Richard Martin Groundwater LLC

Richard J. Martin, LHG

EDUCATION
Graduate Studies, Hydrogeology, Wright State University
BS, Geology, Wright State University, 1989

REGISTRATION
Licensed Hydrogeologist: WA, 337, 2002

PROFESSIONAL SUMMARY

With over 23 years of experience as a hydrogeologist, Richard has been involved with all aspects of hydrogeologic studies, including evaluation of groundwater resources, design and implementation of aquifer testing, delineation of wellhead protection zones, assessment of groundwater/surface water interactions, evaluation of soil and groundwater remedial systems, and determination of historical contaminant plume movement. He also provides hydrogeologic support for geotechnical projects including development of construction dewatering plans, evaluation of groundwater seepage for slope stability problems, evaluation of soil infiltration capacity for stormwater control design, and estimation of groundwater inflows to tunnels and excavations.

Richard was an invited lecturer (2 sessions) for the American Society of Civil Engineers Dewatering Short Course, November 13-14, 2008, on computer modeling and contaminated sites.

PROJECT EXPERIENCE

Washington State Department of Transportation, Alaskan Way Viaduct/Seawall Replacement Project, Seattle, WA. Richard was Project Hydrogeologist for the Alaskan Way Viaduct/Seawall Replacement Project in Seattle, Washington. He reviewed groundwater conditions along each of the five alternative alignments as part of the Environmental Impact Statement (EIS). For preliminary design, Richard evaluated the feasibility of dewatering for a deep cut and cover structure along the waterfront that has been proposed for two of the alternatives. The dewatering evaluation also considered potential impacts for the EIS, including dewatering induced ground settlements and the potential of contaminant migration during construction. Richard also constructed a three-dimensional groundwater flow model for the EIS to assess potential impacts to groundwater including mounding behind the finished structure, changes in groundwater discharge volumes and locations to Elliott Bay, and potential degradation of groundwater quality. Richard completed a detailed evaluation of dewatering requirements for the project, including number, location, and design of dewatering wells, the potential impact of dewatering on near surface soil subject to ground settlement, and the use of recharge wells for mitigating drawdown of the water table in shallow soil.

Anchorage Fish Hatchery, Anchorage, AK. Richard was Project Hydrogeologist to evaluate the effects of proposed groundwater pumping at the Anchorage Fish Hatchery site on local groundwater resources. The project is part of an ongoing study being conducted for expansion of the hatchery, and provides a basis for future groundwater resource planning and support for securing a water right. Richard constructed a three-dimensional groundwater flow model of the Anchorage area to evaluate the impact of the hatchery wells on existing groundwater users in the area. His groundwater modeling results indicate that up to 3,000 gpm is available at the hatchery site from the deep aquifer and pumping will have localized drawdown effects on groundwater levels but relatively small basin-wide drawdown effects.

Richard's analysis indicates the proposed pumping rates appear to be sustainable for the long term (up to 50 years) if the assumed current groundwater conditions remain unchanged. Richard also used the groundwater model to evaluate the potential for mobilization of contaminants toward the hatchery wells and the potential for salt water intrusion as a result of the additional pumping at the hatchery.

Caribbean Utilities Company (CUC), Simulated Groundwater Flow and Heat Transport, Grand Cayman Island. CUC uses diesel engines for power generation and groundwater is used as a coolant for the engines. The preferred means of disposing of the spent cooling water is by reinjection into the underlying karst aquifer system. Richard developed models for the project using MODFLOW for the groundwater flow portion of the model while MT3D was used to simulate heat transport. He used the models for design of the original well field and calibrated the model to field conditions after initiation of the well field. The model was used to assess potential impacts of injection of the heated water on the local aquifer system. The model indicates that local groundwater temperatures may increase as a result of reinjection of the heated water, however, the impacts would be of limited areal extent and would not affect other groundwater users in the area.

