



Wright Water Engineers, Inc.

WAYNE F. LORENZ, P.E.
VICE PRESIDENT OF PUBLIC WORKS ENGINEERING

CURRENT

Project Manager and Chief Engineer on water and wastewater treatment, water quality, potable water distribution systems, watershed evaluations and management, reclamation and reuse, pollutant control and design and planning of treatment controls for water resources projects. Experience includes obtaining state and local approval of projects and costs/funding consulting. Over 49 years of professional engineering experience.

EDUCATION

M.S., Civil and Environmental Engineering, 1981
University of Colorado

B.S., Civil and Environmental Engineering, 1974
University of Colorado

REGISTRATION

Professional Engineer—Colorado #16188, California #C47553, Hawaii #16432, Iowa #24080, Montana #30525, Louisiana #0045820, Nebraska #E-15243, Nevada #020351, New Mexico #25371, Tennessee #123220, Texas #119116, West Virginia #21693, Wyoming #13465

REPRESENTATIVE PROJECTS

Industrial/Hazardous Wastes

Pretreatment Regulations Boeing Company, Seattle, Washington. Performed process analysis of mechanical and passive treatment approaches for Boeing to determine the feasibility of meeting strict numeric effluent limits for stormwater discharges from Boeing's airport facilities.

Nabisco Foods Wastewater Treatment Facility, Oxnard, California. Performed process evaluation and design of a treatment facility for a food-processing center in Oxnard, California. Processes included coarse and fine screening, sedimentation and pH control.

Evaluated Treatment For Reducing Sodium Sulfate and Selenium at Tulare Lake Drainage District, Central Valley, California. Investigated a chilling process to precipitate sodium sulfate and reduce selenium concentrations. Evaluated an electro dialysis process to produce useful products from a highly concentrated brine.

Mt. Emmons Mine, Crested Butte, Colorado. Performed audit of existing wastewater and stormwater treatment facilities of an inactive metals mine near Crested Butte, CO. Provided recommendations for a maintenance and upgrade of treatment systems to comply with existing requirements and performed financial analysis to determine costs to maintain, upgrade and operate the facilities. Prepared a rate study to recommend an appropriate mill levy that could be assessed on a new proposed special district that was being considered to finance the costs if the district acquired the facilities from the mine owner.

Performed On-Site Pilot Testing of Advanced Oxidation Processes for Treating a Hazardous Waste Landfill Leachate at Casmalia, California. Ozone, hydrogen peroxide and ultraviolet light were investigated in addition to granular activated carbon. The pilot testing included removal of iron and manganese prior to advanced oxidation. A preliminary design was performed using the results of the pilot testing. This information was submitted as a section of the Part B Permit Application for the landfill.

Assessed In-Plant Water Quality and Wastewater Pretreatment Requirements for a Food Processing Facility Located in Oxnard, California. A hydraulic assessment was performed that resulted in design and construction of wastewater pretreatment facilities. Included coordination of pretreatment limits with the City.

Landfill Evaluation for Town of Crested Butte. Performed review of landfill assessment of extent and groundwater impacts for potential development.

Developed Local Limits for the City of Westminster, Colorado. Prepared technically based local industrial discharge limits for the City of Westminster industrial pretreatment program. The program included assessment of discharge of process water to the city system from two significant industrial users contributing organic loading to the system.

Developed the Industrial Pretreatment Program for the ACWWA. The industrial pretreatment program addressed water quality limits and operations for the 1.4-MGD Lone Tree Creek wastewater treatment facility.

Cactus, Texas Beef Processing. Assessed wetland treatment processes for removal of BOD and nitrogen from beef processing plant effluent. The wastewater was ultimately intended for agricultural irrigation. Several processes were evaluated, including playas, typical emergent wetlands, seasonally flooded marshes and permanently flooded marshes.

ConAgra Wastewater Treatment Plant Design, Garden City, Kansas. Performed detailed engineering review of the design of a 2-MGD treatment plant to serve a slaughterhouse for meatpacking waste. Processes included pumping, sequencing batch reactors, clarifiers, chemical feed facilities and ultraviolet disinfection.

Industrial Water Treatment Study. Performed a study to improve the efficiency and cost effectiveness of 0.1-MGD surface water treatment facility for the Climax Molybdenum Company. The study addressed the operations of raw water sources to minimize the turbidity of the treatment plant inflows, chemical feed systems and filter backwash improvements.

Wastewater Systems Master Planning and Design

Wastewater Treatment Plant Expansion, Forest Lakes Metro District, Bayfield, Colorado. Project Manager for the design of all facets of the 0.18 million gallon per day (MGD) lagoon wastewater treatment plant to include an anoxic basin (with a liner cover to keep wastewater temperatures from being too low for denitrification), new aerobic lagoon cells, a return solids system, raw wastewater pump station, and treatment system on the fast track.

Wastewater Treatment Plant Evaluation, City of Evans, Colorado. Analyses of planning and design of a 2.88 MGD treatment facility for organics and nutrients removal. Evaluation included population forecasts and organic loading. The treatment plant used a Johannesburg Process for nutrient removal and the performance of this process was assessed.

