AN IMPACT ASSESSMENT OF ALTERNATIVE ACCESS ROADS TO THE MOHALE DAM, LESOTHO

by
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A Dissertation Submitted in Partial Fulfilment of the Requirements of the Degree of Master of Philosophy in Environmental Science

UNIVERSITY OF CAPE TOWN

JUNE 1993

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EXECUTIVE SUMMARY

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1. INTRODUCTION

The construction of the Mohale Dam, which forms part of Phase 1B of the Lesotho Highlands Water Project (LHWP), requires an access road for the transportation of construction materials and machinery from the Lesotho-South Africa border to the dam site on the Senqunyane River in Lesotho.

There are presently two alternative access routes under consideration. These are indicated in Figure 1 overleaf.

One of the proposed routes is the existing Mountain Road or "Western Access Road" (WAR) which runs in an easterly direction from Maseru over the Thaba Putsoa Mountain Range to the village of Patiseng near the site of the dam. The section of the WAR from Maseru to St. Michael's does not currently need upgrading, but the section from St. Michael's to Patiseng will need upgrading to deal with the expected increased traffic load of up to 200 vehicles per day during the peak construction period. The WAR will also involve the construction of a bypass at Maseru.

The second alternative under consideration is the so-called "Least Cost Alternative Route" (LCAR). This route runs along existing roads from Maputsoe, via Teya-Teyaneng, to Ha Mateka and from here along a proposed new road through the Jorodane Valley to Patiseng.

2. PURPOSE OF THIS REPORT

The purpose of this report is twofold.

Its aim is firstly to compare the Western Access Road (WAR) with the Least Cost Alternative Route (LCAR) in terms of their impact on the environment and identify which of the two routes is the preferred alternative. To this end, the report documents and analyses the results of an impact assessment study, carried out by the Environmental Evaluation Unit (EEU) of the University of Cape Town. The report also includes recommended actions to mitigate negative impacts and enhance positive impacts.

The report secondly serves as a dissertation, for the purpose of academic evaluation by examiners, for the degree of Master of Philosophy in Environmental Science. To this end it aims to demonstrate analytical rigour and an understanding of the theoretical basis of the study.

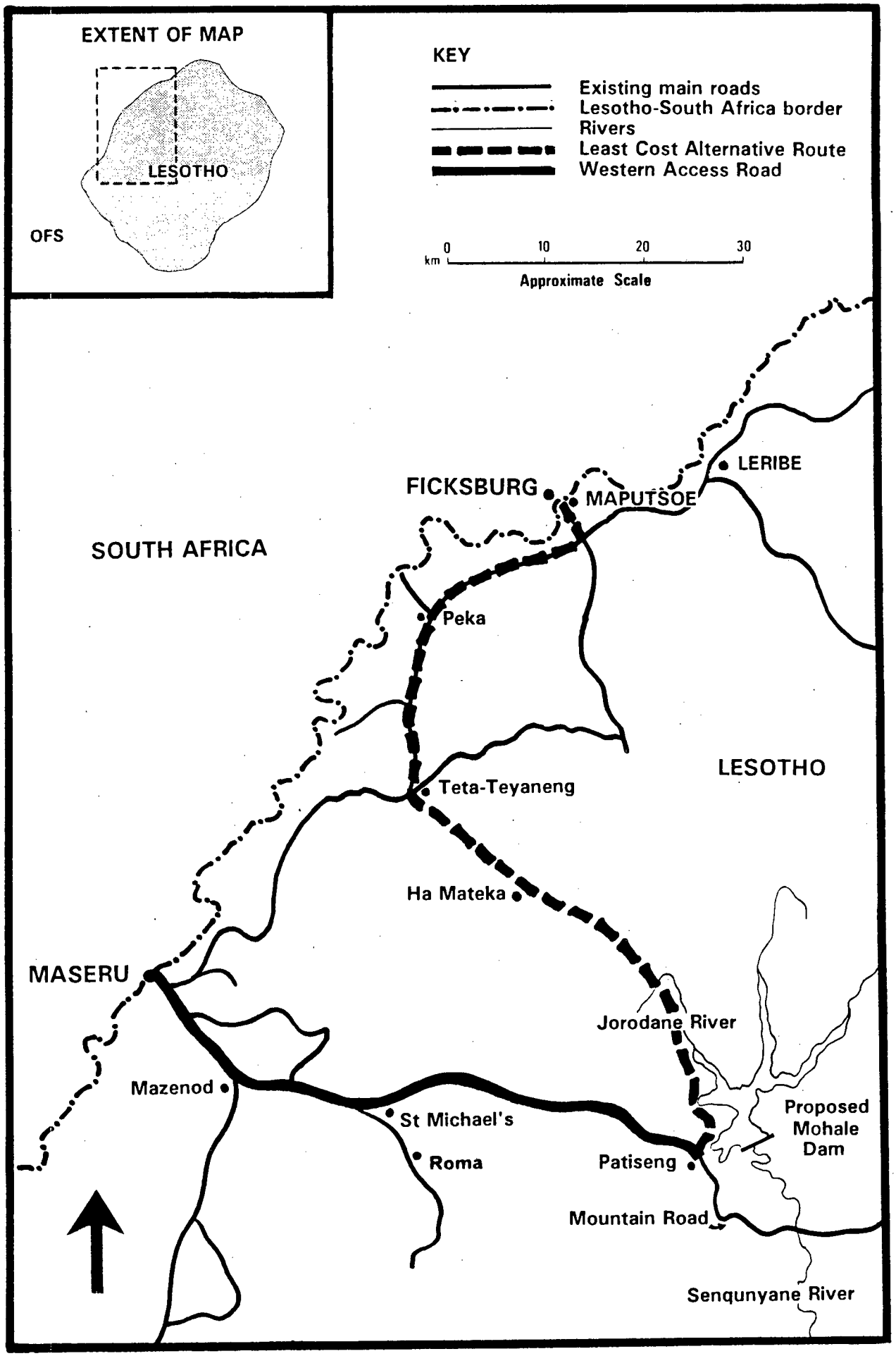

FIGURE 1. MAP OF THE STUDY AREA SHOWING ALTERNATIVE ROUTES

3. TERMS OF REFERENCE FOR THE STUDY

Contract 1000 was awarded by the Lesotho Highlands Development Authority (LHDA) to the Gibb-Bergman Joint Venture (GBJV) on 18 December 1992. This contract is for the planning, design, and supervision of the construction of access roads for Phase 1B of the Lesotho Highlands Water Project. The Environmental Evaluation Unit (EEU) of the University of Cape Town has been appointed as a sub-consultant by Bergman and Partners (consulting engineers) to *inter alia* conduct an environmental impact assessment of proposed alternative access roads to the Mohale Dam.

