

Mexico Experience

Environmental, Geotechnical, and Marine Investigations

Q&S is dedicated to providing *Quality* and *Service (Q&S)* in the environmental, geotechnical, and oceanographic fields. Q&S Engineering is very aware of the Mexico client's need to receive deliverables and services in a timely and cost-effective manner and with no change in quality regardless of location. Q&S senior staff is 100% bilingual in English and Spanish; and has completed over 300 projects in Latin America.

Q&S Mexico projects include multiple LNG terminals, international airports, ports / harbors, railroad terminals, tank farms, and countless industrial, commercial, and undeveloped sites. Q&S senior staff has been invited to speak at Mexican universities / regulatory agencies, and has authored several technical papers regarding: water quality, environmental compliance, and site remediation in Mexico.

Q&S goal for Mexico projects is to provide added value and innovative solutions to challenging problems. Q&S has a proven track record of meeting this goal in Mexico.

Representative Mexico services include:

- Environmental Compliance / Permitting
- Water Quality
- Environmental Impact Assessment (MIA)
- Groundwater, Sediment, and Soil Investigations
- Site Remediation
- Marine Biology / Ecology
- Over-Water and Onshore Geotechnical Services
 - o Drilling services, CPT, permitting
- Client representation / Regulatory liaison
 - o Project monitoring, technical support, translations
- Marine Geophysics
 - o High resolution seismic, multi beam, side scan sonar
- Oceanography
- Underwater Inspections / Diving services



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Select Mexico Project List

Environmental Compliance / Permitting, Various Clients

Assisted US corporations during the site selection and environmental compliance process in Mexico. During the site selection process, prepared Phase I ESAs and worked closely with local and state Mexican governmental agencies in order to gather information regarding potential environmental and zoning concerns in various locations. Subsequently, worked closely with the clients and local government agencies in order to procure and accelerate permits and registrations. General compliance activities included preparation of environmental impact statements, environmental audits, risk assessments, wastewater discharge permits, air emissions permits, production well and water use permits, land use permits, and general regulatory support. Q&S staff has completed over 300 projects in Mexico. Key staff is fluent in Spanish.



Environmental Impact and Mitigation for Underwater Blasting



Impact evaluation and mitigation of underwater impacts associated with underwater blasting leading to high visibility project approval located within grey whale migration route and aquaculture facilities.

Underwater blasting had been previously expressly prohibited by the regulatory agency at the site due to location and receptors. Q&S suggested appealing the regulatory decision based on a comprehensive / site specific assessment of impacts. The Q&S assessment report included an environmental description of the site, a literature review of blasting effects, a conceptual blasting plan, modeling of biotic impacts, designation of blast safe zones, recommendations for blasting controls, potential impacts on fish and fisheries, and, proposed observation, mitigation, and monitoring programs. The Q&S report helped change the opinion of the regulatory agencies and the client received regulatory approval to perform the blasting. Received letter of commendation



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Environmental Baseline Investigation and Environmental Impact Assessment, El Paso Gas / Phillips Petroleum, Proposed LNG Terminal, Rosarito, B.C., Mexico

Q&S staff provided fast-track project management and field investigative support as part of an EIS for a proposed LNG Marine Terminal in Rosarito. The project required computer modeling of wastewater effluent (ocean out fall) in order to evaluate the feasibility of discharging approx. 43,000 m³ /hr at 7 C° below ambient, and with a hypochlorite concentration of 0.05 mg/l; and effects on marine biology. Q&S staff prepared English and Spanish versions of the environmental impact report (MIA) other work included: installation of groundwater MWs, groundwater monitoring, soil sampling, marine and terrestrial biology, air quality sampling, seawater sampling, and noise monitoring. *Received letter of commendation.*



Multi Disciplinary Services, ECA LNG, Ensenada



Provided multi disciplinary environmental, geotechnical, underwater construction monitoring, marine ecological, and marine geophysical support for the first LNG facility on the west coast of the Americas resulting in approx \$1.1 million dollars worth of sole work for Q&S Engineering. *Received letter of commendation.*



Multi Disciplinary Services, Puerto Libertad LNG

Provided multi disciplinary environmental, marine geophysics, and offshore geotechnical services. Performed water quality base line survey, collected sediment samples prior to offshore drilling, evaluated environmental impacts for offshore drilling, served as client representative during marine geophysical survey and offshore drilling geotechnical investigation. Prior to geotechnical drilling, collected sediment samples and oceanographic data, evaluated offshore drilling equipment, performed safety audits in vessel prior to departure, evaluated impacts associated with offshore work, obtained permitting to perform offshore drilling, and helped prepared HSE plans for marine operations. As client representative, made shipboard decisions and provided client with regular updates and independent field log.



