GLOBAL WATER EXPERTS
Tokyo Engineering Consultants Co., Ltd. (TEC) is a leading Japanese consulting firm in the water sector, providing integrated services for water and environmental engineering works for over a half century. In 2012, TEC International Co., Ltd. (TECI) was launched as an affiliated company specialized for the global market, forming TEC Group with TEC aspiring to more comprehensive and broader services.


TEC Group is an independent consultant. By not having any relationship with contractors, manufacturers or any others, we can provide unbiased and independent consideration of projects solely based on sound technology and professional judgment in serving the best interest of the client.

TEC Group also maintains sufficient professional staff to cover the engineering disciplines that are essential to perform a complete line of consultancy services such as civil, sanitary, mechanical, electrical, structural and others, together with financial planning, cost estimation, tender documentation, construction supervision and overall project management. The services provided since our establishment have over and over proven our usefulness and reliability in rendering consulting services to the satisfaction of the client.

TEC Group is duly registered with major national and international funding organizations such as Japan International Cooperation Agency (JICA), Asian Development Bank (ADB) and The World Bank.
TEC Group is a leader in water treatment technology. We excel in large-scale water treatment plants because we have advanced technology for planning and designing them. In fact, TEC Group has participated in the development of Japan’s foremost large-capacity treatment plants which employ advanced treatment processes and sludge treatment facilities, as well as in many water treatment plants in countries around the world. TEC Group is also a leading developer of membrane treatment plants. We designed the Kinuta WTP (Tokyo) which is the largest scale membrane treatment plant in Japan. We also designed RO (reverse-osmosis) desalination plants which are gaining popularity in Middle Eastern Countries.

SERVICES
- Water demand forecast
- Development of efficient treatment processes corresponding to raw water quality
- Planning and design of treatment facilities
- Technical training for operation and maintenance

■ EXPERIENCE TO PRODUCE HIGH WATER QUALITY

Tokyo Misato WTP (Japan)
TEC Service=DD
TEC designed the largest class of advanced water treatment plants which have ozone and activated carbon process and use space-saving multi-stage structures.
- Service area: West and south parts of Tokyo metropolitan wards
- Production capacity: 550,000 m³/day

New Amagasaki WTP (Japan)
TEC Service=DD
TEC designed advanced water treatment process for the Amagasaki WTP using ozone followed by granular activated carbon for higher quality of water. It employs the highest level of technology of water supply engineering with latest aseismic design and high filtration rate.
- Service area: Kobe, Amagasaki, Ashiya and Nishinomiya
- Production capacity: 373,000 m³/day

Project for Water Supply in Corriverton (Guyana)
TEC Service=BD, DD, CSV
TEC designed slow sand filtration for iron removal, which is introduced for the first time in Guyana, thus ensuring easy and stable water treatment process at low operating cost.
- Population served: 15,000 people
- Production capacity: 3,800 m³/day
LARGE SCALE WATER TREATMENT PLANT EXPERIENCE

Phnom Penh Water Supply Project (Cambodia)
TEC Service=MP, FS, BD, DD, CSV
TEC conducted master planning for reconstruction of Phnom Penh water supply systems. We also carried out basic design and feasibility study for entire water supply facilities, including Phum Prek water treatment plant, pump stations, and distribution systems.

For the project, TEC received a national decoration by Cambodian government.
- Population served: 940,000 persons
- Production capacity: 256,000 m³/day

Improvement of Water Supply System for Greater Amman Area (Jordan)
TEC Service=BD, DD, CSV
Amman, the capital city of Jordan with some 1.5 million population, had suffered from water shortage and bad water quality for many years, and increasing intake and production capacity was urgently needed.

TEC carried out basic design, detailed design, tender documentation, and construction supervision to provide clean water for citizens. In designing, TEC employed central control telemetry SCADA system for efficient operation of pumping stations and WTP facilities.
- Production capacity of WTP: 250,000 m³/day
- Raw water pumping station: 16 sets of 2,610 m³/h x 308m x 3300 kW

Kerala Water Supply Project (INDIA)
TEC Service=DD, CSV
This was the largest scale water supply project ever undertaken in Kerala state covering five cities.

