



Wright Water Engineers, Inc.

DRAKE LUDWIG, P.E.
WATER RESOURCES ENGINEER

CURRENT

Drake is a water resources engineer with six years of professional experience in planning, modeling, and design. He has worked on numerous stream restoration and stabilization projects and has been a part of watershed planning studies throughout Colorado. He has extensive experience permitting, designing, and constructing stream projects utilizing both conventional and natural channel principles. Drake is skilled in hydrologic as well as 1D and 2D hydraulic modeling. He has extensive experience using ArcGIS and AutoCAD Civil 3D to develop complex watershed models and detailed stream designs.

EDUCATION

B.S., Environmental Engineering, 2015, Colorado State University

REGISTRATION

Registered Professional Engineer—Colorado #56922

REPRESENTATIVE PROJECTS

Stream Restoration, Evaluation, and Design

Stone Creek Stream Restoration and Fish Passage. Designed and permitted this fast-track stream restoration project aimed at improving aquatic and riparian health while minimizing maintenance along Stone Creek in EagleVail. Developed a natural channel design to replace two four-foot boulder structures while providing habitat in the form of deep pools and woody structures, and fish passage through cobble riffles. Provided construction observation on the project, which needed to be completed quickly to allow the creek to be open for spawning brown trout.

Three Mile Creek Confluence Planning and Design. Supported the development of concepts and construction drawings for open space improvements at the confluence of Three Mile Creek and the Roaring Fork River in Glenwood Springs. Helped facilitate public outreach to determine what was desired at the open space and educate them on proposed techniques and opportunities for improvement. Assisted in the selection of the preferred alternative based upon public input and site constraints. Developed cost estimates and design support for bank stabilization improvements and revegetation of the site.

Green Valley Ranch Tributary T High-functioning, Low-maintenance Stream Design. Developed a natural channel design for a tributary to First Creek in the City of Aurora near the Denver International Airport. Performed hydrologic and hydraulic analysis to determine the range of flows applicable to this reach including low flows, bankfull flows, minor event flows, and major event flows. Conducted hydraulic modeling of the floodplain to aid in developing the design and floodplain permitting, including the submittal of a CLOMR application. The proposed improvements include a geomorphic design that will provide a naturally functioning stream corridor, minimize maintenance needs, and provide an amenity to the developing community.

Wines Ditch Diversion Rehabilitation Design. Assisted in the design development of in-stream structures to improve the condition of the diversion, control fish passage, and provide boater safety on the Dolores River. Helped compile construction details, drafted a grading plan, and provided support for 1D and 2D hydraulic modeling of the improvements for floodplain permitting and design refinement.

Todd Creek Channel Design. Serving as the design engineer on restoring an existing degraded channel through a major development outside Denver. The restored channel will function naturally to convey baseflows and flood flows alike. This work includes an evaluation and development of stable channel sections, planform, and profile for almost a mile of stream corridor. The river restoration will re-connect the channel to its floodplain through use of natural in stream structures and channel grading. The design will provide an amenity to the neighboring development. Supported 404 and floodplain permitting.

Roan Creek Fish Barrier Design. Assisted in the development of design concepts and alternatives for a fish barrier structure on Roan Creek to help protect native fish species from invasive trout. This included an evaluation of the existing site conditions and constraints for such a structure, site visits, and stakeholder engagement, as well as the development of detailed hydraulic modeling to support the function of the barrier.

Coal Creek Due Diligence. Assisted prospective property buyer to understand potential required scope and costs of stream improvements associated with the development of the area of interest. Included an evaluation of previous studies, interviews with other agencies, as well as a site evaluation. This included an assessment of Fluvial Hazard Zones identified through the reach.