New Wastewater Treatment Facilities, Meridian Metro District, Colorado. Facilities design, services during construction and preparation of an operations and maintenance manual for a **1.5 MGD** lagoon wastewater treatment facility; design and preparation of an operations and maintenance manual for a 8,000-gpm water pumping station; planning and design of a computerized data acquisition system and data communication system to serve water and wastewater facilities. Treated effluent is recycled by irrigation of an on-site golf course.

Cascade Village Wastewater Treatment Lagoons, Durango, Colorado. Performed evaluation of an existing aerated lagoon treatment system rated at 0.12 MGD. Conceptual design included a suspended air diffuser system to address ammonia and inorganic nitrogen limits and to replace aging equipment.

The Salvation Army High Peak Camp, Larimer County, Colorado. Prepared design for a new treatment plant at The Salvation Army's High Peaks Camp. Obtained Preliminary Effluent Limits (PELs) from Colorado Department of Public Health and Environment (CDPHE). A membrane bioreactor system (MBR) was considered in the assessment phase of the Project; however, a sequencing batch reactor (SBR) was slightly lower in capital costs and the operations staff preferred an SBR. An exfiltration bed was designed to dispose of the treated effluent.

Wastewater Treatment Plant Modifications Design, East River Regional Sanitation District, Colorado. Evaluated the capacity of an existing lagoon system and recommended modifications for the WWTF in this service area located near Crested Butte. Project Manager for the design and construction for a completely new lagoon aeration system, new headworks mechanical screening, and new inflow measurement for the 0.18 MGD facility.

Basalt Sanitation District Wastewater Treatment Plant Design, Colorado. Planning and design of a treatment plant expansion for a flow of 0.8 MGD. Facilities included a new pretreatment building, nitrification/denitrification activated sludge, clarifier and disinfection. A site application engineering report was prepared.

Wastewater Treatment Plant, Adams County, Colorado. Project Manager for the planning and design of 20,000 gallon per day (GPD) membrane bioreactor plant and exfiltration bed for a development in Adams County.

Lift Station and Force Main Evaluation, Sterling Ranch, Colorado. Study of air release valves and hydrogen sulfide concentrations pertaining to a 900 gallon per minute lift station and a 4 mile long force main. Provided reports and recommendations for repair, maintenance, and odor suppression for the lift station and force main system.

Wastewater Treatment Facility Evaluation, Town of Mancos, Colorado. Evaluation of a 0.2 MGD Multi-stage Activated Biological Process (MSABP) to identify design and/or construction issues for meeting discharge permit limits. Treatment processes included a lift station, rotating drum fine screens, grit removal, fabric filters, and ultraviolet disinfection.

Wastewater Treatment Process Evaluation, City of Ouray, Colorado. Assessment of a 0.47 MGD wastewater treatment facilities plan that included forecasts of population and organic/nutrient loadings. A detailed treatment evaluation of the moving bed biofilm reactor (MBBR) was performed.

Wastewater Treatment Plant Capacity Evaluation, Town of Lyons, Colorado. Project Manager for evaluating the flow and organic loading capacities of a 0.4 MGD sequencing batch reactor (SBR) wastewater treatment plant. Evaluation of headworks screening, grit removal, SBRs, aeration system, and ultraviolet light disinfection. Dewatering of solids by a centrifuge was also investigated.

Wastewater Treatment Plant Assessment for Reuse, City of Broomfield, Colorado. Project Manager for the City of Broomfield wastewater reuse plan that included an assessment of the integrated fixed-film activated sludge (IFAS) treatment process and reliability of the process to produce water for the purposes of the dual pipe water reuse system for the City.

Granby Sanitation District Wastewater Treatment Plant Planning, Colorado. An alternative analysis and evaluation of a 1.5 MGD wastewater treatment facility expansion was conducted for Granby Sanitation District. Processes considered in detail included: rotating biological contactors, anoxic/aerobic activated sludge, expansion of the nitrification facilities, ozone disinfection and chlorination/dechlorination. Pilot testing was performed to evaluate ozone disinfection facilities and methods to increase efficiency. Preliminary design of expansion included site application, anoxic/aerobic activated sludge treatment, centrifuges for solids handling, membrane filtration and UV treatment.

Wastewater Treatment Plant Upgrade Design, City of Banning, California. Design of upgrades to a fixed film trickling filter wastewater treatment process for BOD removal. Included drawings and specification for bid to a general contractor.

Goose Bay Marina Concession Area Modernization, Canyon Ferry Lake, Montana. Project manager for the planning/design of wastewater collection and wastewater treatment systems. Performed a non-degradation analysis for disposal of treated wastewater and potential impacts to the groundwater supply (as required by the Montana DEQ).

Anaerobic Digestion and Pathogenic Indicator Evaluation, Oahu, Hawaii. Performed an analysis of the pathogenic indicators *Enterococci* and *Clostridium Perfringens* through the sludge treatment process at four wastewater treatment facilities on the island of Oahu. The concentrations of these indicator organisms were investigated in biosolids and screenings at the treatment plants.

Wastewater Treatment Evaluation of a 10-Million-Gallon-Per-Day (MGD) Facility for the City of Oceanside, California. Processes included an equalization basin, primary clarifiers, activated sludge, secondary clarifiers, chlorination and land application.