The project included full scale water supply facilities: intakes, water treatment plants, transmission mains with ancillary structures including automation, storage tanks and pumping stations including automation and distribution systems.
- Total population served: 4.3 million people
- Production capacity: 532,000 m³/day (new), 144,000 m³/day (rehabilitation)
TEC Group’s design in the planning of transmission and distribution systems is very advantageous since it lowers maintenance costs. We focus not only on hydraulically even distribution, but also on Non-Revenue Water (NRW) control by introducing district metering areas (DMAs), which facilitates restoration in case of disaster or accidents. We apply GIS to plan and design wider area water transmission and distribution systems that can also be used for other applications such as network analysis and facility management.

To cope with various natural conditions, TEC Group offers rational solutions with high reliability and economic efficiency. For unutilized energy, we also develop hydraulic power generation systems using excessive water level difference which exists in pipelines.

SERVICES
• Efficient layout planning of mains and network
• Hydraulic Analysis
• Development of economically and hydraulically optimal size and shape of pipes
• Development of efficient asset management system by GIS system
• Engineering training for NRW control

WATER PIPELINE DESIGN AND MANAGEMENT EXPERIENCE

GIS Planning and Database in Al-Basrah City (Iraq)
TEC Service=FS

TEC developed extensive GIS applications, not only for planning and facility design but also for asset management as well as customer database using satellite image to prepare GIS base map.
• GIS asset management system
• Coverage area: 46,000 km²

NRW CONTROL EXPERIENCE

NRW Control Program in Kerala State (India)
TEC Service=TA

TEC conducted extensive leakage survey and NRW analysis in the cities in Kerala and drew up overall NRW reduction program
• Survey area: 2.5 km², 4,000 households with 16,500 persons

ADVANCED WATER DISTRIBUTION CONTROL IMPROVEMENT EXPERIENCE

Improvement of Transmission and Distribution System in Hiroshima City (Japan)
TEC Service=DD

TEC designed better NRW control for water transmission and distribution systems by introducing DMAs (District Metering Areas) with telemeter system. This achieved equal water distribution and prompt recovery in case of disaster or accident.
• Total length of distribution network: 4,000 km
• Total population served: 1.1 million
TEC Group has a top reputation in environmental management of water projects. We set up appropriate discharge water quality regulations to assist local communities to effectively manage their water environments based on pollution analyses.

TEC Group offers water quality management planning by using river water pollution analysis software, such as Mike11® and Qual2E®. TEC Group introduces works to conserve local water environments as well as to preserve rare species.

To assist the implementation of projects, we conduct environmental and social research including IEE, EIA and information disclosure to stakeholders at public meetings. We have also implemented public participation and awareness programs sometimes with involvement of NGOs to generate involvement in the project by the beneficiaries.

SERVICES

- Various studies on water resources; river, lake, swamp, estuary and ocean
- Wastewater generation analysis
- Mathematical modeling for water quality
- Water pollution control planning
- Recycled water management & planning
- Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA)

ENVIRONMENTAL MANAGEMENT OF WATER EXPERIENCE

Water Quality Management Plan for Ganga River (India)

TEC Service=MP , FS

Ganga River is the largest among major river basins supporting the lives of about 430 million Indian people. Considered as a sacred river, many people bathe in river water daily, and it also serves as source of water supply for drinking and irrigation purposes. Due to increased population and related human and industrial activities, Ganga and its tributaries are polluted to an alarming level and pose adverse impact on human health and surrounding ecosystem.

TEC performed master plan and feasibility study for improvement of water quality of Ganga River, with sewerage improvement plan for four major cities.

- Catchment area of basin: 838,583 km²
- Total population in 2030 (4 cities): 15.9 million people
- Total treatment capacity: 2,515,000 m³/day (19 sewage treatment stations)
- Establishment of GIS data management system.

Yamuna Action Plan (YAP) Phase I and II (India)

TEC Service=PF, PM, MP, FS, DD

As one of the largest tributaries of the Ganges, Yamuna River passes through important urban centers like Delhi and Agra in Northern India. Rapid urbanization and industrialization have increased water pollution that causes health and sanitation problems for the residents.

