KELLER

Curriculum Vitae

Kenneth E. Wigg, P.E.

Senior Engineer

Mr. Wigg specializes in the design and construction of temporary and permanent groundwater and leachate control systems using dewatering systems, grouting systems slurry trenches, interceptor trenches and ground freezing. His areas of expertise also include groundwater extraction and treatment systems for new construction, remediation and drinking water supply, incorporating technologies such as air stripping, liquid and vapor phase carbon absorption, oil/water separation, filtration, ion exchange, and ultraviolet light oxidation as well as the design and installation of above ground storage tanks, chemical storage and feed systems for use in municipal and industrial water treatment plants. Mr. Wigg is also involved in the design and construction of numerous groundwater recovery systems, storm water management systems and other civil and environmental engineering projects ranging from concrete foundation design to in situ soil remediation.

EDUCATION: BS, Civil Engineering, New Jersey Institute of Technology, Newark, NJ, 1994.

LICENSES: Licensed Professional Engineer, New Jersey, New York, Pennsylvania, Rhode Island and Alabama

Contractor's License, Nevada, West Virginia, Louisiana and Mississippi

YEARS OF EXPERIENCE: Since 1992

PROFESSIONAL HISTORY:

2003 to present:	**Moretrench, Rockaway, NJ**
2000 to 2003:	**Sovereign Consulting Inc., Parsippany, NJ**
1999 to 2000:	**McLaren/Hart, Inc., Warren, NJ**
1992 to 1999:	**Layne Christensen Company, Bridgewater, NJ**

HEALTH AND SAFETY:

OSHA 40-hour HAZWOPER Training, 8-hour Refresher
OSHA 8-hour Supervisor training, OSHA 10-hour Construction
Corporate Drug and Alcohol Testing Program
Annual Medical Monitoring Program

PROFESSIONAL AFFILIATIONS:

Member, American Society of Civil Engineers (ASCE)
ASCE North Jersey Section, Construction Technical Group: Past Chairman
ASCE New York City Metropolitan Section, Geo-Institute Chapter: Treasurer

SELECTED PROJECTS:

GROUND FREEZING

Seattle Sound Transit Northgate Link Tunnel, Seattle, WA: Engineering and design for the installation and operation of six independent ground freezing systems to support cross passage installation between two light rail tunnels. The system at each cross passage included over 1,000 feet of horizontal drilling through blow-out preventers, multiple air-cooled refrigeration plants in each tunnel, pumps and piping for chilled brine distribution, and a data acquisition system to ensure satisfactory system performance.

Boeing Future 4-86 Dinol Booth, Renton WA: Engineering and design for installation and operation of a ground freezing system for groundwater cut-off and support of excavation for a future ventilation air plenum of a paint booth.

Southwest Pipeline Project, Beulah, ND: Engineering and design for ground freezing to allow construction of a concrete segmented liner shaft, 26.5 feet in excavated diameter and 160 feet deep, for water intake from a large reservoir. This project required a frozen bottom plug to provide water cut-off. Concrete liner segments were installed top-down.

First Street Tunnel, Washington, D.C.: Engineering and design for installation of three frozen shafts, three frozen tunnel connections, and one frozen support of excavation. The project involved drilling of over 300 freeze pipes and installation of over 2,500 feet of buried, insulated twelve-inch diameter refrigeration supply and return headers and three refrigeration plants.

Port Mann Tunnel Boring Machine Repair, Vancouver, British Columbia, Canada: Cost estimation, design and engineering for a liquid nitrogen ground freezing program to permit repairs to a 3.5m diameter TBM that developed mechanical issues 900m into a 1300m drive at a depth of 55m below the Fraser River. Ten freeze pipes and two temperature monitors were drilled and installed from a pile supported platform above the river approximately 100m from shoreline to a depth of 62m. Freeze pipes were installed in front of the TBM to form a frozen soil mass, providing the groundwater cut-off and soil stability required to allow repairs to take place.

Fort Hills Basal Aquifer Trials, Fort McMurray, Alberta, Canada: Engineering design and cost development of a ground freezing system composed of over 75 freeze pipes installed to a depth of 500 feet to test the viability of freezing a deep aquifer. Managed the development of execution plans, emergency plans, environmental plans and safety plans required to perform the work. Design challenges included a 480-ton refrigeration system, a 1,500 gpm brine pumping system, specialized freeze pipes and temperature monitoring wells, and a custom instrumentation and SCADA system.