Following discussions with Bergman and Partners, it was agreed that the study of the two proposed alternative access roads should:

- predict all the negative and positive environmental impacts of the two alternative routes, including both biophysical and socioeconomic impacts, taking into account the LHDA's policy objective of promoting development in Lesotho, as well as the regional and national context of the project;
- identify and consult with the people who are likely to be affected by the road to establish their views and concerns;
- assess each of the identified impacts for their overall significance;
- recommend mitigation measures for potentially significant negative impacts as well as identify associated compensation requirements;
- suggest optimisation measures for potentially significant positive impacts, and
- identify the route which is the preferred environmental option.

4. TERMS OF REFERENCE FOR THIS REPORT

No specific technical brief was provided for this report, other than the prescribed report title. Academic guidelines were, however, provided. A copy of these guidelines may be found in Appendix 1 of this report.

On the basis of this information, the following seven report objectives were set by the author:

- Develop the theoretical basis for the study and critically assess the study plan in terms of the requirements of integrated environmental management (IEM) and environmental impact assessments (EIAs).

- Assess impacts of the two routes in a comparative manner and identify appropriate mitigation and optimisation measures.
- Identify impacts and issues of key importance in the decision-making process.
- Evaluate the routes in the light of the key issues identified, and on the basis of the criteria of efficiency, equity and sustainability.
- Identify the route which is the preferred environmental option.
- Recommend measures whereby environmental considerations can be incorporated into future stages of the project.
- Based on the experiences of this study, formulate general recommendations for future EIAs.

5. APPROACH TO THE STUDY

The environmental impact study was conducted according to the broad principles of integrated environmental management (IEM). IEM has been recommended by the Council for the Environment as a means of ensuring that the environmental consequences of development proposals are adequately considered in the planning process [Dept. Env. Affairs, 1992]. The study adopted an open, participatory approach, and included consultation with interested and affected parties (I&APs).

The study plan, which comprised two stages, is outlined in Figure 2.

Stage 1 of the study involved the identification of a "least cost alternative" to the Western Access Road (WAR). Eight possible alternatives to the WAR were identified on the basis of technical feasibility by the road engineers. These alternatives were then assessed and evaluated by the Environmental Evaluation Unit (EEU), and on the basis of this evaluation, and other engineering and cost studies carried out by BS Bergman and Partners, the Least Cost Alternative Route (LCAR) was selected by the Gibb-Bergman Joint Venture (GBJV) team. The stage 1 environmental assessment was essentially a desk-top study, but did include brief site visits to readily accessible sections of the alternative routes, as well as literature surveys. The methodology and results of stage 1 of the study are documented in Appendix 1 of EEU/2/93/104c.

Stage 2 of the study focussed on the assessment of impacts associated with the WAR and the LCAR. This stage of the study included the following tasks:

- scoping to identify important issues - this included meetings with relevant authorities and interested and affected parties (I&APs).

