William Locke, P.E.
President

Education and Credentials

M.S., Civil Engineering (emphasis in Water Resources), Stanford University, Stanford, California, 1989

B.S., Geology, with Distinction, Phi Beta Kappa, Stanford University, Stanford, California, 1987

Registered Professional Civil Engineer, Colorado (License No. 34650)

Continuing Education and Training

Hazardous Waste Operations and Emergency Response 40-Hour Certification

Professional Profile

Mr. William Locke is a hydrologist and registered civil engineer with more than 25 years of experience in environmental investigation, fate and transport assessments, remedy analysis and selection, and regulatory affairs. He specializes in designing physical and chemical investigations of complex environmental systems, including soil, groundwater, sediments, surface water, and biota. He advises a broad range of clients on scientific and engineering issues, regulatory strategy, and management of environmental assets and liabilities. Mr. Locke has overseen and contributed to numerous remedial investigations, risk assessments, engineering feasibility studies, and fate and transport evaluations conducted under CERCLA, RCRA, and state-led environmental cleanup programs. He has also provided expert support for environmental litigation matters and natural resource damage assessments (NRDAs).

Mr. Locke is well versed in the environmental behavior of a wide array of organic chemicals (e.g., dioxins and furans, PCBs, PAHs, and chlorinated solvents) and inorganic chemicals (e.g., cyanide, arsenic, cadmium, lead, and other metals). He has designed and executed technical studies to differentiate site-related releases from natural and anthropogenic background chemical concentrations in soil, water, and sediments. Mr. Locke has evaluated groundwater-sediment-surface water interactions at several sites across the U.S., where he has developed and successfully implemented a multiple-lines-of-evidence approach for differentiating impacts of historical releases to sediments from those caused by migration of upland groundwater plumes. Mr. Locke has also developed analytical and numerical models to assess chemical fate and transport in groundwater and surface water systems, predict the effects of mining on water quality and quantity, analyze the feasibility of environmental remediation projects, and address questions related to water resources quantity and quality.

Relevant Experience

Environmental Site Investigation and Remediation

Lower Passaic River Feasibility Study, New Jersey—Serving as overall technical lead, on behalf of a large group of potentially responsible parties, for an engineering feasibility study to remediate contaminated sediment within a 17-mile reach of the lower Passaic

285 Century Place
Suite 190
Louisville, CO 80027

720.465.3315
wlocke@integral-corp.com

River Superfund site. Sediment, surface water, and biota in this heavily industrialized segment of the Passaic River have been contaminated with dioxins, PCBs, and other hazardous substances from historical and ongoing sources. Remediation at this complex urbanized site will involve numerous implementation challenges arising from difficult dredging conditions, navigational limitations, aging bridges and other infrastructure, utility crossings, transportation constraints, and fish migration restrictions. The feasibility study is evaluating a suite of remedial alternatives involving targeted and bank-to-bank dredging and capping approaches, as well as onsite and offsite options for management of dredged material.

S&W Sawmill Site, Darby, Montana—Providing technical oversight and direction for a fate and transport evaluation, baseline human health and ecological risk assessments, and an engineering feasibility study at a former sawmill and wood treating facility in the Bitterroot Valley of Montana. Chemicals of concern at the site include dioxins/furans and pentachlorophenol, with impacts on surface soil, groundwater, and local surface water features. Directing an empirical and analytical study of unsaturated and saturated zone chemical release and fate and transport mechanisms to refine the conceptual site model and develop site-specific cleanup goals protective of groundwater quality.

San Jacinto River Waste Pits RI/FS, Harris County, Texas—Served as principal-in-charge for the remedial investigation and supporting risk assessments for the San Jacinto River Waste Pits Superfund site. Oversaw the execution of technical work and provided consultation to clients on issues of overall project technical strategy, regulatory issues, and liability management. The site is a closed facility for storage of bleached kraft pulp mill wastes that contain dioxins and furans. Wastes were deposited in impoundments in an estuarine marsh bordering the San Jacinto River estuary in the 1960s. Environmental media of interest include sediments, adjacent upland soils, groundwater, and fish. Key issues involved differentiating site-related dioxin and furan contributions to water, sediments, and biological resources from regional impacts that are related to other sources.

