CURRICULUM VITAE FOR: NATHAN J. JACOBSEN

Associate Hydrologist

EDUCATION

MS Civil and Environmental Engineering, California Polytechnic State University, San Luis Obispo, California

BS Watershed Science, Colorado State University, Fort Collins, Colorado

REGISTRATIONS

Professional Civil Engineer California No. C65203
Certified Professional in Erosion and Sediment Control No. 3652

PROFESSIONAL HISTORY

E-PUR, llc, Portland, Oregon, Associate Hydrologist, 2011-present
GeoSyntec Consultants, San Diego, California, Senior Project Engineer, 2003-2011
URS Corporation, San Diego, California Engineer, Water Resources & Quality, 1999-2003
Regional Water Quality Control Board, San Luis Obispo (Region 3) Engineering Student Assistant, Landfill Compliance Division, 1997-1998
Treatment Technology, Water and Wastewater Technician, 1996-1997
USDA Forest Service, Hydrologic Technician and Forest Fire Fighter, 1994

SUMMARY OF QUALIFICATIONS

Mr. Jacobsen has over 16 years of experience in:

- **civil engineering design**
- **modeling and analyses specific to watershed management**
- **hydrology**
- **stream restoration**
- **conveyance and river hydraulics**
- **drainage design**
- **stormwater management**
- **water quality Best Management Practice (BMP) design projects**
- **project management**

Mr. Jacobsen provides a broad technical and regulatory knowledge and has been the lead engineering designer on a number of stream restoration, drainage design, and water quality Best Management Practice (BMP) design projects (retrofit and new construction).

Mr. Jacobsen's water resource engineering experience includes industrial, private, and public projects that required site specific and regulatory specific BMP selection, design, implementation, and operation and maintenance plans. His experience extends into stream-course design and permitting, water-quality modeling, landfill drainage design, and water-quality monitoring, sample-plan design, and data collection.

Mr. Jacobsen utilizes his diverse project experience and his broad and strong expertise to meet and exceed project goals regardless of the challenges that arise.

REPRESENTATIVE PROJECT EXPERIENCE

Examples of Mr. Jacobsen's project experience are presented below in the areas of Stormwater, Hydrology, and Hydraulic Design Projects, Erosion and Sediment Control Projects, Erosion and Sediment Control Projects, Landfill Stormwater Management and Design Projects, Water Quality Projects, and Other Relevant Experience.

STORMWATER, HYDROLOGY, AND HYDRAULIC DESIGN PROJECTS

- ***Development of Basin Hydrology Model, Colorado River Basin, Nevada and California –*** Developed a hydrologic model for the Colorado River and evaluated perchlorate salt

REPRESENTATIVE PROJECT EXPERIENCE *— continued*

mass-transport in the Lower Colorado River Basin. Tracked the migration of perchlorate that was loaded to the Colorado River from Henderson, Nevada into the various Los Angeles area water basins. The water balance model evaluated river flows for the Colorado River and Bill Williams River, elevation/volume changes in Lake Mead, Lake Mohave, and Lake Havasu, and outflows via surface water exports, canal diversions (All-American Canal, etc.), groundwater recharge, and flows from Parker Dam (Lake Havasu). The water balance model was coupled with a perchlorate mass balance model to assess perchlorate load changes in each of the water bodies (rivers, lakes, and exports). The combined hydrology model (water balance and perchlorate mass balance models) was applied on a monthly time scale from 1957 through 2011 based on publically available data. Where data was missing, data was estimated using regression analyses based on known and qualified data. The hydrology model successfully identified that perchlorate loads originating from Las Vegas Wash in Henderson, Nevada were transported, stored, and exported out of the Lower Colorado River Basin since the 1950's

- ***Oregon Coastal Protection Study, Yachats, Oregon*** **–** Assessed the potential for inundation and beach-face erosion from certain frequency storms events and the accompanying ocean wave heights. Private homes located north of Yachats, Oregon have observed increased flooding/inundation and property loss due to erosive ocean waves. The wave analyses were based on published methodologies utilizing long-term ocean buoy data to identify significant wave heights and tidal extremes. Based on the buoy data and site specific characteristics (beach slope, beach-face elevation, topography), the anticipated wave runup elevation was estimated and mapped for various reoccurrence intervals (e.g., 5-year, 10-year, 25-year, 50-year, and 100-year). To assess the amount of erosion over time, the analyses included methods to estimate the amount of time annually that wave runup is anticipated to meet or exceed the beach-face elevation. These analyses provide engineering and planning data needed for long-term property protection from coastal erosion.

