HOLDING S.P.A.	**Total Nº of staff-months of the assignment:** 940
Address: Via del Mulino n. 2, Building U10 – 20090 Assago (MI), ITALY	**Approx. value of the services provided by your firm under the contract:** 1,315,844.37 € (Partner JV 15%)
Start date (month/year): 01/2020 **Completion date** (month/year): Expected end 06/2026	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** 802 person-months
Name of joint venture partner or sub-Consultants, if any: BM Tecnologie Industriali Srl (IT) – Leader and Supplier of the instruments for monitoring.	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Mauro Castellarin, PhD – **Project Manager** Eng. Davide Russo, PhD – **Team Leader** Eng. Francesca Zanello, PhD – **IT network specialist** Eng. Alex Stefani – **Hydraulic Modeller** Eng. Marco Simon Ostan – **Hydraulic Modeller** Eng. Gianfranco Tamburi – **Hydraulic Modeller** Eng. Fabiana Cavazzon – **Hydraulic Engineer**

Narrative description of Project:

CAP HOLDING Group is the parent company that manages the legacy of **networks** and **plants** for the **Integrated Water Service** of all the Municipalities of Milan (including the city centre and part of the province), is responsible for strategy and financial control, and invests in knowledge and informatisation. It focuses on the planning and implementation of investments in the **water infrastructure** and **asset management**. CAP HOLDING Group guarantees the supply of drinking water and the entire range of services regarding water treatment for potable water (WTP), wastewater collection and related treatment (WWTP). The **municipalities** served are **155** for a total of almost **3,2 million people served** by **water supply**, **wastewater** and **treatments systems**. The Group manages **6,440 km** of **WS networks**, **6,570 km** of **WW networks**, **765 wells**, **345 Water Purification Plants**, **40 WWTP with a total of 845 employees.**

The Group is carrying out the **rehabilitation** of the **WW network system** in order to comply with EU Directive and Italian regulation. Due to the complex WW network system the Group has the need to carry out a series of **monitoring campaigns** of the **wastewater flow rates** in the **sewage networks**, including the **installation** of **flow meters** on the **mains** and **submains** on 78 municipalities, with the aim to analyse the system performance. The project is divided into 4 phases. (1) **Network mapping** (surveys + GIS); (2) **Monitoring Campaigns**; (3) **Hydraulic network modelling**; (4) **WW network reorganization plan development**. The project covers the **residential**, **commercial** and **industrial sewerage networks**.

Idrostudi is in charge for the following activities:

- extensive and detailed **networks surveys (video inspection)**;
- **definition** of the Combined Sewer Overflow basins (**CSO basins**);
- **hydrological modelling**;
- **verify the functioning** of the **sewage networks** in **dry** and **wet** (rainy) **condition**;
- identify/quantify the **extraneous flows infiltrations** and their distribution in the sections of the sewage;
- identify/verify the **wastewater flow rates** and **pollutant loads** to the treatment plants;
- verify the correct hydraulic operation of the weirs (overflow sections);
- calibrate and validate the numerical models of the sewage networks by using the information collected with the monitoring campaigns.

The hydraulic modelling will evaluate the following:


- the average, min and max **non-storm flow** over 24 hours during the **dry months** of the year. It is composed of the average sewage flow and the average dry weather inflow/infiltration;
- the average, min and max **flow** over 24 hours during the **wet months** of the year on days when no rainfall occurred on that or the preceding day;
- functional analysis of the sewerage weirs;
- the **base flow**. Wastewater flow (including a reasonable amount of inflow and infiltration) originating from residential, commercial and industrial sources;
- presence of sediment in the pipes.

An important analysis that will be carried out by Idrostudi refers to groundwater, illegally discharged drainage water, or rainwater flowing into a sanitary sewage causing additional costs in treatment (the so-called **extraneous water**). In order to identify the extraneous flows in the sewer systems and define the necessary operations for their control and reduction, the realization of the measurement campaigns of the wastewater flows in the sewer network will be supporting the analysis.

