Oil & Gas Upstream
Services

MWH® now part of Stantec

MWH, now part of Stantec, brings 30 years of experience in the oil and gas (O&G) industry to ensure the most innovative and sustainable solutions for the upstream sector.

Our global track record in the upstream O&G sector, gives us a thorough understanding of the environmental and safety issues related to these projects and the most advanced technologies and approaches available.

We have a deep awareness of the challenges our O&G clients face when dealing with the upstream phases of a project's life cycle. By bringing our global expertise to assist our clients in upfront planning and front-end engineering design (FEED), we have delivered solutions that are both regulatory compliant and reduce the long-term operational expenditure (OPEX) associated with upstream developments.

Water is a critical component in the development and operation of an Unconventional Oil & Gas (UCOG) field.

Our Relationship with Oil & Gas

We have assisted numerous O&G clients in the permitting, engineering, and construction of infrastructure critical to their operations. Our focus on upfront planning and broad services offerings allows for sustainable solutions to be incorporated into the project life-cycle to reduce environmental impact while increasing capital and operational efficiencies for upstream O&G developments.

Our company plans, designs, develops, builds and operates some of the world's largest and most complex water, wastewater, industrial treatments, sewer, and stormwater systems.

Specifically for the UCOG industry, we provide comprehensive upstream infrastructure permitting, produced water management and treatment solutions, environmental compliance, and reclamation/remediation services to meet the lifecycle needs of UCOG projects.

Given that the management, conveyance, treatment and disposal of produced water and frac flowback represents one of the largest challenges to an upstream UCOG development, our team provides the required expertise to develop solutions that achieve the following:

- Meet regulatory and social acceptance requirements;
- Reduce long-term OPEX; and
- Optimize well field development by ensuring a secure and steady source of water that meets the required water quality requirements for well drilling and completions either via the treatment and conveyance of produced water and/or other water resources (e.g. shallow brackish groundwater).

Our expertise extends throughout the practices, processes and requirements of the industry.

Permitting and Compliance

We have assisted O&G clients to gain regulatory and stakeholder acceptance of new developments and bring complex projects to successful completion through regulatory approvals, environmental planning and assessment, and permitting services including:

- Expertise in local, state and international regulatory requirements
- Environmental, social, health impact assessments
- Surface and subsurface site investigations and risk assessments
- Permitting for discharge systems and underground injection
- Public outreach / Stakeholder management
- Sustainability planning
- Compliance, due diligence and management systems audit
- Land use, siting studies and resource management

Water Supply and Conveyance

Our services are focused in the core areas of water and wastewater, including pump stations, pipelines, storage tanks, canals, and reservoirs. Our water distribution engineering services encompass a wide range of activities from new design and construction to inspection and refurbishment of existing infrastructure. Our expertise includes:

- Water main replacement/rehabilitation
- Condition assessment and analysis
- Design of new water main extensions
- Pump station design and improvements
- Transmission main extension or replacement
- Storage tank design and rehabilitation
- Pump station improvements
- Water treatment and supply facility and watershed land improvements
- Water treatment facility upgrades and equipment improvements
- Investigation of new groundwater supply sources and groundwater treatment facilities
- Water intake design

Wastewater Management

Our company was founded as a water treatment design firm and has continued that emphasis with the design of more than 470 water treatment plants around the world. Our industrial wastewater treatment expertise includes:

- Water flooding optimization
- Hydrocarbon and solids removal
- Soluble organics removal
- Dissolved salts removal
- Emerging technologies
- Disposal options
- Land application
- Evaporation
- Injection wells
- Beneficial use and surface discharge
- Recycle / reuse

Solid Waste Management

O&G companies are recognizing the wider benefits that can be gained from the responsible use of resources and minimization of waste. Our solid waste specialists have expertise in all stages of the waste cycle and can provide practical planning and engineering solutions. Our work is governed by sustainability principles and focuses on a 'cradle to grave' approach. We have evaluated and implemented a wide range of waste minimization initiatives for clients around the world with a focus on developing alternatives to allow for re-use, recycling, reduction and recovery of individual and combined waste streams. A particular strength of our team is in the area of integrated waste management systems.

Wastewater Treatment:

- 470+ water treatment facilities
- 6,000 bbl/d to 350,000 bbl/d in capacity

Water Supply & Conveyance:

- 300,000+ miles of pipelines
- 1,000+ pumping stations
- 66,000+ horsepower

Remediation and Restoration

Leveraging our experience with remediation technology and our ability to proactively engage and respond to regulatory and other stakeholder concerns, our team develops logical and defensible remediation solutions. Our solutions solve technical challenges while addressing our client's needs to balance risk management with cost control in a responsible manner.

