



Serving Stewards of Western Water since 1993

BYRON CLARK, P.E.

Project Manager/Principal Engineer

Education

B.S., Biological Systems Engineering, University of California, Davis

Professional Registrations

Civil Engineer, California (No. C71349)

Summary

Mr. Clark possesses extensive experience in agricultural water management and irrigation engineering in the West. He has conducted projects focusing on farm water management, quantification of consumptive and non-consumptive water use in agriculture and natural ecosystems, estimation of water demands, water balance analysis, irrigation scheduling and irrigator training, soil salinity and drainage investigations, feasibility investigations for management and infrastructure improvements, quantification of groundwater production, and water quality monitoring. He has also conducted multiple projects aimed at improvement of crop coefficients for estimation of crop water use (evapotranspiration) through remote sensing of the surface energy balance. In addition to being experienced as a water management planner, Mr. Clark has served as project manager and design engineer on construction projects aimed at modernizing and replacing irrigation infrastructure, including pipelines, canals, and water control structures. He has taken several projects from initial concept to implementation and has authored more than 20 papers and conference proceedings.

Selected Experience

Colusa County Water District

Lateral 6A and Lateral 5B Pipeline Replacement Projects

Mr. Clark served as Project Manager and Engineer of Record for the design and construction of approximately 11,600 feet of 27" and 30" PVC irrigation pipe and appurtenant structures to replace failing fiberglass reinforced plastic mortar pipe (FRPMP), trade name "Techite" during 2011 and 2012. As project manager and engineer, Mr. Clark was responsible for supervising all engineering aspects of the work on behalf of the District, including surveying, design, permitting, development of legal descriptions for new easements, preparation of contract documents, bidding, contract award, contract administration, construction inspection and testing, and contract closeout.

Pacific States Marine Fisheries Commission and the California Department of Fish and Game Shasta Valley Irrigation Efficiency Studies

Mr. Clark prepared detailed daily estimates of crop consumptive use estimates using a combination of remote sensing techniques and field-scale root zone water balances to support the development of water balances for both the Hart and Cowley Ranches on the Little Shasta River and the Shasta Springs

Ranches on the Shasta River and Parks Creek. To assemble the water balances for hydrologically distinct portions of each ranch, he assembled monthly flow records from field data collection results and assimilated data to fill gaps using statistical methods as needed. Based on the water balance results, strategies to increase streamflow and quality to improve anadromous fish habitat while maintaining or enhancing agricultural production were identified. Then, water conservation alternatives were developed and an implementation strategy formulated to provide near-term improvements to stream conditions while long-term management and infrastructure improvements are implemented.

Imperial Irrigation District

Efficiency Conservation Definite Plan

Mr. Clark performed a comprehensive assessment of on-farm water conservation opportunities and costs for the Imperial Irrigation District in the Imperial Valley of California by (1) assessing historical on-farm water use including deliveries, crop ET, tailwater runoff, and deep percolation for more than 100,000 unique field-seasons; (2) quantifying capital, maintenance, and operations costs associated with various conservation measures currently being implemented or likely to be considered under a long-term voluntary on-farm water conservation program; and (3) developing estimates of delivered water reduction resulting from each applicable conservation measure for each unique field-season based on historical irrigation performance. Mr. Clark evaluated differences between potential and actual ET estimated from traditional and remotely sensed energy balance approaches, respectively, for individual crop-soil-irrigation method field-season groups in the Imperial Valley of California and developed a model to infer actual ET from potential ET calculated using the FAO 56 dual crop coefficient approach to extend the utility of remote sensing results for a single year over multiple years.

Deer Creek Irrigation District

Proposition 50 Water Use Efficiency Grants

For the Deer Creek Irrigation District, Mr. Clark conducted a detailed inventory and assessment of irrigation facilities, rating individual reaches and structures with regards to general condition and operability to support the development and evaluation of alternatives to improve delivery service and decrease losses. The effort included assembly of detailed system and farm water balances representing wet and dry years to estimate all primary flow paths including losses to seepage, evaporation, deep percolation and runoff. Mr. Clark developed estimates of crop evapotranspiration from irrigation using a root zone water balance and compiled available flow data from two years of monitoring and assimilated complete flow records based on available information. Based on this analysis, alternative long term improvements to District operations and infrastructure were developed and evaluated to determine costs and potential benefits to water delivery service to the District's growers along with benefits to migratory fish through reduced diversions during critical periods. From concept through construction, Mr. Clark developed designs, plans, and specifications for replacement of primary water control structures to facilitate improved operations and reduced system losses. Mr. Clark conducted procurement and acted as the District's designated Engineer during construction, providing inspection, contract administration, and construction management services. Mr. Clark additionally prepared detailed specifications for SCADA improvements to facilitate improved operations and reduced system losses including specification of remote monitoring and control functionality, communications technology, and sensor arrays to monitor flow and water levels at key locations.