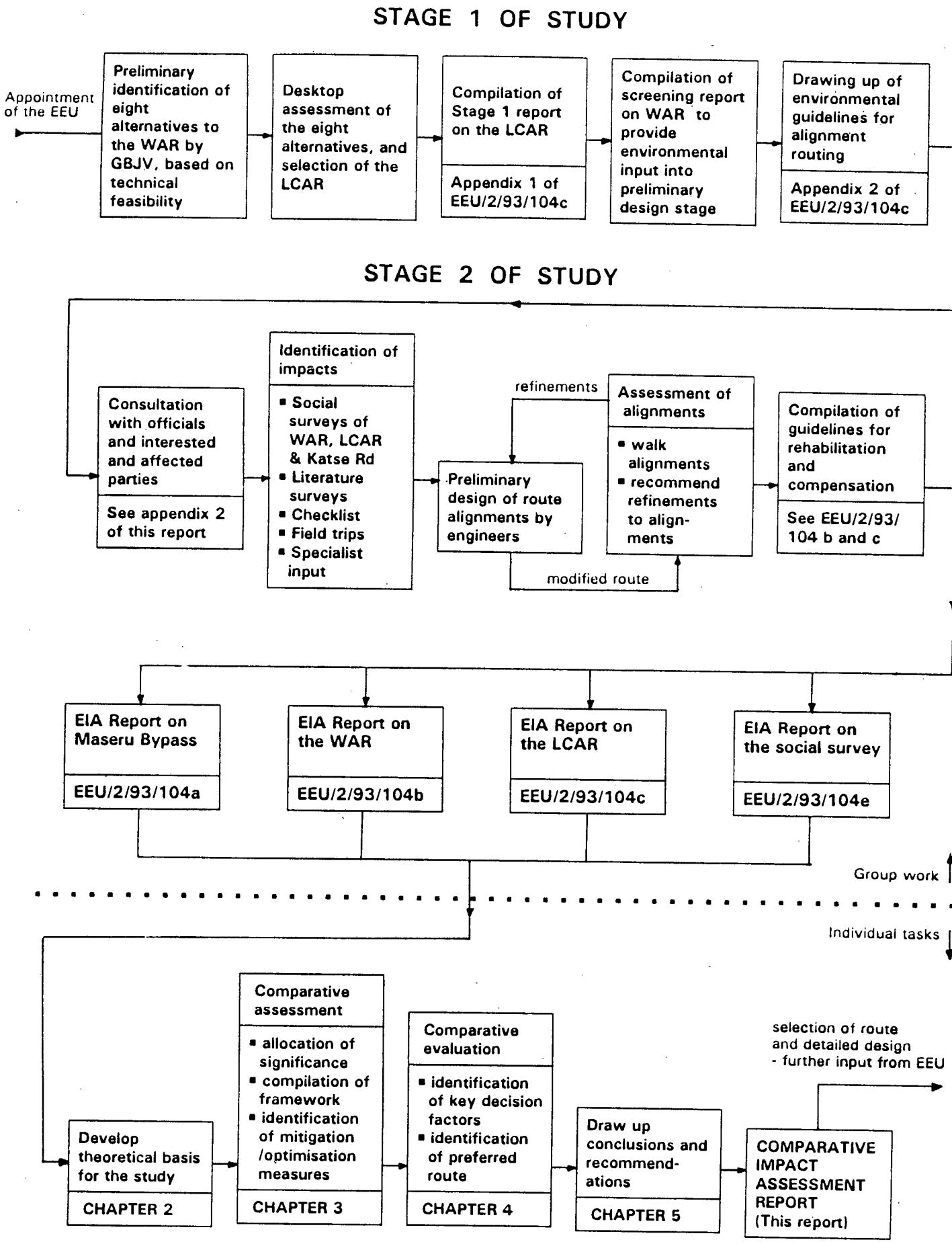

FIGURE 2: FLOW DIAGRAM OF STUDY PLAN

- identification of impacts - this was undertaken by means of literature reviews, further contact with I&APs and with specialist input in a number of fields, including rehabilitation, hydrology, road engineering, and archaeology. Approximately 10 days were spent in the field. To facilitate the identification of socioeconomic impacts, surveys were carried out at villages along the WAR and LCAR, and along the recently completed road to the Katse Dam site.

- identification of appropriate measures to mitigate negative impacts and enhance positive impacts - this was done mainly by consulting specialists and referring to literature and past studies.

- compilation of environmental impact assessment (EIA) reports - these were all compiled using the format and procedures set out in document 3 of the IEM Guideline Series [Dept. of Env. Affairs, 1992], and with reference to recommendations in other literature on EIAs.

This concludes the discussion of the study approach. In the section which follows, assumptions and limitations are outlined.

6. ASSUMPTIONS

The following are the main assumptions on which the study was based:

- Any construction of a road to the Mohale Dam should, as far as possible, serve the interests of the local people, as well as reinforce regional and national development objectives.

- The Lesotho Highlands Development Authority (LHDA) will provide compensation for losses incurred by local inhabitants in the event that land is taken, or buildings or other facilities are demolished by the road.

- There will be no significant impacts along sections of the routes where no major construction or upgrading work is planned. Areas where major construction or upgrading will take place are between St Michael's and Patiseng on the Western Access Road (WAR), between Ha Mateka and Patiseng on the Least Cost Alternative Route (LCAR), and at Maseru and Teya-Teyaneng, where bypasses will be built.

- A bypass will be built at Maseru if the WAR is chosen as the preferred alternative route, and railhead facilities at Maseru will be upgraded. In the case of the LCAR, it was assumed that the proponent will not build a bypass at Maseru, but that a bypass at Teya-Teyaneng will be built.

- The LCAR will not only provide access to the Mohale Dam site, but will link with the Mountain Road at Patiseng.

- If the LCAR is selected as the preferred alternative, further detailed environmental investigations will be carried out.

- The "no-go" alternative is unacceptable, for both practical and political reasons, and the WAR is the "minimum" acceptable proposal.

7. LIMITATIONS

The main limitations associated with the study relate to the project stage at which it was being carried out, the time available for the study, and the fact that the results of certain other relevant studies were not available for integration into the study.

The study took place during the planning and preliminary design stage of the project. This meant that many project actions were still not clearly defined. This is not, however, considered to be a serious limitation in the case of this report, because it is a comparative report, and assumptions made regarding project actions were made in a similar manner for both routes.

Stage 1 of the study was particularly constrained by time, and was required to be completed in 1 month. This resulted, *inter alia*, in limitations on the extent to which scoping could be carried out.

A limitation which applies to this report, is the fact that many of the results of relevant specialist studies, carried out concurrently with the EIA by other sub-consultants, were not available to the author at the time this report was written. Thus this report does not incorporate certain aspects which it ideally should, in particular the results of the transport and traffic studies and the macro-economic study.

8. CONCLUSIONS

The following are the main conclusions arising from the study:

8.1 THEORETICAL CONCLUSIONS

The main procedural shortcomings of the study were the following:

- the lack of early notification of interested and affected parties as required in the *develop proposal* stage of the integrated environmental management (IEM) procedure, due to time constraints and logistical problems. This had repercussions further

on in the process, in particular during scoping for the EIA, mainly because interested and affected parties (I&APs) were not forewarned of the proposal.

- the lack of public participation during stage 1 of the study which meant that the public were not involved in the identification of routing alternatives. This served to alienate I&APs to some extent, and to cast doubt on the legitimacy of the first stage of the study.

- the lack of co-ordination between various studies which were being carried out simultaneously by different sub-consultants. The EIA was thus not as *holistic* as it ideally should have been, as the results of the other studies were not all integrated into the EIA.

In spite of the above shortcomings, the EIA was a good example of a truly integrated and pro-active study, as environmental input into the planning process was timely, ongoing and iterative.

Four aspects of the study are considered to have been particularly successful.

Firstly, the environmental team was involved early on in the planning stages of the proposal. This meant that it was relatively easy to bring about changes, for environmental reasons, to the proposed routing alignments. Secondly, the planning and assessment stages were truly integrated. This ensured that IEM principles directed the planning process, rather than being considerations to be addressed after the development of the proposal.

The third aspect of the study which is particularly noteworthy, it that there was early integration of specialist and public review; this early input from reviewers served to influence and direct the study in a more meaningful way than a "post-study" review is likely to have done.

Finally, the study involved the compilation of mitigation and optimisation measures and general guidelines for rehabilitation *early on* in the life of the project i.e. during the planning stages. This is considered particularly useful because it serves to familiarise and forewarn the proponent of likely resource commitments in the future, thus improving the likelihood that the recommended measures and guidelines will be successfully implemented.

8.2 ASSESSMENT OF IMPACTS

The main positive impacts identified during the study were the following:

- Both routes will promote the safety and well-being of travellers, and the Western Access Road (WAR) will include the construction of a much-needed bypass at Maseru.

- Both proposals will provide improved access to the residents along the route, the Least Cost Alternative Route (LCAR) to a greater extent than the WAR.

- Both proposals will serve to promote Lesotho's national planning objectives of economic growth and employment creation.

- The WAR will reinforce existing plans for the Lesotho road network, and will result in savings to the Lesotho government in this regard.

The following were the main negative impacts identified:

- Construction activities, and improvements in access associated with the proposals, could adversely affect sensitive and rare ecological components. This effect will be more severe in the case of the LCAR, than the WAR.

- The LCAR could adversely affect the local informal cash economy in the Jorodane Valley.

- The LCAR is not in line with national road transport plans, and will be an increased burden on Lesotho's road maintenance budget.

