

Russ Brown River Consulting, LLC

Russell T. Brown, Ph.D.

Hydrology and Water Quality

Russ Brown's areas of expertise include hydrology, river and estuarine hydrodynamics, water quality, aquatic habitat evaluations, water resources operations and planning models, reservoir and river temperature and water quality modeling, water quality analysis, and effluent discharge and mixing systems. Russ develops and applies hydrology and water quality models to integrate and interpret hydrologic, water quality, and ecological data for environmental assessments. He uses biological criteria to develop flow, temperature, dissolved oxygen, and nutrient models appropriate for predicting biological impacts under alternative project operations; and evaluates existing water quality and hydrologic data for relationships useful for predicting project impacts and benefits.

Project Experience

Salinity Patterns and Effects of Tidal Flows and Temporary Barriers in south Delta Channels- California Department of Water Resources, Bay-Delta Branch, Sacramento California

Evaluated tidal elevation, tidal flow and salinity (EC) data from the south Delta to determine likely sources of high salinity water (such as agricultural drainage) contributing to elevated EC at monitoring stations. The extensive 15-minute data from about 25 south Delta channel locations for the years of 2009-2013 were analyzed and evaluated. The project identified and compared several alternatives for reducing the high EC that has been measured in Old River at Tracy Boulevard, including flushing, dredging of channels to redirect Old River flow and installation of a tidal gate in place of the Old River at DMC temporary rock barrier to increase the tidal flushing.

Study Plans for Scott and Shasta River Hydrology and Temperature Habitat Conditions- CDFW

Described the approach and recommended methods for tracking daily flows and water temperatures in the tributaries and main stream for the Shasta River and Scott River watersheds. These plans were built on the information and analysis in the RWQCB TMDL technical support documents and a review of existing flow records and water temperature measurements. Other study plans for stream habitat surveys, and instream flow assessments (IFIM) were developed that would link to the watershed runoff modeling and streamflow recession patterns in each tributary. The effects of irrigation diversions in the summer and the diversion and storage of water in Lake Shastina (reservoir) were the major flow management issues.

San Joaquin River Tributaries and Southern Delta Water Quality Control Plan Substitute Environmental Report—California State Water Resources Control Board, Sacramento, California

Developed the hydrology and water quality sections for the SED; evaluated historical hydrology and water quality data as an appendix; assisted SWRCB staff in developing a monthly reservoir operations model to evaluate the water supply effects of alternative fish flow requirements. Evaluated the effects of the flow alternatives during droughts. Developed daily reservoir operations models for the three tributaries to evaluate potential fish benefits from daily flow sequences, including the effects from hydraulic habitat conditions, floodplain inundation and reduced water temperatures.

Education

- PhD, Civil Engineering and Water Resources, Massachusetts Institute of Technology, 1978
- MS, Ocean Engineering, Massachusetts Institute of Technology, 1974
- BS, Civil and Environmental Engineering, University of California, Irvine, 1972

Memberships and Awards

- California Water and Environmental Modeling Forum
 - CWEMF Hugo B. Fischer Award, 2011
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Delta Water Transfer Impacts—Napa Redevelopment Partners, Napa, California

Developed an evaluation of the effects of increased North Delta aqueduct pumping (water transfer) on juvenile delta smelt entrainment loss, based on DFW monitoring in Cache Slough and Lindsay Slough; incorporated the findings (no significant impacts) in the EIR prepared for the new housing project.

Delta Corridors Salinity Modeling—South Delta Water Agency and Central Delta Water Agency, Stockton, California

Conducted DSM₂ Delta modeling and prepared reports on 1) Delta tidal flows, and 2) Delta salinity effects of the proposed Delta Corridors Plan, which would separate the San Joaquin River inflow from the Delta export pumping. Large fish screens would be installed at the Delta Cross Channel and at Georgiana Slough to allow Sacramento River water to be diverted and conveyed in Middle River to the SWP and CVP intakes near Tracy. The likely fish effects of the project were described, based on the separation of the exports from migrating Chinook and from delta smelt habitat in the lower San Joaquin River, Franks Tract, and Old River. The Delta corridors Plan was subsequently evaluated in the Bay Delta Conservation Plan (Alternative g).

South Delta Improvements Program EIS/EIR—California Department of Water Resources (DWR) and U.S. Bureau of Reclamation (Reclamation), Sacramento, California

Prepared the water supply, Delta tidal hydraulics, and water quality impact assessment chapters for the South Delta improvements program, which includes tidal gates for water level control and fish migration protection. Utilized results from CALSIM (a reservoir operation simulations model for California) and DSM₂ (Delta tidal flows and salinity model) to provide accurate evaluations of natural and modified tidal conditions in the Delta. Prepared technical appendices for Delta tidal flow and salinity modeling, daily flow and fish entrainment modeling, and impact assessment methods for fish entrainment at the Central Valley project and State Water project export pumps.