Portland Harbor RI/FS, Portland, Oregon—Served as the principal-in-charge for the remedial investigation of the Portland Harbor Superfund site. Sediments, pore water, surface water, and biota in this heavily industrialized segment of the Willamette River have been contaminated with PCBs, dioxins, pesticides, PAHs, heavy metals, and other hazardous substances from numerous historical and ongoing sources. Played a leadership role in RI/FS technical strategy development and regulatory negotiations on behalf of a multiparty PRP group. Designed and successfully implemented a sampling program to understand the relative contributions of groundwater to concentrations of multiple organic and inorganic chemicals in pore water and sediments, and to support the evaluation of pore water risks to human health and the environment. The remedial investigation also evaluated the operations, releases, transport pathways, and environmental conditions for more than 75 industrial facilities along the river; and provided conceptual site models for the harbor-wide study area and 27 separate areas of potential concern to be evaluated further in the feasibility study of potential remedial alternatives.

Impacts from a Remediated Wood Treatment Facility, Cass Lake, Minnesota—Project coordinator for human health and ecological risk assessments, along with supporting site investigations, at a former wood-treating facility. The site, which was originally remediated in the late 1980s, resurfaced as part of a five-year review under CERCLA and after a trustee group was formed to evaluate potential natural resource damages. Chemicals of potential concern include dioxins/furans, PAHs, PCBs, and metals. Other concerns are potential migration and/or uptake of site-related chemicals to secondary media, including sediment, surface water, plants, aquatic and terrestrial invertebrates, and fish. Oversaw the preparation of the risk assessments and assisted the client in negotiating a focused, sound technical approach in a context of multiple stakeholders including federal, state, and tribal representatives.

RI/FS for Heavy Metals in Groundwater, Former Smelter Site, Blackwell, Oklahoma—Directed hydrogeologic and engineering aspects of an RI/FS addressing a large cadmium and zinc groundwater plume at a former smelter in Blackwell, Oklahoma. Designed and implemented field investigations, laboratory analyses, and transport and fate modeling. Participated on a technical team that evaluated several innovative *in situ* and *ex situ* treatment approaches for metals remediation in groundwater. Developed a basin-scale numerical groundwater flow model to support hydraulic design of the selected remedy. Provided technical and strategic client support for coordination with regulators, local officials, and the public.

Evaluation of Natural Attenuation of Chlorinated Solvents in a Subterranean Estuary, North Island Naval Air Station, Coronado, California—Leading the design and implementation of a study to quantify the fate and transport processes of chlorinated solvents and ketones migrating in groundwater to sediment and surface water of San Diego Bay. Key concerns include potential ecological risk to benthos and degradation of waters of the state. Providing technical expertise in physical and chemical characterization of groundwater-sediment-surface water interactions, with the goal of developing multiple lines of evidence for natural attenuation of organic chemicals prior to discharging to the bay. Successfully negotiated the project technical approach with the California Department of Toxic Substance Control and the Regional Water Quality Control Board. A sampling and analysis plan is in development for implementation in 2013.

Transport of Semivolatile and Volatile Organic Compounds from a Pesticide Manufacturing Facility to the Benthic Zone, Baltimore, Maryland—Developed technical strategies and supporting regulatory negotiations to address EPA concerns about discharges of a complex mixture of volatile and semivolatile organic compounds in groundwater beneath a former pesticide manufacturing facility in Baltimore to sediments and pore water in Curtis Bay. Although a pump-and-treat groundwater remedy has been in place for more than a decade, hydrologic evidence indicates that hydraulic capture may need to be enhanced. Integral is pursuing a multi-pronged technical approach that includes literature assessment of the toxicity groundwater plume constituents to benthic invertebrates, review and analysis of groundwater toxicity bioassays, and identification of technical alternatives for further mitigating groundwater plume discharges into Curtis Bay.

RCRA Facility Investigation, Pulp and Paper Facility, Savannah, Georgia—Developed investigation work plans for soil, groundwater, surface water, and sediments at a complex site with

165 solid waste management units. Conducted regulatory negotiations to win approval for an innovative approach for addressing potential releases from a 13-mile system of wastewater lines. Oversaw implementation of investigation activities.

