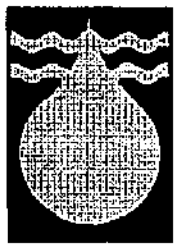
WATER RESEARCH COMMISSION



GEOGRAPHIC INFORMATION SYSTEMS (GIS) AND THE INTEGRATED ENVIRONMENTAL MANAGEMENT (IEM) PROCEDURE IN THE PLANNING AND MANAGEMENT OF WATER RESOURCES

TASK 2: GIS AND HYDROLOGICAL MODELING

USERS MANUAL

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In this report series the following are available:

Task 2	GIS and hydrological modelling: Users Manual
Task 3	Sabie river and Letaba river: Theoretical framework: Users Manual
Task 4	Environmental atlas for the Sabie river catchment
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NOTICE

Users of the provided macro language program (SML) are requested to provide the GISLAB with comment on both the procedure and upgrading of the database. In this manner improvements to the SML can be made speedily and successfully.

ABSTRACT

The development of an environmental database for use in the GIS is essential to the environmental planning of catchment basins.

The GIS is essential to the development of various land-use scenarios for the past, present and the future.

Research illustrated three major hydrological changes causing ecological impacts, i.e. monthly flow rates, flood peaks and sediment interception.

The linking of the GIS with the hydrological model, ACRU, illustrated specific monthly flow rates for the various land-use scenarios.

The impact of these various scenarios on monthly flow rates are as follows: (See Figure 1)

Scenario 1 (present)	100%
Scenario 2 (past)	20% more
Scenario 3 (future)	21% less
Scenario 4 (proposal)	69% more

The GIS (Arc/Info) and the hydrological model (ACRU) proved to be important in determining environmental impacts resulting from changes in land-use.

EKSERP

Die gebruik van 'n geografiese inligtingstelsel het 'n groot bydrae gelewer om die invloed van grondgebruiksverandering op die ekologie van stroom-afgebiede asook die waterleweringsprojekte te illustreer. Deur middel van die geïntegreerde omgewingsbestuur (GOB) -proses en 'n ekologiese beplanningsmodel is die ideale grondgebruik vir opvanggebiedbestuur ontwikkel.

KEYWORDS

Catchment basins, water development projects, environmental impacts, hydrological modeling, geographic information systems, landscape architecture.

INTRODUCTION

The aim of this project is to function as an abbreviated version of Task 1 (Die gebruik van hidrologiese modelle in landskapsbeplanning) and act as a user manual to view the related data. It therefore looks at the role of GIS (Geographic information systems) in the management of water related systems such as the planning of catchment basins. For this to be successful, a GIS system is related to the IEM (Integrated Environmental Management) procedure and through the use of an ecological planning model (Van Riet, 1987) and an hydrological model (Schulze, 1989a, 1989b), the environmental impact on daily flow rates and proposed mitigation measures for the catchment basin of a possible new dam on the Sabie river, is determined.

The goal of this study is to provide decision makers across the spectrum of the public and private sectors including authoritative bodies, developers, planners, and interested and affected parties with a decision-support system based on environmental considerations in order to facilitate holistic and environmentally sound decision making.

The method of presentation will deviate from the normal in that the presentation will follow a series of steps in a flow diagram illustrating the IEM procedure. These steps will be based on the use of a GIS system (ARC/INFO) and the various commands required during the use of GIS in the planning of catchments. The command and the effect of each command resulting from the use of attribute tables or the various graphic information sets will be illustrated on the computer screen.

The total process is linked by a macro language program (SML) written for the purpose of ease of use by other researchers or project managers and can be run on both PC and workstation hardware. The whole procedure was developed as part of a research project completed for the Water Research Commission during 1992 and contributed to the Kruger Park Rivers Research project.

THE PROBLEM WITH WATER MANAGEMENT

The increase in population densities and changing forms of land-use will cause an increase in the demand placed on the water resources of Southern Africa. These changes in land-use in catchment basins create negative ecological impacts in the downstream reaches of these rivers.

To counter the increased pressure on water resources, water development projects are designed and constructed. These development projects also result in environmental impacts in downstream reaches.

The changing forms of land-use can however also affect the success of water development projects proposed for these catchments.

The above is clearly illustrated by the conditions of the rivers of the Kruger National Park (KNP) which have been dramatically altered by large scale changes in land-use in the catchment basins.

A major research program has been conducted to determine the extent of these environmental impacts, the factors causing these impacts and proposals for alleviating these impacts (DREYER, 1991).

GIS can contribute greatly to projects relating to the environmental impact of land-use changes as well as contributing to overall environmentally based planning proposals for these basins.

The study presented has the following goals and objectives:-

Goals

- To evaluate the use of GIS in the planning and management of water resources within catchment basins with special reference to the rivers of the KNP.

Objectives

- To identify the impact of various land-use scenarios through the use of GIS (Arc/Info).
- To complete this evaluation through the linking of the GIS and a hydrological model (ACRU).
- To apply this evaluation to the catchment basin of the Sabie river.
- To develop planning proposals for the Sabie river catchment to alleviate these ecological impacts.

Integrated Environmental Management Procedure

The integrated environmental management procedure as adapted for use in this research project consists of the following broad groups of actions.

STEP ONE	-	PROBLEM ANALYSIS
STEP TWO	-	PROPOSED SOLUTION
STEP THREE	-	POTENTIAL ENVIRONMENTAL IMPACTS
STEP FOUR	-	POTENTIAL MITIGATION MEASURES
STEP FIVE	-	ECOLOGICAL PLANNING PROCEDURES
STEP SIX	-	HYDROLOGICAL MODELING
STEP SEVEN	-	ENVIRONMENTAL IMPACTS
STEP EIGHT	-	IDEAL PLANNING PROPOSALS

The following steps illustrate the actions associated with the various steps in proposed Integrated Environmental Management procedure:

STEP ONE - PROBLEM ANALYSIS

The problems normally associated with changes in catchment basins can result from the following:

Increasing population numbers and densities
Changes and intensification in land-use
Over utilization of water resources
Negative environmental impact in down stream reaches

STEP TWO - PROPOSED SOLUTION

The normal reaction from planners and engineers is to call for and design water development structures. These structures normally include the following:

Water utilization structures
- Dam wall
- Transfer pumps and pipeline
- Receiving weir
- Irrigation canals

Management procedures
- Flow regulation
- Flood retention
- Sediment interception

STEP THREE - POTENTIAL ENVIRONMENTAL IMPACTS

The potential environmental impacts have been determined in studies conducted for the Department of Water Affairs and Forestry on the transfer scheme for the Mhlatuze river in Natal.

Direct on-site impacts and indirect downstream impacts
- Basin inundation
- Reduction in daily flow rates
- Reduction in frequency and extent of flood peaks
- Reduction in sediment yield
- Changes to fluvial geomorphology
- Changes in chemical properties
- Changes in physical properties
- Changes to biological components

STEP FOUR - POTENTIAL MITIGATION MEASURES

Instead of trying to apply measures only at the completion of the project, it is far more valuable to include these measures at the outset.

Apply ecologically based principles to:
- Planning of land-use in the catchment basin
- Designing of structures
- Management procedures

STEP FIVE - ECOLOGICAL PLANNING PROCEDURE

One of the most important of the measures is to plan the land-use in the catchment basin. Van Riet (1987) developed an ecological planning model for use in catchment basins and this method is used in this study. The ecological planning method is dependent on GIS for its operation and a GIS (Arc/Info) is included in this study. The following actions are relevant to the ecological planning procedure.

Determine need and desirability
- Conservation
- Agriculture
- Development

Determine land-use zoning classes
- Conservation
- Agriculture
- Development

Develop Geographic Information System

Arc/Info
Regis
Geo/Sql

Identify relevant data categories
Catchments
Rivers
Land forms
Contours
Land cover
Rainfall

Create data sets containing attributes
Catchments
Rivers
Land types
Contours
Land cover
Rainfall

Develop composite landscape facets
Landscape facets

Complete landscape evaluation

Evaluate attributes
Ecological values
Aesthetic values
Economic values

Evaluate landscape facets by relating attributes
Conservation
Agriculture
Development

Develop ideal land-use proposals
Ideal land-use proposal

Illustrate alternative land-use proposals
Past
Present
Future (Uncontrolled)
Future (Ideal land-use proposal)

STEP SIX - HYDROLOGICAL MODELING

Both the Pitman (1973, 1977) and the ACRU (Schulze 1989a, 1989b) were analyzed. For this study the ACRU model was used, as it contains catchment basin factors that could be altered during the ecological planning procedure.

Environmental impacts to be analyzed were selected and in this study flow rates were selected.

Flow rates
Flood peaks
Sediment yields

Environmental parameters were identified.

Catchments
Land types
Slopes
Climate

Select parameters from GIS for use in the ACRU model.

Select alternative land cover and land-use data sets.

Past
Present
Future (Uncontrolled)

Determine ideal planning proposal based on ecological criteria.

Run hydrological model for four scenarios.

STEP SEVEN - ENVIRONMENTAL IMPACTS

Environmental impacts identified and results reviewed.

STEP EIGHT - IDEAL PLANNING PROPOSALS

Results of ideal planning proposal are illustrated.

CONCLUSION

- The development of an environmental database for use in the GIS contributes successfully to the environmental planning of catchment basins.
- The GIS is essential to the development of various land-use scenarios for the past, present and the future.