Defense Energy Support Center, Defense Fuel Supply Point Site, Anchorage, AK. Richard completed soil leaching, groundwater, and contaminant transport models in support of risk assessment. He simulated the movement of fuel constituents and metals through the soil column to the water table surface. Richard constructed groundwater flow model of complicated site conditions that included areas of unsaturated soil, and numerous surface water seeps and drains. He simulated the transport of contaminants in groundwater to surface water discharge points on the site and used models to evaluate cleanup criteria and time frame for completion of remedial actions. Models used included SESOIL, and MODFLOW and MT3D as part of the DOD Groundwater Modeling System. The results of the modeling indicated that most of the contamination in groundwater eventually discharges to on-site surface drainages, only two of the eight identified source areas cause contamination in groundwater that exceeds cleanup criteria, and cleanup of contamination sources in soil will allow groundwater to meet cleanup criteria within a reasonable time frame.

Washington State Department of Ecology, Review of Groundwater Modeling for Hanford Tank Closure and Waste Management EIS, Richland, WA. Richard was Project Manager and Principal Hydrogeologist working with Ecology providing oversight and technical review of groundwater flow and contaminant transport computer models that are being completed by the U.S. Department of Energy (DOE) for the Hanford reservation. The modeling was being performed to support the EIS that is being completed as part of the consent decree between Ecology, DOE, and EPA. Richard reviewed the site-wide conceptual model for contaminant migration from ground surface downward through the unsaturated zone, and lateral movement of contaminants in the water table aquifer to the Columbia River. He participated in stakeholder meetings to respond to technical questions regarding the modeling work and technical review group meetings to provide recommendations to DOE's contractors for modeling improvement. His review included evaluation of hydrologic and hydrogeologic inputs to the computer models, including recharge, aquifer parameters, historical groundwater fluctuations in response to discharge of liquid waste at the site, and fate and transport mechanisms in the vadose zone.

Deering and Nelson, Nisqually Bend Subdivision, Lacey, WA. Richard was project hydrogeologist for the evaluation of the effects of the proposed development on nearby steep slopes. He performed geologic reconnaissance, reviewed existing subsurface information, coordinated hydrogeologic and geologic studies, performed seepage analyses, and provided recommendations regarding impacts of the proposed development on slope stability. The project proposed a zero stormwater runoff approach, in which all precipitation would be intercepted or used by vegetation, evaporated, or infiltrated. Richard developed time-variant, cross-sectional, seepage model using SEEP/W to assess the effects of concentrated and

dispersed infiltration systems on groundwater elevations and slope stability. His analyses demonstrated that infiltration of stormwater would have a negligible impact on slope stability for deep-seated slides.

US Army Corps of Engineers, Seattle District, Howard Hanson Dam Fish Passage, Palmer, WA. Richard evaluated groundwater conditions for the construction of a fish passage at an existing dam on the Green River. He constructed numerical models to assess dewatering design requirements, including dewatering well spacing, construction design, depths, and pumping rates required to lower heads in the bedrock to prevent blowouts and allow construction. Richard evaluated potential seepage below cofferdam and potential for basal instability as a result of excessive hydrostatic pressure. He designed passive pressure relief wells along base of cofferdam and developed technical specifications for temporary and permanent construction dewatering systems.

US Army Corps of Engineers, Seattle District, Lewiston Levee, Lewiston, ID. Richard completed groundwater flow analyses through the Lewiston Levee to evaluate possible scenarios that led to seepage at the toe of the levee for the Corps of Engineers. He evaluated relationships between river stage, water levels within the levee, and seepage rates. Richard determined that the likely cause of seepage was that the integrity of the impermeable core was compromised as a result of a hydraulic gradient reversal through the levee. Richard evaluated potential remedial actions to limit additional seepage.

Port of Tacoma, Gog-le-hi-te II Habitat Project, Tacoma, WA. Richard was Project Hydrogeologist to evaluate groundwater conditions associated with construction of this habitat restoration project along the Puyallup River in Tacoma, Washington. The project involves construction of a new levee, excavation of fill and debris, and breaching of the existing levee to create a low salinity tidal habitat area. Richard completed a dewatering analysis to estimate potential groundwater flow rates into the excavation during various tide stages and provided dewatering recommendations in the vicinity of the new levee to maintain subgrade stability during construction of the levee. He also constructed a two-dimensional computer seepage model through the existing levee to provide a basis for evaluating levee stability during excavation.