PCB Loading Analysis for a Tidally Influenced Estuary, Ward Cove Sediment Remediation Project, Ketchikan, Alaska—Conducted an analysis of potential groundwater transport of PCBs (which had been detected in unfiltered groundwater samples at the site) into Ward Cove, and estimated the resulting PCB concentrations in the cove as a function of distance from the discharge point. Because groundwater at the site is tidally influenced, the estimate of PCB fluxes considered both freshwater and peak tidal components of groundwater flow. PCB transport and mixing in Ward Cove were estimated by applying the estuary equation and site-specific flow and mixing parameters. The results showed that even under very conservative assumptions, PCB concentrations in Ward Cove were predicted to be below the relevant water quality standard within 0.1 meter of the groundwater discharge point.

RCRA Facility Closure, Golden Valley, Minnesota—Designed and implemented soil and groundwater investigations in support of final closure of a RCRA facility. Evaluated the distribution of trichloroethylene (TCE) and other chlorinated solvents in soil and groundwater, demonstrated that natural attenuation limits the potential for plume migration, and provided documentation leading to a regulatory determination of no further action for the site.

Numerical Groundwater Modeling of TCE Migration from a Former Metals Machining Facility, Milwaukie, Oregon—Developed a numerical groundwater flow and particle tracking model to evaluate the potential for TCE to migrate to public water supply wells, in support of settlement negotiations for litigation involving potential impacts from a TCE release at a former metals machining facility in Oregon. A conceptual site model of important groundwater flow and chemical fate and transport was developed, and a 3-dimensional groundwater flow model was constructed using MODFLOW, a public domain groundwater modeling code developed by the U.S. Geological Survey.

Groundwater Fate and Transport Evaluation, CERCLA RI/FS, Michigan—Evaluated the transport and fate of chlorinated solvents, hydrocarbons, metals, and PCBs in groundwater. Considered multiple transport mechanisms, including dissolved-phase migration, colloidal transport, and nonaqueous-phase flow. Provided key technical and strategic consultation to the client to help resolve regulatory and technical disputes with EPA.

RI/FS for Pesticides, Arsenic, and Volatile Organic Compounds in Groundwater, Pesticide Formulation Facility, Jacksonville, Florida—Served as lead hydrogeologist for a groundwater RI/FS. Designed and implemented site investigation activities, including detailed lithologic characterization, aquifer hydraulic testing, and groundwater sampling and analysis; conducted regulatory negotiations; and identified potential remedial measures to address pesticides, arsenic, and benzene in groundwater. Developed a groundwater flow model using MODFLOW to evaluate the effects of several alternatives on groundwater hydraulics, chemical migration, and groundwater-surface water interactions.

RCRA Corrective Action, Wilmington, North Carolina—Redesigned and re-permitted a RCRA corrective action plan based on enhanced natural attenuation for remediating solvents in groundwater. Prepared technical studies demonstrating that natural attenuation would be sufficient to meet remediation objectives, eliminating the need for construction of the previously proposed and permitted dual-phase (groundwater and soil vapor) extraction and treatment system.

Pesticide Formulation Facility, Texas—Predicted the potential for migration of pesticides and organic compounds in the unsaturated and saturated zones. Used geologic, hydrologic, and chemical data to demonstrate to regulators that the site posed negligible risk for degradation of groundwater resources.

Expert Support for NRDA and Environmental Litigation

Expert Report, Rebuttal of Plaintiffs' Expert Reports, Deposition, Trial Testimony and Cross Examination; Miles & Stockbridge P.C. and Sullivan & Worcester, LLP on behalf of Stanley, Black and Decker, Inc.—Authored comprehensive expert and rebuttal reports and provided expert testimony in deposition (February 27–28, 2014; March 13–14, 2014; May 22, 2014; July 11, 2014; and January 22–23, 2015) and at trial (June 1–3, 2015) before the U.S. District Court, District of Rhode Island, Case No. 01-11CV0023 (Emhart v. New England Container Company, Inc. et al., Case No. 06-218-S and Emhart v. U.S. Air Force et al., Case No. 11-023S, in the U.S. District Court, District of Rhode Island). These expert reports and testimony countered several aspects of EPA's conceptual site model for dioxins/furans and other contaminants at the Centredale Manor Superfund site; critiqued the technical and regulatory foundations of EPA's selection of a preferred cleanup alternative in the 2012 record of decision for the site; and provided expert opinions on issues of operational history, contaminant sources and release mechanisms, timing of releases, and subsequent fate and transport in the environment.