- ***Columbia Crossing Response to Joint Permit Application Comments, Portland, Oregon*** **–** Provided sediment transport analyses associated with placement of dredged material in the Columbia River. Columbia Crossing provides Columbia and Willamette River boaters with marinas and boat storage facilities. Over time, the water depths within the marinas have decreased due to sediment accumulation. SoundEarth provided the US Army Corps of Engineers (USACE) with a Joint Permit Application to dredge the excess sediment from the marinas and place it at the bottom of the Columbia River. The USACE was concerned that the placed sediments would not disperse and create a shoal (shallow waters) in the Columbia River. Mr. Jacobsen provided engineering estimates of the rate of the sediment transport based on the average shear stress versus the permissible shear stress of the placed sediment, anticipated stream power available to move the sediment, and distance the sediment will travel prior to settling on the bottom of the river. The technical analyses found that shallow waters would not be created as a result of the project and provided the USACE with the information needed to move the project forward without further technical studies.

REPRESENTATIVE PROJECT EXPERIENCE *— continued*

- ***Willamette Oaks Retirement Community Floodplain Modification Assessment, Portland Oregon –***Evaluated the impacts from proposed filling of a Federal Emergency Response Agency (FEMA) 100-year floodplain. The proposed development provided a Conditional Letter of Map Revision based on Fill (CLOMR-F) to FEMA for approval of their project which proposed to fill areas adjacent to the Willamette Oaks Retirement Community (Willamette Oaks) above the 100-year floodplain elevation. The results of the floodplain assessment identified that the proposed project could impact Willamette Oaks by directing floodwaters onto their property by modifying an existing designated floodway. The CLOMR-F did not provide technical studies to identify potential impacts nor did it provide mitigation of potential impacts.

- ***La Jolla Alta Channel Repair and Geotechnical Stability Project, City of San Diego, San Diego, California –*** Project manager responsible for preparing site development permit documents, obtaining stream alteration permits, and preparing plans, specifications, and estimates for repair of a severely eroded canyon/stream in La Jolla, CA. The high profile nature of this Capital Improvement Project required the development of a constructible cost-effective alternative design that would ensure long-term geotechnical stability of the adjacent slopes, ensure stream course protection, and improve the overall watershed water quality protection through implementation of stormwater best management practices (BMPs; e.g., biofilter and detention basins), while minimizing disturbance to the local community. The project included coordination with multiple city staff departments (maintenance, planning, and capital improvements), coordination with local agencies and planning groups (city departments, federal agencies, and the La Jolla Community Planning Association), and evaluation of project compliance related to federal, state, and local stormwater and environmental regulations and policies, including environmental codes, building codes, and geotechnical requirements.

- ***The Boeing Company (Plant 2), Seattle, Washington –*** Design team manager for stormwater improvement project that focused on reducing specific constituents from entering Duwamish Waterway. The first phase of the design included an emergency bypass of a damaged drainage pipe. This design included infrastructure to limit additional construction and costs during the second phase of the project. The second phase was designed to meet specific water quality goals while maintaining a gravity drain conveyance. The design included a number of bypasses to divert only first flush and water quality flows to a treatment train (oil/water separator and cartridge filter design). Flows in excess of the water quality flow rate were bypassed, thus minimizing the size of treatment facilities and the amount of maintenance. The design also included treatment of all roof drains without changing internal (building) piping or infrastructure. The roof drains were also treated with cartridge filters and outleted to the existing drainage pipe. The roof drain also included a bypass to limit the size and maintenance of the treatment system. Mr. Jacobsen led the team through significant design challenges resulting from the regulatory-required water quality treatment system, using existing drainage pipes to limit construction costs, and maintaining a gravity drain system at and below sea level.