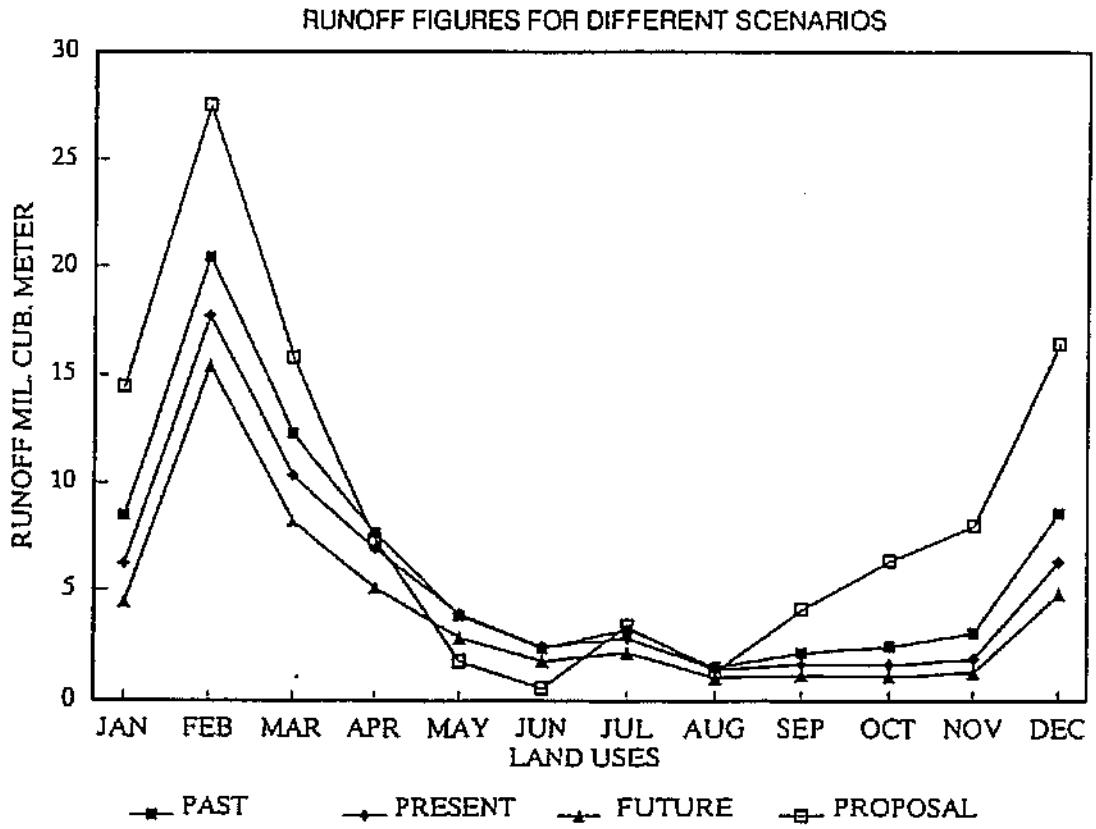
- Research illustrated three major hydrological changes causing ecological impacts, that is monthly flow rates, flood peaks and sedimentation.

- The linking of the GIS with the hydrological model, ACRU, illustrated specific monthly flow rates for the various land-use scenarios.

- The impact of these various land-use scenarios on monthly flow rates are as follows: (See Figure 1)

Scenario 1 (present) mixed land-use	100%
Scenario 2 (past) indigenous	20% more
Scenario 3 (future) developed town	21% less
Scenario 4 (proposal) ideal land-use	69% more

Figure 1



Runoff figures in cubic metres for past, present, future and ideal land-use scenarios

HARDWARE AND SOFTWARE REQUIREMENTS

Hardware

The minimum hardware requirement for running the SML is an 80386-based micro computer with a minimum of 8 Mb random access memory (RAM), a mathematical co-processor, 1.44 Mb stiffy drive and free hard disk space of approximately 8 Mb. It is however recommended that a 80486 DX micro-computer is used for additional data that this report covers (Sabie and Letaba).

Software

ARC/INFO™ is required for the SML and the use of P.C. ARC/VIEW™ based on Microsoft Windows™ operating system will be required to view the new updated Sabie River data and new Letaba River data.

SML INSTALLATION PROCEDURE

The SML and related data coverages that enable it to function are provided on two 1.44 Mb stiffy disks. The steps to install the SML are as follows:

- Make sure there is at least 8 Mb of free disk space on the destination hard disk drive.
- At the DOS prompt insert disk 1 into the stiffy drive (e.g. B:)
- Change the active drive to the stiffy drive (e.g. B:)
- At the DOS prompt type INSTALL and ENTER the command.
- You will be prompted to insert the last disk (disk No. 2) and then remove it to replace the first disk (disk No. 1)
- Upon entering the data will automatically be installed to your hard disk drive to directory WNKSABIE.
- To view the "SML" ARC/INFO is required.
- Go into the WNKSABIE directory and activate ARC as well as ARCPLOT and your relevant display screen (e.g. disp 4).
- At the prompt type &RUN PRESENT.SML

- The SML will be loaded and a menu BOX will be displayed in the top right hand corner of the screen.

- To follow the SML use the mouse or control keys to highlight menu items and enter on them.

- When visuals are selected e.g. (DISPLAY DATA) ***always*** go to the main menu, select PARAMETERS, and then VIEW TOTAL, go back to main menu by selecting BACK MENU and select drawing to be viewed.

- When 3D visuals are selected e.g. (3D VIEW) ***always*** go to the main menu, select PARAMETERS and then 3D VIEW, go back to PREVIOUS MENU and select VIEW TO BE SHOWN.

- Drawings should be CLEARED before the next is drawn, by selecting PARAMETERS and then the CLEAR option.

USER FEEDBACK AND INVOLVEMENT

The SML is used to display data and take the user through the logical steps followed throughout the study. To cater for specific needs is not an easy task and the correct and efficient functioning of the SML will greatly be encouraged through user feedback which in turn can result in updating or modifying the SML.

USER LEVELS OF EXPERTISE AND GIS PROFICIENCY

The level of GIS expertise of users will largely determine the potential use and application of a data set such as this to a variety of application spheres. It is obvious that the potential of such a data set will increase when combined with higher levels of GIS proficiency and available expertise. It is, however, important to note that not all users such as researchers possess the necessary skills to be able to utilise GIS and available data sets to their full potential, and most do not have the desire to become experts in the field of geographic data processing for the fact that the GIS learning curve is fairly long and constitutes a specialist field on its own. It is therefore imperative that GIS specialists direct their energy to supply researchers with enough customised tools and knowledge to be able to utilise GIS for their applications while avoiding an over-involvement in advanced technical matters. Generally speaking, three levels of user proficiency can be considered when dealing with projects and data sets of this nature:

- None
- Basic
- Advanced

The level of GIS proficiency required to be able to utilise the project data through the SML programs in order to understand the project goals, objectives and processes, is minimal. The user will have to possess some computer literacy, the ability to invoke the GIS software, ARC/INFO™, and run the SML (Small Macro Language)program. In order to make use of the data sets through the use of ARCVIEW™, the user will have to be proficient in the use of Microsoft Windows™ and the ARCVIEW program, as well as posessing a fair amount of background knowledge of database management. Users who wish to use and adapt the data sets and SML programs themselves for advanced processing in specialised applications will require much higher levels of GIS expertise and proficiency in the use of hardware and software.

Most researchers use computers and database management software to some extent during execution of their research programs, and the basic ability to adapt to GIS is therefore already in existence. Many have already started or are advanced in the process of utilising GIS and related application software for their research needs and possess the required skills to be able to make use of project data sets. It is, however, important that at least a basic knowledge and proficiency in GIS is required in order to derive benefit from data sets such as these during future research.

CUSTOMISING THE SML PROGRAM FOR OTHER APPLICATIONS

The SML (Small Macro Language) program can be customised by users for their own purposes and applications in a fairly straight-forward and simple manner, provided that they have sufficient expertise regarding ARC/INFO in general, and specific experience in writing of SML programs. The SML program comprises an ASCII file which is well annotated with comments in order to guide users through its procedures and routines, and an experienced SML programmer should have little difficulty in establishing the logical program flow in order to change coverage name calls, etc. for a revised application. A full listing of the SML program is included in this document as Appendix A.

UTILISATION OF DATA SETS ON OTHER PLATFORMS

The development and distribution platform for data sets for this project is ARC/INFO™. Although it is recognised that many other hardware and software platforms are well suited for utilisation with these data sets, most researchers and administrators in the water field are ARC/INFO users. Data sets may be exported to other hardware and software platforms through a number of exchange formats and procedures, most of which will require little time and cost to perform, but generally with good results. Exporting of the SML program to other platforms will require a complete re-write of the program to suit the new platform.

LIST OF REFERENCES

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PITMAN, W.V. (1973). A mathematical model for generating monthly river flows from meteorological data in South Africa. Hydrological Research Unit Report No. 2/73.

PITMAN, W.V. (1977). Flow generation by catchment models of differing complexity - a comparison of performance. Hydrological Research Unit Report No. 1/77

SCHULZE, R.E. (1989a). ACRU: Background, Concepts and Theory. WRC Report No 154/1/89.

SCHULZE, R.E. (1989b). ACRU-2: User Manual. WRC Report No 154/2/89.

VAN RIET, W.F. (1987). An ecological planning model for use in landscape architecture. Ph.D. University of Pretoria. 540 p.