Evaluation of Phosphorus and Ammonia Control at a 0.32-MGD Wastewater Treatment Facility, Perry Park, Colorado. Advanced treatment techniques investigated were alum precipitation and filtration, rapid infiltration basins and slow-rate land application. Costs were presented to meet 0.2-mg/L total phosphorus and 1.0-mg/L total ammonia/nitrogen limitations in the effluent.s

Wastewater System Master Plan Destination Resort Mazatlan, Mexico. Planning of sewage collection, lift station, treatment and reclamation of effluent to serve a beach destination resort. Treatment included alternatives for membrane bioreactor processes and solids handling.

Various Membrane Bioreactor (MBR) Wastewater Treatment Plants, Colorado & Wyoming. Consultant and expert testimony level of research of design and operating aspects of four MBR plants in Colorado (Arapahoe County Water & Wastewater Authority, Aspen Park Metro District, Conifer Metro District and Royal Gorge Visitor Center) and one MBR plant in Wyoming (Jackson Hole Airport).

Onsite Wastewater Treatment Systems Regulations, Pitkin County, Colorado. Prepared an update of onsite wastewater system (OWS) regulations for the County. Included assessment of design criteria for absorption fields and advanced wastewater treatment units. Work performed under review by a technical advisory committee.

Wetland Treatment Process, Coors Brewing and Golden, Colorado. Planning and design of a wetland treatment process for treated wastewater effluent from the City of Golden. The goal of the treatment was to reduce organic and nutrient concentrations. This was a supplemental environmental project under state regulations.

ACWWA Wastewater Utility Master Plan (WUMP). Developed the ACWWA wastewater utility master plan (WUMP). The wastewater collection system consisted of four lift stations, one pretreatment facility (for the County jail) and piping up to 36-inches in diameter. The wastewater treatment process planning included innovative techniques for phosphorus and nitrogen removal.

Lift Station for the Standley Lake Park, Westminster, Colorado. Design of a lift station and force main to serve the boat ramp and park on the north side of Standley Lake. Included Site Application submittal and coordination of approval.

Small Systems Design and Permitting. Project manager for planning, design and permitting of treatment systems serving camps and ski areas including Geneva Glen Camp, Camp Alexander (Boy Scouts), Rocky Mountain Shambhala Center, Taos School, United Parcel Services facilities, Ski Sunlight and others.

Biosolids Disposal Site Design, Steamboat Water, Colorado. Prepared a design for lowering water table at a biosolids application site near Steamboat Springs. A discharge permit amendment application was submitted to the Colorado Department of Public Health and Environment (CDPHE).

Villages at Castle Rock Metropolitan District, Colorado. Performed preliminary design for a wastewater pumping station. The design included three 1,000-gallons-per-minute (gpm) centrifugal pumps with a wet well and dry well pumping structure. An emergency power generator and enclosure were included in the design.

Pilot Study for the ACWWA. Investigation of phosphorus removal in sequencing batch reactor (SBR) and rapid infiltration basin processes.

Planning of Wastewater Treatment and Effluent Disposal Facilities for the Mitchell Creek Wastewater Treatment Facility, Colorado. A phosphorus allocation plan in the Cherry Creek Basin required innovative planning for wastewater treatment at the Mitchell Creek Wastewater Facility. A phased plan was proposed for the project to initially treat wastewater using a sequencing batch reactor and land application of effluent. Phase 2 involved converting the treatment facility to a pump station to pump raw wastewater out of the Cherry Creek Basin for treatment and disposal.

Design of a Sewer Line Relocation, Berkeley Metropolitan District, Colorado. Construction in an old sanitary landfill required special pipe bedding conditions and considerations for methane gas migration.

Purgatory Ski Area Wastewater Treatment Plant Expansion Planning, Colorado. The project also included design of modifications to the wastewater treatment lagoon system serving the Purgatory Ski Area.

Evaluation of Phosphorus and Ammonia Control. Advanced treatment techniques were investigated for phosphorus and ammonia control for the Perry Park District. Costs were presented to meet 0.2 mg/L total phosphorus and 1.0 mg/L total ammonia-nitrogen limitations in the effluent.

Planning and Design of Wastewater Collection System. Design of a 0.4-MGD wastewater treatment facility and a water treatment, storage and distribution system for Country Club Park, Fort Morgan, Colorado.

Wastewater Reuse Plan for City of Phoenix, Arizona. Advanced treatment was investigated to meet more stringent water quality limits for direct discharge. An aquifer storage/recharge and recovery plan was developed as a more economical solution.

Various Sewer Pipeline Projects. Design of sewer pipeline projects for Basalt Sanitation District, Perry Park Water and Sanitation District, ACWWA, City of Westminster and other agencies.

Water Systems Master Planning and Design

Santa Fe, New Mexico Water Treatment System. Provided detailed evaluation and expert reports on the design and operations of a raw water delivery and treatment system for a 15 million gallon per day (MGD) facility. The water system diverts water from the Rio Grande River and pumps that water to a major municipal water treatment plant. Work included review of diversion planning and design, the hydraulics within the raw water system, and the geomorphology of the Rio Grande. Services included preliminary design of facilities to address sediment removal; pumping; ozone/biological activated carbon and membrane treatment processes.

Forest Lakes Metropolitan District, Colorado. Project manager of a new surface water treatment system serving a development in Monument, Colorado. Design included a raw water screen and pumping station, a 1 MGD treatment plant to meet surface water treatment regulations, and backwash waste disposal considerations.

