EXECUTIVE SUMMARY

In August 1995, the Programme Development and Management Committee of the Kruger National Park Rivers Research Programme (KNPRRP) recommended to the Water Research Commission (WRC) that an information synthesis and status report of the Programme be undertaken. The main purpose of the report is to inform all the interested parties (including researchers, managers, and funding agencies) of the achievements and capabilities of the Programme; to assess these in relation to the stated goals and tasks of the "Second Phase: Programme description"; and to identify gaps and priorities for further work.

The structure of the Programme is based on a decision support system which is summarised in figure 1. From this it can be seen that the research and information gathering has been carefully targeted to provide essential information to assist in management decision making.

The aims of this report are as follows:

A. To examine and summarise the information collected within the Programme to date.
B. To relate the resulting synthesis to the objectives of the KNPRRP.
C. To draw conclusions as to how far the objectives of the first phase have been met.
D. To make recommendations of outstanding priority objectives that need to be addressed in the future.
E. To assess how far the information collected within the Programme can contribute to the setting of interim instream flow requirements at the Instream Flow Requirements workshop on the Sabie River, planned for 1996.

The synthesis is primarily based on the KNPRRP Data Catalogue (Biggs *et al*, 1995), which is the most comprehensive reference work for the rivers of the Kruger National Park. The data catalogue includes references for all the projects that have contributed to the knowledge, information and methods required to achieve the goals of the KNPRRP, including those which were begun before the Programme started, or those which were developed outside the Programme. We acknowledge the very important contributions which projects outside the Programme have made to an understanding of the rivers of the KNPRRP, and this synthesis is in no way an attempt to take credit for work that has not been done within the Programme.

The purpose of the synthesis is to allow members of the programme and stake-holders to see clearly what work has been done and how it relates to the aims of the programme. The synthesis does not aim to summarise in detail the information that has been gathered on the rivers of the KNP, but indicates what work has been done, at what level of detail, and how far the aims of the programme have been achieved.

The main part of the report (sections 2.2.1 to 2.2.30) is organised as short reviews of each component of the Programme (headings are listed on the contents page), each one organised under the following sub-headings: Purpose; Tasks; Progress; Evaluation; List of main products; Other relevant documents and datasets.