Delta Wetlands In-Delta Storage Project—State Water Board and Corps, Sacramento, California

Prepared hydrologic, hydrodynamic, and water quality impact assessment of the Delta Wetlands In-Delta Storage Project for the State Water Board and the Corps. Utilized the RMA hydrodynamic Delta model and developed a daily spreadsheet model to investigate the effects of alternative Delta water quality standards on Delta channel flows and exports, and operations of the in-Delta storage. Evaluated data from samples of Delta agricultural drainage and developed a monthly Delta agricultural drainage water quality model that links the water, salinity, and DOC concentrations.

San Joaquin River DO Aeration Facility Project Design and Implementation—CALFED, Port of Stockton, California Department of Water Resources, Stockton, California

Evaluated Deep Water Ship Channel (DWSC) aeration alternatives for CALFED, including initial assessment of oxygenation with a U-tube. This project included the demonstration of an inverted-U oxygen device in the DWSC, with an efficiency of 20%. Prepared the performance monitoring plan for the demonstration oxygenation facility for CBDA to determine the response of the DWSC to oxygen additions. Developed the experimental design (i.e., on-off operations) to evaluate the performance of the full-scale (10,000 lb/day) oxygenation facility constructed by DWR in 2007. Prepared reports for DWR that evaluated the performance of the constructed facility in 2009 and 2010.

Hinkley Site Remediation Subsequent EIR—Pacific Gas & Electric (PG&E), Hinkley, California

Under the direction of the Lahontan RWQCB staff, prepared groundwater and water quality analysis of existing measurements and modeling reports from PG&E to evaluate the proposed remediation of chromium-contaminated groundwater from the PG&E compressor station in Hinkley, California. Technical analysis included water quality evaluation of remedial alternatives, chromium background levels, and groundwater level effects for each alternative.

Evaluation of Fish Protection from Installation of the Head of Old River Temporary Barrier- Bureau of Reclamation, Sacramento, California

Developed daily analysis of the protection of San Joaquin River juvenile Chinook salmon provided by the combination of pulse flows, reduced export pumping, and the temporary rack barrier at the head of Old River, near Mossdale. The analysis compared the daily catch of Chinook at the DFG/USFWS Mossdale Trawl with the CVP and SWP daily Chinook salvage to determine the protection provided by the barrier and by the VAMP export reductions for a range of San Joaquin River flows and exports. A fish-tracking approach determined the water movement at each channel junction, including the CVP and SWP intakes on Old River, and estimated the fish movement and survival at a range of flows during the spring months of 1996-2005.

Hydrologic and Environmental Constraints Evaluation for Proposed Water Transfer to North Texas Water Alliance- Choctaw and Chickasaw Nations and State of Oklahoma

Provided independent evaluation of the effects of proposed diversions from below three reservoirs in southeast Oklahoma to North Texas; prepared daily reservoir operations models of the Kiamichi and Little River basins to investigate the hydrological and ecological effects of additional diversions under various operating rules. Some of the ecological concerns were instream flows for fish and mussels, and suitable reservoir levels for fish spawning, waterfowl habitat, fishing, hunting and other recreational uses.

CVP and SWP Delta Export Reductions for Protection of Endangered Fish- Environmental Water Account- CALFED and Department of Water Resources, Sacramento California

Developed a daily model of Delta exports and San Luis Reservoir operations for use in interactive evaluation of export restrictions to protect endangered fish species for the CALFED Environmental Water Account program, that was implemented in 2001-2005. The daily model combines historical daily salvage (fish density) data with historical flows and Central Valley Project and State Water Project operations data to provide an integrated assessment tool. Project operators and fish resource managers changed the initial export pattern to reduce entrainment during periods of high fish density, and then allowed higher pumping during periods of reduced fish density. The daily model accurately simulated Delta operational constraints and allowed adaptive management actions to be evaluated.

Lake Hodges and Olivenhain Reservoir Water Temperature and Water Quality Modeling—San Diego County Water Agency, San Diego, California

Developed and applied a reservoir temperature and water quality model for Olivenhain Reservoir to help SDCWA design the selective withdrawal outlet facilities. Seasonal temperature stratification as well as salinity gradients that control mixing in the reservoir were evaluated. The withdrawal zone and buoyant inflow plume effects were included in the 1-D model. The effects of aeration from a bubble plume were included in the reservoir model and calibrated with field data from Lake Skinner. A linked water quality model of Lake Hodges and Olivenhain Reservoir was developed to evaluate the effects of planned pumped-storage operations and emergency storage project operations on nutrients, dissolved oxygen and total organic carbon in drinking water.