The installation of the monitoring system is provided by the Lead partner (BM Tecnologie Industriali Srl (IT).

The outcomes of the above activities will **support** of the **investment planning actions** to **rehabilitate** the **WW network** where needed in order to **improve the network efficiency reducing the criticality**.

Description of actual services provided in the assignment:

- **Data collection** and analysis;
- **Topographical surveys**, **drainage** and **wastewater network surveys**;
- **Stakeholder engagement/information/consultation** throughout the project;
- **Extraneous flows detection**;
- BASELINE establishment;
- Web-based platform design;
- **GIS** database;
- CAD implementation;
- **Hydrological modelling**;
- **Hydraulic** and **numerical modelling** of the **stormwater** and **wastewater network**;
- Continuous monitoring system design;
- Execution of **hydraulic monitoring campaigns** and **field test**;
- Knowledge Transfer and **Capacity Building Program**.

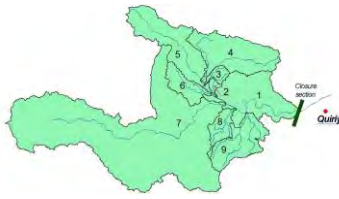
** Pictures taken from CAP HOLDING Group website*

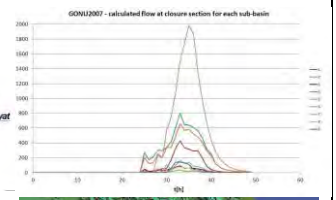
Idrostudi srl
Area Science Park, Padriciano 99
34149 Trieste (TS) – ITALY - P.IVA 01039560329

Assignment name: Consultancy Service for the **flood protection** of Quriyat City in relation to the Wadi Mailass basin.	**Approx. value of the contract:** 35,000.00 € **Approx. Construction cost:** 140,845,000.00 €
Country: OMAN **Location within country:** Quriyat City	**Duration of assignment (months):** 4
Name of Client: EASTSERVICE LTD **Contracting authority:** Ministry of Regional Municipalities and Water Resources of Oman (MRMWM).	**Total № of staff-months of the assignment:** 6
Address: Saburtalo Street 27, Tbilisi (GEORGIA)	**Approx. value of the services provided by your firm under the contract:** 35,000.00 €
Start date (month/year): 06/2012 **Completion date** (month/year): 09/2012	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** N/A
Name of joint venture partner or sub-Consultants, if any: N/A	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Davide Russo, PhD – **Project Manager** Eng. Christian Marson – **Hydraulic expert** Eng. Francesco Peratoner – **Hydrological expert** Eng. Marco Simon Ostan – **Hydraulic Modeller**

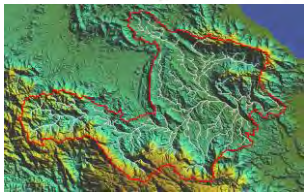
Narrative description of Project:

Cyclone Gonu (2007) and Peth (2009) have caused a hundred of casualties in Oman country with injury for houses, facilities, goods and assets. The overall objective of the project was to conduct feasibility study and prepare detailed design for construction of the **most economically advantageous engineering solution** that would **protect** the **flood prone areas** of Quriyat and of the whole catchment (villages of Mukhadah, Hayfadh and Siya), from floods and avoid losses of lives, damages of properties, delay and disruption in life.



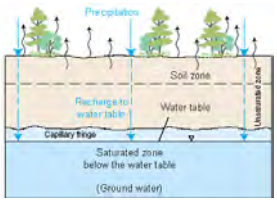


The **protection** of Quriyat was achieved with a **dam** and its reservoir that can **damp the floods** of Wadi Majlass and release discharges that can pass through the town and reach the sea without flooding. The protection of Mukhadah, Hayfadh and Siya was achieved mainly with **wadi arrangements** and **dikes** that increase the hydraulic section available for flood discharge.



The main hydraulic issues were: the definition of the volume of the reservoir necessary to damp the flood wave, the height of the dam and of all the related hydraulic works, basing on the hydrographs calculated in the hydrological study; the hydraulic study of the whole catchment with a 2D model: this model allowed to estimate the flood risk in the existing situation and to check the effectiveness of the design works in protecting people and things from flooding.

