The reviewed and updated South African irrigation design and user manual

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South Africa is located in a water-constrained region; therefore, it is crucial that efforts are made to utilise water more efficiently. Through an initiative by the Water Research Commission (WRC), a report was issued in 2010 titled *Standards and Guidelines for Improved Efficiency of Irrigation Water Use from Dam Wall Release to Root Zone Application*.

The report recommends, among others, that information on improved water-use efficiency (WUE) be shared with everyone involved in the irrigation industry. This includes irrigation equipment suppliers and management services, as well as producers since they play a pivotal role in water management at farm level.

Until recently, the main sources of locally relevant information on the design and management of irrigation systems were the *Irrigation Design Manual* (*IDM*) *and the Irrigation Users' Manual* (*IUM*) originally published by the Agricultural Research Council (ARC) in 1996 and 2002, respectively. The two manuals were updated as recently as 2021 by a team of irrigation experts from the ARC and partners from across South Africa. The following sections present the highlights of the updates.

New chapters added

The updated *IDM* comprises 20 chapters of highly technical information, while the *IUM* contains 16 chapters of information relevant to irrigation system users.

New chapters added to the *IDM* include "Greenhouse Irrigation Systems" (Chapter 14), "Documentation and Drawings" (Chapter 18), "Feasibility Studies" (Chapter 19), and "Terminology, Conversion Tables, Design Norms, and an Overview of Design Software" (Chapter 20).

The new chapters added to the *IUM* are "Greenhouse Irrigation Systems" (Chapter 13), and "Terminology, Conversion Tables, Design Norms, and Overview of Scheduling Software" (Chapter 16).

The chapter/s on greenhouse irrigation systems is a valuable addition to the manuals. A greenhouse irrigation system design is based on the same principles as micro- and drip irrigation, with a few adaptations to facilitate more frequent and intensive irrigation strategies. However, the management requirements for these systems require more sophisticated equipment and application techniques.

Homing in on system efficiency

A significant addition to the chapter/s on system planning (Chapter 6) is the elaboration on irrigation system efficiency under the section on irrigation requirements. The assumption is that the maximum theoretical efficiency of any irrigation system should be 100%. Assumptions are then made for acceptable losses that can occur in any system, and the total losses are deducted from 100% to obtain the maximum recommended efficiency. The minimum acceptable value is based on the previous norms.

In the chapter/s about pipe hydraulics (Chapter 8), a section on the components of an irrigation system was added. This is important in the design of the irrigation system after the planning phase. In addition, two sections were added to this chapter where the on-farm and in-field parts of an irrigation system are discussed.

The purpose of the on-farm water supply system is to convey the water from the source to the in-field part in the most economical and energy-efficient way. This includes rising main pipelines, gravity pipelines and economic pipe sizing.

The purpose of the in-field part is to distribute water uniformly across the field to satisfy the demand of the crop. The focus of this section is on the selection of emitters and their pressure-discharge relationships, the design of steady-uneven systems and the hydraulic gradient thereof, pressure variation in systems, as well as pipe sizing using the Jensen and Fratini factor. A table with the allowable pressure variation in different irrigation systems is also included.

A key improvement

One of the key improvements to the manuals includes a complete section on variable speed drives (VSDs). A VSD is a device that facilitates variation of the speed of a normal fixed-speed motor, ultimately enabling accurate control of the motor speed over a broad range.

The two manuals are valuable and comprehensive reference tools for the irrigation system designer as well as the irrigation system user. The manuals were reviewed and updated by a team of irrigation experts from the ARC as well as private companies, under guidance of the WRC.

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