The main types of mitigation measures recommended in this report are compensation for losses incurred, reduction or avoidance of impacts by design modifications, and rehabilitation of impacted areas. The main types of optimisation measures recommended relate to the enhancement of development opportunities through co-ordinated action.

8.3 KEY ISSUES

Seven issues were identified as being of key importance in the selection of a preferred route. These include the impact on plans for a Maseru bypass, the impact on residents along the proposed routes due to improvements in access, and the likely impact on the informal cash economy of the Jorodane Valley. The impact on conservation initiatives, in particular those concerned with the preservation of rare and endangered species, was also identified as a key issue.

Two other aspects which emerged as being of key importance are whether the route will serve to promote or contradict the National Settlement Policy and national transport plans. A final key issue identified is the financial cost to the Lesotho Highlands Development Authority (LHDA) associated with the alternative proposals.

The above key issues served as a basis for the comparative evaluation of the two alternatives.

8.4 RELATIVE BENEFITS OF THE ROUTES

Issues identified as being of key importance to the decision-making process are indicated in the table below. In the case of each of the key issues, the impact of the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR) is described and the preferred route highlighted in bold print.

Table 4.1 COMPARISON OF ROUTES WITH REGARD TO KEY ISSUES

Key Issues	WAR	LCAR
Impact on plans for a Maseru bypass	**Bypass will be built**	Bypass will not be built
Impact on residents due to improved access	Slight positive impact	**Significant positive impact**
Impact on informal cash economy	**No effect**	Negative impact
Impact on conservation initiatives/plans	**No serious effect**	Significant negative impact
Impact on the National Settlement Policy	**Reinforces**	Contradicts
Impact on national transport plans	**Reinforces**	Contradicts
Total financial cost to LHDA	**M 172 million**	M 225 million

The relative benefits of the Western Access Road (WAR) are thus the following:

- it will include the construction of a bypass at Maseru, with all its associated benefits;
- it will avoid the negative impact on the informal cash economy which will be associated with the LCAR;
- it will not involve a significant negative impact on conservation, and in particular on the conservation of rare and endangered species;
- it serves to reinforce the National Settlement Policy;

- it is in line with national transport plans, and will avoid the additional long-term burden on Lesotho's road maintenance budget associated with the LCAR, and

- it costs M53 million less to construct.

The only relative benefit of the Least Cost Alternative Route (LCAR) is that it will result in a greater improvement in access compared to the WAR.

8.5 IDENTIFICATION OF PREFERRED ROUTE

The Western Access Road is preferable with regard to all three evaluation criteria applied, namely efficiency, equity and sustainability. There are furthermore no serious adverse effects or risks associated with the Western Access Road, which cannot be effectively mitigated.

The Least Cost Alternative Route, on the other hand, is associated with a number of serious negative effects. Not only will it involve adverse long-term cost implications which cannot be mitigated, but it will also contribute towards increasing the risk of extinction of two rare and endangered species.

In the light of the above, the Western Access Road is judged to be the preferred route.

9. RECOMMENDATIONS

The main recommendations of this report are the following:

9.1. The Western Access Road should be constructed, rather than the Least Cost Alternative Route.

9.2 The integrated environmental management (IEM) procedure should be followed during the decision-making and implementation stages of the project - in particular the specific actions listed below. IEM principles should be adhered to throughout the life of the project i.e. "from cradle to grave".

9.3. Specialist, authority and public review should be undertaken.

9.4 A Record of Decision should be drawn up, and made public, and opportunity for appeal provided.

9.5 A Management Plan and an Environmental Contract should be specified by the decision-maker as conditions of approval in the Record of Decision.

9.6 Mitigation and optimisation measures specified in chapter 3 of this report should be carried out.

9.7 An Environmental Control Officer should be appointed on a full-time basis to monitor construction activities.

9.8 If the Least Cost Alternative Route is selected for implementation, a further environmental impact assessment should be carried out during the detailed design stage of the project. The Management Plan should specifically include a detailed strategy to reduce the risk to rare and endangered species. Prior to the commencement of construction, detailed ecological studies should be carried out to serve as a baseline for a rigorous monitoring programme.

9.9 Environmental input into future stages of the project should include a detailed assessment of the impacts of those project components which were not clearly defined during the planning stages, including quarries, borrow pits, spoil areas and construction camps. This input should include recommendations regarding the siting of these components and the mitigation and optimisation of impacts.

9.10 One year after implementation of the proposal, an environmental audit should be carried out. The audit should primarily aim to provide feedback on the efficacy of the overall environmental management process, and should include recommendations for the management of future project components and phases of the Lesotho Highlands Water Project.

9.11 Present research regarding the distribution of the Maluti Minnow, *Pseudobarbus quathlambae*, [Rall *et al*, 1993] should continue in order to establish the extent of occurrence of this species, and the probability of extinction of the Minnow in the present threatened locality i.e. the Jorodane River. The research should be sponsored, if necessary, by the Lesotho Highlands Development Authority.

9.12 An integrated development plan for the entire Phase 1B area should be compiled by the Lesotho Highlands Development Authority, to facilitate co-ordination between various project components.

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EEU/2/93/104b: Environmental Impact Assessment of the Western Access Road (WAR)

EEU/2/93/104c: Environmental Impact Assessment of the Least Cost Alternative Route (LCAR)

EEU/2/93/104e: Report on the Social Survey for LHDA Contract 1000

NOTE: When reference is made in the text to "this report" the author is referring to this individual dissertation. Where the above four reports are mentioned in the text they are referenced by their EEU numbers, or are referred or as "the supplementary reports".

ABBREVIATIONS

EEU	Environmental Evaluation Unit
EIA	environmental impact assessment
GBJV	Gibb-Bergman Joint Venture
GDP	Gross Domestic Product
I&APs	interested and affected parties
IEM	integrated environmental management
JPTC	Joint Permanent Technical Commission
km	kilometres
km/h	kilometre per hour
LCAR	Least Cost Alternative Route
LHDA	Lesotho Highlands Development Authority
LHWP	Lesotho Highlands Water Project
LSPP	Land Surveys and Physical Planning Department
M	maloti
m	meters
m^2	square meters
NGO	non-government organisation
NSP	National Settlement Policy
SIA	social impact assessment
WAR	Western Access Road
UCT	University of Cape Town

ACKNOWLEDGEMENTS

I would like to express my gratitude to all individuals and institutions, whose help, co-operation and interest made this report possible. In particular I would like to thank:

- my supervisors, Janet Barker and Professor Richard Fuggle, for their valuable input and guidance;
- John Raimondo and Shirley Grindley of the Environmental Evaluation Unit, for managing the study;
- Richard Hill for his co-ordination of the Environmental Science course;
- the Council for Scientific and Industrial Research for providing funding in the form of a Foundation for Research and Development (FRD) Postgraduate Bursary for 1992 and 1993;
- the South African Breweries for their financial assistance, and
- the "Class of '93" for their support and friendship.