Sound Transit, Link Light Rail Project, Seattle and Tacoma, WA. Richard was the Project Hydrogeologist for the conceptual, preliminary, and design phases of the Link Light Rail Project. The fast-track project included a 23-mile line in Seattle with multiple tunnel segments. He assessed groundwater flow conditions and aquifer parameters for the proposed tunnel alignment under First Hill, Capitol Hill, and the University District from the results of multiple pumping tests and groundwater measurements. Richard estimated potential short-term transient and long-term steady-state groundwater inflows along the tunnel alignment and for related structures including shafts and stations using analytical and numerical computer modeling techniques depending on subsurface conditions and construction methodology. He evaluated preliminary conceptual construction dewatering design for proposed stations and shafts.

US Coast Guard, Groundwater Investigation, Kodiak, AK. Richard investigated the movement of chlorinated solvents in groundwater at two RCRA-permitted sites at the USCG ISC Kodiak. He developed groundwater flow and contaminant transport models to evaluate the movement of chlorinated solvents in the absence of remediation for each site. MODFLOW and MT3D were used to confirm the direction of contaminant movement and assess if natural attenuation is limiting contaminant migration. The results of the modeling were used to focus additional field efforts in order to identify subsurface conditions controlling the spreading of the plumes. Richard evaluated the effectiveness of existing air sparging/soil vapor extraction systems and assessed the feasibility of alternative remedial measures for the sites.

US Navy, Hydrogeologic Study, Naval Submarine Base, Bangor, WA. Richard evaluated soil and groundwater remediation effectiveness for the Bangor Naval Base site. Simulated groundwater pump and treatment system using the U.S. Geological Survey (USGS) MOC computer model to optimize the number and pattern of groundwater remediation wells. He used MOC to evaluate potential impacts to surface water receptors in the absence of remediation. Richard assessed the effectiveness of soil washing as a remediation technique using an analytical contaminant transport model. Richard evaluated a second site at the Naval Base utilizing pump-and-treat and reinjection to capture and confine a contaminant plume in a deep confined aquifer. He used a groundwater flow and particle tracking computer model to optimize well field performance.

Seattle Tennis Club, Groundwater Flow Analysis, Seattle, WA. Completed a groundwater flow and contaminant transport model in support of a risk assessment. The object of the model was to determine if petroleum contamination released from a UST formerly used on site would pose an unacceptable risk to Lake Washington. A "worst-case" model was constructed. The model indicated that contaminant concentrations discharging to surface water would be less than MTCA criteria. Ecology determined that no further action was needed for the site.

Howard Bend Levee, St. Louis, MO. Constructed a numerical computer model to evaluate groundwater flow beneath a levee along the Missouri River during flood stage. The groundwater model was used to determine the necessary depth and length of a slurry cutoff wall to protect a wetland on the landward side of the levee from groundwater uplift pressures and excessive vertical gradients beneath the wetland. The model was also used to evaluate the affect of pressure relief wells to reduce hydrostatic pressures below the wetland. The results of the model indicated the use of two pressure relief wells in conjunction with the cutoff wall could reduce the size of the wall, thereby reducing project construction costs.

Fairbanks Memorial Hospital, Well Field Design, Fairbanks, AK. Richard was Project Hydrogeologist for this project to design a well system to cool generators for a hospital in Fairbanks, Alaska. The system was designed to pump groundwater from multiple production wells and reinject the heated water into the underlying aquifer. Richard reviewed regional and site-specific groundwater conditions to assess potential impacts to the aquifer as part of the permitting process. He provided well design specifications and addressed well performance concerns from iron precipitation. Richard oversaw the construction of a groundwater flow and thermal transport model to evaluate the potential for short-circuiting of heated water to the production well, limit the off-site migration of heated water, and assess potential impacts of the heated water on permafrost underlying the site.