Reservoir Water Temperature and Water Quality Modeling—Multiple Locations, California

Applied a daily two-dimensional reservoir flow and temperature model (BETTER) to the Lewiston Reservoir on the Trinity River and Lake McClure on the Merced River for evaluating effects of release temperatures on downstream river temperatures. Applied CE-QUAL-W2 reservoir water temperature and DO model to Lake Almanor, San Luis Reservoir, Lake Britton, and Millerton Lake to evaluate stratification and effects on fish habitat and release temperatures. Applied CE-QUAL-R2 to Millerton Reservoir to evaluate stratification and release temperatures for various San Joaquin River restoration flow strategies.

River Water Temperature Modeling—Multiple Locations, California

Developed and applied an hourly river temperature model (JSA-TEMP) for fisheries evaluations on the Owens River, Putah Creek, Merced River, and Guadalupe River. Each application was calibrated (i.e., parameters adjusted) with measured temperatures and used to demonstrate effects of various flow and reservoir management alternatives. The Putah Creek and Guadalupe River applications investigated the effects of riparian

vegetation and low-flow pools on water temperatures. Developed a daily flow and hourly water temperature model of the San Joaquin River from Friant Dam to the Merced River and applied this model to evaluate restoration actions using Chinook salmon and steelhead temperature criteria and habitat assessment calculations. Developed a daily flow and hourly water temperature model for the Battle Creek Restoration Project using MS Excel; hydropower diversions, canals, and return flows to the North Fork and South Fork were estimated and water temperatures were calibrated with 2012 data using longitudinal and timeseries comparisons.

Water Quality Assessments and Models—Multiple Locations, California

Prepared a summary and review of historical daily suspended-sediment data collected in the 1930s and 1960s by the Tennessee Valley Authority. Prepared files for the USGS database and compared the daily patterns of sediment concentrations during storm flows from the 15 watersheds with at least 3-years of daily flow and sediment data. Developed life-stage model of Mono Lake alkaline-fly population to evaluate the effects of larval substrate availability and salinity changes from various lake elevations. Developed daily transport and entrainment model for assessment of plankton and larval fish life-stages resulting from Delta flows and export pumping operations and applied this model to evaluate effects of PG&E's Delta power plant and in-Delta storage operations. Prepared water quality assessment for revisions to the diversions from Mono Lake tributary streams, including the effects on Crowley Lake nutrients and arsenic concentrations. Developed a model for the assessment of the fate of nutrients and metals in the constructed wetlands at the Sacramento Regional Wastewater Treatment Plant. Prepared an evaluation of the Salton Sea restoration alternatives for the Salton Sea Authority; simulated water and salt management alternatives using the USBR water and salt accounting model and compared these alternatives with possible on-shore solar salt concentration ponds.

Publications

- Brown, Russ T., A. Huber. 2004. The Effects of Riparian Shade on Stream Water Temperature. In Proceedings of 2004 Riparian Ecosystems and Buffers: Multi-Scale Structure, Function, and Management. American Water Resources Association Specialty Conference, Olympic Valley, California.
- Brown, Russ T., A. Huber, J. Zhou, K. Steele. 2000. Planning Water Quality Operations for San Diego County Water Authority Emergency Storage Project Reservoirs. Proceedings of 2000 Joint Conference on Water Resources Engineering and Water Resources Engineering and Management. ASCE. Reston, Virginia.
- Brown, Russ T., T. Cannon, D. Fullerton, B. Herbold. 2000. California (CALFED) Daily Environmental Water Management Modeling for Fish Protection and Water Supply Evaluation. Proceedings of 2000 Joint Conference on Water Resources Engineering and Water Resources Engineering and Management. ASCE. Reston, Virginia.
- Brown, Russ T. 1998. Water Quality Impacts from Agricultural Drainage of Peat Soils in the Sacramento-San Joaquin Delta. S.R. Abt, J. Young-Pezeshk, C.C. Watson (eds), Proceedings of the 1998 International Water Resources Engineering Conference. ASCE. Reston, Virginia.
- Brown, Russ T., A. Huber. 1998. Hourly Water Temperature Modeling of the Guadalupe River, California. S.R. Abt, J. Young-Pezeshk, C.C. Watson (eds), Proceedings of the 1998 International Water Resources Engineering Conference, ASCE. Reston, Virginia.
- Brown, Russ T., J. J. Field, M. J. Zanolli, R. W. Crites. 1994. Modeling Pollutant Fate and Transport in Constructed Wetlands. M. Edwards (ed.) Proceedings of the 1994 National Conference on Environmental Engineering, ASCE. New York, New York.
- Brown, Russ T., D. Brewer, D. Owen, Z. Chowdhury. 1994. Trihalomethanes in Chlorinated Sacramento-San Joaquin Delta Drinking Water Simulated with the EPA WTP-THM Model. M. Edwards (ed.). Proceedings of the 1994 National Conference on Environmental Engineering, ASCE. New York, New York.
- Brown, Russ T. P. Wisneropp, D. Smith, R. Rachiele. 1993. Modeled Hydraulic and Salt Transport Patterns in the Sacramento-San Joaquin Delta. H.W. Shen, S. T. Su, and F. Wen (eds.), Proceedings of 1993 National Conference on Hydraulic Engineering. ASCE. New York, New York.