SML/PROJECTS/WNK

APPENDIX A

SML TEXT AND COMMANDS

The following is a text document showing all commands that drive the SML. The maps and other visuals should be viewed through ARCINFO™ as explained in the main report.

```
&REM ==========
&REM BEGINNING OF PROGRAM
&REM ==========
&LABEL START
PAGEUNITS CM
PAGESIZE 25 15
UNITS PAGE
&REM ==========
&REM INTRO SCREEN
&REM ==========
&LABEL INTRO
CLEAR
CLEARSEL
&ECHO &OFF
TEXTCOL 1
TEXTSPACING .9
TEXTFONT 10
KEYBOX .35 .35
KEYSEP .5 .1
SHADESET SPECIAL
MAPE WNKLOGO
MAPPOS LL 1 1
MAPLIM 1 1 13 13
RES WNKLOGO POLY WNKLOGO-ID = 1
NSEL WNKLOGO POLY
POLYGONSH WNKLOGO 6
MAPLIM PAGE
MOVE 1.5 13.1
TEXTSIZE .43 .35
TEXTCOL 6
TEXT 'WATER RESEARCH COMMISSION'
MAPE GISLOGO
MAPPOS LL 10 7
MAPLIM 10 7 19 12
RES GISLOGO POLY GISLOGO-ID = 1
POLYGONSH GISLOGO 9
CLEARSEL
RES GISLOGO POLY GISLOGO_ID = 7
POLYGONSH GISLOGO 1
LINECOLOR 1
ARCS GISLOGO
CLEARSEL
TEXTCOL 1
TEXTSIZE .8 .7
MOVE 10 5
TEXT 'APPLICATION OF GIS'
MOVE 10 3.5
TEXT 'FOR WATER MANAGEMENT'
&REM ==========
&REM START MENU
&REM ==========
&LABEL STARTMENU
&LABEL STARTMENU1
POPUP STARTMEN.POP 43 2 1 66 4 13
&GOTO STUDY &IF &EQ %43 STUDY_GOALS
&GOTO IEM &IF &EQ %43 IEM_PROCEDURE
&GOTO MAINMENU &IF &EQ %43 MAIN_MENU
&GOTO END &IF &EQ %43 QUIT
```

```
&LABEL STUDY
CLEAR
MAPPOS LL LL
MAPLIM 0 0 20 15
TEXTCOL 1
TEXTSIZE .5 .4
MOVE 1 14
TEXT 'STUDY GOALS'
MOVE 1 12
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'To evaluate the use of GIS in the planning and management of water'
MOVE 1 11
TEXT 'resources within catchment basins with special reference to the'
MOVE 1 10
TEXT 'rivers of the Kruger National Park (KNP).'
&GOTO STARTMENU1
&LABEL IEM
TEXTFONT 10
TEXTSPACING .9
CLEAR
TEXTCOL 1
TEXTSIZE .5 .4
MOVE 1 14
TEXT 'INTEGRATED ENVIRONMENTAL MANAGEMENT PROCEDURE'
MOVE 1 12
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'Phase 1 of the integrated environmental management procedure (IEM) as'
MOVE 1 11
TEXT 'adapted for use in this research project consists of the following'
MOVE 1 10
TEXT 'broad groups of actions.'
MOVE 2 8
TEXT 'STEP 1 : PROBLEM ANALYSIS'
MOVE 2 7
TEXT 'STEP 2 : PROPOSED SOLUTION'
MOVE 2 6
TEXT 'STEP 3 : POTENTIAL ENVIRONMENTAL IMPACTS'
MOVE 2 5
TEXT 'STEP 4 : POTENTIAL MITIGATION MEASURES'
MOVE 2 4
TEXT 'STEP 5 : ECOLOGICAL PLANNING PROCEDURES'
MOVE 2 3
TEXT 'STEP 6 : HYDROLOGICAL MODELING'
MOVE 2 2
TEXT 'STEP 7 : ENVIRONMENTAL IMPACTS'
MOVE 2 1
TEXT 'STEP 8 : PROPOSED MITIGATION MEASURES'
&GOTO STARTMENU1
CLEAR
TEXTFONT 10
TEXTSPACING .9
&REM ========
&REM MAIN MENU
&REM ========
```

```
&LABEL MAINMENU
CLEAR
POPUP MAINMENU.POP 1 2 1 58 11 21
&GOTO PROBLEM &IF &EQ %1 PROBLEM_ANALYSIS
&GOTO SOLUTION &IF &EQ %1 PROPOSED_SOLUTION
&GOTO POT_ENV_IMPACTS &IF &EQ %1 POTENTIAL_IMPACTS
&GOTO MITIGATION &IF &EQ %1 MITIGATION_MEASURES
&GOTO PLANSTART &IF &EQ %1 PLANNING_PROCEDURES
&GOTO HYDRO &IF &EQ %1 HYDRO_MODELING
&GOTO IMPACTS &IF &EQ %1 ENVIRONMENTAL_IMPACTS
&GOTO PROPOSAL &IF &EQ %1 PLANNING_PROPOSALS
&GOTO CONCLUSION &IF &EQ %1 CONCLUSIONS
&GOTO INTRO &IF &EQ %1 QUIT_TO_LOGO
&GOTO END &IF &EQ %1 QUIT
&REM ========================
&REM PROBLEM ANALYSIS SUBMENU
&REM ========================
&LABEL PROBLEM
CLEAR
MAPPOS LL LL
MAPLIM 0 0 20 15
TEXTCOL 1
TEXTFONT 10
TEXTSPACING .9
TEXTSIZE .5 .4
MOVE 1 14
TEXT 'STEP 1: PROBLEM ANALYSIS'
MOVE 1 12
TEXTFONT 2
TEXTSPACING .9
TEXTSIZE .4 .35
TEXT 'Problems normally associated with changes in catchment basins can'
MOVE 1 11
TEXT 'be the result of the following:'
MOVE 3 9
TEXT '*  Increasing population numbers and densities'
MOVE 3 8
TEXT '*  Changes and intensification in land use'
MOVE 3 7
TEXT '*  Over-utilisation of water resources'
MOVE 3 6
TEXT '*  Negative environmental impact in down-stream reaches'
POPUP PROBLEM.POP 2 2 1 70 1 9
&GOTO CLEARPROB &IF &EQ %2 MAIN_MENU
&LABEL CLEARPROB
CLEAR
&GOTO MAINMENU
&REM ========================
&REM PROPOSED SOLUTION SUBMENU
&REM ========================
&LABEL SOLUTION
CLEAR
MAPPOS LL LL
MAPLIM 0 0 20 15
TEXTCOL 1
TEXTFONT 10
TEXTSPACING .9
TEXTSIZE .5 .4
```

```
MOVE 1 14
TEXT 'STEP 2: PROPOSED SOLUTION'
MOVE 1 12
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'The normal reaction from planners and engineers is to call for and'
MOVE 1 11
TEXT 'design water development structures, including the following:'
MOVE 3 9
TEXT '* Water utilisation structures:'
MOVE 5 8
TEXT 'Dam walls'
MOVE 5 7
TEXT 'Transfer pumps and pipelines'
MOVE 5 6
TEXT 'Receiving weirs'
MOVE 5 5
TEXT 'Irrigation canals'
MOVE 3 3
TEXT '* Management procedures'
TEXTFONT 10
TEXTSPACING .9
POPUP PROBLEM.POP 3 2 1 70 1 9
&GOTO CLEARPROB &IF &EQ %3 MAIN_MENU
&REM ═══════════════════════
&REM ENVIRONMENTAL IMPACTS SUBMENU
&REM ═══════════════════════
&LABEL POT_ENV_IMPACTS
CLEAR
MAPPOS LL LL
MAPLIM 0 0 20 15
TEXTFONT 10
TEXTSPACING .9
TEXTCOL 1
TEXTSIZE .5 .4
MOVE 1 14
TEXT 'STEP 3: POTENTIAL ENVIRONMENTAL IMPACTS'
MOVE 1 12
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'Potential environmental impacts have been determined in studies for DWAF'
MOVE 1 11
TEXT 'on the transfer scheme for the Mhlatuze river in Natal, as follows:'
MOVE 3 10
TEXT '* Direct construction impacts'
MOVE 3 9
TEXT '* Direct on-site impacts'
MOVE 5 8.3
TEXT 'Basin inundation'
MOVE 5 7.6
TEXT 'Reduction in daily flow rates'
MOVE 5 6.9
TEXT 'Reduction in frequency and extent of flood peaks'
MOVE 5 6.2
TEXT 'Reduction in sediment yield'
MOVE 3 5.2
```

```
TEXT '*  Indirect downstream impacts'
MOVE 5 4.5
TEXT 'Changes to fluvial geomorphology'
MOVE 5 3.8
TEXT 'Changes in chemical properties'
MOVE 5 3.1
TEXT 'Changes in physical properties'
MOVE 5 2.4
TEXT 'Changes to biological components'
POPUP PROBLEM.POP 4 2 1 70 1 9
&GOTO CLEARPROB &IF &EQ %4 MAIN_MENU
&REM ==========
&REM MITIGATION MEASURES SUBMENU
&REM ==========
&LABEL MITIGATION
CLEAR
MAPPOS LL LL
MAPLIM 0 0 20 15
TEXTCOL 1
TEXTFONT 10
TEXTSPACING .9
TEXTSIZE .5 .4
MOVE 1 14
TEXT 'STEP 4: POTENTIAL MITIGATION MEASURES'
MOVE 1 12
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'Mitigation measures should be included from the outset and ecological'
MOVE 1 11
TEXT 'principles should be applied to the following:'
MOVE 3 9
TEXT '*  Planning of land use in the catchment basin'