Town of Larkspur Water System, Colorado. Project manager for the design of a water treatment plant to remove radium, iron, and manganese, a 451,000 gallon steel water storage tank, and distribution piping. Assisted in obtaining revolving fund and USDA funding.

Water Treatment Plant and Storage Tank Plan Design, Palisade, Colorado. Project manager for master planning and final design of a 2 MGD membrane treatment plant and a 2.5 million gallon cast-in-place concrete storage tank. Performed construction administration. Participated in public hearings to inform customers and determine policy preferences for either obtaining water service from a neighboring provider or rebuilding Town system. Performed cost and funding planning and obtained low interest loans for the project.

Shenandoah, Iowa Water Treatment Plant. Performed assessment of treatment processes and concrete integrity on a new 2.4 MGD water treatment plant designed for softening and iron removal.

Brushy Creek Regional Utility Authority Water Treatment Plant, Cedar Park, Texas. Performed evaluation of treatment processes and concrete integrity of water containing structures for a 20 MGD surface water treatment plant. The raw water supply was from a reservoir.

Bell Mountain Ranch Metropolitan District, Colorado. Performed an engineering evaluation and preliminary design of modifications of a 0.4 MGD water treatment plant designed to remove radium, iron, and manganese. The radium removal required special considerations for the disposal of filter backwash wastes.

Goose Bay Marina Concession Area Modernization, Canyon Ferry Lake, Montana. Project manager for the planning/design of water distribution and water treatment systems including a new well, buried storage tank, booster pump station and disinfection. Performed water distribution system modeling. Performed services during construction for the project.

Charleston, West Virginia Water System. Evaluated the water storage tanks, pipeline distribution systems, and a 50 MGD surface water treatment facility. The evaluation included lime softening solids contact reactors and the addition of powdered activated carbon (PAC).

Reclamation/Reuse

Nonpotable System Master Plan, City and County of Broomfield, Colorado. Performed treatment and distribution studies for expansion of a large nonpotable water system. Both raw water and tertiary treated wastewater were used in this system. A computer hydraulic distribution system analysis was performed.

Regulation 84 Reuse Master Planning for Arapahoe County, Colorado. Project manager for planning of wastewater reclamation for the Arapahoe Water and Wastewater Authority (ACWWA) to meet the Colorado Regulation 84. A reclamation site application report was prepared. Rules and regulations were provided that address cross connection control.

ACWWA Nonpotable Water System Plan. The nonpotable water system was developed as a cost effective way for ACWWA to use alluvial water and treated wastewater effluent to conserve the nontributary supply (currently saving approximately 2,000 acre-feet per year). In addition, expensive potable water treatment capacity is not required for the water used for irrigation.

Denver Water Reclamation Project Reclamation Planning. Technical Project manager for the Denver Reclamation Project for supplying reclaimed water to DIA and industries.

Planning and Design of Reclamation in Castle Rock. The Mitchell Creek Wastewater Treatment Facility was designed to treat wastewater using a sequencing batch reactor and land application of effluent.

Meridian Office Park Reclamation. Site application and NPDES permit application, facilities design, services during construction and preparation of an operations and maintenance manual for a 1.5-MGD wastewater treatment facility. Treated effluent is recycled by irrigation of an on-site golf course.

Wastewater Reuse Plan for the City of Phoenix, Arizona. Advanced treatment was investigated to meet more stringent water quality limits for direct discharge. An aquifer storage/recharge and recovery plan was developed as a more economical solution.

Water Reuse Master Plan for the City of Aurora, Colorado. Development of design and management criteria for lakes to be used as storage reservoirs. This project was unique in that beneficial uses (other than storage) were assessed with different levels of wastewater treatment. Stormwater and raw water sources were also included in the evaluation.

Study of Assessment of Human Health Effects. Performed research regarding water supplies contaminated with wastewater effluent for the City of Westminster, Colorado.

Treatment of Groundwater. Evaluation of treatment alternatives for organics removal from a groundwater drinking water supply, South Adams County Water and Sanitation District in Colorado.

Potable Water Reuse Evaluation. Pilot plant design, testing and evaluation of ozone and biological-activated carbon as a process proposed in the Potable Water Reuse Demonstration Plant for Denver Water, Colorado. Participated in operation of a pilot treatment train that included lime softening, dual media filtration, ion exchange, ozonation and carbon filtration.

Groundwater Dewatering

Hilton Garden Inn, Boulder, Colorado. Project manager for abandoning a plan for a complex water treatment plant (ceramic membranes) and going to reinjection wells. A design was prepared for a pumping system and injection wells into the gravel subgrade on the other side of secant walls that were constructed around the perimeter of the building. Included the system approval under the EPA Class V underground injection control program.

Country Club Towers, Denver, Colorado. Project manager for the planning and design of a groundwater pumping system to include an exfiltration bed for reintroduction of the water to the groundwater table. Included the system approval under the EPA Class V underground injection control program.

Snowmass Ski Area – Building 12, Snowmass, Colorado. Investigated the separation of foundation wall perimeter drain flows from building slab underdrain flows. Prepared an engineering report to be submitted to the Colorado Department of Public Health and Environment (CDPHE) to demonstrate this was stormwater and not groundwater

University of Colorado Music Building Addition, Boulder Campus, Colorado. Project manager for the design of treatment processes for dissolved copper and PFAS reduction. This treatment system was not constructed since studies were performed by WWE to show that the foundation discharges were associated with rain events (therefore stormwater) which resulted in termination of the groundwater discharge permit.

