DEPARTMENT OF WATER AFFAIRS AND FORESTRY

CHIEF DIRECTORATE: SCIENTIFIC SERVICES

PROJECT STATUS REPORT

MONITORING AND ASSESSMENT INFORMATION SYSTEMS
MAIS Phase 3

For Project Team Discussion
October 2001

MAIS Project Status Report

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1 INTRODUCTION

1.1 Purpose of this document

This document is an addition to the planned documents for Phase 3 of the MAIS project. It has been submitted in light of planned changes in project personnel for the purposes of:

- recording the present status of the project,
- submitting recommendations for ways to proceed, and
- presenting the project team's conceptual thinking with regard to issues related to governance of water resources monitoring and assessment activities in DWAF.

1.2 Background to the project

The stated purpose of MAIS is to address requirements of the National Water Act (Act 36 of 1998) (NWA), specifically

- Section 137 - requires the development of monitoring systems,
- Section 138 - requires establishment of mechanisms and procedures to co-ordinate the monitoring of water resources, and
- Section 139 - requires development of national information systems regarding water resources.

The goal of the information and monitoring systems is to deliver water related information, which is effectively used in decision making by water management institutions as established by the NWA.

The current phase of the project was preceded by two earlier phases which surveyed the water resources information user community to ascertain the situation, then developed a strategy to address the issues raised. The MAIS strategy was approved by DWAF's Water Resources Management Committee in April 2000 and further elaborated on in the inception report for the current Phase 3 project. This strategy has been developed under the guiding principles that MAIS should:

- be focused on cost-effective delivery of the information required to execute DWAF's water resources management functions,
  - provide its users with "a single version of the truth," for example, the geographic location of a monitoring site, the observed data for the site, *etc*., and
  - minimise duplication of effort and infrastructure for acquiring, storing and managing data
- promote the development and enforcement of a consistent IT platform,
- ensure knowledgeable clients, and
- encourage strong corporate governance of monitoring and assessment.

Governance is considered a critical element in MAIS because the nature of integrated assessment of water resources will require substantial coordination within separate groups at DWAF and between DWAF and a large number of external organisations. Governance issues cover a wide variety of topics, from enforcement of the use of naming conventions and IT platforms, through intergovernmental liaison, funding, and staffing.

The major objective of the MAIS strategy is to enhance the flow of information - from measurement activities, through analysis and incorporation of diverse data types into integrated assessments – to ensure effective use of information in water resources decision making. The major components of this analysis were the assessment of information required for water resources decision making and the proposal of a MAIS structure to achieve enhanced information flow.

Phase 3 was conceived in five stages, namely

1. Inception – planning and mobilisation
2. Initial Investigation – information gathering and analysis to select and plan implementation of the subsequent stage, the pilot study
3. Develop a monitoring and assessment programme using a pilot study – use a process led by information needs for water resources management for the development
4. Generalise the process developed in the previous stage so that it can be applied in all monitoring and assessment designs
5. Plan the implementation of the application of the generic process to all monitoring and assessment designs.

The Inception stage was completed in March 2001 with the submission of an Inception Report to the project sponsor, Chief Director: Scientific Services. The Initial Investigation has been completed with the exception of planning for the pilot study. A Task Team composed of representatives from DWAF Directorates involved in monitoring and assessment was established during the Initial Investigation. The Task Team commented on a draft Initial Investigation report, which was subsequently submitted to the project sponsor. A recommendation to use information requirements for Reserve assessments as the pilot study was also submitted to the project sponsor.

1.2.1 Information flow model

The model of information flow developed during the Inception and Initial Investigation stages contained three components, namely, Data Acquisition, Data Storage and Management, and Information Generation and Dissemination. The model, with examples of the components, is shown in **Figure 1**. The rows in the graphic represent the generic components of the information system, Data Acquisition, Data Storage and Management, and the Information Products that result from Information Generation and Dissemination. The row at the bottom, labelled Complex Knowledge Products, represents the documents, reports, decisions, recommendations, *etc* that are used in conducting the business of water resources management. Complex knowledge products use output from the information system as input into their assessment and decision-making processes. Although not shown in the graphic, design of the data acquisition activities would be determined by the requirements of the information products.

An important aspect of the model is the identification of the output from MAIS – the information products – as distinguished from further knowledge addition by domain specialists to create the complex knowledge products. Although the model clearly demarcates the boundary of the information system, its location in practice would be negotiated with clients to agree on specifications for the information system products.

