DESALINATION

WORLD-CLASS EXPERTISE IN ALL TYPES OF DESALINATION — SEAWATER, BRACKISH WATER, AND WASTEWATER REUSE
GLOBAL EXPERIENCE, COMPREHENSIVE EXPERTISE, SUSTAINABLE SOLUTIONS

Black & Veatch is a leader in desalination, assisting clients with a comprehensive range of technologies and project types. Our global portfolio addresses all types of challenging source waters treating seawater, brackish groundwater and wastewater for both municipal and industrial clients with projects on six continents.

We offer a full program of services tailoring our approach to each client’s needs, from traditional engineering and design services to turnkey design-build.

DIVERSE SERVICE OFFERINGS

We execute desalination projects with our clients’ best interests in mind, which includes offering a variety of project execution methods. In addition to providing traditional consulting and Owner’s Engineering services in both energy and water, Black & Veatch is a leading EPC company furnishing projects under a full range of design-build (DB) and design-build-operate (DBO) models as well as offering operational and management consulting services to address clients’ financial needs.

- Traditional Engineering Consulting & Design Services
- Feasibility & Economic Studies
- Facility Planning
- Research & Pilot Programs
- Owner’s Engineering
- Lender/Investor’s Engineering
- Permitting & Regulatory Compliance
- Construction Phase Services
- Startup & Commissioning
- Operational Assessments
- Design-Build (DB)
- Design-Build-Operate (DBO)
- Program Management

AWARD-WINNING TUAS DESALINATION PLANT
Singapore
PROCESS UNDERSTANDING
We apply appropriate technology solutions, tailored to meet the individual needs of each project. Our experience in source water characterization enables us to develop cost-effective process solutions to achieve finished water quality objectives over the full spectrum of desalination options and associated systems. We address all design challenges from intakes and pretreatment to corrosion control in the distribution piping and waste brine minimization and disposal:

- **Intakes** – Subsurface, Wells, Open
- **Pretreatment** – Dissolved Air Flotation, Sedimentation, Membrane Filtration, Granular Media
- **Desalination** – Membranes (Reverse Osmosis, ED, NF), Thermal (MSF, MED)
- **Stabilization** – Air Stripping, pH Adjustment (e.g. Caustic, Lime, Carbon Dioxide, Calcite Media)
- **Disinfection** – Chlorine, Chlorine Dioxide, Ozone, UV, Oxidation with UV/H₂O₂
- **Reduced or Zero Liquid Discharge (ZLD)** – Thermal, Chemical and Membrane-based Methods
- **Concentrate Disposal** – Discharge, Injection Wells, Beneficial Use.

ENERGY EFFICIENCY
Desalination is an energy-intensive treatment alternative, where operating costs can make up more than 50% of the total cost of treated water. Black & Veatch develops energy-conscious solutions to minimize energy use applying the best available membranes, energy recovery devices and high-efficiency motors with variable frequency drives.

LIFE-CYCLE COSTS
Prudent selection of process equipment, RO membranes, and materials of construction is critically important to balancing capital costs with longer-term operational costs. Optimizing life-cycle costs requires a careful balance – understanding the importance of process decisions to meet the finished water quality requirements while applying energy-efficient solutions with reasonable rate of return.

EXPERIENCE HIGHLIGHTS
Black & Veatch received the Distinction Award for Desalination Company of the Year at the 2016 Global Water Summit.

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<th>SIZE</th>
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<td><strong>Seawater Desalination for Municipal Drinking Water</strong></td>
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<td>Claude Lewis Carlsbad Desalination Plant</td>
<td>54 MGD (254 MLD)</td>
<td>Investor’s due diligence (technical, financial, permit reviews)</td>
<td>Desalination Plant of the Year (2016), Global Water Intelligence</td>
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<td>Carlsbad, CA USA</td>
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<td>Tseung Kwan O (TKO) Plant Water Services Dept., Hong Kong</td>
<td>36 MGD (164 MLD)</td>
<td>Owner’s engineer, Design</td>
<td>Landfill gas used for power generation</td>
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<td>Tuas, Tuas II, and Marina East PUB, Singapore</td>
<td>3 projects totaling 156 MGD (590 MLD)</td>
<td>Consultancy, Owner’s Engineer, Design</td>
<td>Includes a fast-track (7-month) project</td>
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| **Seawater Desalination for Industrial Use** |                 |                                               |                                                  |
| Escondida Water Supply BHP Billiton, Chile | 57 MCD (259 MLD) | Preliminary through Detailed Design and Resident Engineering | Largest desalination plant in the Americas, serving world’s largest copper mine |

| **Brackish Groundwater Desalination for Municipal Drinking Water** |                 |                                               |                                                  |
| Brackish Groundwater Desalination SAWs, San Antonio, TX USA | 12 MGD (55 MLD) with 30-MGD planned expansion | Led multi-firm design effort, from wells to distribution | New water source to meet growing municipal demand |

| **Wastewater Reclamation for Municipal Potable Reuse** |                 |                                               |                                                  |
| Groundwater Replenishment System Expansion Orange County Water District, CA USA | 30 MGD (113 MLD) | Design-Build                                  | For aquifer injection to prevent seawater intrusion; WEF Project Excellence Award (2016) |
BUILDING A WORLD OF DIFFERENCE®

Black & Veatch is an employee-owned, global leader in building critical human infrastructure in Power, Oil & Gas, Water, Telecommunications and Government Services. Since 1915, we have helped our clients improve the lives of people in over 100 countries through consulting, engineering, construction, operations and program management. Our revenues in 2015 were US $3 billion. Follow us on www.bv.com and in social media.