- ***Westchester Rainwater Improvement Project. City of Los Angeles Proposition O Project, Los Angeles, California –*** Technical design manager for the Westchester Rainwater Improvement Project, a subregional water-quality treatment project located in the City of

REPRESENTATIVE PROJECT EXPERIENCE *— continued*

Los Angeles. The project is pending completion and is designed to be an integral part of compliance activities associated with Total Maximum Daily Load Implementation Planning for Santa Monica Bay beaches and funded by the City of Los Angeles. Upon completion, the plant will be a subregional BMP serving approximately 2,400 acres of urbanized land. The project design includes interception and treatment of urban runoff through diversion structures and three water quality treatment methods/BMPs (also known as "treatment train" design). Natural filtration and degradation processes within the soil are designed to clean the stormwater, and recharge groundwater. The various project features are designed to reside underground and preserve the existing land uses including open space.

- ***Corral Howell Watershed Analysis–Carnegie State Vehicular Recreational Area, California Department of Parks and Recreation –*** Project manager for the entire project, overseeing and delivering project-cost estimates, interdisciplinary team coordination, civil design deliverables, and construction schedules. Carnegie State Proactively assessing and improving water quality was a major aim for Off-Highway Motor Vehicle Recreation (OHMVR) Division of the California Department of Parks and Recreation (DPR). DPR was interested in developing a management plan for Carnegie SVRA, and other off-highway vehicular parks, that would provide increased off-highway vehicular recreation while concomitantly complying with Phase II of the National Pollutant Discharge Elimination System and the Clean Water Act. Worked with OHMVR from 2004 forward as part of an interdisciplinary team comprised of environmental professionals, historians, engineers, and maintenance staff to produce the Corral Hollow Watershed Assessment and develop stream restoration design plans, identify BMP testing and demonstration projects, develop a SVRA-specific BMP manual, and develop a model Stormwater Pollution Prevention Plan and Stormwater Management Plan.

- ***Kimball and Bickmore Wetland Design, Chino, California –*** Lead designer, providing a retrofit design below the invert of the existing detention basins while maintaining gravity flow. Kimball and Bickmore wetlands are located in the City of Chino as part of a regional treatment of nonstorm water discharges (dry-weather flow) and first flush flows (to the extent possible). The wetlands provided treatment of a number of constituents related to dry-weather flows, including pathogens, suspended solids, metals, and nutrients. The design has been constructed and in service since 2005.

- ***California Department of Transportation (Caltrans) Detention Basin Optimization Study, Orange County, California –*** Task leader in the redesign of 18 detention basins along California State Route 73. The redesign effort was aimed to assess the effectiveness of various detention basin sizes and outlet controls to improve water quality. Some of the design tasks included estimating existing hydrology and hydraulics; establishing basin layouts to minimize construction costs; facilitating maintenance equipment access; designing a basin layout that included flow and water quality monitoring at the inlet and outlet of the basins; and developing plans, specifications, and estimates meeting Caltrans standards for construction.

- ***San Diego County Floodplain and Culvert Analysis (Confidential Client) –*** Performed hydrologic calculations on an 8.5–square-mile watershed using HEC-HMS and County of San Diego Hydrology Manual guidelines. Using the peak discharges from the model

REPRESENTATIVE PROJECT EXPERIENCE *— continued*

output Mr. Jacobsen used HEC-RAS to delineate the 100-year floodplain for approximately 2.5 miles of stream. In addition, assessed the peak flows for four sub-watersheds to estimate the ability of roadway cross-culverts to convey the flows.

- ***State Route 125 Construction BMP Monitoring Project, San Diego, California –*** Project manager and lead designer of the monitoring design for 18 permanent BMPs. This project included an extension of California State Route 125 located in District 11 that serves south San Diego County commuters and required water quality treatment and compliance monitoring to meet California permit requirements. The monitoring design included redesign of existing Caltrans infrastructure (headwalls, inlets, etc.) to implement primary flow monitoring devices (H-flumes) and water quality sampling equipment. The designs were implemented into final design and included plans, specifications, and engineer estimates.