MOVE 3 8
TEXT '*  Designing of structures'
MOVE 3 7
TEXT '*  Construction of facilities'
MOVE 3 6
TEXT '*  Management procedures'
TEXTFONT 10
TEXTSPACING .9
POPUP PROBLEM.POP 5 2 1 70 1 9
&GOTO CLEARPROB &IF &EQ %5 MAIN_MENU
&REM ==========
&REM ECOLOGICAL PLANNING SUBMENU
&REM ==========
&LABEL PLANSTART
CLEAR
&LABEL PLANSTART1
POPUP PLANNING.POP 6 2 1 58 10 21
&GOTO PLANNING &IF &EQ %6 LIST_ACTIONS
&GOTO NANDD &IF &EQ %6 NEED_&_DESIRABILITY
&GOTO ZONING &IF &EQ %6 ZONING_CLASSES
&GOTO GIS &IF &EQ %6 DEVELOP_GIS
&GOTO DISPLAY &IF &EQ %6 DATA_SABIE_RIVER
&GOTO DISP9 &IF &EQ %6 DATA_INJAKA_DAM
&GOTO DISP15 &IF &EQ %6 LANDSCAPE_FACETS
&GOTO SUBACT &IF &EQ %6 LANDSCAPE_EVALUATION
```

```
&REM ZONING CLASSES SUBMENU
&REM ═══════════════════
&LABEL ZONING
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'ACTION 2: ZONING CLASSES'
MOVE 3 11
TEXT '- Conservation'
MOVE 3 10
TEXT '- Agriculture'
MOVE 3 9
TEXT '- Development'
MOVE 3 8
TEXT '- Residential'
&GOTO PLANSTART1
&REM ═══════════════════
&REM DEVELOP GIS SUBMENU
&REM ═══════════════════
&LABEL GIS
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'ACTION 3: DEVELOP GEOGRAPHIC INFORMATION SYSTEM'
MOVE 3 11
TEXT '- ARC/INFO'
MOVE 3 10
TEXT '- ReGIS'
MOVE 3 9
TEXT '- GEO/SQL'
&GOTO PLANSTART1
&REM ═══════════════════
&REM DATA SABIE RIVER SUBMENU
&REM ═══════════════════
&LABEL DISPLAY
CLEAR
&LABEL DISPLAY1
POPUP DISPLAY.POP 7 2 1 67 3 12
&GOTO TEXT &IF &EQ %7 DISPLAY_TEXT
&GOTO TOTAL &IF &EQ %7 DISPLAY_DATA
&GOTO PLANSTART &IF &EQ %7 BACK_MENU
&LABEL TEXT
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'ACTION 4: DEVELOP GIS DATABASE FOR SABIE RIVER CATCHMENT'
MOVE 3 11
TEXT '- Regional location'
MOVE 3 10
TEXT '- Sabie river catchment area'
MOVE 3 9
TEXT '- Subcatchments'
```

```
&GOTO DISPROP &IF &EQ %6 ALTERNATIVE_PROPOSALS
&GOTO CLEARPROB &IF &EQ %6 MAIN_MENU
&LABEL PLANNING
CLEAR
MAPPOS LL LL
MAPLIM 0 0 20 15
TEXTFONT 10
TEXTSPACING .9
TEXTCOL 1
TEXTSIZE .5 .4
MOVE 1 14
TEXT 'STEP 5: ECOLOGICAL PLANNING PROCEDURE'
MOVE 1 12
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'The following actions are relevant to the ecological planning procedure:'
MOVE 3 10
TEXT '* Determine need and desirability'
MOVE 3 9
TEXT '* Determine land use zoning classes'
MOVE 3 8
TEXT '* Develop Geographic Information System'
MOVE 3 7
TEXT '* Identify relevant data categories for Sabie river catchment'
MOVE 3 6
TEXT '* Create data sets for Injaka dam site'
MOVE 3 5
TEXT '* Develop composite landscape facets'
MOVE 3 4
TEXT '* Complete landscape evaluation'
MOVE 3 3
TEXT '* Illustrate alternative land use proposals'
&GOTO PLANSTART1
&REM ==========
&REM NEED & DESIRABILITY SUBMENU
&REM ==========
&LABEL NANDD
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'ACTION 1: DETERMINE NEED & DESIRABILITY'
MOVE 3 11
TEXT '- Project proposals for Sabie River catchment'
MAPE CATC
MAPLIM 0 0 15 8
MAPPOS CEN CEN
LINEC 1
ARCS SABI
POLYGONSH DAMM 4
MOVE 3 10
TEXT '- Project proposals for the Injaka dam site'
LINEC 5
ARCS CATCH
&GOTO PLANSTART1
&REM ==========
```

```
MOVE 3 8
TEXT '- Rivers'
MOVE 3 7
TEXT '- Dams'
MOVE 3 6
TEXT '- Rainfall'
MOVE 3 5
TEXT '- Land types'
MOVE 3 4
TEXT '- Land cover'
MOVE 3 3
TEXT '- Reserves'
&GOTO DISPLAY1
&REM ==========
&REM DISPLAY DATA SUBMENU
&REM ==========
&LABEL TOTAL
MAPPOS CEN CEN
MAPLIM 0 0 15 15
TEXTFONT 2
TEXTSIZE .3 .2
TEXTSPACING 0.9
CLEAR
&LABEL TOTAL1
POPUP TOTAL.POP 8 2 1 62 18 17
&GOTO PARAM10 &IF &EQ %8 PARAMETERS
&GOTO LOCA &IF &EQ %8 REGIONAL_LOCATION
&GOTO GREN &IF &EQ %8 STATE_BOUNDARIES
&GOTO TOWN &IF &EQ %8 TOWNS
&GOTO ROAD &IF &EQ %8 ROADS
&GOTO SABI &IF &EQ %8 CATCHMENT_AREA
&GOTO CATC &IF &EQ %8 SUB_CATCHMENTS
&GOTO RIVE &IF &EQ %8 RIVERS
&GOTO DAMS &IF &EQ %8 DAMS
&GOTO RAIN &IF &EQ %8 RAINFALL
&GOTO SOIL &IF &EQ %8 LAND_TYPES
&GOTO LAND &IF &EQ %8 LAND_COVER
&GOTO RESE &IF &EQ %8 RESERVES
&GOTO BOSB &IF &EQ %8 AFFORESTATION
&GOTO GEOL &IF &EQ %8 GEOLOGY
&GOTO GEOM &IF &EQ %8 GEOMORPHOLOGY
&GOTO PLAN &IF &EQ %8 VEGETATION
&GOTO DISPLAY &IF &EQ %8 BACK_MENU
&LABEL LOCA
MOVE 16 7
TEXT 'REGIONAL LOCATION'
LINECOL 1
ARCS TRANSVAAL
ARCS SABI
POLYGONSH SABI 2
ANNOTEXT TRANSVAAL
&GOTO TOTAL1
&LABEL GREN
MOVE 16 6
TEXT 'STATE BOUNDARIES'
MOVE 16 5
KEYSHADE GREN.KEY NOBOX
LINECOL 1
```

```
ARCS SABI
POLYGONSH GRENS GRENS-ID
ARCS SABI
&GOTO TOTAL1
&LABEL TOWN
ARCS SABI
POINTS basetow
ANNOTEXT basetow
&GOTO TOTAL1
&LABEL ROAD
MOVE 16 10
TEXT 'ROADS'
LINECOL 2
LINE 15 9 15.5 9
MOVE 16 9
TEXT 'R40'
LINECOL 3
LINE 15 8 15.5 8
MOVE 16 8
TEXT 'MAIN ROAD 532'
LINECOL 1
LINE 15 7 15.5 7
MOVE 16 7
TEXT 'SECONDARY ROADS'
LINECOL 1
ARCS SABI
RES basepad LINE basepad-ID = 2
LINECOL 2
ARCS basepad
CLEARSEL
RES basepad LINE basepad-ID = 3
LINECOL 3
ARCS basepad
CLEARSEL
RES basepad LINE basepad-ID = 4
LINECOL 1
ARCS basepad
CLEARSEL
&GOTO TOTAL1
&LABEL SABI
LINEC 1
LINE 15 9 16 9
MOVE 16.5 9
TEXT 'CATCHMENT BOUNDARY'
ARCS SABI
&GOTO TOTAL1
&LABEL CATC
LINEC 1
LINE 15 8.5 16 8.5
MOVE 16.5 8.5
TEXT 'SUB CATCHMENT BOUNDARIES'
ARCS CATC
&GOTO TOTAL1
&LABEL RIVE
LINEC 6
LINE 15 8 16 8
MOVE 16.5 8
TEXT 'RIVERS'
```

```
ARCS RIVE
&GOTO TOTAL1
&LABEL DAMS
SHADESYM 4
SHADE 15 7 15 7.5 15.5 7.5 15.5 7
MOVE 16.5 7
TEXT 'DAMS'
POLYGONSH DAMM 4
&GOTO TOTAL1
&LABEL RAIN
MOVE 16 10
TEXT 'RAINFALL'
MOVE 16 9
KEYSHADE RAIN.KEY NOBOX
POLYGONSH RAIN RAIN-ID
&GOTO TOTAL1
&LABEL SOIL
MOVE 16 10
TEXT 'LAND TYPES'
MOVE 16 9
KEYSHADE SOIL.KEY NOBOX
POLYGONSH SOIL SOIL-ID
&GOTO TOTAL1
&LABEL LAND
MOVE 16 10
TEXT 'LAND COVER'
MOVE 16 9
KEYSHADE LAND.KEY NOBOX
POLYGONSH LAND LAND_NU
&GOTO TOTAL1
&LABEL RESE
MOVE 16 10
TEXT 'RESERVES'
LINECOL 1
MOVE 16 9
KEYSHADE RESE.KEY NOBOX
ARCS SABI
POLYGONSH RESE RESE-ID
&GOTO TOTAL1
&LABEL BOSB
MOVE 16 10
TEXT 'AFFORESTATION'
LINECOL 1
MOVE 16 9
KEYSHADE BOSB.KEY NOBOX
ARCS SABI
ARCS BOSB
POLYGONSH BOSB BOSB-ID
&GOTO TOTAL1
&LABEL GEOL
MOVE 16 10
TEXT 'GEOLOGY'
LINECOL 1
MOVE 16 9
KEYSHADE GEOL.KEY NOBOX
POLYGONSH GEOL GEOL-ID
&GOTO TOTAL1
&LABEL GEOM
```

```
MOVE 16 10
TEXT 'GEOMORPHOLOGY'
LINECOL 1
MOVE 16 9
KEYSHADE GEOM.KEY NOBOX
POLYGONSH GEOM GEOM-ID
&GOTO TOTAL1
&LABEL PLAN
MOVE 16 10
TEXT 'VEGETATION'
LINECOL 1
MOVE 16 9
KEYSHADE PLAN.KEY NOBOX
POLYGONSH PLAN PLAN-ID
&GOTO TOTAL1