Data Acquisition
Data Storage & Management
Information Products
Complex Knowledge Products
Hydrological Water Quality, Geo-hydrology, Environmental
Water use, conservation
Legislation, policy, regulations
Industrial development Land development objectives, etc
Infrastructure: Size, type, location, etc
Population, location
HIS, NGDB, WMS, WARMS
?
?
Resource status
Daily flow
License Compliance
Regulatory information, funding sources
Pricing, subsidies
Water demand, Water services
Scenarios, projections?
State of the Water Resource
Compliance reports
National Water Resources Strategy
State of water use
Allocation plans
Catchment management
Decision Support for Operations

The model has been accepted by most of those with whom the project team interacted, although some concerns were raised. Those concerns were primarily related to two areas, namely,

1. lack of a systematic approach within DWAF to identifying its business processes, and
2. lack of trust in the capability to develop and implement information systems that produce appropriate information products.

These valid concerns indicate the ongoing need for extensive interaction between the information system and its clients to encourage, facilitate, and support the identification of business processes and resultant information needs and to develop and execute service level agreements with clients that define specifications for information products. Energetic auditing of the range of water resources management activities with highly visible communication of results will also improve the probability of success.

1.2.2 Identification of Complex Knowledge Products

Considerable effort was expended in identifying complex knowledge products currently used in the Department and the information products that would support them. The first attempts at identification were compiled into a table structured in the functional areas suggested by the Restructuring and Transformation Project and included in the Initial Investigation Report.

This effort is intended as an ongoing, dynamic perspective of the current business processes of water resources management created with interactions among essential stakeholders. As that perspective changes with changing external and internal conditions, the requirements for business processes and resultant information products will change. The concepts presented in the compiled list of products should serve as the basis for discussion and debate, within the MAIS project team and between MAIS and its clients.

1.2.3 Communication and capacity building

In addition to the technical aspects of monitoring and assessment information system development, a communication strategy for the project and for the completed information system has been developed. Substantial support from the Directorate: Communications has been received and interaction between that directorate and MAIS should continue.

Adequate technical capacity has been identified as a major risk in implementing a more extensive information system. Attempts have been made to include DWAF staff in MAIS conceptual development. The most successful efforts have been in the establishment of the Task Team, with representatives from a number of DWAF directorates. The purpose of the team is to review project activities and to communicate the concepts broadly within their specific areas. Secondment of staff for more intensive interaction has been unsuccessful to date. Additional efforts are planned to incorporate specific domain expertise and monitoring design competence in the pilot study phase (see section 1.2 5 below).

1.2.4 Funding

While funding has been recognised as a major constraint from the inception of the project, no funds from external sources have been secured. Estimates of budget requirements for the Medium Term Expenditure Framework (MTEF) for implementation of the design approach for the next five years were established and submitted to the Chief Director: Scientific Services. MAIS budget for the financial year

2001/2 is R800 000. Until the end of September 2001, R 355 000 had been spent. This represents an under-expenditure of approximately R 155 000 which was a result of the loss of one project member early in the financial year, and the lack of availability of some consultants on the project.

1.2.5 Pilot study

Information products for Reserve assessment studies were selected as the prime choice for a pilot study to develop the process for designs of monitoring and assessment systems under the MAIS model. The proposal to use this example as the pilot study has been submitted to the project sponsor.

Reserve assessments are procedures that have been established since enactment of the NWA and are, therefore, not yet mature, although relatively stable. No attempts have been made to complete a systematic monitoring and assessment design to ensure adequate information for the assessments and none are planned. Reserve assessments are required by the NWA, so constitute a specific business process in terms of water resource management. Reserve assessments will be completed for each catchment, with the highest priorities those water stressed catchments where compulsory licensing will be required. Each assessment is currently treated as a specialist study, with data acquisition, storage and management, and information generation designed and executed within each project.

The project team considered Reserve assessments as the first choice for a pilot study because information production would be greatly enhanced by the provision of a design framework for data acquisition and with greater consistency in data storage and management and in information generation. In addition, more general access to the information products by other information users was considered an important benefit in improving the cost efficiency of information production. If the data collected during those studies were more generally accessible, it would eliminate duplication by others who would otherwise acquire the same data. Expertise and resources exist outside the MAIS project team in DWAF's RDM office, Reserve assessments teams, and Water Research Commission projects and can contribute to the effort, if properly coordinated. In addition, these studies represent an excellent opportunity to integrate data acquisition activities related to chemical, biological, and physical components of the resource, including habitat characteristics together with water quantity components in both surface and ground water. Therefore, all the existing directorates with data acquisition responsibilities would have a role and coordination mechanisms could be developed.

2 RECOMMENDATIONS FOR FUTURE DIRECTIONS

2.1 Changes in the project team

The MAIS project team will change at the end of October 2001, with the resignation of DWAF's Project Manager, Ms Alison Howman, and one of the project consultants, Dr Jane Harris. Another project team member, Dr Dirk Grobler, will be unavailable during November and December 2001.

2.2 Recommendations for continuity

The project team recommends the actions described below to continue MAIS.

Appoint an appropriate project manager within DWAF to champion and lead the current MAIS project.

