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WinFlume Simplifies Open-Channel Flow Measurement

WinFlume software is used worldwide to design and calibrate long-throated flumes and broad-crested weirs

What Is The Problem?

To improve management of irrigation water delivery systems, accurate flow measurement is needed in main and secondary canals, laterals, and farm ditches. Flumes and weirs have always been practical, popular measurement devices, but adding new structures into existing systems can be difficult when limited hydraulic head is available, because structures must operate partially submerged. Traditional sharp-crested weirs and Parshall flumes are widely available in standard sizes, but they perform poorly in such conditions. Broad-crested weirs and long-throated flumes are more tolerant of submergence, but standardized designs with established rating tables have typically been less readily available.

What Is The Solution?

WinFlume is a Windows-based computer program that can be used to design new flow measurement structures and calibrate existing broad-crested weirs and long-throated flumes. With WinFlume, structures can be custom-designed and calibrated to meet site-specific needs. Structures calibrated with WinFlume do not need to be tested in a hydraulic laboratory, since the ratings produced by WinFlume rely on generalized hydraulic theory developed from previous laboratory testing. WinFlume has also been used to develop calibrations for several families of standardized long-throated flumes and broad-crested weirs.



To use WinFlume, a designer provides information about the site, the range of flows to be measured, and design requirements such as freeboard limits, and flow measurement accuracy objectives. The software guides the designer to a solution that meets all of the site conditions and design requirements. Typical benefits include:

- The structures designed with WinFlume are very adaptable and can be customized to meet unique site requirements.
- Long-throated flumes and broad-crested weirs tolerate more submergence (and thus require less head) than any other critical-flow measurement device.
- Weirs and flumes are stable, easy-to-build structures that operate without moving parts or electronics, so maintenance is minimal.
- WinFlume can develop calibrations for structures based on as-built dimensions.

Who Can Benefit?

Irrigation and drainage districts, water masters, water resource management agencies and farmers can all benefit from WinFlume. In some cases, spillways and other structures never specifically intended to measure water can be calibrated by WinFlume for use as flow measurement devices.

Where Have We Applied This Solution?

WinFlume and its predecessors have been used to design and calibrate tens of thousands of water measurement structures worldwide. Applications have ranged from the 3000 ft³/s Arizona Canal to tiny flumes that measure flows in alpine headwaters and individual farm furrows. Although many users build their own flumes, commercial off-the-shelf flumes are available in sizes appropriate for typical applications.



More Information

A book published in 2001, *Water Measurement with Flumes and Weirs*, provides detailed design and construction guidance. The book is available for purchase in softcover or free download in PDF format. The software, links to publications, and other supporting resources are available at http://www.usbr.gov/pmts/hydraulics_lab/winflume/. A hands-on workshop is presented annually by Reclamation to provide training in the use of WinFlume. Students can register at http://www.usbr.gov/pmts/hydraulics_lab/workshops/.

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Collaborators

WinFlume was originally developed with funding from Reclamation's Water Conservation Field Services Program, the USDA Agricultural Research Service, and the International Institute for Land Reclamation and Improvement (ILRI, now known as Alterra), headquartered in The Netherlands. Reclamation's Science & Technology Program has funded additional software improvements and development of the technology.

The findings and conclusions in this bulletin are those of the author and do not necessarily represent the views of Reclamation.