Hanford Reach, Well Field Design for Groundwater Source Heating and Cooling, Richland, WA. Richard was Project Manager for design and testing of a production/injection well system to support a groundwater source heating and cooling system for the proposed Hanford Reach Interpretative Center in Richland, Washington. The Interpretive Center will be an environmental education center for the last free flowing portion of the Columbia River and a key component of the project is development of an environmentally friendly, sustainable building. Richard worked with the architect to determine the number and location of wells based on installation and pumping of a test well at the site.

US Navy, NAVFAC NW, Dewatering Evaluation of Drydock No. 6, Puget Sound Naval Shipyard, Bremerton, WA. Settlement in areas of the drydock raised concerns regarding the stability of the slab and the effectiveness of the underlying drainage system to dewater the soils below the slab and prevent excessive uplift pressures on the slab. Richard developed a three-dimensional groundwater flow model to evaluate the current state of the drainage system and the impact of remedial measures proposed to prevent further settlement. His analysis indicated that a series of passive relief wells would be more effective at reducing hydrostatic pressures than the existing drainage system. He designed a deep well dewatering

system that could be pumped during construction activities to repair the slab and passively drain during operation of the drydock. Richard also designed a monitoring system to measure water pressure under the slab and an operation procedure during unwatering of the drydock.

Forest Grove Wastewater Treatment Plant Expansion, Forest Grove, OR. Richard was Project Hydrogeologist in support of six new treatment-plant structures: an influent structure, a screening building, an influent pump station, a grit basin, a diversion structure and an aeration basin. Excavations ranging from 20 to 35 feet are required for the construction of the below-grade structures. Richard constructed a three-dimensional groundwater flow computer model to design dewatering systems for each of the excavations. His evaluation also considered the impact of various shoring systems on groundwater inflow to the excavations. Based on his model, Richard recommended a series of vacuum-extraction well points will multiple lifts to dewater and depressurize the fine-grained soil at the site and drainage layers with sumps in the center of the excavations. His evaluation demonstrated that a combination of water-tight shoring adjacent to sensitive structures combined with the well points allowed for groundwater control without excessive drawdown beneath the sensitive structures.

Balch Consolidation Conduit, Bureau of Environmental Services, Portland, OR. Richard was Project Hydrogeologist for this 6,000-plus foot long, 84-inch diameter micro tunnel and shafts project. Richard reviewed soil and groundwater conditions for the project and constructed a three-dimensional groundwater flow computer model to evaluate potential dewatering systems for each of the excavations. He also evaluated potential mitigation measures for the excavation base failure of Shaft M, including various grouting, shoring, and dewatering combinations. From the model, Richard estimated discharge rates for the dewatering systems and potential area of drawdown, which was critical given the presence of sensitive structures founded on soils susceptible to consolidation and ground settlement.

City of Portland 3rd and Alder Diversion Structure and Outfall 28, East Side CSO, Portland, Oregon. Richard was Project Hydrogeologist for a sewer diversion structure and an outfall in Portland, Oregon. The diversion structure was located near 3rd and Alder near a settlement susceptible building and an area of known groundwater contamination. Richard constructed a groundwater model to perform parametric analyses of various dewatering scenarios. The modeling results indicated that a design consisting of multiple dewatering wells in different soil formations could effectively dewater the excavation while reducing the potential risk of adverse affects during construction. For Outfall 28, adjacent to the Willamette River, Richard developed a groundwater model to evaluate the use of well points and deep dewatering wells to control groundwater during excavation. The model considered variable river stages. The final design consisted of multiple well points around the perimeter of the excavation and a deep dewatering well adjacent to the pipeline going into the river.