For Phase I, TEC performed river pollution analysis for whole river basin including analysis of pollution loads from 33 major towns, impact of solid and industrial waste management, linkage between slum settlements in Delhi and pollution, and pollution abatement and water quality improvement plan of Yamuna River.

- Catchment area of basin: 345,848 km²
- Total treatment capacity: 726,000 m³/day
- Total length of sewer pipe: 179 km
- Sewage treatment plants: 29 stations
- Pumping stations: 58 stations
- Small sewage treatment plants: 15 stations
TEC Group is an expert in planning and designing large scale sewage treatment plant. We designed the largest sewage treatment plant in Japan: Morigasaki STP in Tokyo metropolitan with capacity of 1 million m$^3$/day.

TEC Group is a leader in regional sewerage system planning, and is especially well-known for planning and designing of the so-called riverbasin-wide sewerage system. TEC Group revitalized the most polluted river in Japan, Furoh River, by planning riverbasin-wide sewerage system; river pollution was reduced to 10% (as BOD$_5$) after 15 years of the project.

TEC Group has broad experiences in developing countries covering research and pilot study of new technologies, sewerage study and planning, training and management consulting for sewerage construction projects. By adopting appropriate technologies based on local conditions, affordability and available technology, we have decentralized sewerage systems and utilized onsite treatment such as Micro STPs and septic tanks, community and public toilets especially for low income communities. Other solutions include:
- Conventional or advanced activated sludge (AS) method and fluidized aerated bed (FAB) for densely populated urban area
- Trickling filter (TF) method, Up-flow anaerobic sludge blanket (UASB) method and USAB and aerated lagoon method as a low cost technology for urban area
- Waste stabilization method (WSP) as the lowest cost technology for rural city and villages

TEC Group is a pioneer of CDM (Clean Development Mechanism) projects, which is a global approach to reduce greenhouse gas (GHG) emission. In sewerage projects, we have good experience in planning digestion gas collection and generation system.

SERVICES
- Identification of pattern of wastewater, wastes and night soil generation
- Hydraulic analysis and design of sewerage facilities
- Development of efficient treatment processes to meet effluent standards
- Development of low cost sewerage technologies
- Treatment and reuse of sewage sludge as a resource
- GIS information systems to integrate all planning, designing, maintenance information to support effective management of a wide-range of facilities

LARGE SCALE SEWERAGE PROJECT EXPERIENCE

**Morigasaki Sewage Treatment Plant (Japan)**

TEC Service=DD

TEC designed the largest capacity sewage treatment plant in Japan, the Morigasaki STP in Tokyo with coverage of a quarter of the densely populated Tokyo metropolitan area.

Water is treated and discharged into Tokyo Bay, and some amount is filtrated and recycled. The plant also has digestion gas generation system and hydropower generation system for effective use of energy.
- Coverage area: 14,675 ha
- Design sewage treatment capacity: 1,540,000 m$^3$/day

**Shibaura Sewage Treatment Plant (Japan)**

TEC Service=DD

In the most dense urban business district in Tokyo, TEC designed the largest class sewage treatment plant, Shibaura Sewage Treatment Plant.

Treated water is cleaned and discharged into Tokyo Bay, and some amount is further treated and supplied to the surrounding office buildings as toilet flushing water.
- Coverage area: 6,440 ha
- Design population: 500,000 people
- Design sewage treatment capacity: 910,000 m$^3$/day
LARGE SCALE SEWERAGE PROJECT EXPERIENCE (Cont’d)

Water Supply and Sewerage Project in Karachi (Pakistan)
TEC Service=MP, FS
Although Karachi, the largest city in Pakistan, is growing rapidly, the capacity of existing water supply and sewerage systems fell short of demand and physical conditions, and service quality of the water supply and sewerage systems were seriously deteriorated causing water pollution and environmental problems.

Through rehabilitation, upgrading and expansion of the existing facilities, TEC planned to increase coverage rate from 30% to 100%, and reduced water pollution load from 600 to 80 mg/L by introducing a sewage treatment plant.

- Design population: 15.6 million people
- Design sewage treatment capacity: 1.5 million m³/day (total of four plants)
- Total length of sewers: 10,200 km

Project for Wastewater Management in Skopje (Macedonia)
TEC Service=MP, FS
Although about 80% of population had sewerage in Skopje, the capital of Macedonia, wastewater was not treated and discharged into the river that caused water pollution of Vardar River, the biggest river spanning the country.