NRDA, Petroleum Refinery, Colorado—Provided expert analysis and consultation in support of expedited settlement of a natural resource damage claim involving alleged injuries to wetlands, waterfowl, aquatic and riparian resources, and waterfowl stemming from a release of refined petroleum product to the environment. The work involved dissecting the scientific and engineering foundations of injuries and damages alleged by state and federal natural resource trustees, and providing alternative analyses that provided the basis for achieving a successful mediated settlement among the parties.

NRDA, Confidential—Providing technical and strategic expert consultation for NRDA litigation on a matter involving widespread impacts of an emerging contaminant on public and private groundwater supplies, surface water, sediment, and fish in an urban/suburban area. Directing technical analyses geared toward providing accurate information on the magnitude of resource injuries, resulting service losses, and ranges of potential restoration/replacement costs. The work has involved close scrutiny and critique of trustee and stakeholder claims and their supporting scientific, engineering, and economic foundations.

NRDA, Petroleum Site, Minnesota—Advised an industry client on a groundwater natural resource damage claim involving alleged injuries to groundwater and a wetland. Evaluating the

hydrogeologic, economic, and methodological basis for state trustee estimates of resource injury and associated damages.

NRDA, New Jersey—Analyzed the transport and fate of TCE in groundwater in response to an natural resource damage claim in southern New Jersey involving alleged groundwater quantity and quality impacts associated with TCE contamination of a water supply aquifer. Provided technical consultation, developed a written report in response to the natural resource damage claim, and offered critical strategic input that resulted in favorable claim settlement terms for the client.

Fate and Transport Evaluation, Confidential Client—Provided expert analysis and deposition testimony on the fate and transport of methyl *tert*-butyl ether (MTBE) in groundwater. Evaluated local hydrogeologic conditions, estimated the timing and magnitude of MTBE releases from a gas station, and conducted analytical modeling to estimate the upper-bound potential mass flux of MTBE via groundwater to a nearby river. Model results were used to estimate resulting concentrations in the river and support of an evaluation of potential human exposures to MTBE in surface water.

Methanex v. United States of America—For litigation involving allegations of risk to human health from MTBE releases to groundwater from gasoline supplies in California, prepared a critical review of MTBE degradation studies and conducted a realistic fate and transport assessment to evaluate plume development and MTBE source depletion. Provided written contributions to expert opinion of Dr. Pamela Williams.

Mining Hydrology and Geochemistry

Water Quality Monitoring Program of an Exploration Project, Prince of Wales Island, Alaska—Served as project manager and lead investigator for the development and implementation of an innovative, natural-conditions-based water quality monitoring program at an underground mine exploration project on Prince of Wales Island near Ketchikan, Alaska. The program was developed based on the State of Alaska's recently issued guidance for natural-conditions-based water quality standards, and it includes monitoring of surface water, groundwater, and effluent to evaluate compliance with site-specific water quality criteria developed using pre-exploration water quality data and ongoing monitoring results from nearby reference areas. Provided technical and regulatory support in the water quality permitting process and developed a multiple-lines-of-evidence approach using statistical and graphical tools to evaluate compliance with the natural-conditions-based standards. Developed technical recommendations to the State of Alaska for improving its approach to and implementation of natural-conditions-based water quality standards.

Hydrological Evaluation of the Big Springs Mine, Nevada—Assessed the potential for outflow from two mining-related pit lakes to discharge into, and potentially degrade, the North Fork of the Humboldt River. The multidisciplinary approach included extensive field studies, development of a basin-scale hydrologic balance, quantitative modeling of the pit-lake water balance, evaluation of

groundwater and surface water flow conditions, and use of chemical and isotopic data to trace the flow of water through the basin and quantify pit-lake outflow.