River Run Ranch Diversion Structure and Fish Passage. Project engineer for a water diversion structure on the Colorado River in Granby, Colorado. Developed the design and provided construction observation for the river work associated with the diversion. The design included a boulder cross vane that encourages flow towards the diversion and allows for upstream fish passage while maintaining the river's natural aesthetics and function. The diversion structure includes an intake screen that prevents fish from entering the new irrigation pump station. The intake screen is a wedge wire type with an air burst system to clean debris off the screen. The design included consideration of the low-water and high-water elevations and current velocity across the screen face, detailed components to minimize the entry of sediment and to sluice out sediment that would otherwise tend to settle, and special provisions to address access and maintenance of the intake.

Shay Ditch Channel Design. Provided design support for a channel through a proposed commercial development, including the development of the channel dimension, planform, profile, and bed material. Developed detailed grading of channel improvements to inform floodplain permitting and design parameters. The design will result in a healthy stream corridor through an otherwise commercial area.

Eagle River Diversion Repair Design. Project engineer supporting the EagleVail Metro District in developing a long-term solution to repair their diversion on the Eagle River. The design will include a new intake structure and bypass channel to more efficiently divert water during low and high flows alike. To understand the diversion function, hydraulic modeling of the river, diversion, and delivery system was completed. The final design will maintain the function of the Eagle River while diverting flows to support much of the irrigation throughout the community, including its many parks and the golf course.

Coal Creek Stream Design (Previous Firm). Integrated natural channel design principles and structures into a park landscape along Coal Creek through Superior's Town Center Park. The design utilizes reference reach information to formulate a stable and naturally functioning stream design while providing creek access to park visitors through the use of constructed riffles and ungrouted boulder features. The design balances geomorphic function with recreational access to create a unique amenity for park visitors. Provided permitting and construction oversight support on the project.

Big Dry Creek Floodplain Restoration and Open Space Master Plan Pilot Project (Previous Firm). Led the stream restoration design and modeling efforts on Big Dry Creek. To the maximum extent possible, the project design utilizes natural channel approaches to create a resilient stream with a high functioning riparian corridor. Setting a precedent for future restoration work along Big Dry Creek, the pilot project aims to marry stream and habitat enhancement with passive recreation improvements to create an amenity for the City of Thornton. To restore the eroding banks of Big Dry Creek and protect adjacent habitat and infrastructure, developed alternatives, a comprehensive stream design, and provided permitting support to ensure the success of each project objective.

Cherry Creek Stabilization at the Denver Country Club (Previous Firm). Developed a design through the Denver Country Club to stabilize and restore Cherry Creek to a resilient and functioning corridor. The design balances channel planform, cross-sectional geometry, and slope to establish an equilibrium that functions with the use of bioengineered bank treatments and aesthetic, ungrouted, rock features. The design provides an enhanced riparian habitat with the native vegetation while complementing the golf course landscape. Prepared permitting exhibits and design documents, and provided construction oversight for the proposed improvements.

Masciantonio Trust Bank Restoration (Previous Firm). Evaluated a variety of natural channel design approaches appropriate for the restoration of a reach along the Fountain Creek corridor. Creating both 1D and 2D hydraulic models for the project reach, evaluated alternatives and quantified the hydraulic benefits of each approach. Helped direct design decisions based upon this detailed stream analysis, in addition to aiding the project team in the permitting process.

Watershed and Stormwater Planning

Proactive Planning for Post-Fire Hazards in Pitkin County, Colorado. Coordinated with Pitkin County to understand their needs and concerns regarding debris flow risks throughout the county. Reviewed hydrologic modeling and methodology for the development of potential, future post-fire watershed conditions. Used debris flow rates to inform a 2D hydraulic model to assess the approximate extents of a debris flow event for select watersheds.

East Vail Stormwater Master Plan. Finalized detailed hydrologic and hydraulic analyses for the assessment of stormwater infrastructure throughout East Vail. Snowmelt hydrology and the latest NOAA Atlas 14 precipitation depths and distributions are being used for runoff calculations. This effort includes an analysis of the capacity of over one hundred culverts and roadway crossings, and nearly 28 miles of streams and open channel drainageways. A prioritized list of stormwater improvement projects was developed from the identified deficiencies in the Town's existing stormwater infrastructure, including opportunities to improve stormwater quality throughout the community.