5075 Leetsdale, Denver, Colorado. Project manager for design of a groundwater system to include a cartridge filter, storage, and pumping from a foundation of a strip mall. Included discharge permit negotiations with the CDPHE.

5050 S. Syracuse, Greenwood Village, Colorado. Project manager for investigating alternatives for selenium removal from a groundwater discharge for a new office building. Small drinking water flows were used to dilute the groundwater flows to meet the selenium limit. This approach was approved by the CDPHE.

Copper Springs Lodge Condominium Association, Inc. v. Copper Mountain, Inc. 2011. Evaluation of a building dewatering system for a condominium located in Copper Mountain. The system included a large underdrain, vault, pump station and piping. Provided deposition.

Water Quality Studies and Watershed Management

Chambers Reservoir. Project manager for monthly groundwater sampling and analysis of groundwater wells surrounding a 1,400 acre-foot-capacity reservoir in southeast Metro Denver.

Best Management Practices for Golf Courses. Project manager for the development of a manual for the golf course industry to address stormwater runoff and quality. This project was funded by the Colorado Nonpoint Source Task Force under the 319 Grant process.

Water Quality Assessment of the Big Thompson River for the City of Loveland, Colorado. Two major fish kills occurred in the transitional zone (mountain to plains stream). The assessment was performed to identify causes; a public hearing was also conducted.

Planning and Design of Urban Lakes Water Quality Improvement Projects for the City of Denver. Studies on eight lakes were performed to determine the status of water quality and impacts to the intended uses. Water quality goals were established and design of mitigation measures was performed. Guidance manuals for lake management were provided.

Dillon Reservoir Water Quality Assessment. Included evaluation of eleven years of data to establish the trends that have occurred in the reservoir as growth and development increased in Summit County. Recommended refinements to the reservoir sampling and monitoring program.

Colorado Water Quality Control Commission Hearings. Prepared and presented an annual report on the status of point and nonpoint controls within the Cherry Creek Basin for 1986. This report was prepared for the Cherry Creek Basin Authority.

Bear Creek Reservoir In-Lake Treatment Plan and Conceptual Design. Hypolimnetic aeration and destratification were assessed to improve the water quality and beneficial uses of the reservoir. A conceptual design of the required equipment was performed.

Participated as a Technical Consultant for Water Quality Monitoring and Evaluation for Bear Creek Reservoir. A USEPA Clean Lakes Study grant was obtained for the project in 1988.

Participated as a Technical Advisor During USEPA Clean Lakes Studies of Cherry Creek and Chatfield Reservoirs, Colorado. Included data analysis, modeling assessment to determine the future trophic status of the reservoirs, and basin management of point and nonpoint discharges. The results of these studies established total phosphorus water quality standards in the reservoirs and determined waste load allocations for upstream point dischargers.

Cherry Creek Basin Master Plan. This work included planning for point and nonpoint sources control of pollutants to Cherry Creek Reservoir.

Standley Lake Water Quality Evaluation. Included evaluation of water quality analyses, establishing trends in reservoir quality, developing approaches for managing and mitigating the potential water quality impacts from stormwater, investigating the impacts of increased recreation on water quality monitoring, and management of the Standley Lake watershed. The results of this study established total phosphorus limits in the lake, defined criteria for water treatment plant operations, and were instrumental as a basis for requiring diversion of wastewater from this drinking water supply. Testified before the Colorado Water Quality Control Commission to establish phosphorus standards in the reservoir.

Evaluated Water Quality and Trophic Status of Arvada Reservoir, City of Arvada, Colorado. The impacts of tributary water quality and volume on drinking water produced from the reservoir were investigated. Included data analysis and modeling assessment.

Conducted Fieldwork and Analyses of Water Quality and Lake Conditions of Twin Lakes, Colorado. Included sampling and analysis of benthic organisms, water column sampling, evaluation of oxidation-reduction potential within the lakes' hypolimnion, and determination of the physical characteristics of the lakes. The work performed established baseline water quality data prior to construction of a pumped-storage power plant on the shores of the lower lake.

Developing Methods for Assessing Nonpoint Sources of Pollution on U.S. Army Installations, Performed for the U.S. Army CERL. Included literature and research data review applicable to the U.S. Army needs. A summary of state nonpoint source pollution management plans was also presented.

Mitigation Plan for Restoring Water Quality in Denver Parks Lakes. This project was performed for the Denver Water Department and focused on lakes in Washington and City Park that have inflows from City Ditch, a ditch system owned by the Denver Water Department. The recommendations focused on improving water clarity, odors, fishing and other recreation uses. A unique aspect of this project was that one of the lakes in City Park appeared to be the source of an area-wide outbreak of a bird disease: avian botulism. The lake was drained and dredged, and improvements were made to the inlet and outlet works.

Denver Water Department, Colorado. Potable Water Reuse Demonstration Plant. Pilot plant design, testing and evaluation of ozone and biological activated carbon as a proposed process.