- ***Color Spot Nursery Water Management Design, Fallbrook, California –*** Lead engineer to assess Color Spot's water management practice to determine the necessary BMPs to control irrigation runoff entering a nearby tributary of the San Luis Rey River. Coordinated with the Regional Water Quality Control Board to ensure the new water management design met the regulatory requirements. Developed design plans identifying the specific locations where BMPs were required for regulatory compliance to minimize required maintenance. After construction was complete, the site did not discharge any irrigation water and Color Spot used the reclaimed water in its ongoing nursery operations.

WATER QUALITY PROJECTS

- ***Huntington Beach Urban Runoff Investigation, Huntington Beach, California*** – As lead investigator of a sanitary surveys specifically designed to identify bacterial water quality of urban runoff for the Huntington Beach watershed to identify sources of bacteria causing beach closures, developed sanitary survey protocols and field strategies and led field crews during a sampling effort that included more than 200 bacteria samples throughout the watershed. Other duties included defining watershed boundaries through analysis of storm drain and topographic maps to better understand the sub-watershed sources of bacteria, assessing water quality data by applying statistical and logarithmic averaging methods with the applicable water quality standards to identify possible source trends by sub-watershed, and assisting in the conceptual designs of mitigation measures to remedy bacterial effects in the surf zone.

- ***Huntington Beach Surf Zone Water Quality Investigation, Huntington Beach, California*** – Assisted in the design of a surf zone monitoring plan, which included continuous water quality sampling at various locations of state- and city-owned beaches. Led a field crew of 15 employees to conduct the 24-hour surf zone sampling for two weeks and coordinated with the analytical laboratory to analyze over 1,300 bacteria samples.

- ***California Department of Transportation Public Education Litter Management Study, Fresno, California*** – Task leader and engineer to assess the effects of public education as a BMP to reduce highway litter loads in the Fresno metropolitan area. Project duties included design hydrology and hydraulics, selection of monitorable outfalls, review of "as-built" drawings, field verification of watershed areas and outfall configurations, and

REPRESENTATIVE PROJECT EXPERIENCE *— continued*

site construction management. During the monitoring season, Mr. Jacobsen analyzed data from on-site American Sigma flow monitoring equipment and created hydrographs and hyetographs. Analyzed data for anomalies to assess possible problems in the field and mitigate prior to the next monitored storm event.

- ***California Department of Transportation Roadside Vegetated Treatment Study, Various Statewide Locations*** – Assistant project manager for the monitoring of 23 biofiltration treatment systems and 8 roadside systems for stormwater treatment within six California Department of Transportation districts. The project evaluated treatment efficiency of roadside biofilters located at various distances from the roadway. Led monitoring activities, which included 24-hour weather tracking during storm events, remote operation of all monitoring sites via internet based applications, coordination of field teams, monitoring equipment installation (CR10 data loggers and Isco samplers), and performing hydrologic and hydraulic data analysis.

- ***Peters Canyon Reservoir Water Quality Assessment, Orange County Regional Parks, Orange County, California*** – Field team leader for two rounds of depth-integrated sampling to identify changes in water quality within the water column. Some of the sampling included depth-integrated water quality samples and sediment core samples at various locations in the reservoir to identify the depth and quality of the deposited sediments and changes in water quality throughout the reservoir. The data were eventually used by the client to produce reservoir management plans aimed to restore the water quality and habitat of the reservoir. Peters Canyon Reservoir is part of the Orange County Regional Parks and has experienced historic water quality impairment. The reservoir's water quality has degraded over the past few decades as a result of decreased inflows and increased nutrient concentrations.