TEC planned to introduce water pollution control through construction of a sewage treatment plant after carrying out hydrologic and water control simulation of Vardar River to estimate water flow and water quality. We also made the process design of treatment system utilizing sludge for digestion gas, industrial wastewater management plan, planning for institutional strengthening, and environmental study.

- Total area of sewerage: 87,831 km²
- Design population in treatment districts: 662,520 persons

Imagery:
- Vardar River
- Existing Plant of Karachi
- Digestion Tank

Improvement of Sewerage System of Niamey (Niger)
TEC Service=MP, FS
In Niger, the rapid growth of the urban population had considerably aggravated sanitary environment of Niamey since 1980s.

TEC master planning for sanitation improvement focused on improvement of sewerage and drainage system, sewage treatment and solid waste management as well as technology transfer on water quality monitoring, planning and management of sewerage systems, and pilot plant installation.

- Study Area: 11,210 ha
- Length of sewer main: 258 km

CLEAN DEVELOPMENT MECHANISM (CDM) PROJECT EXPERIENCE

Abu Rawash Sewage Treatment Plant (Egypt)
TEC Service=MP, FS
TEC planned the CDM application to reduce emission of GHG produced during sludge treatment process. The TEC design will introduce an egg-shaped digester combined with digestion gas generation system.

- Design sewage treatment capacity: 1,200,000 m³/day
- Estimated reduction of GHG emission: 208,000 ton CO₂/year

Imagery:
- Existing Plant of Niamey
- Digestion Tank
**Reconstruction**: TEC Group is a leading consultant for reconstruction of the lifeline water supply and sewerage systems in post-conflict countries and areas. In these projects, TEC Group assesses damaged and rehabilitation needs for water supply and/or sewerage facilities, prepares a reconstruction master plan, conducts a feasibility study, prepares designs for works, and consults on project implementation.

TEC Group has contributed to reconstruction works in countries that have experienced severe conflict such as Cambodia, East Timor, Bosnia-Herzegovina, Iraq.

**Prevention of Disruption**: In planning prevention of lifeline disruption prior to a disaster incident, TEC Group creates disaster hazards map and prepares a regional scale comprehensive disaster management plan. In addition, priority of disaster prevention measures are proposed based on expected magnitude of damage, budget, cost effectiveness and importance of the facilities after diagnosis assessment.

TEC Group has provided services to prepare disaster prevention guidelines in anti-seismic projects of water supply and sewerage system in Iran, and services for rapid damaged assessment of water supply infrastructure needs in Indonesia, just after the Central Java Earthquake.

**SERVICES**

- Baseline data collection and sector analysis
- Rehabilitation needs assessment
- Master planning for short to mid term rehabilitation plan
- Formulation of urgent rehabilitation program
- Institutional capacity development program
- Disaster prevention on earthquake

**RECONSTRUCTION OF LIFELINES EXPERIENCE**

**Rehabilitation of Water Supply Systems in Timor Leste (Timor Leste)**

TEC Service=MP, FS, BD, DD, CSV, TA

In the post-referendum violence in Timor Leste, many of the water supply facilities were damaged resulting in lack of potable water. In addition, the management of the water supply systems in the country was on the verge of collapse from the withdrawal of Indonesian engineers who had given technical and management support.

Just after the conflict, TEC entered in Timor Leste and prepared a master plan of water supply system for 15 cities after conducting a development study. TEC rendered rehabilitation plan, design and construction supervision for the major cities of Dili, Same and Ainaro.

- Total population served (15 towns): 200,000 persons

**Urgent Rehabilitation of Wastewater Treatment Plant of Sarajevo City (Bosnia and Herzegovina)**

TEC Service=FS

During the military conflict in Bosnia and Herzegovina, proper maintenance of the wastewater treatment plant (WWTP) which was at the forefront of the fighting zone was not done. In addition, the water quality of the Miljacka River and the Bosnia River declined due to effluents from the plant.

TEC together with counterpart personnel of Government carried out review of existing plan, formulation of basic plan for rehabilitation of WWTP and feasibility study on urgent rehabilitation of WWTP. The feasibility study included the technical study, environmental impact assessment (EIA), comprehensive evaluation, implementation plan, financial analysis, and recommendations for improvements.

