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Tony L.Wahl, U.S.A.
Winner of WatSave Young Professionals Award 2003

(For his significant contribution in the field of flow measurement, canal system modernization and operations improvements, debris and fish screening at irrigation diversions, hydrology, and improved hydraulic laboratory techniques.)

Mr. Tony L. Wahl (b.1966) is a Hydraulic Engineer at Bureau of Reclamation, Water Resources Research Laboratory, Denver, USA. He holds Masters in Civil Engineering (Hydraulics) and has a vast research and project execution experience in Hydraulic Engineering. Mr. Wahl has been honoured with several prestigious awards including the Special Act Award for development of WinFlume software in 1999. He has made numerous contributions to worldwide efforts to save, conserve, and use water resources more effectively. Mr. Wahl's work spans the fields of flow measurement, canal system modernization and operations improvements, debris and fish screening at irrigation diversions, hydrology, and improved hydraulic laboratory techniques. Mr. Wahl may be contacted on <twahl@do.usbr.gov>.

Mr. Wahl's Works related to Water Saving/Conservation

- ***WinFlume Software for Design of Long-Throated Flumes and Broad-Crested Weirs:*** Accurate water measurement is essential for the success of any water conservation program. One of the most important recent improvements in water measurement technology is the widespread application of long-throated flumes and broad-crested weirs. Mr. Wahl has been a driving force in this effort, writing the new WinFlume software used to design and calibrate these devices, and disseminating the technology through software distribution, publications, and hands-on training. Mr. Wahl initiated this effort in 1997, working cooperatively with the USDA-Agricultural Research Service and the International Institute for Land Reclamation and Improvement to create the new Windows-based software. The new software is easier to use than previous programs, provides improved output, and utilizes a more robust design algorithm. The program was formally released in 1999, and has been distributed freely to users in 70 countries via direct mailings and the Internet. Mr. Wahl continues to update and improve the program as computer technology evolves.

  Mr. Wahl conducts regular workshops on irrigation flow measurement and the use of WinFlume. He is a co-author with Drs. Albert J. Clemmens, Marinus G. Bos, and John A. Replogle, of *Water Measurement with Flumes and Weirs* (2001), the definitive reference text on the design, construction, and calibration of long-throated flumes and broad-crested weirs.

Long-throated flumes and broad-crested weirs are truly modern flow measurement structures. They are unique in the fact that they can be easily calibrated by computer analysis, which makes it possible to easily and quickly develop custom designs to satisfy unique site requirements and operational conditions. Structures also may be accurately calibrated using as-built dimensions. They are the most accurate open-channel flow measurement structures, having a rating uncertainty of ±2% or lower, which surpasses the accuracy of traditional short-throated, lab-calibrated devices like the Parshall flume.

They also have the lowest head loss requirement of any critical-flow device, and are scalable for use in the smallest drainage, seepage, and on-farm applications or in the largest main stem canals. All of these characteristics make these structures extremely adaptable for installation into existing canal systems.

Water savings due to improved flow measurement can be estimated by assuming that when water is measured inaccurately, or not at all, the water loss approximately matches the measurement error. Inaccurate measurements probably have an uncertainty on the order of ±15% or more, while properly designed and constructed long-throated flumes have an uncertainty of about ±2%. WinFlume has been distributed to at least 2,000 users worldwide, and has been used to design or calibrate at least 20,000 flumes and weirs.

- ***Flow Measurement at Canal Radial Gates –*** Mr. Wahl has recently been working again with the Agricultural Research Service to develop improved methods for calibrating canal radial gates for use as flow measurement devices.

- ***Workshops on Modern Methods for Canal Operations and Control*** - Mr. Wahl teaches modules on water measurement methods and local control algorithms applicable to check structures and turnout gates. He has developed a PIDSim computer program, which simulates the performance of a gate controller using a PID algorithm to regulate an upstream or downstream water level or turnout discharge.

- ***Coanda-Effect Screens:*** A serious problem for many irrigation systems is the removal of fish and debris from diverted waters. When flows cannot be adequately screened, water waste often results, due to clogging of conveyance channels, sprinkler systems, and flow measurement devices. When irrigation diversions threaten fisheries, a lack of effective fish screening can cause regulators to limit irrigator's use of water, causing the loss of a valuable water resource that cannot otherwise be put to beneficial use. For many years, Coanda-effect screens have been a promising screening technology that addresses many of these problems, but their application has been relatively limited due to a lack of adequate design information and operational experience.

  Mr. Wahl conducted a multi-year research effort that tested prototype screen structures and samples of screen materials with a variety of properties. He then developed a numerical model for predicting the flow profile across and through a Coanda-effect screen. This work will improve the reliability of water diversions and irrigation delivery and application systems, thereby increasing the utility of available water resources.

- ***Computing an Index to Base Flow:*** Mr. Wahl wrote BFI, a computer program to determine an index to annual base flow in small and medium sized unregulated watersheds. The program automates the previously tedious and subjective process of separating an annual streamflow hydrograph into its base flow and direct runoff components. The program was used to study decades-long streamflow records for the Beaver River near Guymon, Oklahoma and demonstrate a link between increased deep-well pumping for center-pivot irrigation systems in the 1960's and corresponding dramatic reductions in

annual volumes of base flow for the Beaver River. In 1995, Mr. Wahl updated the program and enhanced its capabilities to allow it to betuned and applied to a wider range of conditions.

- ***Support of Acoustic Doppler Velocimetry for Better Hydraulic Engineering and Water Conservation:*** Water conservation efforts often benefit from overall improvements in hydraulic engineering and water measurement technologies. The 1993 introduction of the acoustic Doppler velocimeter has revolutionized the profession's ability to precisely measure water velocities around prototype and model hydraulic structures, including irrigation intakes, screens, and water measurement devices. Mr. Wahl wrote the first version of the WinADV software. This program loaded data from the native ADV file format and allowed graphical review, data filtering, and post-processing to compute summary statistics. The program is now freely available to the public through the WRRL's Internet site and from SonTek and Nortek (ADV manufacturers).