Port of Miami Tunnel, Miami, FL: Engineering design for the installation of a ground freezing system used to temporarily support the open excavation of two fifty-foot long cross-passages between two concrete segment tunnels 100 feet below ground surface. Design challenges included the installation of a 200-ton refrigeration system above ground, a 400 gpm brine pumping system to deliver the brine to the two cross passages through over 5,000 feet of polyethylene piping, and a custom instrumentation and SCADA system.

Northern Boulevard Crossing, East Side Access, Queens, NY: Engineering oversight for a program of horizontal ground freezing to create a canopy of stabilized soil above the tunnel crown for mining of a 125-foot long tunnel through difficult ground beneath a pile-supported elevated New York City transit rail line, a five-track subway tunnel, and the heavily travelled Northern Boulevard.

Second Avenue Subway, New York City, NY: Design Engineer for ground freezing to provide ground stabilization and groundwater cut-off to remediate mixed face soil/rock conditions and inadequate rock cover above the crown of one of twin, 22-foot diameter tunnels to be mined through rock. A grid of 100 angled freeze pipes was installed over a 150-foot length of the tunnel alignment to create a frozen mass extending below the invert and 10 feet either side of the tunnel.

No. 7 Line Extension, New York City, NY: Design Engineer for ground stabilization of a hand mined portion of tunnel. The top of rock was found to dip below the crown of the tunnel, which was originally planned to be excavated fully in rock. 40 angled freeze pipes installed to depths of 80 to 110 feet were used to establish a stabilized frozen zone of overburden soil and weathered rock above the section of tunnel to be mined.

East Side CSO Tunnel, Portland, OR: Project Engineer for the design and installation of a ground freezing system in complex subsurface geologic conditions to permit hand-mining of a tunnel between two existing concrete slurry wall shafts at a depth of 140 feet below ground surface.

Brightwater Conveyance System, Seattle, WA: Engineering oversight of ground freezing for support of excavation to 200 feet below ground surface in saturated silts, sands and clay materials. 40 freeze pipes were installed to a depth of 240 feet connected to a 300-ton refrigeration system. Other aspects of the project include a depressurization dewatering system for the deep excavation.

123 Washington Street, New York, NY: Project engineer for installation and operation of a liquid nitrogen ground freezing for support of excavation of a 12-foot by 24-foot elevator shaft. 40 freeze pipes were keyed into underlying bedrock 45 feet below ground surface to provide both structural support and groundwater control.

Narragansett Bay Commission CSO, Providence, RI: Engineering design and QA/QC support during the installation and operation of a ground freezing system to facilitate raise bore shaft excavation. The project encompassed two, 250-foot deep shafts with the requirements that the entire cross-sectional area of the shafts be frozen for the contractor to raise bore from the tunnel to ground surface through the frozen ground.

New York City Water Tunnel No. 3, New York NY: Project engineer for installation of 200 steel freeze pipes to depths ranging from 75 feet to 140 feet at five different shaft locations in midtown Manhattan to provide excavation support for the 34-foot diameter open excavations. All five shafts were frozen concurrently. At two of the five shafts, Mr. Wigg conducted additional ground improvements to reduce moving groundwater which was preventing the ground from fully freezing. Permeation grouting was performed in the areas of moving groundwater and successful closure of the frozen walls was achieved.

Salt Museum, Hutchinson, KS: Project engineer for ground freezing to facilitate construction of an access shaft to a new underground museum. Scope of work involved installation of 20 steel freeze pipes to a depth of 140 feet to provide support for the 12-foot diameter excavation.

TECHNICAL PAPERS & PRESENTATIONS:

Wigg, K.E. (2011) “Ground Freezing Challenges for Horizontal Connection between Shafts Under Difficult Geologic and Hydrostatic Conditions” New Jersey Society of Professional Engineers, North Central Jersey Chapter Fall Meeting

Mueller, D.K., McCann, J.M, Wigg, K.E., Schmall, P.C. and Bartlett, M. L. (2010). “Ground Freezing Challenges for Horizontal Connection between Shafts under Difficult Geologic and Hydrostatic Conditions.” North American Tunneling Conference, Portland, OR

Schmall, P.C., McCann, J.M., Mueller, D.K., and Wigg, K.E. (2010). “Ground Freezing for Mine Shaft Sinking: A Proven Technology with Unique Advantages.” SME Annual Conference, Phoenix, AZ