- ***Urban Spill Response Plan, Kinder Morgan Energy Partners, L.P, Los Angeles, California*** – Engineer and co-author of an Urban Spill Response Plan for a petroleum pipeline from Carson to Norwalk, CA. The plan included emergency response procedures, fate and transport model results, emergency contacts, sensitive receptor inventory, and various spill response scenarios. Assessed various pipeline break scenarios and fate and transport scenarios to evaluate the amount of petroleum that would spill into the Los Angeles River and ultimately flow to the Pacific Ocean.

EROSION AND SEDIMENT CONTROL PROJECTS

- ***2007 Post-Fire Hazard Mitigation Assessment, various locations within the City and County of San Diego, San Diego, California*** – Project manager and technical design lead for the Post-Fire hazard response project. The Post-Fire hazard response project was created as a result of the 2007 Firestorm, which burned approximately 500,000 acres in Southern California, with over 340,000 acres within San Diego County. Over 2,300 structures were destroyed and several people lost their lives. With winter rains fast approaching, the County of San Diego faced the potential for devastating mudslides and debris flows that could inundate thousands of homes, close evacuation routes and cause significant environmental damage. The Post-Fire response included an Emergency Flood/Erosion Protection Program that first assisted homeowners in protecting their property, and then aimed to stabilize watersheds to reduce mudslides and debris flows. Utilizing innovative design techniques, this massive effort was completed in less than four

REPRESENTATIVE PROJECT EXPERIENCE *— continued*

months at a cost of approximately $5 million. During the implementation phase of the project, several large storm events inundated the burned areas and tested the resilience of the protective measures. As a result of the protective measures, no homes in burned areas were damaged by mudslides or debris flows, nor was any evacuation routes closed for a significant time during several large rainstorms.

- ***2003 Post-Fire Hazard Mitigation Assessment, various locations within the City and County of San Diego, San Diego, California*** – As ground assessment task manager, directed 15 staff to perform assessments throughout the county. Within the borders of San Diego County, over 381,000 acres were burned as a result of the October 2003 wild fires. The primary purpose of the assessment was to identify sites that are of greatest threat to public health and safety, property, and infrastructure, and to recommend mitigation measures appropriate for the identified risks and site conditions. Mr. Jacobsen performed initial aerial reconnaissance, identified the areas of greatest risk, and assigned focused ground assessment data collection on these areas. Using a combination of the satellite imagery, soil data, and topographic information, Mr. Jacobsen assisted in the development and generation of a Post-Fire Hazard Index of Relative Erodibility using sophisticated GIS spectral analysis. These maps provided the ground team's additional guidance in identifying areas of greatest risk and siting specific mitigation measures. As part of the field teams, Mr. Jacobsen identified sites that had high hazard potential and high impacts (e.g., homes, infrastructure, etc.), assigned mitigation measures (e.g., sediment, erosion, and runoff controls), estimated quantities, and provided construction cost estimates. During implementation of the mitigation measures, Mr. Jacobsen acted as field team leader for all hand labor activities. An additional assessment was performed to identify sites within and surrounding the City of San Diego reservoirs that were at risk of damage or that were damaged during the fire. For the reservoir protection assessments, Mr. Jacobsen served as overall task manager and worked with city water department staff to identify appropriate mitigation measures to protect reservoir water quality.

- ***Oregon Statewide Erosion and Sediment Control Manual, Oregon Department of Environmental Quality*** – Assisted in the development of the Erosion Prevention and Sediment Control Manual for use by the construction industry and state and local inspectors. The manual included development of site planning guidelines as well as BMP details for erosion control, sediment control, runoff control, and nonstorm water management BMPs. Mr. Jacobsen developed BMP details for the erosion and sediment control measures to the climate of Oregon and consistent with Volume 2 of the Oregon Department of Transportation Hydraulics Manual (Erosion and Sediment Control) and Oregon Department of Transportation Standard Specifications.

- ***Nationwide National Pollutant Discharge Elimination System Construction Site Audits– Confidential Client*** – As regional audit coordinator and senior site auditor, performed internal National Pollutant Discharge Elimination System compliance audits of construction sites throughout the United States for a large commercial builder. The audits involved a technical review of documentation and field implementation to assess compliance with internal protocols and state construction general permit requirements. Mr. Jacobsen assisted in the development of the audit procedures to focus fact gathering protocols and optimization reporting to provide the client up-to-date feedback.