CHAPTER 1
INTRODUCTION

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1.1 INTRODUCTION

1.1.1 BACKGROUND

The construction of the Mohale Dam, which forms part of Phase 1B of the Lesotho Highlands Water Project (LHWP), requires an access road for the transportion of construction materials and machinery from the Lesotho-South Africa border to the dam site on the Senqunyane River in Lesotho (see Figure 1.1 overleaf). The stated objective of the proponent, the Lesotho Highland Development Authority (LHDA), is that the road construction project should not only provide access to the construction site, but should also serve to enhance the existing road network within Lesotho [LHDA, 1986a].

The Environmental Evaluation Unit (EEU) of the University of Cape Town has been appointed to provide environmental input into all stages of the road construction project. The project is still in the planning and preliminary design stages, and environmental studies to date have been mainly concerned with the identification of a preferred access route.

There are presently two alternative access routes under consideration. These are indicated in Figure 1.1 overleaf.

One of the proposed routes is the existing Mountain Road or "Western Access Road" (WAR) which runs in an easterly direction from Maseru over the Thaba Putsoa Mountain Range to the village of Patiseng near the site of the dam. The section of the WAR from Maseru to St. Michael's does not currently need upgrading, but the section from St. Michael's to Patiseng will need upgrading to deal with the expected increased traffic load of up to 200 vehicles per day during the peak construction period.

Eight alternatives to the WAR, identified by road engineers on the basis of technical feasibility, were evaluated by the EEU during the first stage of the environmental study. One of the eight was selected as the "Least Cost Alternative Route" (LCAR), which is the second alternative under consideration. The LCAR runs along existing roads from Maputsoe, via Teya-Teyaneng, to Ha Mateka and from here along a proposed new road through the Jorodane Valley to Patiseng, on the Mountain Road.

1.1.2 PURPOSE OF THIS REPORT

The purpose of this report is twofold.

Its aim is firstly to compare the Western Access Road (WAR) with the Least Cost Alternative Route (LCAR) in terms of their impact on the environment and to identify which of the two routes is the preferred alternative. To this end, the report documents and analyses the results of an impact assessment study carried out by EEU researchers, which

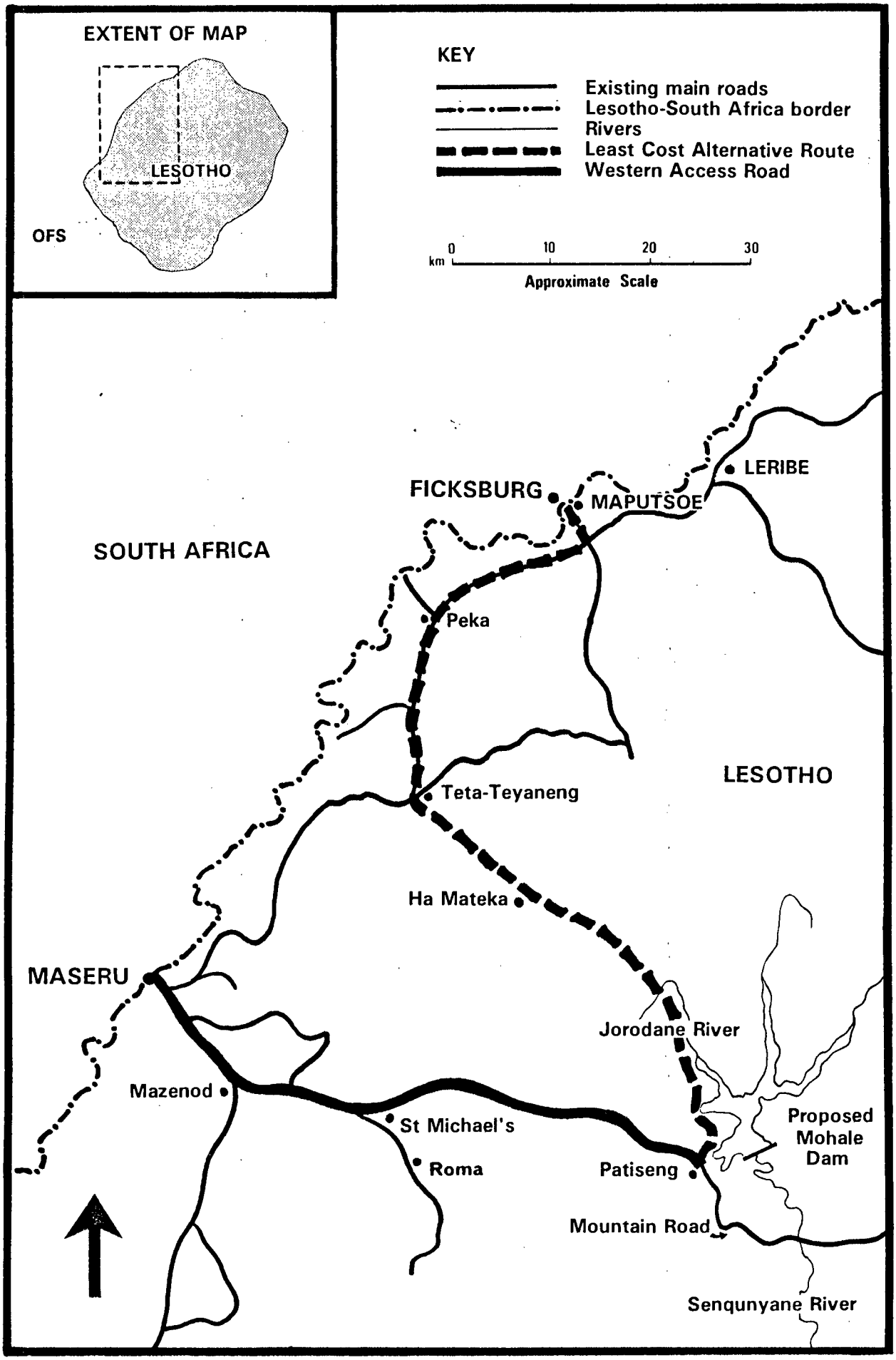

FIGURE 1.1: MAP OF THE STUDY AREA SHOWING ALTERNATIVE ROUTES

included a consideration of both biophysical and socioeconomic components of the environment. The report also includes recommended actions to mitigate negative impacts and enhance positive impacts.