- Treatment capacity: 172,600 m³/day
- Total length of sewer pipe: 45.3 km
Projects for Rehabilitation and Reconstruction of Water Supply and Sewerage Systems in Iraq (Iraq)

TEC Service=MP, FS

From over two decades of wars, water supply and sewerage systems were seriously deteriorated, resulting in severe water shortage and poor hygiene conditions. TEC performed the following:

Feasibility Study on Reconstruction of Baghdad Water Supply Systems
• Total length of rehabilitation network: 294 km
• Total number of water meters: 149,200.

Urgent Improvement Plan for Reconstruction of Al-Basrah Water Supply System covering feasibility study, institutional improvement plan and preparation of non-revenue water control plan.
• Total length of rehabilitation network: 285 km
• Production capacity: 245,000 m$^3$/day
• RO plant: 145,000 m$^3$/day

Feasibility Study on Expansion of Karkh Sewage Treatment Plant
• Served population: 1.7 million people
• Treatment capacity: 351,000 m$^3$/day

PREVENTION OF LIFELINES DISRUPTION EXPERIENCE

Earthquake Resistant Plan of Water Supply System in Nishinomiya City (Japan)

TEC Service=MP

Thousands of people were killed in Hanshin-Awaji Great Earthquake in 1995. Lifelines of water facilities were also seriously damaged.

TEC designed earthquake resistant plan for reinforcement of water supply facilities, increase of backup capacity, emergency water supply and quick recovery measures.
• Total population served: Approx. 430,000 people

Earthquake-Resistance Plan for Water Supply System in Teheran (Iran)

TEC Service=MP

Although Teheran is located in an area well-known for frequent occurrence of large earthquakes, disaster management to maintain water supply system lifeline in an earthquake was not established.

TEC conducted study to prepare earthquake- resistant plans for water supply system in Teheran with concrete prioritized countermeasures against earthquake damages. The study included seismic motion analysis in several earthquake scenarios, damaged assessment of water supply system and evaluation of damage prevention measures. Damaged assessment was used to prepare an earthquake resistance plan.
• Total population: Approx. 11 million people
TEC Group is a leading consultant in the control of storm water discharge. Using storm water discharge analysis and our own storm water discharge simulation model, TEC Group offers the most cost effective plan for storm water discharge control, with the capability to visually show the impact of urban flooding and the improvement effects of countermeasures.

For improving combined sewerage systems, TEC Group offers a range of countermeasures to reduce pollution load including: increase of discharge ability of sewer network, decrease of collection of rainwater by increasing reserve capacity of rainwater upstream and infiltration ability, and improvement of rainwater overflow facilities.

TEC Group also provides consulting services on the reuse of rainwater for increase of water resources and as a countermeasure to draught periods or as a reserve for urban disaster prevention and emergency water source. We also provide consulting on the recycle of storm water by groundwater recharge and on the mitigation of heat island phenomena in dense urban area.

SERVICES

- Investigation of location and capacity of existing drainage
- Inquiry of previous floods and magnitude of their damages
- Hydrological research and analysis
- Development of economical measures to prevent flood

DRAINAGE CONTROL EXPERIENCE

Comprehensive Urban Flood Control in Yokohama (Japan)
TEC Service=MP

Recently in Yokohama, one of the highest density urban areas in Japan, intense rainfall and build-up of the pavement area have caused large urban flooding which paralyzed most city functions.

TEC identified the causes of urban flooding through rainwater discharge analysis and prepared comprehensive and urgent urban flood control plans to minimize damage by flooding including:

- Preparation of development plan of flood mitigation facilities
- Preparation of non-facility measures for mitigation in intense rainfall

Hazard Map for Hiroshima City (Japan)
TEC Service=MP

In order to minimize damages caused by intense rainfall efficiently, TEC realized that self-help of residents was vital and should be promoted by non-facility measures, in addition to facility measures that are implemented through public works based on discharge analysis. As a non-facility measures to promote awareness of the residents, TEC prepared “inland water hazard maps,” which contains the information on urban flooding, evacuation routes and centers, etc.
TEC Group has completed groundwater development projects in many countries with particular experience in Africa. In addition to engineering services, TEC Group also provides technical assistance services including technical training and capacity development programs.