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Site Assessments, International Airports: Cancun, Mexico City, Merida, Veracruz, and Culiacan, Mexico

Q&S staff completed site assessments in order to estimate the vertical and horizontal extent of soil and groundwater impacted by jet fuel at 5 international airports. The project included remediation feasibility studies and human health risk assessments. Limestone formations were encountered at three of the five sites. Accomplished geophysical surveys in order to help locate subsurface channels and caverns within the limestone formations that were facilitating preferential migration of the contaminant. Based on the estimated location of the channels and caverns, the soil and groundwater plumes were better identified. Sole source project



Expert Witness, FNM (Mexican National Railroad), Guadalajara, Mexico

Expert witness and project management in support of Mexican Government Railroad (FNM) legal department. Focus of the project involved reviewing site assessment reports by other consultants, related to the subterranean explosions in the City of Guadalajara that caused loss of human life and over \$1 billion US dollars of damages. The regulatory agency (PROFEPA) accused FNM of being the sole responsible party. Review of documents revealed potential multiple sources, other possible responsible parties, and methodology errors in past data. FNM was subsequently acquitted by PROFEPA as a result of the expert witness support provided by Q&S staff.



Site Remediation, Railroad Repair and Fueling Facility, Mazatlan, Mexico

Q&S staff used ex-situ and in-situ remediation technologies to remediate soil and groundwater. The ex-situ system consisted of 5 bio-cells of approximately 800 cubic yards each. The in-situ system consisted of approximately eighty CO₂ extraction-ventilation wells and sixty five air sparging wells. CO₂ data collected from the extraction blower exhaust was converted into pounds of TPH removed and used to estimate advances. Performed confirmatory sampling every six-month in order to evaluate advances. Interacted with environmental authorities on behalf of the client and negotiated soil and groundwater cleanup levels. This project was among the largest full scale federal government sponsored soil and groundwater remediation projects in Mexico.



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Site Assessment, Remediation; Mobil Oil Corp, Mexico City, Mexico

Q&S staff performed environmental site assessment, and site remediation of a service station in Mexico City. An underground fuel storage tank leaked into the subsurface environment. The plume migrated and entered into an adjacent Tacuba Metro Tunnel. Government officials shut down the metro line, affecting approximately 1,000,000 commuters, due to the detection of 100% of the LEL inside the metro tunnel. Performed an ESA, located the LUFT, and estimated the vertical and horizontal extension of the plume. Installed a pneumatic free product recovery system in monitoring wells during the site investigation; excavated a retention trench between the service station and the metro tunnel which included a horizontal perforated 8" PVC extraction line; removed free product from the site; and subsequently installed a vapor extraction / air sparging system to remediate the vadose and saturated zones.



Ecological Risk Assessment, Confidential Client, Train Derailment, Michoacan, Mexico

Responded to train derailment, contained coal-tar spill that migrated into corn field, evaluated the site, and later remediated the site. Collected and analyzed soil samples in order to assess the impact of a spill caused by a train derailment. A PRG was developed for the site based on the toxicity of a specific selected contaminant representative from a hazardous perspective of the spilled compound. Selected PAHs (benzo pyrene) for its potential toxicity. Collected bibliographical data regarding native species that could have been exposed to the contaminant. Negotiated site specific PRG with regulatory agency. Used PRG recommended in ecological risk assessment and confirmatory sampling to demonstrate to the authorities that the site did not represent a significant ecological risk after remediation.



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Environmental Evaluation and Wastewater Treatment, Confidential Client, Railroad Facility, Mexico City, Mexico

Consultant on investigations to evaluate polluted wastewater in an industrial site. The wastewater had been discharged by a third party and had accumulated in a natural depression of the railroad facility. Evaluated laboratory results from water samples collected by other consultants. The water samples contained a BOD between 1,000 and 3,000 mg/l which exceeded wastewater discharge parameters at the time of the investigation. Worked with senior engineers in order to design a wastewater treatment system. The wastewater treatment system contained PVC horizontal aerators in the initial treatment stage and used macrophytes to polish the treated effluent.
Sole source / direct award project.