Merced Irrigation District

LeGrand-Planada Canal Capacity Investigation

Mr. Clark conducted an investigation to evaluate the causes and implications of delivery delays that occurred during the summer of 2006 at MID. The investigation included detailed review of operations and water delivery data as well as interviews with district staff and growers in affected areas. Mr. Clark determined that the delivery delays occurred as a result of the convergence of challenging conditions, including increased irrigation demand resulting from annexation of additional irrigated lands, aquatic weed growth and associated operational and capacity constraints stemming from available treatment technologies, reduced capacity due to sedimentation in canals over time, belated start of the irrigation season resulting in large simultaneous demand for water later in the season, and persistent, abnormally high temperatures resulting in increased demands.

University of California Cooperative Extension

Proposition 50 Water Use Efficiency Grant

Mr. Clark prepared a successful California Proposition 50 Water Use Efficiency Research Proposal for the University of California Cooperative Extension to apply the Surface Energy Balance Algorithm for Land (SEBAL[®]) to validate the remotely sensed energy balance for quantification of actual crop ET and to identify factors contributing to differences among crop coefficients for individual fields of primary local crops. Under the grant, Mr. Clark assessed crop coefficients developed through the remotely sensed surface energy balance for California's southern San Joaquin Valley and led the development of a web-based map interface to allow growers to access water use information for individual fields and to compare field-specific water use to similar fields based on crop and soil type.

Coachella Valley Water District

Potential Water and Energy Conservation and Improved Flexibility for Water Users in the Oasis Area of CVWD

For the Coachella Valley Water District, Mr. Clark conducted a Proposition 13 feasibility study and recommended improvements to increase the efficiency of pump stations and to reduce operational spillage and regulatory discharge for a 15,000-acre area. This study involved review of pump efficiency tests and pumping requirements for centrifugal and vertical turbine lift stations based on irrigation demand and evaluation of energy and associated cost savings associated with conversion to variable frequency drives (VFDs). VFDs were found to substantially reduce energy requirements to satisfy variable flow, constant head demands downstream from the pump stations.

Newhall Land and Farming Company

Pump Efficiency Testing

For the Newhall Land and Farming Company, Mr. Clark conducted more than 50 pump efficiency tests to evaluate various pump operational characteristics and to identify opportunities to improve overall pumping plant efficiency while continuing to meet irrigation demands.

Coachella Valley Water District

Water 2025 Challenge Grant

For the Coachella Valley Water District, Mr. Clark developed a successful Water 2025 grant proposal to quantify water savings from agricultural conservation practices using detailed field monitoring and a combination of statistical and spatial analyses. Additionally, Mr. Clark managed a program to provide water user training and farm water management services in response to a temporary 31% reduction in surface water supply. Mr. Clark developed and implemented GIS analysis techniques to quantify water

savings by program participants as well as planning and conducting over 15 meetings for agricultural producers to provide training in irrigation and salinity management. Mr. Clark developed water balance software to predict required irrigation amounts and develop irrigation recommendations for a large variety of crops and farm irrigation systems. Mr. Clark also developed salinity assessment software to calculate reclamation leaching requirements based on soil, water, irrigation system, weather, and crop considerations.

Coachella Valley Water District Water Advisory Committee

For the Coachella Valley Water District Water Advisory Committee, Mr. Clark identified a 7,000-acre area of a water district with potential for groundwater recharge from farm irrigation utilizing spatial analysis techniques and crop, soil, tile drainage, and irrigation method data. Mr. Clark additionally designed structures and instrumentation to provide continuous monitoring of the quantity and quality of water draining from individual drainage channels into the Salton Sea, including preparation of detailed plans and specifications for bid. As design engineer, Mr. Clark assisted contractor in interpretation of plans and specifications during construction.

Mr. Clark designed and performed a survey of agricultural pumping plants for the 90,000-acre Coachella Valley Water District. Pumping systems included a variety of booster pumps and groundwater wells ranging from small domestic systems to large agricultural pumping plants. As part of this effort, Mr. Clark developed an energy and water balance using GIS to determine groundwater production for agricultural irrigation and independently verify an existing groundwater model.

Professional Organizations

American Society of Civil Engineers, Environmental and Water Resources Institute

- Past Chair, Water Quality and Drainage Technical Committee, Environmental and Water Resources Institute, American Society of Civil Engineers
- Member, Publications Committee, Journal of Irrigation and Drainage Engineering

California Irrigation Institute

U.S. Committee on Irrigation and Drainage

Honors and Awards

- Boy Scouts of America, Eagle Scout Award, 1994.
- Robert C. Byrd Honors Scholarship Recipient, 1994.
- Invited Speaker: "Application of SEBAL for Improved Water Management in Agricultural, Natural, and Urban Environments." CalGIS 4th Biannual Geospatial Technologies in Agriculture Symposium. April 4-6, 2007. Oakland, California.
- Invited Speaker: "Statewide Estimates of Water Use Using SEBAL." California Irrigation Institute 46th Annual Meeting. January 31-February 1, 2008. Sacramento, California.

Publications

Mr. Clark has authored dozens of project reports and professional papers.