The report secondly serves as a dissertation, for the purpose of academic evaluation by examiners, for the degree of Master of Philosophy in Environmental Science. To this end it aims to demonstrate analytical rigour and an understanding of the theoretical basis of the study.

1.1.3 OUTLINE OF ALTERNATIVE PROPOSALS

In the case of the Western Access Road (WAR), the proposal is to upgrade a section of the degraded Mountain Road between St. Michael's and Patiseng, to form a wider paved road. Upgrading will generally follow the existing road alignment, with small exceptions where widening of selected curves is required for safety or operational reasons. Minor improvements will also be made to the section of the road between Mazenod and St Michael's.

In addition to these road improvements, the WAR proposal includes the construction of a southern bypass at Maseru, aimed at preventing further congestion of the central business district. The proponent also intends to upgrade the railhead facilities at Maseru Station, in order to facilitate the movement of construction materials and equipment at this break-of-bulk point.

The Least Cost Alternative Route (LCAR) will involve the construction of a new section of road between Ha Mateka and Patiseng. It is also proposed that a bypass be built at Teya-Teyaneng.

A detailed description of the proposed alignments and project actions is provided in section 1.6 of this report.

1.1.4 REPORT STRUCTURE

At the beginning of this report is an executive summary, which provides a brief outline of the approach and methodology of the study, and highlights the main conclusions and recommendations arising from it.

The main body of the report is divided into five chapters, each of which is preceded by a detailed table of contents. Pages of coloured paper indicate where new chapters begin.

Chapter 1 provides a general overview and introduction to the study. It includes background information, the terms of reference, and a description of the general approach to, and methods of, the study. Assumptions and limitations are discussed, and administrative, policy and

legal requirements outlined. This chapter also includes a summary of project actions, and a description of the affected environment.

In chapter 2, the theoretical basis for the study is developed. The study is assessed in the light of procedures and principles of integrated environmental management (IEM), and methods and techniques used in the study and in the compilation of this report, are discussed with reference to theory.

Chapter 3 provides a comparative assessment of potential environmental impacts associated with the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR). Each impact is identified as being of either high, moderate or low significance, and measures which should be taken to mitigate negative impacts and optimise positive ones, are described. This chapter also includes a detailed discussion of the criteria and methods used to identify impacts, and to assign significance. The chapter concludes with a framework table, summarising all significant impacts associated with the two alternative routes.

In Chapter 4, issues of key importance in the selection of a preferred route are identified. The WAR and the LCAR are then evaluated in a comparative manner in the light of these key issues, and a preferred route is identified.

Chapter 5 presents the conclusions and recommendations arising from the study. It includes conclusions and recommendations relating to theoretical aspects considered in the report, as well as those concerning the findings of the assessment and evaluation process.

Additional information of relevance to the study is contained in the appendices. Included here is an outline of the scoping procedure, and information regarding the composition of the study team.

1.2 TERMS OF REFERENCE

1.2.1 APPOINTMENT

Contract 1000 was awarded by the Lesotho Highlands Development Authority (LHDA) to the Gibb-Bergman Joint Venture (GBJV) on 18 December 1992. This contract is for the planning, design, and supervision of the construction of access roads for Phase 1B of the Lesotho Highlands Water Project (LHWP). The Joint Venture comprises a 50% Lesotho partner (Sir Alexander Gibb & Associates, Maseru) and a 50% South African partner (BS Bergman & Partners, Pretoria). The Environmental Evaluation Unit (EEU) of the University of Cape Town has been appointed as a sub-consultant by Bergman and Partners (consulting engineers) to *inter alia* conduct an environmental impact assessment of proposed alternative access roads to the Mohale Dam.

1.2.2 SCOPE OF THE STUDY

The impact assessment of the proposed alternative access roads to the Mohale Dam forms part of a larger, and ongoing environmental study being conducted by the EEU. The main requirement of the overall brief for the study is the following:

"The EEU is to provide an environmental assessment of the potential environmental effects associated with the provision of permanent advanced access and certain infrastructure in Phase 1B of the Lesotho Highlands Water Project."

Following discussions with BS Bergman and Partners, it was agreed that the study of the two proposed alternative access roads should:

- predict all the negative and positive environmental impacts of the two alternative routes, including both biophysical and socioeconomic impacts, taking into account the LHDA's policy objectives of promoting development in Lesotho, as well as the regional and national context of the project;
- identify and consult with the people who are likely to be affected by the road to establish their views and concerns;
- assess each of the identified impacts for their overall significance;
- recommend mitigation for potentially significant negative impacts and identify associated compensation requirements;
- suggest optimisation measures for potentially significant positive impacts, and
- identify the route which is the preferred environmental option.

It was furthermore agreed that the following were to be specifically excluded from the scope of the study:

- An assessment of localised impacts along sections of the road not subject to major upgrading or construction. This included the section of the Western Access Road (WAR) between Maseru and St. Michael's, and the section of the Least Cost Alternative Route (LCAR) north of Ha Mateka, with the exception of the bypass at Teya-Teyaneng.
- The evaluation of road construction costs and geotechnical considerations. These were to be determined by B.S. Bergman & Partners.

1.2.3 DEFINITION OF THE STUDY AREA

The different components of the study require investigation at different scales.

At the broadest scale, where impacts on policies concerning *national* interests are evaluated, the study area is considered to be the entire country of Lesotho.

Where impacts are considered in a *regional* perspective, the study area narrows its focus to the north-west sector of Lesotho, and, in particular, the Maseru, Berea and Leribe districts. The regional study area is indicated by the extent of the map in Figure 1.1.

At the *local* level, the study area is essentially the two proposed road corridors. While the extent of localised effects varied, they were generally considered to have a sphere of influence within a 2 km wide corridor along the proposed routes.

1.2.4 TERMS OF REFERENCE FOR THE REPORT

No specific technical brief was provided for this report, other than the prescribed report title. Academic guidelines were, however, provided. A copy of these guidelines may be found in Appendix 1 of this report.