Remediation Center, Confidential International Oil Company, Mexico City, Mexico

Responsible for developing the concept, design, construction, and operation of an ex-situ centralized remediation center. The client used the center to deposit contaminated soils extracted during remodeling and tank pulling operations. Contaminated soil from service stations was brought into the center and deposited in windrows. Mechanical aerators and extraction blowers extracted vapors from soils contaminated with gasoline. At the same time, the aeration system helped maintain aerobic conditions during the bioremediation of diesel contaminated soils which were segregated from the gasoline contaminated soils. The center was able to treat over 1,000 cubic meters of soil every 3 to 4 months. Prior to establishing the Center, the client paid to remediate each service station separately and in-situ. The center allowed the client to consolidate its soils in one place. This represented significant savings to the client (designs, blowers, drilling, PVC, etc.) as compared to in-situ remediation at each site location.



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Wastewater Treatment, SCI de Mexico, Guadalajara, Mexico

Provided conceptual designs to build a wastewater treatment plant. Compared industrial discharges with applicable Mexican parameters for BOD, TSS, pH, TDS, temperature, and metals. Used data to prepare a feasibility study that contained various treatment options, including a macrophytes pond, a macrophyte pond with a primary clarifier, and an extended aeration plant.



Marine CPT Testing, Port of Ensenada and Port of El Sauzal

Q&S provided project management / coordination in support of dredging studies at the ports of Ensenada and El Sauzal, Mexico. In order to receive more competitive bids and reduce costly change orders, the port authority (API) wanted to provide dredging contractors with site specific information regarding sediments properties in the two ports.

Unlike, a conventional CPT that requires a drill ship or barge, the Mini-cone used was contained in a self righting seabed deployment frame and lowered directly to the sea floor. It is operated remotely from the surface by an electromechanical umbilical that provides the power and digital control to coiled rod that is pushed into the sea floor. The mini-CPT was deployed from a fishing boat and provided stratigraphic detail and soil strength information based on the tip pressure, sleeve friction and pore pressure sensors of the cone. The Mini-cone is capable of operating in depths up to 10000 feet with a maximum penetration depth of 30 feet below mudline and a maximum tip resistance of approximately 350 tsf. This was the first time that API Ensenada had used this technology to evaluate sediments for dredging. *Sole source contract*



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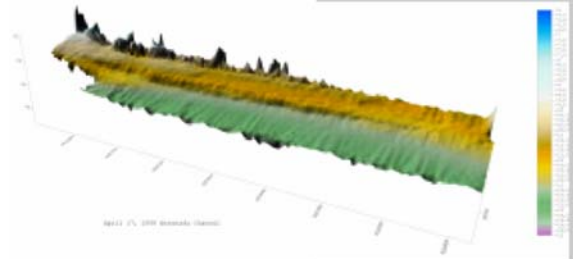
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Multi Beam Survey, Port of Ensenada

Q&S performed a mutli beam survey of the port of Ensenada in support of the deepening of the entrance channel adjacent to a breakwater. The client was concerned that the dredging would affect the stability of the breakwater foundation. Q&S used state of the art system equipped with a heave compensator. In order to help visualize the conditions, Q&S provided the client with data in 3D.

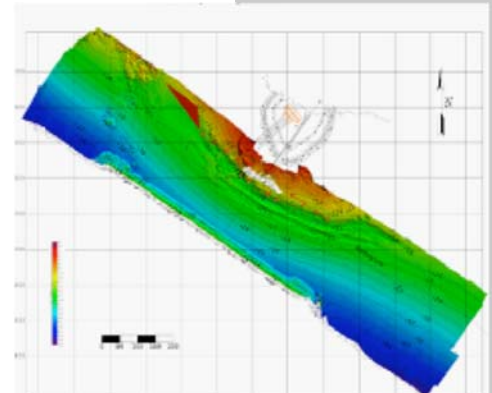


Sole source contract.