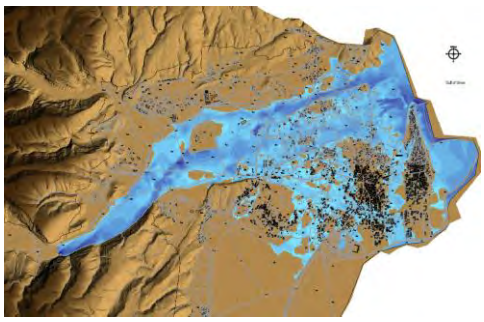
Idrostudi was in charge for the **hydrological study** of the wadi catchment by means of **rainfall-runoff modelling** (including in-depth evapotranspiration analysis, **climate change** and PMP – Probable Maximum Precipitation definition), for the **definition** of the **areas prone to flooding** for different return periods (5, 20, 100, 200, 500, 1,000 and 10,000-year), **flood hazard analysis** and **flood risk assessment** (FRA), **solid transport assessment**, **dam break analysis** and **lifespan** analysis of the **dam reservoirs**.

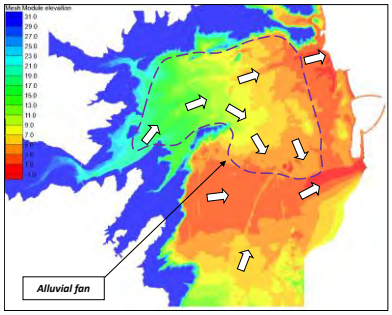


For the hydrological modelling local scale processes, namely **infiltration** and **runoff production**, were modelled by analysing a unit ground surface and using soil water levels as state variables. Four distinct **soil layers** were distinguished: soil surface; root zone (properly, the soil); unsaturated zone; saturated zone (the **aquifer**). On the basis of a preliminary analysis of the basin orography, the catchment area was then sub-divided into 9 sub-basin in order to overcome modelling problems arising from lack of homogeneity in basin morphology and rainfall distribution.

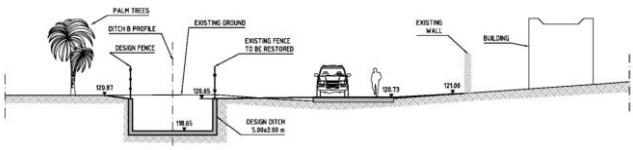
For a good representation of the physical phenomena an accurate description of the morphology of the study area was needed. In order to satisfy the requirement of the hydraulic modelling, a **detailed topographical survey** of all dam **reservoir** and the **urban area of Quriyat** including **rivers**, **levees**, **roads**, **land**, and **buildings** etc. has been performed.

Starting from the **topographic survey** a triangular mesh, in which every element has three computational nodes with different lengths of cells edges (within a range of 10 – 30 m) has been defined. A **2-dimesions hydraulic model** has then been developed in order to study the hydraulics of the Wadi Majlass in the villages of Mukhadah, Hayfadh, Siya and in the Quriyat area (protected by the dam).



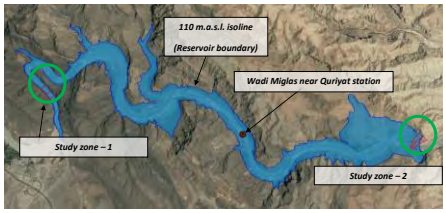


Additional flood **mitigation measures** for the protection of buildings/assets from flooding were **modelled** and **designed** in Hayfadh, Mukhadah and Siya. The hydraulic verifications of the design works have been performed through a bidimensional hydraulic model, developed for each site. The design works consisted mainly in **new dikes** (diverting part of the incoming flows outside of the village), **wadi bed excavation**/arrangement, riverbed **debris removal**, **new canalization** passing through the villages, new **diversion channels**.



The **dam break effects** are evaluated using a **two-dimensional numerical model** for the simulation of the shock wave propagation to the downstream areas. The numerical simulations results described the flood area extension, the velocity field and the maximum water levels in the downstream areas.