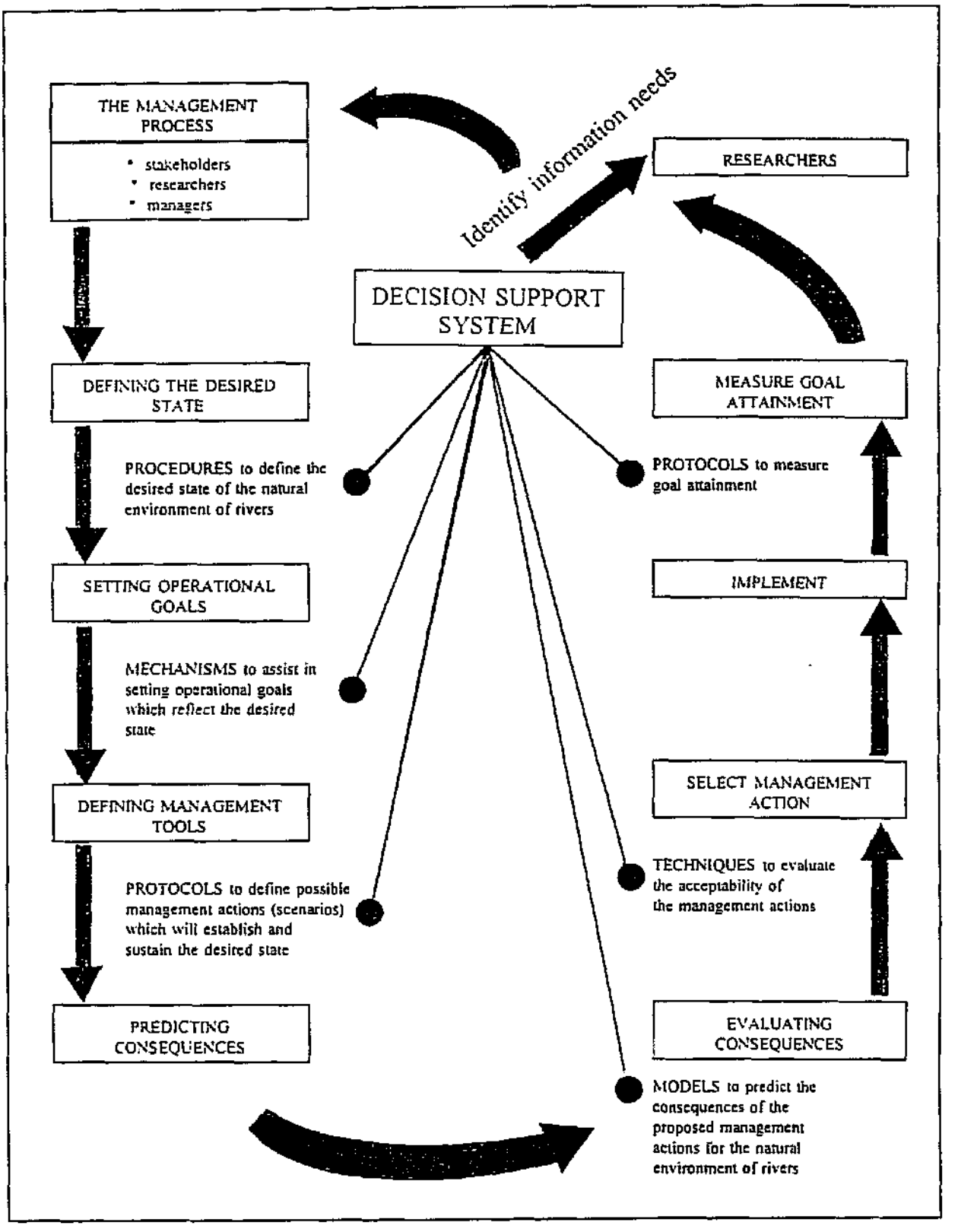

Figure 1. Elements of the Decision Support System and their relationship to the management process. (From the Second Phase Programme Description).

CONCLUSIONS AND RECOMMENDATIONS

The final section of the report summarises the achievements of the programme in relation to its goals and tasks, lists the main products and expertise that has emerged, and identifies the remaining gaps and priorities for further work.

3.1 ACHIEVEMENTS IN RELATION TO THE SUBSIDIARY GOALS OF THE PROGRAMME

Each of the subsidiary goals is quoted below, and a brief summary of the Programme's achievements is appended:

a. To develop, refine and maintain Decision Support systems (DSS) for responding to information needs.
The DSS has been developed, and is a dynamic process which continues to guide and refine the activities of the Programme. Modelling components are still being developed.

b. To establish an interdisciplinary team with common principles, goals and commitment to design, guide and evaluate the programme thereby ensuring it achieves its primary goals.
The Programme team has become a close-knit and effective unit, and has developed considerable inter-disciplinary skills.

c. To develop the understanding of the functioning of the natural environment of rivers required for predicting their responses to changing conditions.
The current project to link abiotic and biotic models of the river functioning will be a major contribution to our understanding and predictive ability.

d. Develop methods for assessing the asset value of the natural environment of rivers and for evaluating the acceptability of predicted changes in asset value.
This is an area in which the Programme has not yet made significant progress, and should be a focus of further effort.

e. Implement and manage a cost-effective research programme.
By linking with other research outside the Programme's direct funding, a great deal of knowledge and information has been gained from a relatively modest research budget. This has sometimes meant that the research sequence and focus have not exactly followed the Programme plan.

f. Adapt the methodologies developed for management of the natural environment of rivers for application to rivers elsewhere.
There has yet to be a concerted effort to extrapolate from the Kruger national Park (KNP) rivers (and the Sabie River in particular) to other rivers in the country, but the partnership between the Instream Flow Requirements (IFR) process and the Programme, which will culminate later in 1996 in the Sabie River IFR workshop, will be a major contribution to this goal.

Figure 2, based on the design of the DSS in the second phase Programme description (Breen *et al*, 1994) summarises the progress that has so far been made towards achieving the main tasks of the Programme.