- Brown, Russ T. 1992. Hydrologic Constraints for Water Management in Owens Valley and Mono Basin. C. A. Hall, Jr., V. Doyle-Jones, B. Widowski (eds.), *The History of Water: Eastern Sierra Nevada, Owens Valley, White-Inyo Mountains*. White Mountain Research Station Symposium. Volume 4. Los Angeles, California.
- Brown, Russ T., G. Yates, P. Johnson. 1992. Physical and 2-D Computer Models Of Skimmer Curtain Effects On Lewiston Reservoir and Outlet Temperatures. M. Jennings and V. G. Bhowmik (eds.), *Proceedings of the Hydraulic Engineering Sessions at Water Forum '92*. ASCE. New York, New York.
- Brown, Russ T, W. R. Hutchison. 1992. Applications of monthly model of Los Angeles aqueduct system to investigate impacts from Mono Lake Tributary diversions. M. Jennings and N. G. Bhowmik (eds.), *Proceedings of the Hydraulic Engineering Sessions at Water Forum '92*. ASCE. New York, New York.
- Chang, L. H., S. F. Railsback, R. T. Brown. 1992. Use of a Reservoir Water Quality Model to Simulate Global Climate Change Effects on Fish Habitat. *Climate Change* 20:277-296.
- Brown, Russ T., H. Crouch, T. Higgs. 1991. Application of 2-D Water Quality Model (BETTER) to Manage Effects of Low Flow and Wastewater Effluents in Cheatham Lake, Tennessee. R. M. Shane (ed.), *Proceedings of the 1991 National Hydraulic Engineering Conference*. ASCE. New York, New York.
- Brown, Russ T., R. C. Young. 1991. Measurements to Calibrate Suspended Sediment Model for Adsorbed Contaminant Transport Study of North Fork Holston River, Virginia. R. M. Shane (ed.), *Proceedings of 1991 National Hydraulic Engineering Conference*. ASCE. New York, New York.
- Brown, Russ T. and J. L. Young. 1989. Hydrologic Interpretation of Ambient Water Quality Data from the Tennessee River Basin. S. Ragone (ed.), *Regional Characterization of Water Quality*. (Publication Number 182.) International Association of Hydrological Sciences Press. Wallingford, United Kingdom.
- Brown, Russ T., K. D. Choate. 1989. Daily Suspended Sediment Model for Water Resources Management. S. S. Ywang (ed.), *Sediment Transport Modeling: Proceedings of International Symposium*. ASCE. New York, New York.
- Brown, Russ T. and K. Choate. 1988. Daily Water Budget Model for Water Resources Management. M. Strech (ed.), *Critical Water Issues and Computer Applications: Proceedings of the 15th Annual Water Resources Planning and Management Division Conference*. American Society of Civil Engineers. New York, New York.
- Brown, Russ T., M. H. Mobley, and C. F. Nubbe. 1988. Surface Water Pumps: Model-prototype Calibration. P. H. Burgi (ed.), *Model-Prototype Correlation of Hydraulic Structures: Proceedings of the International Symposium*. American Society of Civil Engineers. New York, New York.
- Carey, W. P., R. T. Brown, and C. G. Chatham. 1988. History of Suspended-Sediment Data Collection and Inventory of Available Data for the Tennessee and Cumberland River Basins. Open-File Report 88-497. U.S. Geological Survey. Nashville, Tennessee.
- Brown, Russ T. 1987. Analysis of Storm Event Suspended Sediment Data from Tennessee. R. M. Ragan (ed.), *Proceedings of the 1987 National Conference on Hydraulic Engineering*. American Society of Civil Engineers. New York, New York.
- Brown, Russ T. and C. Nubbe. 1987. Modeled Effects of Hydraulic Mixing Devices on Reservoir Water Quality. R. M. Ragan (ed.), *Proceedings of the 1987 National Conference on Hydraulic Engineering*. American Society of Civil Engineers. New York, New York.
- Brown, Russ T. and D. L. Dycus. 1986. Characterizing the Influence Of Natural Variables During Environmental Impact Analysis. B. G. Isom (ed.), *Rationale for sampling and interpretation of ecological data in the assessment of freshwater ecosystems*. (ASTM STP 894.) American Society of Testing Materials. Philadelphia, Pennsylvania.
- Wilson, T. M., V. D. Adams, R. T. Brown, J. A. Gordon, and H. H. Mills. 1986. Design of a Statewide Monitoring Network for Groundwater Quality. Tennessee WRRC Technical Report No. 113. University of Tennessee. Knoxville, Tennessee.