The **potential sedimentation volume rate** (reservoir lifespan analysis) that can accumulate upstream the Majlass dam has been performed taking into account two different zones: the upstream area of the dam reservoir and the downstream area near the dam site.



Description of actual services provided in the assignment:

- Site visits, **data collection** and analysis;
- **Soil investigations** and **topographical surveys**;
- Support the process of stakeholder information and consultation throughout the project;
- **Hydrological modelling**;
- **Hydraulic modelling** (**1D** and **2D**);
- Flood **hazard mapping**; Flood Risk Assessment (**FRA**) and mapping;
- River long profiles with different return periods plotted;
- Calculation of Expected Annual flood Damages (**EAD**) for the appraisal of flood risk management options;
- Modelling and design of structural measures for flood risk reduction;
- BoQ, cost estimates Cost and Benefit analysis (**CBA**).

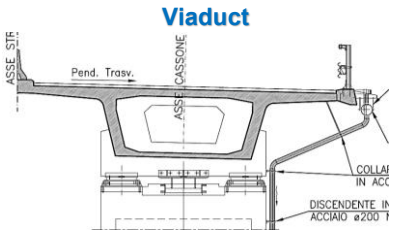
** Pictures taken from the project outputs delivered by Idrostudi srl*

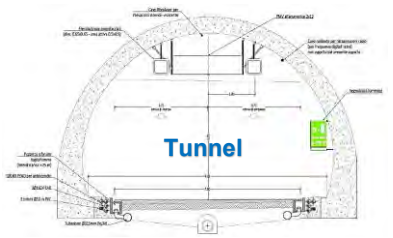
Idrostudi srl
Area Science Park, Padriciano 99
34149 Trieste (TS) – ITALY - P.IVA 01039560329

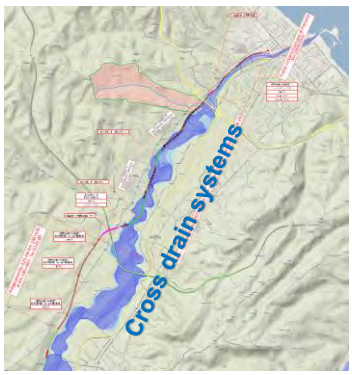
Assignment name: Consultancy service for the preliminary design of the surface drainage system of the viaducts and the tunnels of the motorway A24 Roma – L'Aquila – Teramo and A25 Torano-Pescara.	**Approx. value of the contract:** 67,300.00 € **Approx. Construction cost:** 95,450,000 €
Country: ITALY **Location within country:** Lazio and Abruzzo Region	**Duration of assignment (months):** 6
Name of Client: Infra Engineering Srl	**Total Nº of staff-months of the assignment:** 10
Address: Viale Abruzzo, 66100 Chieti (CH) – ITALY	**Approx. value of the services provided by your firm under the contract:** 67,300.00 €
Start date (month/year): 07/2013 **Completion date** (month/year): 12/2013	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** N/A
Name of joint venture partner or sub-Consultants, if any: N/A	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Davide Russo, PhD – **Team Leader** / **Project Manager** Eng. Christian Marson, PhD – **Drainage Expert** Eng. Francesco Peratoner – **Hydrological expert**

Narrative description of Project:

The Autostrada A24-A25 or "Motorway of the Parks" is a motorway connecting Rome (Tyrrhenian Sea) to the Adriatic Sea. The A24-A25 motorway creates a new historical linkage between Rome and the **insidious Apennine mountains**, alongside historical Romans roads Salaria, Flaminia and Tiburtina. The total motorway length is about 280 km spread over an almost **completely hilly** and **mountainous area**, with **complex orography**. For this reason, the motorway requires the adoption of **complex civil engineering solutions**, with extensive sections in viaducts and in tunnels. It worth to mention that the Gran Sasso double tunnel is the longest in Europe. The route is currently managed by Strada dei Parchi S.p.A..