City of Fort Morgan, Colorado. Evaluation and comparison of ozone and chlorination/ dechlorination for use as treated wastewater disinfectants.

South Adams County Water and Sanitation District, Colorado. Evaluation of treatment alternatives for organics removal from a groundwater drinking water supply.

Lake Engineering

Double L Ranch, Durango, Colorado. Design for an aesthetic and irrigation lake at a private ranch and tree farm. The project included two ditch intakes, sedimentation pond, two pump stations, a meandering channel, geomembrane lining of two ponds and the channel and two water return structures. The project included construction-phase services.

Lake Restoration Design, Little Lake Lodge (Pine Lake), Aspen, Colorado. Design of a major sediment removal project to increase depth of a lake for trout habitat and recreation uses. Work included wetland benches and hydraulic control of water sources.

Barnum Park Lake, City of Denver Park System. Design of lake-edge treatment and water quality features to enhance lake aesthetics and stormwater detention. This project, which was a design of restoration for the lake, included three methods of lake-edge treatment: wetland shelf, biotechnical erosion control and rock wall. Sediment removal was a key component.

Gateway Park, Vicinity of Denver International Airport. Design of a lake that is a keystone to the image of the Gateway Park development located near Interstate 70 and Peña Boulevard. A large fountain/pump station was the key water feature of this lake. The pump station served a dual purpose for irrigation of the landscaped areas.

Restoration of Water Quality in Denver Parks Lakes. This project was performed for the Denver Water Department and focused on lakes in Washington and City Parks that have inflows from City Ditch. The recommendations focused on improving water clarity, odors, fishing and other recreation uses. Improvements were designed; the lake was drained and dredged, and improvements were made to the inlet and outlet works.

Analyses of Water Quality and Lake Conditions of Twin Lakes. Included sampling and analysis of benthic organisms, water column sampling, evaluation of oxidation-reduction potential within the lakes' hypolimnion, and determination of the physical characteristics of the lakes.

Design and Construction Observations for Garland Park Lake. Sediment removal was performed by draining and excavation. Dewatering was a key aspect to the project. A wetland was designed for stormwater quality control. Coordinated 404 permit for the project.

Design of a Forebay and Wetland Area for Grasmere Lake. Design for the City of Denver. The project included sediment removal and a new outlet works for the lake. Pre- and post-project water quality analysis showed substantial improvement in the water quality of the lake.

Water Quality Improvement of a Lake. Study conducted for a lake in Lakewood, Colorado that had received substantial sediment loading over a period of ten years. Coordination and meetings with the local homeowners association was one of the project tasks.

Monitoring Program and Data Evaluation for Upper Justin Reservoir in Arapahoe County, Colorado. Recommendations included a forebay at the inlet of the lake to remove sediment prior to entering the main body. Dragline excavation was used to create the forebay.

Design of Improvements to Harvey Park Lake. Study and design of improvements to Harvey Lake in Denver. A unique sediment dewatering system was proposed for slurry from the hydraulic dredging of the lake bottom. This system used far less space and was environmentally acceptable to the homeowners when compared to dewatering ponds.

Design for Forebay and Wetland Areas. Work was conducted for the City of Denver including design of lake sediment removal techniques.

Expert Testimony

Evaluation of four ongoing, confidential claims.

Richard Jeffries vs. West Virginia American Water Company, Inc. 2020 - 2024. Investigated the technical aspects of a concrete cylinder pipeline break in the water distribution system for the City of Charleston, West Virginia. Provided deposition. Case is in progress.

Buckman Direct Diversion Board, New Mexico vs. CDM Smith, Inc. 2019 – 2022. Provided engineering evaluation and detailed reports regarding the raw water system and water treatment processes owned by the Buckman Direct Diversion Board, Santa Fe, New Mexico. Case was settled for \$71 million.

Town of Lyons, Colorado vs. Honeywell International, Inc. and others. 2021. Performed engineering evaluation of the design and construction of a domestic wastewater treatment plant serving the Town of Lyons. Case was settled.

Town of Mancos, Colorado vs. Souder, Miller & Associates. 2020 – 2021. Assessed the treatment plant processes at the wastewater treatment plant for the Town of Mancos. Provided deposition and testimony at arbitration hearing.

Walters vs. MD Nursery & Landscaping et al. 2016-2017. Performed engineering evaluation of a membrane bioreactor wastewater treatment facility serving the Jackson Hole, Wyoming airport regarding a safety related claim. Case was settled prior to trial.

Crystal Good et al vs. American Water Works Company, Inc. 2016. Engineering expert for the plaintiff regarding a chemical spill in the Elk River upstream of a water treatment plant intake serving the City of Charleston, West Virginia. Evaluated the water storage tanks, pipeline distribution systems, and a 50 MGD surface water treatment facility. Provided deposition. Case was settled for \$151 million prior to trial.

USA vs. Waste Management of Hawaii et al., Oahu. 2014-2015. Provided engineering support and analysis in the defense of two landfill operators and their parent company who had allegedly conspired to defraud the Department of Health and conspired to discharge pollutants in violation of the Clean Water Act. Case was settled.

Taisei Corporation v. Inland Empire Utilities Agency and Nikkiso Pumps. 2012. Analysis of the design of a chemical metering system at a 14 MGD wastewater treatment and reclamation plant. The technical data and performance of the feed pumps were evaluated with respect to the equipment specifications. Case was settled prior to deposition.