REPRESENTATIVE PROJECT EXPERIENCE *— continued*

LANDFILL DESIGN AND STORMWATER MANAGEMENT PROJECTS

- ***El Sobrante Landfill Stormwater Designs, Riverside County, California*** — Lead hydrology and hydraulic design engineer for the site for numerous projects. Managed the project design staff, prepared design reports and construction drawings for expansion, prepared new phase/cell development and landfill closure projects, and developed the hydrology/hydraulics sections of the Joint Technical Document (regulatory documentation) that provided long-term strategies for stormwater management preliminary designs of necessary water conveyance and storage infrastructure. Some of the projects required specific hydrologic calculations to estimate discharge volumes from surrounding watersheds to evaluate possible run-on issues associated with landfill lateral expansion and/or management of run-on/runoff during interim operation. Regulations required specific proportions of the active waste discharge area, disturbed area, and restored/revegetated area to be maintained during each phase of the landfill development. Mr. Jacobsen identified the areas of concern with respect to control of runoff (including run-on) influencing site design/infrastructure, detention basin construction requirements, and location and design of major drainage conveyances as part of future landfill phasing analyses. Mr. Jacobsen integrated site-specific maintenance methods into the designs to minimize degradation of conveyances, storage basins, and other BMPs that require regular maintenance to function properly.

- ***Kettleman Landfill Expansion, Kettleman City, California*** — As engineer, designed the drainage facilities for proposed covers on two Class I/II and one Class II/III landfills for permit documentation. The drainage design focused on facilities to minimize permanent infrastructure (e.g., concrete structures and culverts) such as bench drains and roadway conveyances to create a low-maintenance system. The design complied with California regulations (CCR Title 27), which requires the drainage structures (conveyances and ponds) to convey and retain the runoff associated with the Probable Maximum Precipitation (Class 1 facilities) or the 1,000-year storm event (Class 2 facilities).

- ***County of San Diego Inactive Landfill Evaluation and Basin Design, San Diego County, California*** — As engineer, evaluated the need for additional BMPs and detention basins at five inactive landfills to regulate the amount of sediment entering receiving waters from the sites. As part of the project deliverables, designed hydraulic conveyances and detention basins at two landfills that were ineffective.

- ***Design of Liston Pit Impoundment, Corona, California*** — As engineer, designed a conveyance channel for a 25,000-cubic-yard, lined, CCR Title 27 surface impoundment and leak detection system for stormwater runoff at a biosolids processing facility. As part of the design package, developed a hydrology and hydraulics design and calculations report that supported the project design.

OTHER RELEVANT EXPERIENCE

REPRESENTATIVE PROJECT EXPERIENCE *— continued*

- ***Regional Water Quality Control Board—Central Coast Region, San Luis Obispo, California*** –Assisted in the San Luis Obispo County inactive mercury metal mine project, which prepared environmental data and observation (e.g., water quality samples, soil samples, changing stream characteristics, etc.) specific to mercury-laden mine discharges into a regulated water body. Mr. Jacobsen's efforts on this project assisted Sr. regulatory staff with regulatory enforcement actions, environmental health litigation, and waste discharge requirements .
- ***Treatment Technology, Evergreen, Colorado*** – Responsible for operations and maintenance of municipal water and wastewater treatment facilities at numerous Colorado locations. Operations included a pipeline assessment at Saint Mary's Glacier, Colorado to identify groundwater infiltration sources entering the wastewater system.
- ***U.S. Department of Agriculture Forest Service, Fremont National Forest, Bly, Oregon*** – Performed a Level II riparian survey on the South Fork of the Sprague River in southern Oregon. Inventoried existing riparian vegetation and identified potential natural vegetation and identified existing and past beaver habitats within the Sprague River's drainage system. Mr. Jacobsen also obtained his forest firefighter certificate and fought forest fires on- and off-district.