&LABEL PARAM10
POPUP PARAM10.POP 10 2 1 66 5 13
&GOTO CLEAR10 &IF &EQ %10 CLEAR
&GOTO ZOOM10 &IF &EQ %10 ZOOM
&GOTO TOTAL10 &IF &EQ %10 VIEW_TOTAL
&GOTO IDENT11 &IF &EQ %10 IDENTIFY
&GOTO TOTAL1 &IF &EQ %10 BACK_MENU
&LABEL CLEAR10
CLEAR
&GOTO PARAM10
&LABEL ZOOM10
MAPE *
&GOTO PARAM10
&LABEL TOTAL10
MAPE SABI
&GOTO PARAM10
&LABEL IDENT11
POPUP IDENT11.POP 11 2 1 63 11 16
&GOTO RAIN11 &IF &EQ %11 ID_RAINFALL
&GOTO SOIL11 &IF &EQ %11 ID_LAND_TYPES
&GOTO LAND11 &IF &EQ %11 ID_LAND_COVER
&GOTO RESE11 &IF &EQ %11 ID_RESERVES
&GOTO BOSB11 &IF &EQ %11 ID_AFFORESTATION
&GOTO GEOL11 &IF &EQ %11 ID_GEOLOGY
&GOTO GEOM11 &IF &EQ %11 ID_GEOMORPHOLOGY
&GOTO PLAN11 &IF &EQ %11 ID_VEGETATION
&GOTO RIVE11 &IF &EQ %11 ID_RIVERS
&GOTO DAMM11 &IF &EQ %11 ID_DAMS
&GOTO PARAM10 &IF &EQ %11 BACK_MENU
&LABEL RAIN11
IDENTIFY RAIN POLY *
&GOTO IDENT11
&LABEL SOIL11
IDENTIFY SOIL POLY *
&GOTO IDENT11
&LABEL LAND11
IDENTIFY LAND POLY *
&GOTO IDENT11
&LABEL RESE11
IDENTIFY RESE POLY *
&GOTO IDENT11
&LABEL BOSB11
IDENTIFY BOSB POLY *
```

```
&GOTO IDENT11
&LABEL GEOL11
IDENTIFY GEOL POLY *
&GOTO IDENT11
&LABEL GEOM11
IDENTIFY GEOM POLY *
&GOTO IDENT11
&LABEL PLAN11
IDENTIFY PLAN POLY *
&GOTO IDENT11
&LABEL RIVE11
IDENTIFY RIVE LINE *
&GOTO IDENT11
&LABEL DAMM11
IDENTIFY DAMM POLY *
&GOTO IDENT11
&REM ====================
&REM DATA INJAKA DAM SUBMENU
&REM ====================
&LABEL DISP9
CLEAR
&LABEL DISP91
POPUP DISPLAY.POP 9 2 1 66 3 13
&GOTO DAMTEXT &IF &EQ %9 DISPLAY_TEXT
&GOTO DAM &IF &EQ %9 DISPLAY_DATA
&GOTO PLANSTART &IF &EQ %9 BACK_MENU
&GOTO DISP91
&LABEL DAMTEXT
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'ACTION 5: DEVELOP GIS DATABASE FOR INJAKA DAM SITE '
MOVE 3 11
TEXT '- Catchment area Injaka dam'
MOVE 3 10
TEXT '- Subcatchments'
MOVE 3 9
TEXT '- Rivers'
MOVE 3 8
TEXT '- Dams'
MOVE 3 7
TEXT '- Rainfall'
MOVE 3 6
TEXT '- Land types'
MOVE 3 5
TEXT '- Land cover'
MOVE 3 4
TEXT '- Topography'
MOVE 3 3
TEXT '- Visual exposure'
&GOTO DISP91
&LABEL DAM
CLEAR
&LABEL DAM1
MAPPOS CEN CEN
MAPLIM 0 0 15 15
```

```
TEXTFONT 2
TEXTSIZE .3 .2
TEXTSPACING .9
POPUP DAM.POP 12 2 1 65 12 14
&GOTO PARAM13 &IF &EQ %12 PARAMETERS
&GOTO DAMSABI &IF &EQ %12 CATCHMENT_AREA
&GOTO DAMCATC &IF &EQ %12 SUB_CATCHMENTS
&GOTO DAMRIVE &IF &EQ %12 RIVERS
&GOTO DAMDAMS &IF &EQ %12 DAMS
&GOTO DAMRAIN &IF &EQ %12 RAINFALL
&GOTO DAMSOIL &IF &EQ %12 LAND_TYPES
&GOTO DAMLAND &IF &EQ %12 LAND_COVER
&GOTO DAMTOPO &IF &EQ %12 TOPOGRAPHY
&GOTO VISI1_1 &IF &EQ %12 VISIBILITY
&GOTO 3DVIEW &IF &EQ %12 3D_VIEW
&GOTO DISP9 &IF &EQ %12 BACK_MENU
&LABEL DAMSABI
LINEC 1
LINE 15 9 16 9
MOVE 16.5 9
TEXT 'CATCHMENT BOUNDARY'
ARCS CATCH
&GOTO DAM1
&LABEL DAMCATC
LINEC 1
LINE 15 8.5 16 8.5
MOVE 16.5 8.5
TEXT 'SUB CATCHMENT BOUNDARIES'
ARCS SUBCATCH
&GOTO DAM1
&LABEL DAMRIVE
LINEC 6
LINE 15 8 16 8
MOVE 16.5 8
TEXT 'RIVERS'
ARCS RIVERS
&GOTO DAM1
&LABEL DAMDAMS
SHADESYM 4
SHADE 15 7 15 7.5 15.5 7.5 15.5 7
MOVE 16.5 7
TEXT 'INJAKA DAM'
POLYGONSH DAM 4
&GOTO DAM1
&LABEL DAMRAIN
MOVE 16 10
TEXT 'RAINFALL'
MOVE 16 9
KEYSHADE RAINFALL.KEY NOBOX
POLYGONSH RAINFALL RAINFALL-ID
&GOTO DAM1
&LABEL DAMSOIL
MOVE 16 10
TEXT 'LAND TYPES'
MOVE 16 9
KEYSHADE SOILS.KEY NOBOX
POLYGONSH SOILS SOILS-ID
&GOTO DAM1
```

```
&LABEL DAMLAND
MOVE 16 10
TEXT 'LAND COVER'
MOVE 16 9
KEYSHADE LANDUSE.KEY NOBOX
POLYGONSH LANDUSE LANDUSE-ID
&GOTO DAM1
&LABEL DAMTOPO
MOVE 16 10
TEXT 'TOPOGRAPHY'
MOVE 16 9
KEYSHADE CONTOURS.KEY NOBOX
POLYGONSH CONTOURS CONTOURS-ID
&GOTO DAM1
&LABEL VISI1_1
MOVE 16 10
TEXT 'VISIBILITY'
MOVE 16 9
KEYSHADE VISIBLE.KEY NOBOX
POLYGONSH VISIBLE VISIBLE-CODE
&GOTO DAM1
&LABEL 3DVIEW
LINEC 5
LINE 15 10 15.5 10
MOVE 16 10
TEXT 'RIVERS'
LINEC 3
LINE 15 9.5 15.5 9.5
MOVE 16 9.5
TEXT 'SUB CATCHMENTS'
MOVE 15 9
KEYSHADE 3DVIEW.KEY NOBOX
LINECOL 2
ARCS D3VIEW
POLYGONSH DAMDRP 1
LINECOL 5
ARCS RIVDRP
LINECOL 3
ARCS SUBDRP
&GOTO DAM1
&LABEL PARAM13
POPUP PARAM13.POP 13 2 1 66 6 13
&GOTO CLEAR13 &IF &EQ %13 CLEAR
&GOTO ZOOM13 &IF &EQ %13 ZOOM
&GOTO DAM13 &IF &EQ %13 VIEW_DAM_SITE
&GOTO THREED13 &IF &EQ %13 3D_VIEW
&GOTO IDENT14 &IF &EQ %13 IDENTIFY
&GOTO DAM1 &IF &EQ %13 BACK_MENU
&LABEL CLEAR13
CLEAR
&GOTO PARAM13
&LABEL ZOOM13
MAPE *
&GOTO PARAM13
&LABEL DAM13
MAPE CATCH
&GOTO PARAM13
&LABEL THREED13
```

```
MAPE D3VIEW
&GOTO PARAM13
&LABEL IDENT14
POPUP IDENT14.POP 14 2 1 66 5 13
&GOTO RAIN14 &IF &EQ %14 ID_RAINFALL
&GOTO SOIL14 &IF &EQ %14 ID_LAND_TYPES
&GOTO LAND14 &IF &EQ %14 ID_LAND_COVER
&GOTO TOPO14 &IF &EQ %14 ID_TOPOGRAPHY
&GOTO PARAM13 &IF &EQ %14 BACK_MENU
&LABEL RAIN14
IDENTIFY RAINFALL POLY *
&GOTO IDENT14
&LABEL SOIL14
IDENTIFY SOILS POLY *
&GOTO IDENT14
&LABEL LAND14
IDENTIFY LANDUSE POLY *
&GOTO IDENT14
&LABEL TOPO14
IDENTIFY CONTOURS POLY *
&GOTO IDENT14
&REM ==========
&REM LANDSCAPE FACETS SUBMENU
&REM ==========
&LABEL DISP15
CLEAR
&LABEL DISP151
POPUP DISPLAY.POP 15 2 1 67 3 12
&GOTO FACTEXT &IF &EQ %15 DISPLAY_TEXT
&GOTO FACET &IF &EQ %15 DISPLAY_DATA
&GOTO PLANSTART &IF &EQ %15 BACK_MENU
&GOTO DISP151
&LABEL FACTEXT
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'ACTION 6: DEVELOP COMPOSITE LANDSCAPE FACETS.'
MOVE 3 11
TEXT 'The following data categories were used in this action.'
MOVE 5 10
TEXT '- Catchment area'
MOVE 5 9
TEXT '- Subcatchments'
MOVE 5 8
TEXT '- Rivers'
MOVE 5 7
TEXT '- Dams'
MOVE 5 6
TEXT '- Rainfall'
MOVE 5 5
TEXT '- Land types'
MOVE 5 4
TEXT '- Land cover'
MOVE 5 3
TEXT '- Visibility'
MOVE 5 2
```

```
TEXT '- Slope'
&GOTO DISP151
&LABEL FACET
CLEAR
&LABEL FACET1
MAPPOS CEN CEN
MAPLIM 0 0 15 15
POPUP FACET.POP 16 2 1 65 10 14
&GOTO PARAM17 &IF &EQ %16 PARAMETERS
&GOTO FACCATC &IF &EQ %16 SUB_CATCHMENTS
&GOTO FACRIVE &IF &EQ %16 RIVER_ZONES
&GOTO FACDAMS &IF &EQ %16 DAM_ZONES
&GOTO FACRAIN &IF &EQ %16 RAINFALL
&GOTO FACSOIL &IF &EQ %16 LAND_TYPES
&GOTO FACLAND &IF &EQ %16 LAND_COVER
&GOTO FACVISI &IF &EQ %16 VISIBILITY
&GOTO FACFINAL &IF &EQ %16 FINAL_FACETS
&GOTO DISP15 &IF &EQ %16 BACK_MENU
&GOTO FACET1
&LABEL FACCATC
MAPPOS CEN CEN
MAPLIM 0 0 15 15
TEXTFONT 2
TEXTSIZE .3 .2
TEXTSPACING 0.9
LINECOL 1
LINE 15 8.5 16 8.5
MOVE 16.5 8.5
TEXT 'SUB CATCHMENT BOUNDARIES'
ARCS SUBCATCH
&GOTO FACET1
&LABEL FACRIVE
LINEC 6
LINE 15 8 16 8
MOVE 16.5 8
TEXT 'RIVER ZONES'
ARCS RIVBUF
&GOTO FACET1
&LABEL FACDAMS