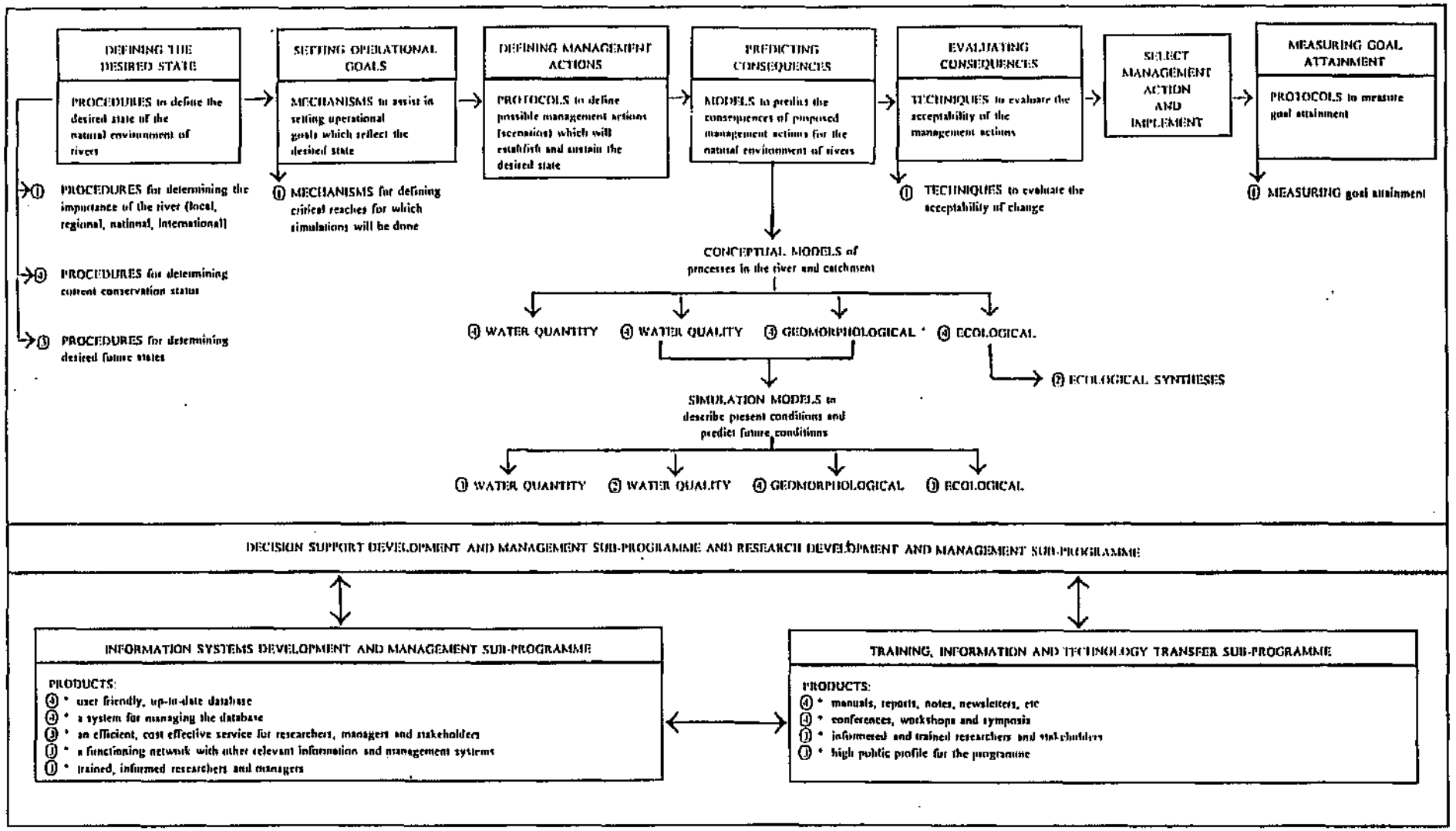

Figure 2: Planned elements of the decision support system (from the second phase: Programme Description), summarising the progress that has been made to date. Numbers beside each element indicate the following:
1 = not done; 2 = some work done; 3 = work in progress; 4 = substantial work completed

3.3 CAPABILITIES OF THE PROGRAMME BY THE END OF PHASE 2 (DECEMBER 1996)

This section summarises the products and expertise that has been, or will have been developed by the end of the current phase. These achievements are once again expressed in relation to the specific goals and tasks of the Programme, but should also be seen in the context of the main holistic achievement of the Programme: The development of a multi-disciplinary, multi-institutional research management team which has made a substantial contribution to the understanding of fundamental environmental processes in rivers.