An appropriate person would be familiar with the DWAF organisation, knowledgeable about water monitoring issues in general and DWAF conditions specifically; demonstrate an understanding of monitoring issues for a range of components such as flow, chemical constituents, biological and/or habitat elements, ground water, estuaries, or other related components as well as information technology, statistical analysis, and report production.

Implement the pilot study for Reserve assessments recommended during the MAIS Initial Investigation

The pilot study would offer an opportunity to identify coordination mechanisms that can be applied during the pilot study and expanded for other coordination requirements

Continue collaboration with the restructuring and transformation initiative

Organisational structure has been a recurring issue throughout the MAIS investigation. The parallel efforts to revise the organisational structure of the water resources activities within DWAF represent an opportunity to inform that process and potentially influence its final outcome. Interaction between the two initiatives has occurred in the past and should continue.

The advantages of following these recommendations would be to continue the efforts that are essential to improving information flow for water resources management by maintaining the momentum developed by this project team. Two project members will be available from January 2002 and will provide continuity for the pilot study. The difficulty in the timely identification of a champion with appropriate perspective and available capacity is seen as a major obstacle to the proposed continuation. It would probably be necessary to transfer some of the current duties of the champion, since substantial time would be required for MAIS, inferring that sufficient additional capacity exists for that transfer.

2.3 Alternative courses of action

If an appropriate champion for MAIS cannot be found, it is strongly suggested that efforts continue to improve coordination of existing monitoring and assessment activities within DWAF, postponing implementation of the pilot study until a more appropriate time.

The primary focus of monitoring and assessment should be moved from the current emphasis on data acquisition to one of information generation. As a minimum, mechanisms should be created to provide liaison with information clients, the complex knowledge products required for the business of water resources management, and provide procedures to modify existing data acquisition activities in response to client needs. A strong commitment to meeting client needs for information will assist in developing whatever coordination is necessary among data acquistion efforts, so direct intervention of data acquisition activities could be addressed after the identification of client needs.

3 CONCEPTS RELATED TO GOVERNANCE OF MONITORING AND ASSESSMENT ACTIVITIES IN DWAF

As noted in Section 1.2, governance is considered a critical element for effective information flow. This section records the MAIS Project Team's:

- Underlying assumptions for a desirable future state in terms of information flow in DWAF,
- The requirements related to governance we consider essential to be addressed, and
- Functions related to information that must be performed within any organisational structure.

3.1 Underlying assumptions

The project team developed an understanding of the existing conditions with respect to monitoring and assessment in DWAF and proposes the following assumptions for the scenario that will exist in the future – a realistic "To Be" state toward which institutional conditions should move.

1. Data acquisition will be conducted to a larger extent by water management institutions other than DWAF's central organisation. Some data acquisition activities will continue within DWAF, for example, specialist engineering surveys, chemical, biological, river health surveys, etc including special studies on project-level scale for incidents or investigations. The capacity to design and operate those activities must, therefore, be maintained. The coordination of DWAF's monitoring activities and those of other water management institutions will be a critical success factor determining the effectiveness of monitoring and assessment activities.
2. DWAF data acquisition activities will share a common IT infrastructure. The demand for consistent access and external developments, such as SITA, will eventually result in sufficient coordination to develop a common platform for data storage. The process can be expedited and improved by an early proactive effort to develop and enforce standards within all DWAF's data acquisition activities.
3. DWAF will maintain a central logistics/ integrative group that manages and facilitates relationships between DWAF and all data acquisition activities, internal and external. The functions of the group would include, for example establishing service level agreements, conducting quality control activities, auditing, technical support, and training. This group will also maintain central facilities as appropriate, for example chemical analysis facilities, GIS storage and map publication, data analysis, publications, and reporting.

   It should be noted, however, that the content, audience identification, and purpose of all publications are the responsibility of the business processes related to water resource management, not MAIS. Therefore, all information dissemination, even though published through a mechanism like MAIS, will be authorised through other functions. This implies that there may be routine annual reports, for example, on the status of water resources in South Africa, that are produced by MAIS, but the accountability for the content, the determination of its clients, the evaluation of the suitability of the content and its accuracy, etc will be done by the group whose business requires the information dissemination.

3.2 Governance requirements

During the information gathering phases of MAIS, governance was identified as a major constraint to improving information flow. The primary ways in which inappropriate governance is expressed are listed below.

1. Duplication of effort, infrastructure, and human resources in analysing data to produce essentially the same information. An obvious example is the number of catchment situation assessment activities that produce reports aimed at different audiences and serving different decision-making procedures, but requiring very similar input. These assessments are done by Directorates: Project Planning, Water Quality Management, Water Utilisation, and Water Resources Planning, in addition to the RDM Office and IWQS. Additional development for new analysis procedures are currently being undertaken for Strategic Environmental Assessment studies, for Catchment Management Agency use in a project sponsored by DANCED, and by Water Quality Management for Catchment Assessment Studies.