LINEC 5
LINE 15 7.5 16 7.5
MOVE 16.5 7.5
TEXT 'DAM ZONES'
ARCS DAMBUF
&GOTO FACET1
&LABEL FACRAIN
LINEC 2
LINE 15 7 16 7
MOVE 16.5 7
TEXT 'RAINFALL'
ARCS RAINFALL
&GOTO FACET1
&LABEL FACSOIL
LINEC 3
LINE 15 6.5 16 6.5
MOVE 16.5 6.5
TEXT 'LAND TYPES'
ARCS SOILS
```

```
&GOTO FACET1
&LABEL FACLAND
LINEC 9
LINE 15 6 16 6
MOVE 16.5 6
TEXT 'LAND COVER'
ARCS LANDUSE
&GOTO FACET1
&LABEL FACVIS1
LINEC 10
LINE 15 5.5 16 5.5
MOVE 16.5 5.5
TEXT 'VISIBILITY'
ARCS VISIBLE
&GOTO FACET1
&LABEL FACFINAL
LINEC 11
LINE 15 5 16 5
MOVE 16.5 5
TEXT 'FINAL FACET BOUNDARIES'
ARCS FACETS
&GOTO FACET1
&LABEL PARAM17
POPUP PARAM17.POP 17 2 1 66 5 13
&GOTO CLEAR17 &IF &EQ %17 CLEAR
&GOTO ZOOM17 &IF &EQ %17 ZOOM
&GOTO DAM17 &IF &EQ %17 VIEW_DAM_SITE
&GOTO IDENT18 &IF &EQ %17 IDENTIFY
&GOTO FACET1 &IF &EQ %17 BACK_MENU
&LABEL CLEAR17
CLEAR
&GOTO PARAM17
&LABEL ZOOM17
MAPE *
&GOTO PARAM17
&LABEL DAM17
MAPE CATCH
&GOTO PARAM17
&LABEL IDENT18
POPUP IDENT18.POP 18 2 1 64 6 15
&GOTO RAIN18 &IF &EQ %18 ID_RAINFALL
&GOTO SOIL18 &IF &EQ %18 ID_LAND_TYPES
&GOTO LAND18 &IF &EQ %18 ID_LAND_COVER
&GOTO VISI18 &IF &EQ %18 ID_VISIBILITY
&GOTO FINAL18 &IF &EQ %18 ID_FINAL_FACETS
&GOTO PARAM17 &IF &EQ %18 BACK_MENU
&LABEL RAIN18
IDENTIFY RAINFALL POLY *
&GOTO IDENT18
&LABEL SOIL18
IDENTIFY SOILS POLY *
&GOTO IDENT18
&LABEL LAND18
IDENTIFY LANDUSE POLY *
&GOTO IDENT18
&LABEL VISI18
IDENTIFY VISIBLE POLY *
&GOTO IDENT18
```

```
&LABEL FINAL18
IDENTIFY FACETS POLY *
&GOTO IDENT18
&REM ==========
&REM SUB ACTION SUB MENU
&REM ==========
&LABEL SUBACT
POPUP SUBACT.POP 19 2 1 60 5 19
&GOTO LIST &IF &EQ %19 LIST_SUB_ACTIONS
&GOTO DISTAB &IF &EQ %19 EVALUATE_ATTRIBUTES
&GOTO DISP22 &IF &EQ %19 EVALUATE_FACETS
&GOTO DISP26 &IF &EQ %19 DEVELOP_PROPOSALS
&GOTO PLANSTART &IF &EQ %19 BACK_MENU
&LABEL LIST
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'ACTION 7: COMPLETE LANDSCAPE EVALUATION'
MOVE 3 11
TEXT '* Evaluate attributes'
MOVE 3 10
TEXT '* Evaluate landscape facets by relating attributes'
MOVE 3 9
TEXT '* Develop ideal land use proposals'
&GOTO SUBACT
&LABEL DISTAB
POPUP DISTAB.POP 20 2 1 65 3 14
&GOTO TABTEXT &IF &EQ %20 DISPLAY_TEXT
&GOTO TABLES &IF &EQ %20 DISPLAY_TABLES
&GOTO SUBACT &IF &EQ %20 BACK_MENU
&LABEL TABTEXT
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'SUB ACTION 1: EVALUATE ATTRIBUTES'
MOVE 3 11
TEXT '* Ecological values'
MOVE 3 10
TEXT '* Aesthetic values'
MOVE 3 9
TEXT '* Economic values'
&GOTO DISTAB
&LABEL TABLES
POPUP TABLES.POP 21 2 1 65 9 14
&GOTO TABCATC &IF &EQ %21 SUB_CATCHMENTS
&GOTO TABRIVE &IF &EQ %21 RIVERS
&GOTO TABDAMS &IF &EQ %21 DAMS
&GOTO TABRAIN &IF &EQ %21 RAINFALL
&GOTO TABSOIL &IF &EQ %21 LAND_TYPES
&GOTO TABLAND &IF &EQ %21 LAND_COVER
&GOTO TABVISI &IF &EQ %21 VISIBILITY
&GOTO TABSLOP &IF &EQ %21 SLOPE
&GOTO DISTAB &IF &EQ %21 BACK_MENU
TEXTFONT 2
```

```
TEXTSIZE .4 .3
&LABEL TABCATC
CLEAR
MOVE 2 13
TEXTFILE SUBCATCH.TAB
&GOTO TABLES
&LABEL TABRIVE
CLEAR
MOVE 2 13
TEXTFILE RIVER.TAB
&GOTO TABLES
&LABEL TABDAMS
CLEAR
MOVE 2 13
TEXTFILE DAMS.TAB
&GOTO TABLES
&LABEL TABRAIN
CLEAR
MOVE 2 13
TEXTFILE RAINFALL.TAB
&GOTO TABLES
&LABEL TABSOIL
CLEAR
MOVE 2 13
TEXTFILE SOILS.TAB
&GOTO TABLES
&LABEL TABLAND
CLEAR
MOVE 2 13
TEXTFILE LANDUSE.TAB
&GOTO TABLES
&LABEL TABVISI
CLEAR
MOVE 2 13
TEXTFILE VISIBLE.TAB
&GOTO TABLES
&LABEL TABSLOP
CLEAR
MOVE 2 13
TEXTFILE SLOPE.TAB
&GOTO TABLES
&LABEL DISP22
POPUP DISPLAY.POP 22 2 1 67 3 12
&GOTO DATTEXT &IF &EQ %22 DISPLAY_TEXT
&GOTO DATA &IF &EQ %22 DISPLAY_DATA
&GOTO SUBACT &IF &EQ %22 BACK_MENU
&LABEL DATTEXT
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'SUB ACTION 2: EVALUATE LANDSCAPE FACETS'
MOVE 3 11
TEXT '*  Conservation'
MOVE 3 10
TEXT '*  Agriculture'
MOVE 3 9
```

```
TEXT '*  Development'
MOVE 3 8
TEXT '*  Residential'
&GOTO DISP22
&LABEL DATA
MAPPOS CEN CEN
MAPLIM 0 0 15 15
POPUP DATA.POP 23 2 1 66 6 13
&GOTO PARAM24 &IF &EQ %23 PARAMETERS
&GOTO DATCONS &IF &EQ %23 CONSERVATION
&GOTO DATAGRI &IF &EQ %23 AGRICULTURE
&GOTO DATDEVE &IF &EQ %23 DEVELOPMENT
&GOTO DATRESI &IF &EQ %23 RESIDENTIAL
&GOTO DISP22 &IF &EQ %23 BACK_MENU
&LABEL DATCONS
CLEAR
MAPPOS CEN CEN
MAPLIM 0 0 15 15
TEXTFONT 2
TEXTSIZE .3 .2
TEXTSPACING 0.9
MOVE 16 10
TEXT 'CONSERVATION'
MOVE 16 9
KEYSHADE CLASS.KEY NOBOX
POLYGONSH CONS CLASS_CONS
&GOTO DATA
&LABEL DATAGRI
CLEAR
MOVE 16 10
TEXT 'AGRICULTURE'
MOVE 16 9
KEYSHADE CLASS.KEY NOBOX
POLYGONSH AGRI CLASS_AGRI
&GOTO DATA
&LABEL DATDEVE
CLEAR
MOVE 16 10
TEXT 'DEVELOPMENT'
MOVE 16 9
KEYSHADE CLASS.KEY NOBOX
POLYGONSH DEVE CLASS_DEVE
&GOTO DATA
&LABEL DATRESI
CLEAR
MOVE 16 10
TEXT 'RESIDENTIAL'
MOVE 16 9
KEYSHADE CLASS.KEY NOBOX
POLYGONSH RESI CLASS_RESI
&GOTO DATA
&LABEL PARAM24
POPUP PARAM24.POP 24 2 1 66 5 13
&GOTO CLEAR24 &IF &EQ %24 CLEAR
&GOTO ZOOM24 &IF &EQ %24 ZOOM
&GOTO DAM24 &IF &EQ %24 VIEW_DAM_SITE
&GOTO IDENT25 &IF &EQ %24 IDENTIFY
&GOTO DATA &IF &EQ %24 BACK_MENU
```

```
&LABEL CLEAR24
CLEAR
&GOTO PARAM24
&LABEL ZOOM24
MAPE *
&GOTO PARAM24
&LABEL DAM24
MAPE CATCH
&GOTO PARAM24
&LABEL IDENT25
POPUP IDENT25.POP 25 2 1 64 5 15
&GOTO CONS &IF &EQ %25 ID_CONSERVATION
&GOTO AGRI &IF &EQ %25 ID_AGRICULTURE
&GOTO DEVE &IF &EQ %25 ID_DEVELOPMENT
&GOTO RESI &IF &EQ %25 ID_RESIDENTIAL
&GOTO PARAM24 &IF &EQ BACK_MENU
&LABEL CONS
IDENTIFY CONS POLY *
&GOTO IDENT25
&LABEL AGRI
IDENTIFY AGRI POLY *
&GOTO IDENT25
&LABEL DEVE
IDENTIFY DEVE POLY *
&GOTO IDENT25
&LABEL RESI
IDENTIFY RESI POLY *
&GOTO IDENT25
&LABEL DISP26
POPUP DISPLAY.POP 26 2 1 67 3 12
&GOTO PROPTEXT &IF &EQ %26 DISPLAY_TEXT
&GOTO PROPO &IF &EQ %26 DISPLAY_DATA
&GOTO SUBACT &IF &EQ %26 BACK_MENU
&LABEL PROPTEXT
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'SUB ACTION 3: DEVELOP IDEAL LAND USE PROPOSAL'
MOVE 3 11
TEXT '*  Ideal land use proposal'
&GOTO DISP26
&LABEL PROPO
MAPPOS CEN CEN
MAPLIM 0 0 15 15
POPUP PROPO.POP 27 2 1 65 3 14
&GOTO PARAM28 &IF &EQ %27 PARAMETERS
&GOTO IDEAL &IF &EQ %27 IDEAL_PROPOSAL
&GOTO DISP26 &IF &EQ %27 BACK_MENU
&LABEL PARAM28
POPUP PARAM24.POP 28 2 1 66 5 13
&GOTO CLEAR28 &IF &EQ %28 CLEAR
&GOTO ZOOM28 &IF &EQ %28 ZOOM
&GOTO DAM28 &IF &EQ %28 VIEW_DAM_SITE
&GOTO IDENT29 &IF &EQ %28 IDENTIFY
&GOTO PROPO &IF &EQ %28 BACK_MENU
&LABEL CLEAR28
```

```
CLEAR
&GOTO PARAM28
&LABEL ZOOM28
MAPE *
&GOTO PARAM28