Our environmental remediation and restoration services include:

- Site investigations
- Human health and ecological risk assessments
- Remedial feasibility studies
- Facility closure strategies
- Remediation design and construction
- Groundwater, soil and sediment decontamination
- Operation, maintenance and monitoring
- Impoundment development and closure
- Regulatory negotiations, community relations, and stakeholder engagement
- Litigation technical support

Design/Build Capabilities

We offer a full range of high-value, "start-to-finish" preconstruction, construction and construction management services. We provide engineering, design, construction, commissioning, and start up services for projects ranging from water treatment and conveyance to environmental remediation. We perform services based on specific enginweering and construction management tasks or under turnkey design/build approaches to meet demanding schedules. We also serve as an owner's representative and coordinate all equipment vendor and contractor activities on behalf of the client.

Our Research Team

We offer research services, including:

- Treatability studies
- Pilot testing
- Third-party technology evaluations
- Brine treatment

We have staff that are specifically dedicated to the evaluation and development of water and waste treatment technologies, and to facilitate their integration into our projects worldwide.

- Projects conducted for industrial waste and wastewater treatment include acid rock drainage, petrochemical processes, oil and gas produced water, VOCs, perchlorate, explosives contaminated groundwater, heavy metals removal, and treatment of various industrial waste streams.
- Projects conducted for water applications have focused on ozonation, chemical clarification, filtration, carbon adsorption, air-stripping, membrane filtration, taste and odor control, corrosion control, biofilter control and disinfection.
- Projects conducted for wastewater applications have focused on UV disinfection, ozone disinfection, biological treatment, and membrane treatment for water reclamation and reuse.

Specialized Software Tools for Oilfield Water Management Planning

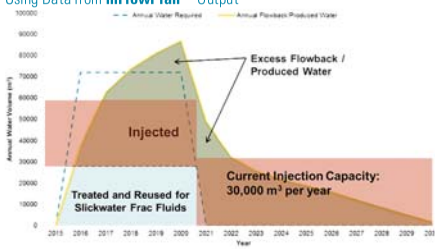
We have invested in developing specialized software tools that codify the analytical processes for estimating water yields from UCOG wells to support the optimization of oilfield water management plans. Our software tools, mFlowPlan, mVIPER, and WBER provide the following utility:

mFlowPlan® uses decline curve analysis to estimate the water requirements of a hydraulic fracturing program as well as the water yields of an UCOG well for the purpose of preparing an oilfield water balance;

mVIPER® is a computer-aided design and geographic information system based on the Autodesk InfraWorks™ platform that supports the efficient planning, layout, and visualization of oilfield water management schemes, and is a 5D tool that allows cost databases to be linked to engineering designs for efficient updates as revisions are made;

WBER® is a water balance, efficiency, and reuse software tool that allows for the efficient evaluation of water treatment processes and their effectiveness relative to treatment requirements.

Using Data from **mFlowPlan®** Output



The capacity of anticipated water infrastructure is overlaid onto the anticipated water volumes to forecast a water balance and identify any gaps in water infrastructure planning

Our Company is a **Top Performer** in All Things **Water**

Engineering News-Record Global Sourcebook, December 15, 2014

#1 Top 50 International Design Firms in Sewer

#1 *Top 15 International Design Firms in Sanitary and Storm Sewers*

#2 *Top 25 International Design Firms in Wastewater Treatment*

#2 *Top 25 International Design Firms in Water Treatment and Desalination*

#3 *Top 50 International Design Firms in Water Supply*

Australian produced water treatment plant benefits from intelligent water management solutions

Our detailed design of two 40 Ml/d water treatment plants for Origin Energy resulted in reduced waste volumes and increased recovery of the water produced from the gas extraction process.

Produced water is reused for horticultural developments in Australia

We planned and designed solutions to utilize treated associated water from gas production activities. Water was reused by local farmers on various crops and will increase beef production in their land.

Husky exploration activities receive our permitting services in Canada

We obtained SLWB approval for eight land use permits (LUP), one LUP amendment, and five water license applications for these winter exploration programs.

Our team completes feasibility study for waste management facility in Azerbaijan

SOCAR's waste management and treatment facility focused on optimizing recovery of oil and other materials from the waste streams, using various state of the art processes.