- Brown, Russ T. 1985. Flow and Mixing Calculations for a Two-Dimensional Reservoir Water Quality Model. W. R. Waldrop (ed.), *Hydraulics and Hydrology in the Small Computer Age: Proceedings of the Hydraulics Specialty Conference*. American Society of Civil Engineers. New York, New York.
- Brown, Russ T., 1985. Browns Ferry Nuclear Plant Thermal Compliance Monitoring Network: Utilization of Data. W.R. Waldrop (ed.), *Hydraulics and Hydrology in the Small Computer Age: Proceedings of the Hydraulics Specialty Conference*. ASCE. New York, New York.
- Brown, Russ T. 1984. Relationships between Suspended Solids, Turbidity, Light Attenuation and Algal Productivity. In *Lake and Reservoir Management Proceedings of the Third Annual Conference of The North American Lake Management Society*. EPA 440/5-84-100. U.S. Environmental Protection Agency. Washington, DC.
- Hauser, G. E., L. M. Beard, R. T. Brown, and M. K. McKinnon. 1983. Modeling the Downstream Improvements in Dissolved Oxygen from Aeration of Cherokee and Douglas Releases. TVA Report No. WR28-1-590-103. Tennessee Valley Authority. Norris, Tennessee.
- Brown, Russ T. 1981. Reservoir Temperature Modeling Uncertainties. H. Stefan (ed.), *Proceedings of the Symposium on Surface Water Impoundments*. ASCE. New York, New York.
- Brown, Russ T. 1980. Modeling Hourly Water Temperature Dynamics. G. Ashton (ed.), *Proceedings of the Specialty Conference on Computer and Physical Modeling in Hydraulic Engineering*. ASCE. New York, New York.

Recognition and Awards

Hugo B. Fischer Award from the California Water and Environmental Modeling Forum, March 2011. In recognition of modeling investigations of low dissolved oxygen in the Stockton Deep Water Ship Channel and effective use of models in planning, operations, and regulations of California water facilities.

Employment History

Russ Brown River Consulting. Principal. Carmichael, California. 2017-Present.

Jones and Stokes Associates and ICF. Technical Director- Hydrology and Water Quality. Sacramento, California. 1989–2017. Participated in the projects, studies, and environmental impact evaluations listed in resumé, above.

Tennessee Technological University. Associate Professor of Civil Engineering. Cookeville, Tennessee. 1985–1989. Developed research proposals and participated in research activities at the Center for the Management, Utilization, and Protection of Water Resources. Conducted water quality data collection, data analysis, and modeling. Authored numerous technical reports on reservoir water quality modeling for the Corps, USBR, Tennessee Valley Authority, and Oak Ridge National Laboratory. Directed graduate student research projects and taught courses in hydrology and water quality modeling.

Tennessee Valley Authority Engineering Laboratory. Research Engineer. Knoxville, Tennessee. 1978–1985. Conducted engineering studies of water temperature effects from thermal power plant discharges and hydropower dam releases. Analyzed data obtained from hourly water temperature monitoring systems. Participated in multi-disciplinary water resource studies, assisted in planning field data collection activities, and developed and applied reservoir water quality models to evaluate environmental concerns.

U.S. Army Corps of Engineers Waterways Experiment Station. Graduate Fellow. Vicksburg, Mississippi. 1976–1977. Studied the range of reservoir water quality model predictions resulting from uncertain river loadings. Investigated data requirements for reservoir inflow concentrations and coefficient estimates. Participated in reservoir water quality model development and calibration.