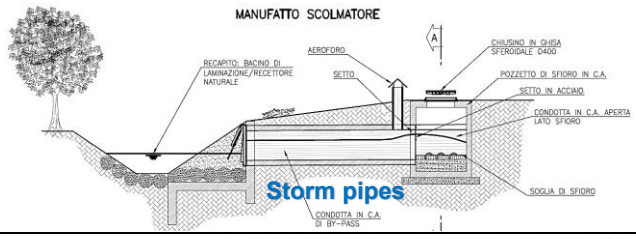




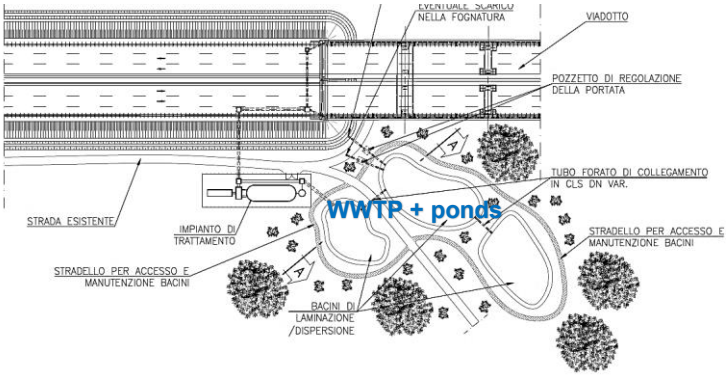
Proper drainage is a very important consideration in design of a motorway. The general function of a **motorway surface drainage system** is to **remove rainwater** (or snow melted) from the road and water from the motorway right-of-way. The motorway affects also the natural surface and subsurface drainage pattern of a watershed. The motorway A24-A25 has to be aligned often as to **cross natural drainage channels**, **streams** and major **rivers** coming from the catchments. In such cases, the need for constructing **cross drainage system** arises to ensure that the water flows beneath the road without causing any inconvenience or instability to the motorway structure.

Idrostudi was in charge for the **hydrological-hydraulic modelling** and the **design** of the motorway surface drainage system (**viaducts** and **tunnels**). The **patterns formed** by existing **cross drainage system** such as **natural streams**, **rivers**, **irrigation/drainage channels** in the **drainage basin** were **studied** as well by means of extensive hydrological and hydraulic modelling in order to understand the impact of different drainage solutions in the behaviour of the motorway. The **intensity** of **rainfall**, **frequency** and **duration** which contribute to surface **run-off** were properly study.

The scope of the consultancy service was the study and design of: inlets for stormwater collection, **storm pipes**, **longitudinal drains** (open, trapezoidal, rectangular), **chutes**, **toe drains**, **ditches**, open channels (trapezoidal or V-shaped ditches), **inverted siphon**, **pump stations** for covering differences in altitude, reinforced concrete **culverts** (slab culverts, masonry arch culverts, pipe culverts, R.C.C. box culverts), **rivers** and **channels slopes improvement**, **flood storage areas**, **rivers cross-sections enlargement** and improvement.