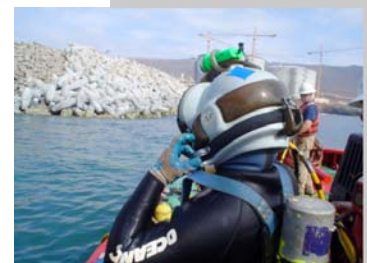
Multi Beam Bathymetric Survey and Dredge Volume Calculations for Entrance Channel

Q&S used an EM 3002 multi beam echo sounder equipped with electronic pitch, heave and roll compensation to survey the site. The line spacing between survey lines was approximately 20 meters. Depth below surface was calibrated using an Odom Digibar pro sound velocity profiler. Data was displayed in real-time using HYPACK software. Volume calculations were compared to previous survey conducted in 2006. The scope of work also included the collection of six bulk sediment samples from the dredge area in order to help identify the type of sediments that may have been deposited since the 2006 dredging event. Received letter of commendation



Verification of High Resolution Seismic Survey / Ground Truth and Sand Thickness Survey

Used divers equipped with a water jet to probe sea floor at 90 locations in order to provide verification (truthing) of a previous high resolution seismic survey (sub-bottom profiling). The divers obtained an average penetration of over 20 feet and identified rock outcropping not previously reported. Q&S determined that the actual sand thickness (based on probing) was significantly greater than what was previously estimated based on a previous seismic survey. Q&S estimates were subsequently confirmed during the offshore geotechnical drilling. Received letter of commendation.



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High Resolution Seismic Survey Ground Truth and Sand Thickness Survey

Used divers equipped with a water jet to probe sea floor at 90 locations in order to provide ground truth for a high resolution seismic survey (sub-bottom profiling). Q&S divers obtained an average penetration of over 20 feet below the seafloor and identified rock outcropping not previously reported. Q&S concluded that the actual sand thickness (based on probing) was significantly greater than what was previously estimated based on a previous seismic survey performed by the client. Q&S estimates were subsequently collaborated during the offshore geotechnical drilling in time before the issuance of the contract to build the terminal. *Received letter of commendation.*



Seafloor Coring and Sampling

Q&S used divers to drive a Ogeechee Sand Corer (core sampler) about 1.8 meters into the seafloor bottom in order to collect core samples from six separate locations along the footprint of a proposed breakwater running parallel to the coast line. Information regarding the upper 1.8 meters of sand was required for the engineering design phase of the breakwater. Due to sand density, Q&S had to use casing and multiple drives to reach the desired depth. The options to use divers to collect the cores in lieu of a vibro-core technology saved the client tens of thousands of dollars in mobilization and equipment fees. *Q&S received letter of commendation*



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Water Quality Baseline Survey, Black & Veatch, Energia Costa Azul LNG Facility



The primary objective of the water quality sampling was to establish baseline conditions at the site prior to the construction of the proposed rock filled causeway. Q&S collected approximately 30 water quality measurements at the site and adjacent areas. The water quality measurements were collected at various depths ranging from 1 meter below the surface to the seafloor. Approximately three to four

measurements were collected from each sampling station. The sampling was performed on board a small vessel (approximately 26 feet) with the use of a Horiba U-22 water quality meter. Data collected included: pH, conductivity, turbidity, dissolved oxygen, temperature, salinity, total dissolved solids, and depth.



Sea Water and Sediment Sampling, Puerto Libertad LNG, Sonora, Mexico

Q&S collected water quality samples from 6 locations upstream, downstream and in the general area of the intake and discharge outlets, breakwater, and trestle of proposed LNG facility. A total of 12 water samples were collected below the surface and slightly above the sea floor. The samples were sent to a Mexico laboratory for chemical parameters as per applicable Mexican water quality standard (NOM-001-ECOL-1996) and additional parameters including: TPH, grease / oils, sedimentary solids, total suspended solids, floating matter, total nitrogen, total phosphorus, nine regulated metals (arsenic, cadmium, cyanide, copper, chromium, mercury, nickel, lead, and zinc), Total Organic Carbon, Chemical Oxygen Demand, and Biochemical Oxygen Demand. The water samples were collected by means of a standard discrete sampler (bomb sampler) that allows the extraction of a water sample from a discrete depth. In addition to the laboratory water quality analysis, Q&S staff used a Horiba U-22 Hydrolab (probe unit) to measure physical-chemical parameters in the field and collected bulk sediment samples using a Ponar Benthic Sample sampler for physical analysis.



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Underwater Rock Bolting , Energia Costa Azul LNG

Q&S Engineering was contracted by Black & Veatch to install rock anchors into boulders at the toe of the causeway that were too large to be removed with a crane bucket. Q&S divers used air powered rock drills to install 1 ¾ stainless steel Williams Rock Anchors (all-thread rods) approx 16 –20 inches into selected boulders. Eyebolts were screwed into the all-threads and were subsequently used to lift the boulders out of the water. The large boulders were interfering with the placement of the Core Locs.