Olinghouse Mine Groundwater Model, Truckee River Basin, Nevada—As part of the technical foundation for an environmental impact statement for a proposed mine expansion, developed a regional groundwater flow model to evaluate the effects of mine-related groundwater pumping on groundwater levels in the Truckee River Valley and on surface water flows in the Truckee River itself. The river is the principal source of freshwater inflows to the nearby Pyramid Lake, located within tribal lands and home to a National Wildlife Refuge. The model incorporated site-specific geologic and structural controls on groundwater flow, regional estimates of groundwater recharge, and groundwater-surface water interactions. Results of the study indicated that the proposed groundwater pumping would have a *de minimis* impact on surface water resources.

Evaluation of Cyanide Seepage from a Tailings Impoundment, Twin Creeks Mine, Nevada—Developed a numerical model of unsaturated-zone flow and transport to estimate cyanide flux rates from a tailings impoundment in support of a permit application to expand the tailings facility. Estimated moisture movement and cyanide mass flux under existing, proposed, and post-closure conditions. This effort showed that installing wick drains in the tailings could offset the increased seepage and cyanide flux caused by raising the impoundment, and that seepage would drop substantially soon after closure.

Pit-Lake Water Quality Modeling for the Twin Creeks Mine, Nevada—Oversaw the development of multiple refinements and enhancements to pit-lake water quality model of the Twin Creeks mine. Directed QA/QC effort, implemented code changes, and resolved hydrological and geochemical challenges. Served on the senior technical review team for project deliverables.

Pit-Lake Water Quality Study, Batu Hijau Project, Indonesia—Worked with other project team members to incorporate hydrological data and groundwater modeling results into the pit-lake water quality study. Developed a numerical method for determining the chemical mass balance in thermally stratified pit lakes. Wrote and provided senior technical review of report elements.

Tara and Bootstrap/Capstone Pit-Lake Study, Nevada—Collaborated on the development of technical approaches to address agency concerns regarding future groundwater quality downgradient of two open pit gold mines. Implemented several pit-lake model refinements, conducted model simulations, and developed recommendations for data collection and analysis.

Geochemical and Hydrological Evaluation of the Robinson Project, Ely, Nevada—Managed an evaluation of the environmental geochemistry and hydrology of a proposed major mine expansion of the Robinson Project in Ely, Nevada. Study components included pit-lake geochemistry, the environmental stability of waste rock, and mine hydrology (groundwater and surface water).

Publications

Dunford, R.W., and W.W. Locke. 2015. A framework for assessing groundwater damages from contamination. *Environmental Claims Journal* 27(1):19-39. doi: 10.1080/1040602.2014.986409.

Presentations

Greenblatt, M., W. Locke, and R. Law. 2019. Adaptive management: A practical approach to remediation of the Lower Passaic River. Platform presentation at Tenth International Conference on the Remediation and Management of Contaminated Sediments, New Orleans, LA. February 11–14.

Locke, W., C. Hawley, and A. Wood. 2007. Source Determination for Chemicals in Transition Zone Water – Upland Plume Groundwater Discharge vs. Legacy Sediment Contamination. 2007 Washington Environmental Cleanup Conference, Environmental Law Education Center, Seattle, WA.

Locke, W. 2007. Technical Tools for Groundwater Resource Valuation. Workshop on Natural Resource Damages: Emerging Legal and Technical Issues. Colorado Hazardous Waste Management Society, Denver, CO.

Locke, W.W., C. Henderson, T.A. Martin, and C. Hawley. 2005. Comparison of interstitial water sampling methods in near-surface sediments, lower Willamette River, Portland, OR. SETAC North America 26th Annual Meeting, Baltimore, MD.

Locke, W.W., J.K. Sueker, and M. Marks. 2004. Forensic methods to evaluate pit lake hydrology and geochemistry: application of isotope and geochemical tools. U.S. Environmental Protection Agency Pit Lakes 2004 Conference, Reno, NV.

Locke, W., J.H. Kempton, D. Atkins, R.R. McDonald, L.N. Bliss, and C.L. Travers. 1998. Comparison of the measured and modeled composition of a Nevada pit lake. 214th National Meeting of the American Chemical Society, Las Vegas, NV.

Kempton, H., W. Locke, D. Atkins, A. Nicholson, L. Bliss, and R. McDonald. 1998. Probabilistic prediction of water quality in mine pit lakes. In: Proc. 1998 Annual Meeting of the Society for Mining, Metallurgy, and Exploration, Orlando, FL.