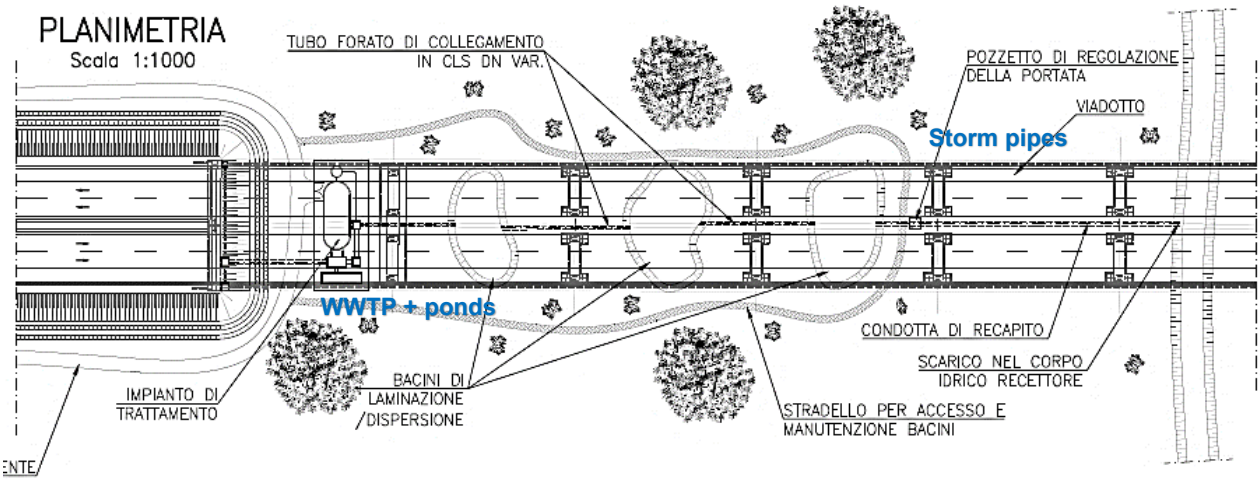


Road operation contributes litter, suspended solids, toxicants, oil and other hydrocarbons to storm run-off. Tyre wear contributes to road grit and traces of the zinc used in tyre manufacture. Vehicle parts are a source of iron, nickel, copper, cadmium and chromium. Fuel combustion and additives produce lead, sulphur and nitrogen compounds. Fuel or lubricant spills may result in release of petrol or oils and hence hydrocarbons into storm water systems and/or ground water.

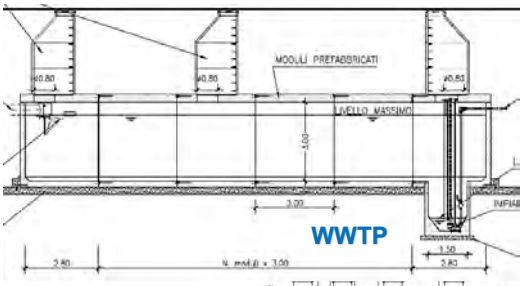


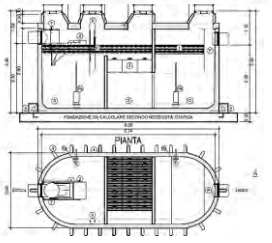
In order to **clean the water** from oil and other pollutants left on the surface from the vehicles during the dry period and washed away during a single storm event, Idrostudi designed the surface drainage system in order to collect and treat the stormwater by **WWTPs** (e.g. **grease trap**).

Particular effort was put to the hydraulic parametrisation of viaducts and tunnels of the motorway concerning lengths, average slopes, position of **flood alleviation/storage areas** and **WWTPs** for treating the **accidental spillage** of **hydrocarbons/oils** over the asphalt.



Description of actual services provided in the assignment:





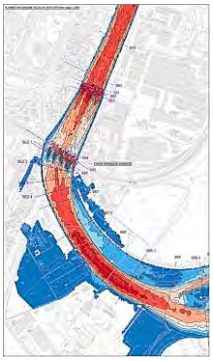
- **Data collection** and analysis; **topographical surveys**;
- Hydrogeological analysis of the drainage system; **watersheds definition**;
- **Hydrological modelling; Peak flow estimation**;
- **Hydraulic modelling** of **streams**, **rivers** in the drainage basins;
- **Analysis** of the **hydraulic interaction** between the **drainage patterns** and the **motorway alignment;**
- **Hydraulic modelling** of the **motorway surface;**
- **Design** of the **surface drainage system**;
- **Design** of the **cross drainage system**;
- **Design** of **flood alleviation/storage areas**;
- **Design** of **WWTPs** for **treating the accidental spillage** of **hydrocarbons/oils** over the asphalt.;
- Use of Sustainable drainage systems (**SuDS**): swales, buffer strips, infiltration systems, litter traps, sedimentation basins, bio-retention systems,
- **BoQ** and **cost estimates**; **Technical specification**.