On the basis of this information, the following seven report objectives were set by the author:

- Develop the theoretical basis for the study and critically assess the study plan in terms of the requirements of integrated environmental management (IEM) and environmental impact assessments (EIAs).
- Assess impacts of the two routes in a comparative manner and identify appropriate mitigation and optimisation measures.
- Identify impacts and issues of key importance in the decision-making process.
- Evaluate the routes in the light of the key issues identified, and on the basis of the criteria of efficiency, equity and sustainability.
- Identify a preferred access route.
- Recommend measures whereby environmental considerations can be incorporated into future stages of the project.
- Based on the experiences of this study, formulate general recommendations for future EIAs.

1.3 APPROACH TO THE STUDY

The environmental impact study was conducted according to the broad principles of integrated environmental management (IEM). IEM has been recommended by the Council for the Environment as a means of ensuring that the environmental consequences of development proposals are adequately considered in the planning process [Dept. Env. Affairs, 1992]. The study adopted an open, participatory approach, and including consultation with interested and affected parties (I&APs).

The study plan, which comprised 2 stages, is outlined in Figure 1.2.

Stage 1 of the study involved the identification of a "least cost alternative" to the Western Access Road (WAR). Eight possible alternatives to the WAR were identified on the basis of technical feasibility by the road engineers. These alternatives were then assessed and evaluated by the Environmental Evaluation Unit (EEU) using five criteria, namely, the number of people who would benefit from improved access; the possible effects on sensitive ecological components; likely impacts on agricultural land; sub-regional development opportunities created, and the length of corridor above the snow line. On the basis of the environmental evaluation, and other engineering and cost studies carried out by BS Bergman and Partners, the Least Cost Alternative Route (LCAR) was then selected by the Gibb-Bergman Joint Venture (GBJV) team.

The stage 1 environmental assessment was essentially a desk-top study, but did include brief site visits to readily accessible sections of the alternative routes, as well as literature surveys. The methodology and results of stage 1 of the study are documented in Appendix 1 of EEU/2/93/104c.

Stage 2 of the study focussed on the assessment of impacts associated with the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR). This stage of the study included the following tasks:

- scoping to identify important issues - this included meetings with relevant authorities and interested and affected parties (I&APs). An outline of the scoping procedures followed, and list of parties contacted and issues raised, are included in Appendix 2 of this report.

- identification of impacts - this was undertaken by means of literature reviews, further contact with I&APs and with specialist input in a number of fields, including rehabilitation, hydrology, road engineering, and archaeology. Approximately 10 days were spent in the field. To facilitate the identification of socioeconomic impacts, surveys, based on questionnaires and informaldiscussions, were carried out at villages along the WAR and LCAR, and along the recently completed road to the Katse Dam site. The Katse Road

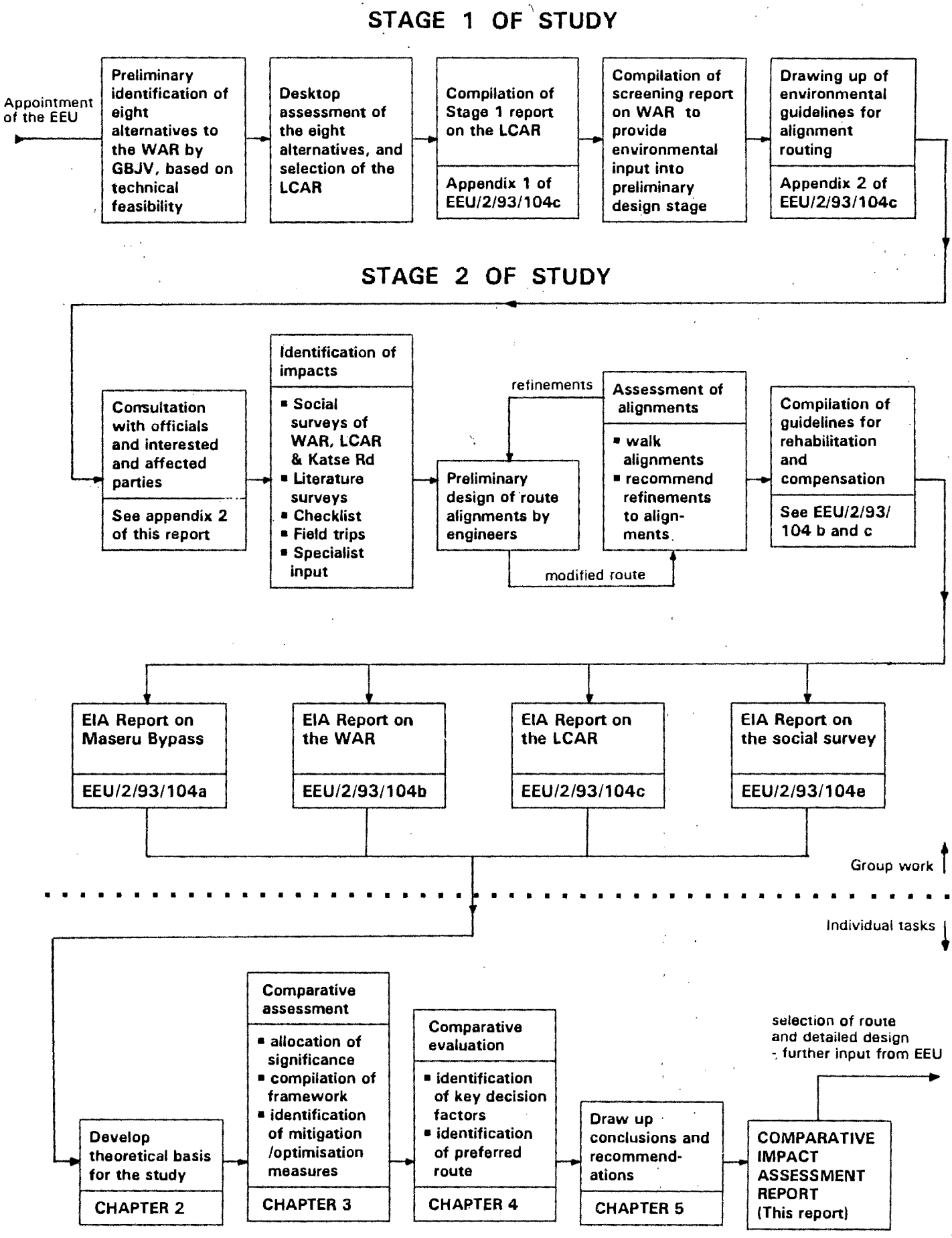

FIGURE 1.2: FLOW DIAGRAM OF STUDY PLAN

served as an example of a similar project in a more advanced project stage, and provided assistance in the prediction of likely impacts. Methods used to identify impacts are discussed further in section 3.2.1 of this report.