City of Manitou Springs, Colorado. 2011 – 2012. Performed engineering evaluations and prepared preliminary report to address the engineering services provided to the City of Manitou Springs. WWE specifically investigated service line connections, pressure relief valves, 60 percent/100 percent design completion plans and flowfill requirements that are major engineering service issues. These issues were investigated with respect to the planning, design and related construction administration. Participated in mediation. Case was settled as a result of mediation.

Arapahoe County Water and Wastewater Public Improvement District and Arapahoe County Water and Wastewater Authority v. HDR Engineering, Inc. 2008 – 2011. Prepared Expert Report to address the design/construction of the existing Chapparral Pump Station, City of Centennial, Colorado. Performed review of available information, including design and construction documents, record drawings, reports and correspondence, operations records, testing results, depositions and photographs. Provided deposition and expert witness in Federal Court.

Water Technology Solutions, LLC v. Conifer Metropolitan District, Jefferson County, Colorado. Jefferson County District Court Case No. 09CV3659, Division: 5. 2010. Performed engineering evaluations and prepared an Expert Report to address the claims and counterclaims regarding design and operation and maintenance (O&M) on the potable water and wastewater systems serving the Conifer Metropolitan District (Conifer) in Jefferson County, Colorado. In particular, wastewater treatment plant operations and performance, O&M Manual, raw wastewater screening, membrane treatment tanks, ozone unit and drain sump pumps were investigated.

Lakehurst Water and Sanitation District v. Willowbrook Water and Sanitation District. 2010. Performed evaluation and prepared an Expert Report regarding the complaint of Lakehurst Water and Sanitation District (Lakehurst) against the Willowbrook Water and Sanitation District (Willowbrook). Reviewed the available information regarding the raw wastewater flows, pollutant loadings, charges for wastewater service and allocation of costs for an outfall replacement and expansion. Participated in successful mediation.

Mountain View Recreation, Inc. v. Utilities, Inc. of Central Nevada, et al. – Expert Report, Fifth Judicial District Court Case No.: CV 22655. 2009. Performed engineering evaluations and prepared two Expert Reports addressing the potable water availability for fire protection at the Mountain View Casino site in Pahrump, Nevada. In particular, the water system infrastructure and operational conditions prior to the April 29, 2003, casino fire were investigated. Provided deposition.

Colorado Renaissance Festival Inc. v. the Town of Larkspur. District Court, Douglas County, Colorado. Case No. 03 CV 393. 2005. Performed engineering evaluations and provided testimony regarding wastewater flow and organic loading impacts from the Colorado Renaissance Festival to the Town of Larkspur wastewater treatment plant processes. The evaluation included calculation of the number of taps based on the impact to the treatment plant. Provided deposition and expert testimony at trial in Douglas County court.

Maria Figlus v. The Consolidated Mutual Water Company. Jefferson County District Court. Case No. 2004 CV 3483. 2004. Performed evaluation and provided an expert report regarding water pipeline design/construction; leak detection and condition of pipelines; estimating volume of water lost during leaking conditions; and pipeline replacement programs. Provided deposition.

City of Idaho Springs v. Harrison Western Construction. Clear Creek County District Court. Case No. 03 CV 69. 2004. Performed evaluation and provided testimony regarding the impact of upstream construction activities to a water treatment plant serving the City of Idaho Springs. Provided deposition.

City of Pottsboro, Texas v. Joe McElreath Company, Inc. Grayson County, Texas. Case No. 03-1115. 2005. The City claimed damages related to a City-owned wastewater treatment plant as a result of a contractor breaking a City sewer pipe. Performed an evaluation that showed that the problems at the wastewater treatment plant were due to management and operations. A technical report was prepared.

Santa Fe Trail Ranch et al. v. XL Specialty et al. Las Animas County District Court. Case No. 02CV135. 2004 – 2005. Performed engineering evaluation of a large water supply and distribution system located in southern Colorado. Provided consultation for settlement purposes.

Bradbury Stamm Construction, Inc. v. The City of Trinidad and the City of Trinidad v. RG Consulting Engineers, Inc. U.S. District Court, for the District of Colorado. Case No. 02-W-0059. 2003. Performed review of design and construction management approach for a wastewater treatment plant expansion project. A claim was made by the contractor against the City and the City, in turn, made a claim against the design engineer. Expert testimony was provided on approach, responsibilities and amount of claim.

U.S. Justice Department v. Dick Anderson Construction Company. 1997. Investigated and prepared written testimony regarding a discharge permit violation that occurred during construction of a treatment plant expansion. The U.S. Department of Justice decided not to pursue the case.

District Court, Water Division No. 1, State of Colorado, Case No. 89CW136. Application for Water Rights of Stonegate Developments. 1996. Prepared written testimony for acceptability of effluent discharged upstream of raw water supplies to be used for potable purposes for the District No. 1 Water Court. Work included case strategy, depositions and negotiations for settlement.

Colorado Water Quality Control Commission Testimony. Prepared technical testimony regarding narrative and numeric water quality standards for wetlands in Colorado. Testimony was presented to the Colorado Water Quality Control Commission.