California Post-wildfire Hydrology and Debris Flow Analyses. Studied the post-wildfire risks associated with the Thomas and Woolsey Wildfires in Santa Barbara, Ventura, and Los Angeles Counties, California. Analyzed post-fire debris flows through two-dimensional hydraulic modeling and utilizing GIS mapping to compare the heightened risk to that of pre-burn conditions. Complimentary to the risk assessment, potential mitigation measures to minimize debris flow risk to downstream communities were identified.

Floyd Hill Stormwater Drainage Evaluation, Clear Creek County. Currently identifying deficiencies and developing potential improvement alternatives to address drainage issues throughout the Floyd Hill community. In addition to the evaluation of the existing drainage infrastructure, an assessment of potential erosion and stormwater quality concerns will be completed along with the development of solutions to address the known drainage or flooding problems. The costs and benefits of potential alternative solutions will be evaluated to develop an actionable plan to address identified deficiencies.

Chaparral Mudflow Analysis. Developed a watershed model to estimate potential clearwater, mud, and debris flow rates under current and potential future post-fire watershed conditions. Evaluated potential flow paths across alluvial fan to inform the development and design of a lot near Aspen, Colorado.

Silverthorne Stormwater Master Plan. Completed detailed hydrologic and hydraulic evaluations of the Town's stormwater infrastructure to identify deficiencies and potential strategies and solutions to address deficiencies. Evaluation of potential improvements included the quantification of benefits and estimates of the costs associated with high priority improvements. Work also included updating the Town's stormwater manual and design guidelines.

Regional Stream Stewardship and Recovery Handbook (Previous Firm). Performed engineering for handbook to provide critical stewardship information to landowners living on streamside properties. The handbook provides a toolbox of techniques a homeowner can use to be a good river steward, along with circumstances that require outside help. The handbook was sponsored by the Lefthand Watershed Oversight Group, the Big Thompson Watershed Coalition, The Little Thompson Watershed Restoration Coalition and the St. Vrain Creek Coalition. Worked with team members and clients to design restoration projects using empirical and physically based engineering principles while complying with local guidelines and criteria.

Cottonwood Creek Drainage Basin Planning (Previous Firm). Analyzed the Cottonwood Creek watershed as a component of the Drainage Basin Planning Study. Utilized a complex hydrologic model to assess current and future watershed conditions and understand the effects of development and stormwater improvements throughout the watershed. Evaluated a number of improvement scenarios to quantify their function and benefit to the greater watershed.

Monument Creek Watershed Restoration Master Plan (Previous Firm). As a component of the Monument Creek Watershed Restoration Master Plan, completed extensive analyses of 237 square miles of watershed hydrology. Hydraulic modeling was completed for a 100-mile reach. The Restoration Master Plan provided a framework from which local jurisdictions are able to identify and execute cost-effective projects that promote a resilient watershed. Contributed to the planning process, identifying over 250 potential projects and ranking each to compose a prioritized list of actionable projects within the Monument Creek watershed. The planning process integrated technical and socio-economic evaluations as well as stakeholder and community input to provide a holistic restoration plan complete with general stewardship recommendations, cost estimates, conceptual design information, and plan mapbooks that illustrate project locations and extents as well as updated floodplain extents throughout the watershed, reflecting the post-fire condition.

OTHER EXPERIENCE

Water Resources Engineer, Matrix Design Group. Responsibilities included hydrologic and hydraulic modeling, stream restoration, natural channel design, and flood recovery.

Drake Ludwig, P.E.

PROFESSIONAL AFFILIATIONS

Northwest Regional Representative for the Colorado Association of Stormwater and Floodplain Managers

\\WWE-SERVER1\Resources\Resources\Proposals, Contracts & Marketing\Proposal Resources\Resumes\Glenwood\Ludwig.doc