Clean Water Services, Lower Tualatin Pump Station, Tualatin, OR. Richard was Project Hydrogeologist for a deep influent pump station supplying waste to Clean Water Services' main treatment facility. The project required innovative solutions in order to maintain a high level of service the adjacent city park and minimize impacts to two nearby rail lines. Richard developed a three-dimensional groundwater flow computer model to evaluate potential dewatering and shoring scenarios for the pump station and pipeline excavations. Based on the results of his model, we designed a caisson excavation and trenchless construction techniques for several of the pipelines, in lieu of traditional open cut construction to reduce the risk of drawdown-induced ground settlement beneath the rail lines. For other project excavations, Richard evaluated various dewatering systems and estimated dewatering discharge rates for the systems.

Bonneville Power Administration, Echo Lake Substation, King County, WA. Developed temporary construction and permanent dewatering recommendations for the new Echo Lake Substation. Evaluate

groundwater flow conditions at the site, including rainfall-groundwater interactions. Several numerical and analytical techniques were used to evaluate site groundwater control (dewatering) options including the use of dewatering wells, horizontal drains, and sumps within the excavation. An evaluation of groundwater levels for summer (low-rainfall), winter (high-rainfall), and 50-year storm event conditions was completed to provide a better understanding of dewatering requirements during construction. For the permanent dewatering system, an interceptor trench located upgradient of the facility was designed to capture groundwater.

Badger Properties LLC, Groundwater Analysis for Proposed Comprehensive Plan Amendment, Benton County, WA. Richard was project hydrogeologist for a groundwater study to evaluate the on-site sewage capacity and potential impacts on the groundwater regime in the area from a new development in Benton County. He developed a three-dimensional groundwater flow model to evaluate potential groundwater mounding below the site. Richard's evaluation indicated groundwater mounding of less than 5 feet below the septic system, which would rapidly dissipate toward the edge of the development site.

City of Seattle Water Department, Groundwater Study, Seattle, WA. Richard evaluated groundwater resources at the Highline Well Field as part of an aquifer storage and recovery (ASR) program. This project was one of the first ASR programs of its kind in the country. Richard completed computer simulations of groundwater flow using MODFLOW to assess impacts of artificial recharge on the aquifer during the winter months using excess surface water resources. The model was used to optimize pumping scenarios during summer peak period use to maximize capacity. His modeling indicated that the ASR program may not be able to increase production at the well field, however could maintain previously declining aquifer water levels at pre-production levels. Richard also delineated wellhead protection areas using particle-tracking methods for 1-, 5-, and 10-year travel times for the well field.

Port of Tacoma, Groundwater/Surface Water Study Sitcom Waterway Superfund Project, Tacoma, WA. Analyzed groundwater and surface water interactions for the Sitcum Waterway confined disposal facility. Modeled impacts of surface water tidal fluctuations on groundwater levels beneath the site using MODFLOW. Used MT3D and analytical models to evaluate potential movement of dissolved metals from the disposal site to adjacent surface water receptors. Developed long-term groundwater monitoring well program to assess potential migration of

Groundwater Flow Analysis, Adams County, WA. Assessed groundwater flow and predicted contaminant movement beneath a future county landfill facility. Simulated groundwater conditions in weathered and fractured bedrock beneath the site using MODFLOW. Used the calibrated model to evaluate changes in groundwater flow under pumping stresses. Assessed the effectiveness of the planned groundwater monitoring system using particle-tracking methods to simulate the movement of contaminants from potential leaks in the landfill.

US Department of Energy, Radionuclide Evaluation, Hanford Site, Richland, WA. Evaluated radionuclide movement beneath storage tanks at the Hanford site. Used pore water chemistry to determine controlling factors in transport and geophysical logs to analyze historical plume movement. Assessed future radionuclide movement using a two-dimensional vadose zone transport model.

Parker Paint, Soil and Groundwater Contamination Study, Tacoma, WA. Evaluated soil and groundwater contamination at a paint facility in Tacoma. Supervised drilling and installation of monitoring wells and a soil vapor extraction system. Conducted soil vapor extraction tests to determine air/soil flow properties. Used a numerical model to assess the radius of influence and effectiveness of soil vapor extraction system.