&LABEL DAM28
MAPE CATCH
&GOTO PARAM28
&LABEL IDENT29
POPUP IDENT29.POP 29 2 1 62 2 17
&GOTO IDEA &IF &EQ %29 ID_IDEAL_PROPOSAL
&GOTO PARAM28 &IF &EQ %29 BACK_MENU
&LABEL IDEA
IDENTIFY IDEA POLY *
&GOTO IDENT29
&LABEL IDEAL
MAPPOS CEN CEN
MAPLIM 0 0 15 15
TEXTFONT 2
TEXTSIZE .3 .2
TEXTSPACING 0.9
MOVE 16 10
TEXT 'IDEAL PROPOSAL'
MOVE 16 9
KEYSHADE ZONING.KEY NOBOX
POLYGONSH FACETS CLASS_ZONING
&GOTO PROPO
&LABEL DISPROP
POPUP DISPROP.POP 30 2 1 63 3 16
&GOTO PROPTEXT &IF &EQ %30 DISPLAY_TEXT
&GOTO PROP &IF &EQ %30 DISPLAY_PROPOSAL
&GOTO PLANSTART &IF &EQ %30 BACK_MENU
&LABEL PROPTEXT
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'ACTION 8: ILLUSTRATE ALTERNATIVE PROPOSALS'
MOVE 3 11
TEXT '* Past'
MOVE 3 10
TEXT '* Present'
MOVE 3 9
TEXT '* Future'
MOVE 3 8
TEXT '* Ideal future'
&GOTO DISPROP
&LABEL PROP
MAPPOS CEN CEN
MAPLIM 0 0 15 15
POPUP PROP.POP 31 2 1 67 6 12
&GOTO PARAM32 &IF &EQ %31 PARAMETERS
&GOTO PAST &IF &EQ %31 PAST
&GOTO PRES &IF &EQ %31 PRESENT
&GOTO FUTU &IF &EQ %31 FUTURE
&GOTO IFUT &IF &EQ %31 IDEAL_FUTURE
&GOTO DISPROP &IF &EQ %31 BACK_MENU
```

```
&LABEL PARAM32
POPUP PARAM24.POP 32 2 1 66 5 13
&GOTO CLEAR32 &IF &EQ %32 CLEAR
&GOTO ZOOM32 &IF &EQ %32 ZOOM
&GOTO DAM32 &IF &EQ %32 VIEW_DAM_SITE
&GOTO IDENT33 &IF &EQ %32 IDENTIFY
&GOTO PROP &IF &EQ %32 BACK_MENU
&LABEL CLEAR32
CLEAR
&GOTO PARAM32
&LABEL ZOOM32
MAPE *
&GOTO PARAM32
&LABEL DAM32
MAPE CATCH
&GOTO PARAM32
&LABEL IDENT33
POPUP IDENT33.POP 33 2 1 64 5 15
&GOTO IPAST &IF &EQ %33 ID_PAST
&GOTO IPRES &IF &EQ %33 ID_PRESENT
&GOTO IFUTU &IF &EQ %33 ID_FUTURE
&GOTO IIDEA &IF &EQ %33 ID_IDEAL_FUTURE
&GOTO PARAM32 &IF &EQ %33 BACK_MENU
&LABEL IPAST
IDENTIFY PAST POLY *
&GOTO IDENT33
&LABEL IPRES
IDENTIFY LANDUSE POLY *
&GOTO IDENT33
&LABEL IFUTU
IDENTIFY FUTURE POLY *
&GOTO IDENT33
&LABEL IIDEA
IDENTIFY SCENE100 POLY *
&GOTO IDENT33
&LABEL PAST
CLEAR
MAPPOS CEN CEN
MAPLIM 0 0 15 15
TEXTFONT 2
TEXTSIZE .3 .2
TEXTSPACING 0.9
CLEAR
MOVE 16 10
TEXT 'PAST'
MOVE 16 9
KEYSHADE PAST.KEY NOBOX
RES SUBCATCH POLY SUBCATCH-ID = 1
POLYGONSH SUBCATCH 1
CLEARSEL
RES SUBCATCH POLY SUBCATCH-ID = 2
POLYGONSH SUBCATCH 1
CLEARSEL
RES SUBCATCH POLY SUBCATCH-ID = 3
POLYGONSH SUBCATCH 5
&GOTO PROP
&LABEL PRES
CLEAR
```

```
MOVE 16 10
TEXT 'PRESENT'
MOVE 16 9
KEYSHADE LANDUSE.KEY NOBOX
POLYGONSH LANDUSE LANDUSE-ID
&GOTO PROP
&LABEL FUTU
CLEAR
MOVE 16 10
TEXT 'FUTURE'
MOVE 16 9
KEYSHADE FUTU.KEY NOBOX
RES CATCH POLY CATCH-ID = 1
POLYGONSH CATCH 3
CLEARSEL
&GOTO PROP
&LABEL IFUT
CLEAR
MOVE 16 10
TEXT 'IDEAL FUTURE'
MOVE 16 9
KEYSHADE SCENE100.KEY NOBOX
POLYGONSH SCENE100 SCENE100-ID
&GOTO PROP
&REM ==========
&REM HYDRO SUB MENU
&REM ==========
&LABEL HYDRO
CLEAR
&LABEL HYDRO1
POPUP HYDRO.POP 34 2 1 67 8 12
&GOTO LIST34 &IF &EQ %34 LIST_ACTIONS
&GOTO HYDRO34 &IF &EQ %34 HYDRO_MODEL
&GOTO IMP34 &IF &EQ %34 IMPACTS
&GOTO VAR34 &IF &EQ %34 VARIABLES
&GOTO DISALT &IF &EQ %34 ALTERNATIVES
&GOTO PROP34 &IF &EQ %34 PROPOSAL
&GOTO RUNM &IF &EQ %34 RUN_MODEL
&GOTO MAINMENU &IF &EQ %34 MAIN_MENU
&LABEL LIST34
CLEAR
MAPPOS LL LL
MAPLIM 0 0 20 15
TEXTFONT 10
TEXTSPACING .9
TEXTCOL 1
TEXTSIZE .5 .4
MOVE 1 14
TEXT 'STEP 6: HYDROLOGICAL MODELING'
MOVE 1 12
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'The following actions are relevant to the hydrological model:'
MOVE 3 10
TEXT '* Select hydrological model'
MOVE 3 9
TEXT '* Select environmental impacts to be analyzed'
```

```
MOVE 3 8
TEXT '*  Identify environmental variables'
MOVE 3 7
TEXT '*  Select alternative land cover and land use data sets'
MOVE 3 6
TEXT '*  Select ideal planning proposal'
MOVE 3 5
TEXT '*  Run hydrological model for four scenarios'
&GOTO HYDRO1
&REM ==========================
&REM HYDRO MODEL SUB MENU
&REM ==========================
&LABEL HYDRO34
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'ACTION 1: SELECT HYDROLOGICAL MODEL'
MOVE 3 11
TEXT '-  ACRU'
MOVE 3 10
TEXT '-  Pitman'
&GOTO HYDRO1
&REM ========================
&REM IMPACTS SUBMENU
&REM ========================
&LABEL IMP34
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'ACTION 2: SELECT ENVIRONMENTAL IMPACTS TO BE ANALYZED'
MOVE 3 11
TEXT '-  Flow rates'
MOVE 3 10
TEXT '-  Flood peaks'
MOVE 3 9
TEXT '-  Sediment yield'
&GOTO HYDRO1
&REM ======================
&REM VARIABLES SUBMENU
&REM ======================
&LABEL VAR34
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'ACTION 3: IDENTIFY ENVIRONMENTAL VARIABLES'
MOVE 3 11
TEXT '-  Catchments
MOVE 3 10
TEXT '-  Land types
MOVE 3 9
TEXT '-  Slope'
MOVE 3 8
```

```
TEXT '- Climate'
MOVE 3 7
TEXT '- Land cover'
&GOTO HYDRO1
&LABEL PROP34
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'ACTION 5: SELECT IDEAL PLANNING PROPOSAL FROM THE ECOLOGICAL'
MOVE 3 12
TEXT 'PROCEDURE'
&GOTO HYDRO1
&LABEL RUNM
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'ACTION 6: RUN HYDROLOGICAL MODEL FOR FOUR SCENARIOS'
MOVE 3 11
TEXT '- Past
MOVE 3 10
TEXT '- Present
MOVE 3 9
TEXT '- Future'
MOVE 3 8
TEXT '- Ideal future'
&GOTO HYDRO1
&LABEL DISALT
POPUP DISALT.POP 35 2 1 59 3 20
&GOTO ALTTEXT &IF &EQ %35 DISPLAY_TEXT
&GOTO ALTER &IF &EQ %35 DISPLAY_ALTERNATIVES
&GOTO HYDRO &IF &EQ %35 BACK_MENU
&LABEL ALTTEXT
CLEAR
MOVE 1 13
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'ACTION 4: SELECT ALTERNATIVE LAND COVER AND LAND USE DATA SETS'
MOVE 3 11
TEXT '- Past
MOVE 3 10
TEXT '- Present
MOVE 3 9
TEXT '- Future'
&GOTO DISALT
&LABEL ALTER
POPUP ALTER.POP 36 2 1 69 5 10
&GOTO PARAM37 &IF &EQ %36 PARAMETERS
&GOTO ALTPAST &IF &EQ %36 PAST
&GOTO ALTPRES &IF &EQ %36 PRESENT
&GOTO ALTFUTU &IF &EQ %36 FUTURE
&GOTO DISALT &IF &EQ %36 BACK_MENU
&LABEL PARAM37
POPUP PARAM24.POP 37 2 1 66 5 13
```

```
&GOTO CLEAR37 &IF &EQ %37 CLEAR
&GOTO ZOOM37 &IF &EQ %37 ZOOM
&GOTO DAM37 &IF &EQ %37 VIEW_DAM_SITE
&GOTO IDENT38 &IF &EQ %37 IDENTIFY
&GOTO ALTER &IF &EQ %37 BACK_MENU
&LABEL CLEAR37
CLEAR
&GOTO PARAM37
&LABEL ZOOM37
MAPE *
&GOTO PARAM37
&LABEL DAM37
MAPE CATCH
&GOTO PARAM37
&LABEL IDENT38
POPUP IDENT38.POP 38 2 1 69 4 10
&GOTO IDEPAST &IF &EQ %38 ID_PAST
&GOTO IDEPRES &IF &EQ %38 ID_PRESENT
&GOTO IDEFUTU &IF &EQ %38 ID_FUTURE
&GOTO PARAM37 &IF &EQ %38 BACK_MENU
&LABEL IDEPAST
IDENTIFY PAST POLY *
&GOTO IDENT38
&LABEL IDEPRES
IDENTIFY LANDUSE POLY *