** Pictures taken from the project outputs delivered by Idrostudi srl*

Idrostudi srl
Area Science Park, Padriciano 99
34149 Trieste (TS) – ITALY - P.IVA 01039560329

Assignment name: Framework Contract: Consulting Services for Feasibility Studies, Preliminary Designs and Detailed Designs of railways and roads infrastructure in relation to hydrology and hydraulic constructions.	**Approx. value of the contract:** 100,000.00 €
Country: ITALY **Location within country:** Whole Country	**Duration of assignment (months):** 24
Name of Client: ITALFERR S.p.A. - Italian State Railways Group	**Total № of staff-months of the assignment:** 12
Address: Via V. G. Galati, 71, 00155 Roma (ITALY)	**Approx. value of the services provided by your firm under the contract:** 100,000.00 €
Start date (month/year): 01/2016 **Completion date** (month/year): 01/2018	**No. of professional person-months provided by the Joint Venture Partners or the Sub-Consultants:** N/A
Name of joint venture partner or sub-Consultants, if any: N/A	**Name of senior regular full time employees of your firm involved and functions performed:** Eng. Davide Russo, PhD – **Team Leader** / **Project Manager** Eng. Christian Marson, PhD – **Hydraulic constructions** Eng. Luca Falcomer, PhD – **Hydraulic expert** Eng. Francesco Peratoner – **Hydrological expert** Eng. Marco Simon Ostan – **Hydraulic Modeller**

Narrative description of Project:



ITALFERR S.p.A. – a company belonging to the Italian State Railways Group – operates throughout Italy and abroad, providing engineering services in the field of conventional and high speed railways and other transport infrastructure projects, such as metropolitan railways, tram transport systems, roads, intermodal and port transportation systems. The core operations include feasibility studies, detailed design, tendering & contract management, work supervision, acceptance testing and commissioning of infrastructure subsystems (civil works and conventional and innovative technology systems). Italferr has made a substantial contribution to Italy's national railway infrastructure, designing, supervising, building, upgrading, modernising rail lines. In this context Idrostudi's has been awarded a **Framework Contract** covering the major Italian railways lines in order to carry out **hydrological-hydraulic analysis** and **design hydraulic infrastructure serving** and **protecting** the lines. Railways affect the natural surface and subsurface drainage pattern of a watershed or individual hill slope. Idrostudi was in charge for **studying** and **designing solutions** for the **reduction** and/or **elimination** of **energy generated by flowing water**, **improving** the **drainage** and **removing** the **risk of floods** caused by the rail lines. The designer imposed that water must not be allowed to develop sufficient volume or velocity so as to cause excessive wear along ditches, below culverts, or along exposed running surfaces, cuts, or fills. Idrostudi, after carrying out a robust **hydrological-hydraulic analysis** of the catchments involved by the rail lines included in the Framework Contract, developed a proper design of the catchment drainage systems involving rivers and channels networks as well. The **drainage schemes** involved the design of **inlets** for **stormwater collection**, **storm sewers**, **open channels** (trapezoidal or V-shaped ditches), reinforced concrete **culverts**, rivers and channels **slopes improvement, thalweg lowering, rivers cross-sections enlargement and improvement, bridge pier/abutment scour evaluation and protection.**

Description of actual services provided in the assignment:

- **Data collection** and analysis; **topographical surveys**, **bathymetric surveys**; (LiDAR remote sensing, DTM)
- Collection of rainfall depth data at several rain gauge stations;
- Collection of water levels and flows (where available) of the existing rivers/channels crossed by the rail lines;
- Geomorphological analysis of complex drainage systems; **watersheds definition**;
- GIS-CAD design;
- **Hydrological modelling**; **Peak flow estimation** for **different period of occurrence**;
- **Hydraulic modelling (1D-2D);**
- Identification of flood hazard and flood risk (**FRA**) and mapping; Platform drainage;
- **Hydraulic** and **structural design** of standard solutions for crossing works (ditches, culverts, pipes, ...) with rivers and channels; **BoQ** and **cost estimates**; **Technical specification**.

** Pictures taken from the project outputs delivered by Idrostudi srl [AQ n° 200000991]*