In working towards MDGs (Millennium Development Goals) that highlight the significance of rural water and sanitation, TEC Group has contributed to many projects worldwide such as Sierra Leone, Mali, Vietnam, etc. In planning and designing, TEC Group provides appropriate solutions in terms of ecological and financial sustainability. Besides engineering works, TEC Group introduces a participatory approach and proposes suitable capacity development program to ensure sustainability.

SERVICES
- Planning water and sanitation projects in rural areas
- Water resources development and management planning
- Hydrologic, hydraulic and water quality study
- Design and construction supervision of water and sanitation facilities
- Technical assistance in rural water and sanitation projects

SAFE WATER EXPERIENCE FOR DOMESTIC USE

**Improvement of Water Supply in Sikasso Region (Mali)**
TEC Service=BD, DD, CSV, TA

Many people living in Sikasso region of Mali didn’t have access to safe water in their villages. Fetching water over long distances was a heavy burden for women and children, and people were always at high risk of water borne disease.

TEC implemented a well construction program which increased rate of access to safe water through the project: from 10% to 86%. We also provided technical assistance for institutional strengthening of the implementing agency.
- No. of beneficiaries: 63,300 persons
- Solar powered water supply systems: 5
- Deep well with hand pumps: 150

**Project for Improvement of Water Supply Systems in Kambia District (Sierra Leone)**
TEC Service= TA

Although water supply facilities were constructed in major cities of Sierra Leone 30-40 years ago, most facilities fell out of operation after a few years of construction because of lack of technical knowledge, skills and finance. In addition, they were severely damaged during the civil war.

TEC proposed slow sand filtration which enables easy operation and low operation cost. TEC also carried out capacity development for management, operation and maintenance of waterworks.
- Population served: 14,000 people

SANITATION EXPERIENCE

**Rural Water Supply and Sanitation Project in Southern Coastal Zone (Vietnam)**
TEC Service= MP, FS

In rural communes of the southern coastal provinces, sanitary conditions were poor since only 40% of rural households were estimated to have access to sanitary latrines.

TEC conducted a pilot program in communes and IEC (Information, Education and Communication) activities to promote sanitation improvement. Also, TEC developed a new type of urine-feces diversion toilet which enables resource recycling and protection against groundwater pollution.
**TEC Group**

- We provide Clients with professional and the highest quality consultancy services for making a safe and hygienic water environment.
- We are client-oriented, specifically in the fields of Water Supply and Sanitary Engineering, leading to improvement in water quality and aiming at improved access to safe drinking water and sanitation facilities worldwide.
- We practice timely delivery of projects with optimized budget.
- We maintain our competitive edge by staying at the forefront of technology. We offer leading solutions to clients who want to optimize their output.

**Group Profile**

**TEC Holdings Co., Ltd.**
Establishment: 2014      Capital: 80 million yen

**Tokyo Engineering Consultants Co., Ltd. (TEC)**
Establishment: 1959      Capital: 80 million yen

**TEC International Co., Ltd. (TECI)**
Establishment: 2012      Capital: 60 million yen

**AQUA PARTNERS CO., LTD.**
Establishment: 2002      Capital: 20 million yen

**Professional Staff**

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Major Projects Worldwide

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TEC Branch Offices
► Tokyo ► Tohoku ► Kansai ► Kyushu ► Niigata ► Nagoya ► Hiroshima
Sub-Branch Offices ► We have 37 sub-branch offices as of October 2015

TECI Branch/Liaison Offices
► India/New Delhi City ► India/Kerala ► Azerbaijan/Baku

Professional Affiliations
Consulting Engineer No.21-67 (TEC), No.24-9920 (TECI), Ministry of Land, Infrastructure, and Transport
1st Class Architectural Office No.-4391 Tokyo Municipality
Surveyor No.13-822 Ministry of Land, Infrastructure, and Transport
Geological Survey No. 21-2152

Quality Standards:
We are an ISO certified consulting firm, always proactively providing clients with the most updated
technological solutions available in the world.
ISO 14001: 2004, JMAQA-E321