&GOTO IDENT38
&LABEL IDEFUTU
IDENTIFY FUTURE POLY *
&GOTO IDENT38
&LABEL ALTPAST
CLEAR
CLEARSEL
MAPPOS CEN CEN
MAPLIM 0 0 15 15
TEXTFONT 2
TEXTSIZE .3 .2
TEXTSPACING 0.9
MOVE 16 10
TEXT 'PAST'
MOVE 16 9
KEYSHADE PAST.KEY NOBOX
RES SUBCATCH POLY SUBCATCH-ID = 1
POLYGONSH SUBCATCH 1
CLEARSEL
RES SUBCATCH POLY SUBCATCH-ID = 2
POLYGONSH SUBCATCH 1
CLEARSEL
RES SUBCATCH POLY SUBCATCH-ID = 3
POLYGONSH SUBCATCH 5
CLEARSEL
&GOTO ALTER
&LABEL ALTPRES
CLEAR
CLEARSEL
MOVE 16 10
TEXT 'PRESENT'
MOVE 16 9
KEYSHADE LANDUSE.KEY NOBOX
```

```
POLYGONSH LANDUSE LANDUSE-ID
&GOTO ALTER
&LABEL ALTFUTU
CLEAR
CLEARSEL
MOVE 16 10
TEXT 'FUTURE'
MOVE 16 9
KEYSHADE FUTU.KEY NOBOX
RES CATCH POLY CATCH-ID = 1
POLYGONSH CATCH 3
CLEARSEL
&GOTO ALTER
&REM ==================
&REM ENVIRONMENTAL IMPACTS
&REM ==================
&LABEL IMPACTS
CLEAR
&LABEL IMPACTS1
POPUP IMPACTS.POP 39 2 1 65 4 14
&GOTO IMPTEXT &IF &EQ %39 DISPLAY_TEXT
&GOTO IMPTAB &IF &EQ %39 DISPLAY_TABLES
&GOTO IMPGRAP &IF &EQ %39 DISPLAY_GRAPHS
&GOTO MAINMENU &IF &EQ %39 MAIN_MENU
&LABEL IMPTEXT
CLEAR
MAPPOS LL LL
MAPLIM 0 0 20 15
TEXTFONT 10
TEXTSPACING .9
TEXTCOL 1
TEXTSIZE .5 .4
MOVE 1 14
TEXT 'STEP 7: ENVIRONMENTAL IMPACTS'
MOVE 3 12
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'Review results of four scenarios'
&GOTO IMPACTS1
&LABEL IMPTAB
CLEAR
&LABEL IMPTABA
POPUP IMPTAB.POP 40 2 1 70 4 9
&GOTO IMPAST &IF &EQ %40 PAST
&GOTO IMPRES &IF &EQ %40 PRESENT
&GOTO IMFUTU &IF &EQ %40 FUTURE
&GOTO IMPACTS1 &IF &EQ %40 BACK_MENU
&LABEL IMPAST
TEXTFONT 0
TEXTSPACING 1.3
TEXTSIZE .28
MOVE 0.2 13
TEXTFILE PAST.CLA
TEXTFONT 2
TEXTSIZE .4 .3
TEXTSPACING 0.9
&GOTO IMPTABA
```

```
&LABEL IMPRES
TEXTFONT 0
TEXTSIZE .28
TEXTSPACING 1.3
MOVE 0.2 8
TEXTFILE PRES.CLA
TEXTFONT 2
TEXTSIZE .4 .3
TEXTSPACING 0.9
&GOTO IMPTABA
&LABEL IMFUTU
TEXTFONT 0
TEXTSIZE .28
TEXTSPACING 1.3
MOVE 0.2 3
TEXTFILE FUTU.CLA
TEXTFONT 2
TEXTSIZE .4 .3
TEXTSPACING 0.9
&GOTO IMPTABA
&LABEL IMPGRAP
CLEAR
CLEARSEL
&LABEL IMPGRAPA
POPUP IMPGRAP.POP 41 2 1 70 5 9
&GOTO GRPAST &IF &EQ %41 PAST
&GOTO GRPRES &IF &EQ %41 PRESENT
&GOTO GRSING &IF &EQ %41 SINGLE
&GOTO GRFUTU &IF &EQ %41 FUTURE
&GOTO IMPACTS1 &IF &EQ %41 BACK_MENU
&LABEL GRPAST
MAPE 22 3 35 10
MAPPOS CEN CEN
MAPLIM 0 0 25 15
RES GRAFIEK ARCS GRAFIEK-ID = 0
LINEC 1
ARCS GRAFIEK
ANNOTEXT GRAFIEK
TEXTFONT 2
TEXTSIZE .3 .2
TEXTSPACING 0.9
MOVE 14 10
KEYSHADE GRAFIEK.KEY NOBOX
CLEARSEL
RES GRAFIEK ARCS GRAFIEK-ID = 2
LINECOL 2
ARCS GRAFIEK
CLEARSEL
&GOTO IMPGRAPA
&LABEL GRPRES
RES GRAFIEK ARCS GRAFIEK-ID = 1
LINECOL 3
ARCS GRAFIEK
CLEARSEL
&GOTO IMPGRAPA
&LABEL GRSING
CLEAR
&LABEL GRSING1
```

```
POPUP GRSING.POP 46 2 1 66 4 13
&GOTO FORSING &IF &EQ %46 FORESTS
&GOTO AFFSING &IF &EQ %46 AFFORESTATION
&GOTO CITSING &IF &EQ %46 CITY
&GOTO IMPGRAPA &IF &EQ %46 BACK_MENU
&LABEL FORSING
MAPE 35 10 44 15
MAPPOS CEN CEN
MAPLIM 0 0 25 15
RES GRAF1 ARCS GRAF1-ID = 20
LINEC 1
ARCS GRAF1
ANNOTEXT GRAF1
TEXTFONT 2
TEXTSIZE .3 .2
TEXTSPACING 0.9
MOVE 14 10
KEYSHADE GRAF1.KEY NOBOX
CLEARSEL
RES GRAF1 ARCS GRAF1-ID = 1
LINECOL 3
ARCS GRAF1
CLEARSEL
&GOTO GRSING1
&LABEL AFFSING
CLEARSEL
RES GRAF1 ARCS GRAF1-ID = 34
LINECOL 6
ARCS GRAF1
CLEARSEL
&GOTO GRSING1
&LABEL CITSING
CLEARSEL
RES GRAF1 ARCS GRAF1-ID = 56
LINECOL 2
ARCS GRAF1
CLEARSEL
&GOTO GRSING1
&LABEL GRFUTU
CLEAR
&LABEL GRFUTU1
POPUP GRFUTU.POP 45 2 1 63 5 16
&GOTO GRFUTU3 &IF &EQ %45 AFFORESTATION
&GOTO GRFUTU4 &IF &EQ %45 AFFOR_AND_FOREST
&GOTO GRFUTU5 &IF &EQ %45 FOREST_AND_CITY
&GOTO GRFUTU6 &IF &EQ %45 AFFOR_AND_CITY
&GOTO IMPGRAPA &IF &EQ %45 BACK_MENU
&LABEL GRFUTU3
MAPE 37 7 46 12
MAPPOS CEN CEN
MAPLIM 0 0 25 15
RES GRAF ARCS GRAF-ID = 20
LINEC 1
ARCS GRAF
ANNOTEXT GRAF
TEXTFONT 2
TEXTSIZE .3 .2
TEXTSPACING 0.9
```

```
MOVE 14 10
KEYSHADE GRAF.KEY NOBOX
CLEARSEL
RES GRAF ARCS GRAF-ID = 3
LINECOL 3
ARCS GRAF
CLEARSEL
&GOTO GRFUTU1
&LABEL GRFUTU4
CLEARSEL
RES GRAF ARCS GRAF-ID = 4
LINECOL 4
ARCS GRAF
CLEARSEL
&GOTO GRFUTU1
&LABEL GRFUTU5
CLEARSEL
RES GRAF ARCS GRAF-ID = 5
LINECOL 5
ARCS GRAF
CLEARSEL
&GOTO GRFUTU1
&LABEL GRFUTU6
CLEARSEL
RES GRAF ARCS GRAF-ID = 6
LINECOL 7
ARCS GRAF
CLEARSEL
&GOTO GRFUTU1
&REM ==========
&REM IDEAL PROPOSAL
&REM ==========
&LABEL PROPOSAL
POPUP IMPACTS.POP 42 2 1 65 4 14
&GOTO PRTEXT &IF &EQ %42 DISPLAY_TEXT
&GOTO PRTAB &IF &EQ %42 DISPLAY_TABLES
&GOTO PRGRAP &IF &EQ %42 DISPLAY_GRAPHS
&GOTO MAINMENU &IF &EQ %42 MAIN_MENU
&LABEL PRTEXT
CLEAR
MAPPOS LL LL
MAPLIM 0 0 20 15
TEXTFONT 10
TEXTSPACING .9
TEXTCOL 1
TEXTSIZE .5 .4
MOVE 1 14
TEXT 'STEP 8: IDEAL PLANNING PROPOSAL'
MOVE 1 12
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
TEXT 'Illustrate results of ideal planning proposal'
&GOTO PROPOSAL
&LABEL PRTAB
CLEAR
MOVE 0.2 13
TEXTFONT 0
```

```
TEXTSIZE .28
TEXTSPACING 1.3
TEXTFILE SCENE100.CLA
TEXTFONT 2
TEXTSPACING 0.9
TEXTSIZE .4 .35
&GOTO PROPOSAL
&LABEL PRGRAP
CLEAR
MAPE 22 3 35 10
MAPPOS CEN CEN
MAPLIM 0 0 25 15
MOVE 2 2
RES GRAFIEK ARCS GRAFIEK-ID = 0
LINEC 1
ARCS GRAFIEK
ANNOTEXT GRAFIEK
CLEARSEL
RES GRAFIEK ARCS GRAFIEK-ID = 2
LINEC 2
ARCS GRAFIEK
CLEARSEL
RES GRAFIEK ARCS GRAFIEK-ID = 4
LINECOL 6
ARCS GRAFIEK
CLEARSEL
TEXTSIZE .4 .35
MOVE 13 10
TEXTFONT 0
TEXTSPACING 1.5
TEXTCOL 2
TEXT 'PRESENT'
TEXTCOL 6
MOVE 13 9
TEXT 'IDEAL FUTURE'
TEXTCOL 1
TEXTFONT 2
TEXTSPACING 0.9
&GOTO PROPOSAL
&LABEL CONCLUSION
CLEAR
MAPPOS LL LL
MAPLIM 0 0 20 15
TEXTCOL 1
TEXTFONT 10
TEXTSPACING 0.9
TEXTSIZE .5 .4
MOVE 1 14
TEXT 'CONCLUSIONS'
MOVE 1 12
TEXTFONT 2
TEXTSPACING .9
TEXTSIZE .4 .35
TEXT '* Planning of catchment basins can contribute to an improved water budget'
MOVE 1 10.5
TEXT '* Conservation is a valid form of land use when planning for a resource'
MOVE 1 9.5
TEXT '  such as water.'
```

```
MOVE 1 8
TEXT '*  Planning of urbanisation around and not below dam levels results in'
MOVE 1 7
TEXT '  an improved water budget.'
MOVE 1 5.5
TEXT '*  Indigenous vegetation types use less water than exotic plantations.'
MOVE 1 4
TEXT '*  GIS can be successfully applied with a hydrological model such as ACRU.'
MOVE 1 2.5
TEXT '*  GIS contributes to the development and testing of a variety of land use'
MOVE 1 1.5
TEXT '  scenarios.'
TEXTFONT 10
TEXTSPACING .9
POPUP PROBLEM.POP 2 2 1 70 1 9
&GOTO CLEARPROB &IF &EQ %2 MAIN_MENU
&LABEL END
QUIT
```