Colorado Water Quality Control Commission Testimony. Prepared and presented testimony to the Colorado Water Quality Control Commission regarding ammonia and chlorine stream standards in West Plum Creek, Colorado.

Colorado Water Quality Control Commission Testimony. 1994. Prepared and presented testimony to the Colorado Water Quality Control Commission regarding the impacts of wastewater effluent on a downstream alluvial public water supply. Technical issues focused on viruses and disinfection by-products.

Colorado Water Quality Control Commission Testimony. 1993. Testimony to the Colorado Water Quality Control Commission regarding Basic Standards for Groundwater.

Colorado Water Quality Control Commission Testimony. 1985. Testimony to the Colorado Water Quality Control Commission regarding phosphorus standards in Standley Lake.

District No. 1 Water Court Testimony. Testimony regarding the components of a water master plan for a water district in the Chatfield Reservoir Basin in Colorado. This case included preparing written depositions and testimony.

PROFESSIONAL SOCIETIES

American Society of Civil Engineers
Water Environment Federation
Nonpoint Sources of Pollution Committee, Former National Chairman
International Water Association
Society For American Archaeology

PUBLICATIONS AND PRESENTATIONS

Lorenz, W.F, Trusler, A.K., Bernstetter Totsch, Jessica N., 2022. Ancient water management in the casa dell'Efebo in Pompeii. *Water History*, July 2022. DOI: 10.1007/s12685-022-00304-z

Lorenz, W. 2021. Exploring Pompeii's Water Supply. *Water Environment & Technology, Water Environment Federation*, February.

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- Trusler, A.K., Martin-Apostolatos, G., and Lorenz, W. 2019. Around the Watering Hole: An In-Depth Analysis of Pompeii's Fountains. Society For American Archaeology 84th Annual Meeting, Albuquerque, New Mexico. April 2019.
- Lorenz, W.F., G. Libertini, B. Miccio, N. Leone and G. De Feo. 2018. Prominent features of the Augustan aqueduct in the Naples Bay area. International Water Association Online Publishing. January. ws2018019; DOI: 10.2166/ws.2018.019.
- DeFeo, G., and W.F. Lorenz. 2015. Route and tunnels of the Aqua Augusta for the water supply of Pompeii. *Journal of Global Environmental Issues*. Inderscience Publishers. Vol.14, No.3/4, pp.177 – 186.
- Lorenz, W.F., E.J. Wolfram. 2014. The Wells of Pompeii. *Groundwater*, Journal of the National Groundwater Association. September-October, Vol. 52, No. 5.
- Lorenz, W.F., DeFeo, G. 2014 Pompeii Water Supply–Route and Tunnels of the Serino Aqueduct. In IWA Regional Symposium on Water, Wastewater and Environment: Traditions and Culture Patras, Greece, 22-24 March 2014 Patras, HELLENIC OPEN UNIVERSITY, 477-485.
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- Lorenz, W.F. 2012. Barbegal Watermills: Rome's Revolutionary Power. *Current World Archaeology*, 54: 36-40.
- Lorenz, W.F., P.J. Wolfram. 2012. Ancient Water Quality: Roman Engineering of the Barbegal Mill. *Journal AWWA*, April.
- Lorenz, W.F., DeFeo, G., Baros, E., DeGisi, S. 2012. Ancient Pompeii Water Supply: Sources, Routes, Hydraulics of the Aqueducts. IWA Specialized Conference on Water & Wastewater Technologies in Ancient Civilizations. Istanbul-Turkey. March 22-24.
- Lorenz, W.F., Wolfram, P.J., Castermans, P. 2012. Water Flow to the Ancient Industrial Mill of Barbegal – La Burlande Basin. IWA Specialized Conference on Water & Wastewater Technologies in Ancient Civilization. Istanbul-Turkey. March 22-24.
- Lorenz, W.F., P.J. Wolfram. 2011. Valley Crossings and Flood Management for Ancient Roman Aqueduct Bridges. *ASCE Journal of Irrigation and Drainage Engineering*, December.
- Lorenz, W.F., S.M. Tillack, S. Witter, M. Letourneau. 2011. Unique Aspects of a Nonpotable Water System with Two Supply Sources. Presented at the 2011 Rocky Mountain Water Environment Association (RMWEA) and Rocky Mountain Section of the American Water Works Association (RMSAWWA) Joint Annual Conference, Loveland, CO. September 18-21.
- Lorenz, W.F. 2011. OWS Failures: How to Avoid Them. Presented at the Colorado Professionals for Onsite Wastewater Annual Conference, Denver, CO. January 20-21.

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- Lorenz, W.F., E.C. Becker, M. Billingsley. 2010. Facultative Lagoon Aeration System Improvement Project – East River Regional Sanitation District. Presented at the American Water Works Association (AWWA)/Water Environment Federation, Rocky Mountain Section Annual Conference. Keystone, CO. September 12-15.
- Earles, T. A., W.F. Lorenz, W.L. Koger, M.Y. Trujillo. 2008. Nonpoint Source Phosphorus Trading in the Cherry Creek Reservoir Watershed in Colorado. *ASCE Journal of Irrigation and Drainage Engineering*, September/October.
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- Lorenz, W.F., P.J. Wolfram. 2007. The Millstones of Barbegal. *Civil Engineering*, The Magazine of the American Society of Civil Engineers, 77(6): 62-67.
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