The site subcontractor had claimed that the large boulders could not be removed. Q&S and its diving contractor, Underwater Resources, demonstrated that it could be done. *Q&S received commendation letter*



Removal of Underwater Rock Outcrop Using Hydraulic Splitter

A rock outcrop adjacent to a loading terminal was preventing an LNG tanker from coming along side / discharging. The rock outcrop had been recently identified but the site contractor handling the work had failed to remove it in time. *Q&S was called to the scene and recommended an alternative innovative approach.* Q&S successfully removed rock outcrops using underwater drills and a hydraulic rock splitter. Q&S drilled a pattern of holes each approx 28 inches into the rock. Q&S then inserted the hydraulic splitter into each boring to break up / fracture the rock into smaller pieces that could be removed by divers. The hydraulic splitter is powered by a 10,000 P.S.I. pump. The cylinder contains a control valve and a piston that moves a plug between two feathers. The plug and feather end is placed into a drilled hole. The plug moves down between the two feathers forcing them against the wall of the hole. When the tension increases beyond the tensile strength of the material, a split occurs. The hydraulic rock splitter allowed the divers to break free large pieces of rock. Once the rock was removed, the tanker tied up along the terminal and discharged. *Q&S received commendations.*



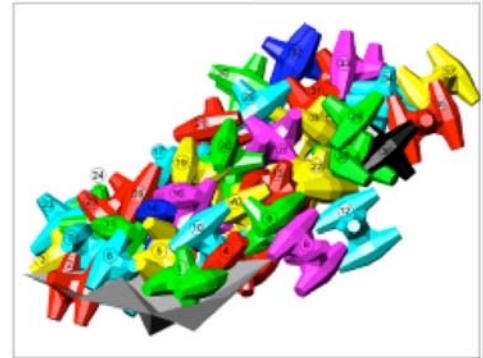
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Shallow Water CoreLoc Inspection, SEMPRA LNG Marine Terminal, Black & Veatch 2007

The objective of the underwater reconnaissance is to determine if rock toe material is founded on bedrock, to determine the correctness of the Core-Loc placement behind the toe and to verify that the first row of Core-Locs were properly founded on bedrock as well and properly supported by the toe in front (seaward side) and underlayer behind (shoreward side). Due to the limited depth of the water, Q&S had to carefully monitor and forecast weather, tides, and wave conditions in order to mobilize during optimum conditions and help reduce project costs. Q&S received a letter of commendation.



Deep Water Core Loc Inspection, SEMPRA Energy



Q&S performed an underwater inspection of Core Locs located around a breakwater. Due to depth of water in excess of 90 feet, Q&S was required to provide a decompression chamber, chamber operator / medic, and specialized safety



equipment. Q&S purchased specialized low light / high definition color underwater video equipment that allowed the client's technical representative to evaluate conditions in real time. Q&S divers made visual observations and measurements of Core Locs. The diver observation, measurements, and comments were recorded live for permanent record. Prior to mobilization, Q&S prepared a Health, Environmental and Safety (HSE) Plan and Job Safety Analysis (JSA). Safety was emphasized during the entire project. Additional safety / back up equipment included three dive air compressors (two spares with additional external sources of back up air / compressed SCUBA air bottles), additional oxygen bottles for decompression chamber, and on board medical first aid oxygen supply system.

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About Our Organization...

Located in San Diego, California, Q&S Engineering, Inc. (Q&S) is a multidisciplinary consulting firm dedicated to providing *Quality* and *Service (Q&S)* in the environmental, geotechnical, and oceanographic fields. Our definition of *Quality* is deliverables that meet or exceed expectations. Our definition of *Service* are deliverables that are provided on schedule, safely, and within the agreed upon budget.

There are many reasons to contract with Q&S Engineering for Mexico and Latin America.

But why select Q&S Engineering?

- Experienced staff....most with advanced degrees
- Seasoned managers....with large project & line management expertise
- Multidisciplinary services
- Bilingual staff
- International experience...over 300 Mexico projects completed
- Cultural sensitivity and ability to get things done
- Large pool of consultants, contractors, and resources
- Familiarity with local, state and federal regulations
- Excellent references...proven track record
- A commitment to Quality and Service

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