Produced water management planning and treatment services for enCana, Wyoming

Short-term water management options included SWDs, evaporation ponds, and beneficial reuse. Long-term recommendations included the pilot testing of reverse osmosis membranes to allow for a surface water discharge.

Our team assesses Naturally Occurring Radioactive Materials (NORM) at gas production facilities in Middle East

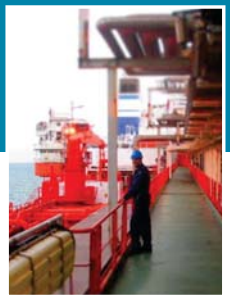
Through desktop review and site survey, the project identified the presence of NORM in the client's onshore and offshore operations, the level of potential contamination and any risks posed to workers.

Supporting oil and gas companies in livelihood restoration programs in China

For this conventional gas development project, our team supports its clients in resettling individuals living in the development area. International standards and socially responsible actions are a priority.

Chukchi Sea Oil Exploration project gains comprehensive HSE compliance

We provided technical support for ConocoPhillips' offshore oil exploration program in this remote and environmentally challenging arctic area, with a high level of regulatory and political interest.



Assessing safety for a Dutch oil and gas company in Asia and Europe

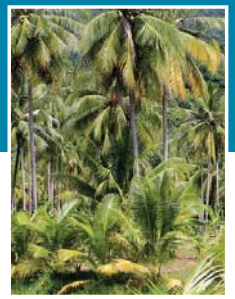
Our team performed risk assessments on the FPSOs (Floating Production, Storage and Offloading) operated by the client for oil and gas producers worldwide to achieve country regulation compliance.

Anadarko seeks our produced water support in Utah

Our company engineered and constructed produced water management and treatment systems at three locations in the Natural Buttes field, where injection wells have run out of capacity.

A state-of-the art waste management facility for Agip KCO oil and gas field in Kazakhstan

We developed the design of the Koshanai waste management facility to treat domestic and industrial waste for an oil and gas field and provided the detailed design of the energy from waste building. The desert environment requested special attention to water conservation and re-use and limiting air borne emissions.



Risk-Based Corrective Action (RBCA) Study for Petrobras gas exploration in the Peruvian Amazonian forest

The characterization involved barite-bearing soils and waters coming in contact with spent drilling mud and cuttings during gas wells drilling. Based on human health and ecological risk analysis we recommended corrective actions.

We bring **global expertise** and **services** to assist the **upstream O&G** sector in **all phases** of the upstream **project life-cycle**.

Upstream O&G Project Phases

Asset Acquisition

Exploration & Planning

Production & Development Plans

Field Development

Facilities Construction

Production & Optimization

Decommissioning

Our Service Offerings

- Due diligence
- Asset inventories
- Cost analysis
- Environmental, health, safety & security (EHS&S) due diligence

- Power sourcing
- Regulatory permitting
- Baseline surveys
- Concept design
- Upfront water resource planning
- Water forecast modelling
- Associated water management planning, and feasibility studies
- Waste management planning, concept and feasibility studies
- Environmental & baseline assessments and monitoring
- Geophysical & drilling exploration program support
- Environmental, social and health impact assessment (ESHIA)
- Land acquisition and resettlement policy framework

- FEED
- Procurement support management
- Supply chain
- Environmental compliance
- Concept design
- Water resource assessments well
- Pilot permitting
- Produced water management, treatment evaluations and disposal
- Facility siting
- Deep well brine injection scheme design
- Field development options assessment

- Roads
- Well pads
- Stormwater structures
- Geotechnical investigations
- Environmental monitoring

- EPCM
- Design/Build
- EPC
- Commissioning and start-up
- Environmental monitoring
- EHS&S coordination and training

- Water system optimization
- Supply chain management
- Asset integrity assessments
- EHS support
- Waste management
- Water flooding design
- Asset and liability assessment

- Decommissioning and demolition
- Remediation
- Regulatory closeout
- Site reclamation
- Plugging and abandonment
- Post-closure monitoring

We're active members of the communities we serve. That's why at MWH, now part of Stantec, we always **design with community in mind.** Our community unites approximately 22,000 employees in over 400 locations across six continents. Our work as architects, engineers, and consultants from initial project concept and planning through design, construction, and commissioning begins at the intersection of community, creativity, and client relationships.

Our local knowledge and relationships, coupled with our global expertise, qualify us to go anywhere to solve clients' challenges in creative and personalized ways. Visit us at mwhglobal.com and stantec.com, or find us on social media.

We provide responsive service and expertise from offices around the globe:

North America, Latin America, Europe, Africa, India, the Middle East, Asia and the Pacific

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