- Existing information on the rivers of the KNP has been collated and can now be accessed by all potential users.
- A decision support system has been developed which can provide users with an information pathway to assist in management decisions, or in explaining and motivating environmental water use.
- The desired state, or goals, for KNP rivers will be clearly defined in terms that can be implemented.
- Catchment studies have been completed for all the main rivers, describing land-use, present development of water use, probable future demand, and possible scenarios for supply.
- Detailed inventories and the status of the following components of the Sabie River are available:
  - Riparian vegetation
  - Fish
  - Invertebrates
  - Large aquatic animals
  - Geomorphological units/sediment transport
  - Water quality
  - Hydrology
  - Hydraulics
- A predictive capability will be available to link the effects of changing flows on all of the above, at differing levels of resolution.
- First estimates of environmental water requirements for all the major rivers are available.
- There will be a refined assessment of the environmental flow requirements of the Sabie River, with motivations, following the Sabie IFR workshop in September 1996.

3.4 PRIORITIES FOR FURTHER WORK

Because of the inevitable constraints of finances and resources, the Programme has concentrated on a small number of key projects, the synthesis of existing information, and the development of a coherent research management framework, rather than attempting all the tasks that are necessary for the comprehensive achievement of the goals. There has also been a reliance on research and monitoring activities funded and motivated outside the Programme, to augment the internal activities. For these reasons, there are still considerable gaps in the structure of the DSS, which need to be filled to maximise its potential as a toolbox for river managers. These are summarised briefly below:

- Although the information base and understanding of the Sabie River is probably the most comprehensive for any South african river, no structured research programme has

yet been applied to the other KNP rivers. Valuable research has been done on other rivers (eg water quality in the Olifants River), but is mostly individual projects carried out for specific purposes. One of the results is that it is difficult to assess how far the information and knowledge on the Sabie can be extrapolated to other rivers.

- Even the research on the Sabie has mostly been confined to reaches within the KNP. This has been to avoid, as far as possible, the confounding variables of anthropogenic disturbance, but means that there is much less environmental information available for the upper and middle reaches of the river, than for the lower reaches in the Park.
- No work has yet been done on the macro links between the riverine systems and the adjacent terrestrial ecosystems. The dependence of most of the larger animals on the rivers is obvious, but needs to be quantified and made explicit, as part of the motivation for the maintenance of the rivers as major resources for the Park as a whole.
- Most of the work of the Programme has concentrated on the natural environments of the KNP rivers, since this was the original terms of reference. However, it has become increasingly important to assess the direct use of the rivers by the local people, and to direct research and management to the long-term maintenance of the natural resource values of the rivers. (Direct use includes all activities involving contact with the river and riparian zone, including fishing, water collection, laundry, recreation, reed-cutting etc; but excluding pumped extraction or storage for domestic, industrial or irrigation use)
- The Programme has concentrated more on water quantity requirements than on water quality. This has largely been a consequence of the Sabie focus of the Programme, where reduced flows are presently a greater threat than impacts on water quality. However, there are major water quality problems in the Olifants and Crocodile Rivers in particular. At present only rudimentary methods for the assessment of environmental water quality requirements are available, and methods similar to those for IFR assessment are necessary.
- Very little work has been done to quantify the value of maintaining the rivers in a good environmental state. This resource economics approach will become a vital part of the motivation for the conservation of rivers, and the obvious value of the KNP rivers in sustaining the Kruger National Park as the country's leading tourist destination has yet to be assessed.
- The implementation of the findings and products of the Programme is perhaps the major priority for further work. The main project for 1996 is the integration of biotic and abiotic knowledge of the Programme into models that will predict the effects of changing flow regimes. Once this has been completed, the Programme will have a suite of powerful management tools for assessing environmental impacts on rivers, and for recommending future management. The implementation of these tools will require that they be understood and supported by a variety of water users, researchers, and managers.