EXECUTIVE SUMMARY

SAPWAT3, in its present form, is the product of WRC Project K5/1578 as well as 20 years of research related to irrigation, agricultural engineering, soil, crop, agricultural meteorology and agricultural economics funded by the Water Research Commission. Development time and the cost involved accentuate the need to disseminate knowledge of SAPWAT3 to as wide a scope of potential users as possible, as well as to provide the necessary back-up, otherwise the danger exists that SAPWAT3 will not be used to its fullest potential and development time and funding would have been wasted. The next program version will include the expansion of functionality and correction of errors that have been identified, some of which is included in this report.

The development of models that could be used as tools in the estimation of irrigation water requirements have all been faced with varying degrees of the problem of credibility. The Green Book and its update used A-pan based crop factors. Irrigation estimates went well as long as the A-pan evaporation was calibrated for the specific area. In the energy-balance and mass-transfer approaches the potential for shorter-term verification of crop coefficient became more of an option, although credibility problems were still present.

The one problem that could not be solved with the development of estimation approaches is that of correct crop coefficients, which are usually costly to determine through mainly lysimeters testing. Some crops, have been well researched while other have been less well researched. Unexpected deviations of estimated irrigation from measured requirements are found from time to time, even in well researched crops. The result is that crop irrigation requirements need to be continuously verified and the relevant crop coefficients adapted where required. Furthermore, it is acknowledged that problems are found with the fitting of the FAO four-stage crop curve to perennial tree and vine crops. The problem of the costly verifying crop coefficients used for irrigation estimate output could be solved by the inclusion of a subroutine in an irrigation estimation program that compares the daily estimated program output with actual, measured data from a field. Such a subroutine has now been included in SAPWAT3, it seems to work, but it still needs extensive field testing.

The acceptance of SAPWAT by more than 300 users in 13 countries shows that the program has qualities that make it acceptable to potential users. While a lot of speculation about the reasons for this phenomenon has been going on for quite a while, the real reasons for this widespread adoption has not been field-tested. The characteristics that make SAPWAT acceptable as an innovation, as well as the potential for adoption of SAPWAT3 have been researched.

The theory of diffusion of innovations and the acceptance thereof seeks to explain the spread of new ideas through a social system through communication over time. Members of a community go through five stages of adoption. During its communication, an idea is rarely evaluated from a scientific standpoint. Instead, subjective perceptions of the innovation influence its diffusion, a process that happens over time. Finally, social systems determine diffusion; the system's norms on diffusion, roles of opinion leaders, types of innovation decisions, as well as innovation consequences.

More recent research into the adoption of innovations has been on ways that are characteristic of an innovation influence potential acceptance. One such approach is the technology accep

tance model (TAM), which seems to be particularly suitable for testing technological innovations that can make office and related work easier. It is mainly based on two factors that are theorized to be fundamental determinants of system use and are therefore predictors of adoption. These characteristics are the perceived usefulness of the innovation as well as the perceived ease of use. TAM proposes that perceived ease of use and perceived usefulness of technology are predictors of user attitude towards the use of such technology, subsequent behavioural intentions and actual usage and can therefore predict user acceptance of a technology before the users get heavily involved in it, and thus is a cost-effective tool in screening potential systems that could possibly be used.

The main objectives of this project were to verify program outputs, to demonstrate SAPWAT3 and its use to potential users and to determine the adoption potential of SAPWAT3. In this process, the characteristics of SAPWAT which led to its large scale adoption, was also researched.

For the estimation of irrigation requirements with a program such as SAPWAT3 that is not a crop growth model, but a model that imitates crop growth and development on a fairly simple basis, it is necessary that crop growth and development be described as accurately as possible. The one input that remains fairly rough and ready, is the description of crop growth and development through the four stage FAO crop growth curve and its related crop coefficients.

The next version of SAPWAT3 will contain a module described in this report which will enable researchers to improve the accuracy of the FAO four stage crop growth stages and the related crop coefficients.

SAPWAT is used by a variety of professional groups, mostly used for designing and planning of irrigation systems, and to a lesser extent for planning and management of irrigation water reticulation systems. It is mostly used on a monthly basis, which is in line with the expected use of such a tool. Reasons for its popularity are mainly its ease of use, the quick results and good crop irrigation requirement output, its user-friendliness, the credibility of its results, as well as the fact that it is scientifically based.

Evaluating SAPWAT against the characteristics that make an innovation acceptable, SAPWAT scored much better than average in the fields of relative advantage, observability and compatibility and better than average on complexity and trialability. Comparing this to the TAM approach, there was a marked better than average score for usefulness and a better than average score for ease of use, which is an accurate reflection of the results of the Rogers scores.

The acceptability of SAPWAT3 was tested after about three months' use through the TAM approach. SAPWAT3 is used by most of the more experienced and higher trained people that have to do with irrigation water planning, management and use. Of these users, the designers and planners of irrigation systems are the biggest group.

Slightly more than half of the respondents are of opinion that the Water Act imposes necessary regulations to irrigation water users, even though there is no clear opinion on whether or not irrigation scheduling could be effectively applied only if farmers have full control of the water supply.

Most SAPWAT3 users are familiar with research done by the WRC and are also users of the knowledge generated. The generated knowledge is mostly used for planning and designing of systems, research and for irrigation water management.

The original SAPWAT was built as simply as possible with the aim of involving all sectors of the irrigation fraternity as well as all levels of training in its use. SAPWAT3 has more functionality and is therefore less simple to use than SAPWAT, but at the same time giving users more flexibility of application. It is designed as a planning tool, and the expected major users were found to be irrigation water use planners, irrigation water use managers and designers of irrigation systems.

The credibility of SAPWAT3 output is relatively high and all users use it for assessing water resource demand and supply in some way. WUA managers tend to concentrate on water resource assessment and demand management while consultants use SAPWAT3 more for the on-farm part of irrigation planning and management as well as for larger scale water resource demand and supply assessment. Lecturers use SAPWAT on a very wide scope of application, whereas scheduling services tend to concentrate on the on-farm water management part. Designers and planners concentrate on the on-farm irrigation requirement planning and management, and they also see the use of SAPWAT3 as leading to increased productivity.

The importance of a user manual for SAPWAT3 is high, and though the flexibility of SAPWAT3 was highly acclaimed by just about all groups, a disappointing number of user groups have indicated that SAPWAT3 is difficult to use.
SAPWAT3 users prefer back-up support by the research team with visits and e-mail support being the most important. Most respondents are satisfied with the present communication and support by the research team. SAPWAT3 users see lack of available time as the biggest barrier to learning to use the program or, alternatively, to use the program as an analysing tool.