   Duplication is also apparent in the data storage and management component where Directorates: Geo-hydrology, Geomatics, and Hydrology and IWQS are investigating software package purchase or development to store and access data acquisition results.

2. Accountability for information reporting is not clearly visible, therefore, there is:
   2.1 Insufficient reporting which results in decisions based on inaccurate or insufficient information and affects the quality with which DWAF addresses its prime function – water resources management.
   2.2 Repeated analysis of data because there is no "official" analysis that is trusted by information users. Trust must be built by interacting with clients and demonstrating a willingness to modify activities to meet their needs. A possible option to develop more support quickly would be to use the analysis currently conducted by consultants or clients as the official analysis and eliminate other analysis. A single "official" version of interpreted data would facilitate defence of legal challenges by presenting a "version of the truth" accepted by a wider audience. The repeated analysis is more prevalent in analysis of flow records to create "naturalised" records.
   2.3 Generic information products, such as the status of water resources in South Africa or the nature and extent of resource monitoring, are not currently easily accessible, since much of the analysis effort is devoted to repeating situation assessments.

3.3 Functions required for effective information management

Table 1 contains the list of functions, compiled with input from the MAIS Task Team, which were identified as requirements for effective information management of water resources. These functions must be fulfilled in at least one organisational structure, with substantial coordination among all the structures, since some of the functions will undoubtedly overlap, given the selection of any particular structure. The functions are presently performed to some extent in DWAF, but are not systematically coordinated between existing directorates. The functions listed under the "Information Product Management" category are perhaps least well developed.

The references in the table to "integrative" and "specialised" are to the requirements for input to the function. Integrative functions are those that require input or analysis from a number of specialist areas to perform the function adequately. Specialist

functions are those that require in-depth knowledge of a particular technical area in order to perform the function. The existence of integrative functions does NOT imply that the need for specialist input would decrease, it rather implies that the specialists input must be coordinated.

Communication channels must be established and maintained between the specialists through some organisational structures. This can be accomplished within the existing Directorates, although additional committees or other mechanisms must be empowered with authority to accomplish the specific integrative activities. The major areas where integrative mechanisms will be essential are:

- Management, particularly in policy and strategy development;
- Communication;
- Client liaison;
- Generation of integrative assessments;
- Systems management;
- Information systems coordination; and
- Operations management of data acquisition activities.

The MAIS project team compiled a suggested organisational structure and assigned functions to the groups, acknowledging that the final decisions regarding the structure should be done in a consultative process, accounting for a wide range of existing conditions and current realities and ensuring the widest acceptance. The suggested structure is available on the Web site.

Table 1 Functions and sub-functions required for MAIS, using the proposed model

INFORMATION PRODUCT MANAGEMENT	
Management	***Integrative***
- MAIS Policy and strategy development	
- Planning	
- Supervision	
- Budgeting	
Coordination/Communication	***Integrative***
- Information source for all data acquisition efforts	
internal efforts; coordinating DWAF data acquisition activities in all programmes and in all locations	
external efforts; liaison with CMAs, central and Provincial government, influencing other data acquisition	
- Enforce specifications for data acquistion; "enforce" includes communication, support, training, and other facilitative actions with punitive measures forming a second tier of enforcement mechanisms	
- Enforce guidelines, procedures, standards and methods for data acquisition, data storage and management	
- Meet requirements of Access to Information Act	
- Training (for all areas)	
Client Liaison	***Integrative***
- Information dissemination to internal and external clients	
- Identification and negotiation with clients to define Information Products	
- Publications	
- User support (for all areas)	
Information Generation	
- Applications design	Specialised
Modelling	
Spatial analysis	
Apply design principles and standards in software development	

Table 1 Functions and sub-functions required for MAIS, using the proposed model

- Measurement network design	Specialised
Design	
Update instrumentation	
Communications systems	
- Generate integrated assessments	Integrative
Conduct standardised assessments	
Conduct special assessments	

DATA STORAGE AND MANAGEMENT	
Systems management, enhancement and quality assurance	***Integrative***
- Database administration	
- Software enhancement	
- Integration support	
Systems development	***Specialised***
- Project based{Need for development established by Policy & Strategy}	
Information systems coordination	***Integrative***
- Coordination with other systems	
DWAF	
CMAs	
Other government departments	
- Liaison with users (primarily through established user groups)	

DATA ACQUISITION	
Programme Implementation	***Specialised***
- Establish new data acquisition programmes	
- Instrumentation installation	
- Construction	
- Institutional coordination	
Technical Support	***Specialised***
- Data processing, for example, converting water level to discharge	
- Chemical analysis	
- Skills identification / development	
- Data capture, data entry	
Operations Management	***Integrative***
- Sampling	
- Scheduling	
- Equipment maintenance	

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