- identification of appropriate measures to mitigate negative impacts and enhance positive impacts - this was done mainly by consulting specialists and by referring to past studies and literature, in particular the LHDA's Compensation Plan [1990].

- compilation of environmental impact assessment (EIA) reports - these were all compiled using the format and procedures set out in document 3 of the IEM Guideline Series [Dept. of Env. Affairs, 1992], and with reference to recommendations in other literature on EIAs. The compilation of EIA reports is discussed in some detail in section 2.5 of this report.

Section 2.4 of this report, discusses how the above-mentioned study components fit into the IEM procedural framework, and gives an indication of planned, and recommended, steps to be taken in future stages of the study.

This concludes the discussion of the study approach. In the section which follows, assumptions and limitations are outlined.

1.4 ASSUMPTIONS AND LIMITATIONS

A number of assumptions were made during the study, and during the compilation of this report. These are outlined in section 1.4.1. Limitations which applied during the course of the study, and their implications are discussed in section 1.4.2.

1.4.1 ASSUMPTIONS

The study, was based on the following assumptions:

- Any construction of a road to the Mohale Dam should, as far as possible, serve the interests of the local people, as well as reinforce regional and national development objectives.

- The Lesotho Highlands Development Authority (LHDA) will provide compensation for losses incurred by local inhabitants in the event that land is taken, or buildings or other facilities are demolished by the road.

- There will be no significant impacts along sections of the routes where no major construction or upgrading work is planned. Areas

where major construction or upgrading will take place are between St Michael's and Patiseng on the Western Access Road (WAR), between Ha Mateka and Patiseng on the Least Cost Alternative Route (LCAR), and at Maseru and Teya-Teyaneng, where bypasses will be built.

- A bypass will be built at Maseru if the WAR is chosen as the preferred alternative route, and railhead facilities at Maseru will be upgraded. In the case of the LCAR, it was assumed that the proponent will not build a bypass at Maseru, but that a bypass at Teya-Teyaneng will be built.

- The LCAR will not only provide access to the Mohale Dam site, but will link with the Mountain Road at Patiseng.

- If the LCAR is selected as the preferred alternative, further detailed environmental investigations will be carried out.

A number of further assumptions were made during the compilation of this report.

It was firstly assumed that the need for the road is established. According to J.Schaap of GBJV [pers. comm.], the "no-go" alternative is unacceptable for both practical and political reasons, and the WAR should be presumed to be the "minimum" acceptable proposal. The "no-go" and other "do minimum" alternatives were thus not considered during the EIA.

Another assumption made by the author, is that the client will not read this report. Thus at times, for academic purposes, comments have been made or insights offered which would not normally be appropriate in a report which would go to the client. This aspect is discussed further in section 2.5.

It was furthermore assumed that the reader will have access to supplementary reports no. EEU/2/93/104 a,b,c, and e. Thus reference has been made to these reports throughout this dissertation. Information from the supplementary reports has, however, been repeated or summarised where the author considered it necessary to achieve the objectives of the dissertation, or for the convenience of the reader.

1.4.2 LIMITATIONS

The main limitations associated with the study related to the project stage at which it was being carried out, the available time for the study, and the fact that it was of a "fragmented" nature.

The study took place during the planning and preliminary design stage of the project. This meant that many project actions were still not clearly

defined. Details of the siting of construction camps, blasting areas and schedules, quarries and borrow pits, were not available at the time of the study, and the impacts of these actions were thus not assessed in a site-specific manner. Predicted traffic volumes of construction vehicles were furthermore uncertain, because no decision had yet been made regarding the construction of the Mohale Dam i.e. whether it will be a concrete arch or embankment dam.

The fact that many project actions were not clearly defined is, however, not considered to be a serious limitation in the case of this report, because it is a comparative one, and assumptions made regarding project actions were made in a similar manner for both routes.

Another limitation which applied to the study was the time constraint, particularly during stage 1 of the study, which was required to be completed in 1 month. The limitations which this imposed on the study plan, and in particular on scoping, are discussed in section 2.3. and 2.4. of this report.

The fragmented nature of the study was a further limitation. The proposed access road is only one component of Phase 1B of the Lesotho Highlands Water Project (LHWP). Other component projects include the Mohale Dam itself, other access roads, the resident engineer's camp and construction camps. The terms of reference of this study specifically excluded a consideration of the impacts of construction camps and the Mohale Dam itself. The impacts of other access roads and the resident engineers camp were addressed in separate "sub-studies" (see EEU/2/93/104d). This created a artificial situation which tended to deny the interconnectedness of the project components, and limited the application of a holistic approach.

The fact that the impacts of the Mohale Dam itself were not considered in the study, had implications for the evaluation process. It essentially precluded any "absolute" evaluation of the routes, because such an assessment would not be meaningful without an inclusion of the costs and benefits of the Dam itself. For the "relative" evaluation of the routes, however, the fragmented nature of the study was not a serious limitation.

Another limitation which applies to this dissertation itself, is the fact that many of the results of other relevant specialist studies, carried out concurrently with the EIA by other sub-consultants, were not available to the author at the time this report was written. Thus this report does not incorporate certain aspects which it ideally should have, in particular the results of the transport and traffic studies and the macro-economic study. This aspect is discussed further in section 2.3.2.3 of this report.

1.5 ADMINISTRATIVE, LEGAL AND POLICY REQUIREMENTS

This section provides a brief summary of administrative, legal and policy requirements of relevance to the project.

An understanding of the legal and administrative framework of the Lesotho Highlands Water Project (LHWP), is important in that it serves to explain how a decision regarding the proposal will be made, and by whom. It also provides an indication of why this environmental impact assessment (EIA) is being undertaken, and whether mitigation and optimisation measures recommended in this report are likely to be implemented.

A treaty to give effect to the Lesotho Highlands Water Project, was signed by the Kingdom of Lesotho and the Republic of South Africa in 1986. In terms of this treaty two parastatal bodies, the Lesotho Highlands Development Authority (LHDA) in the case of Lesotho, and the Trans-Caledon Tunnel Authority (TCTA) were created to implement that part of the project within their respective boundaries (see Figure 1.3 below). A Joint Permanent Technical Commission (JPTC), on which the countries have equal representation, was also created, to monitor and advise the LHDA and TCTA.

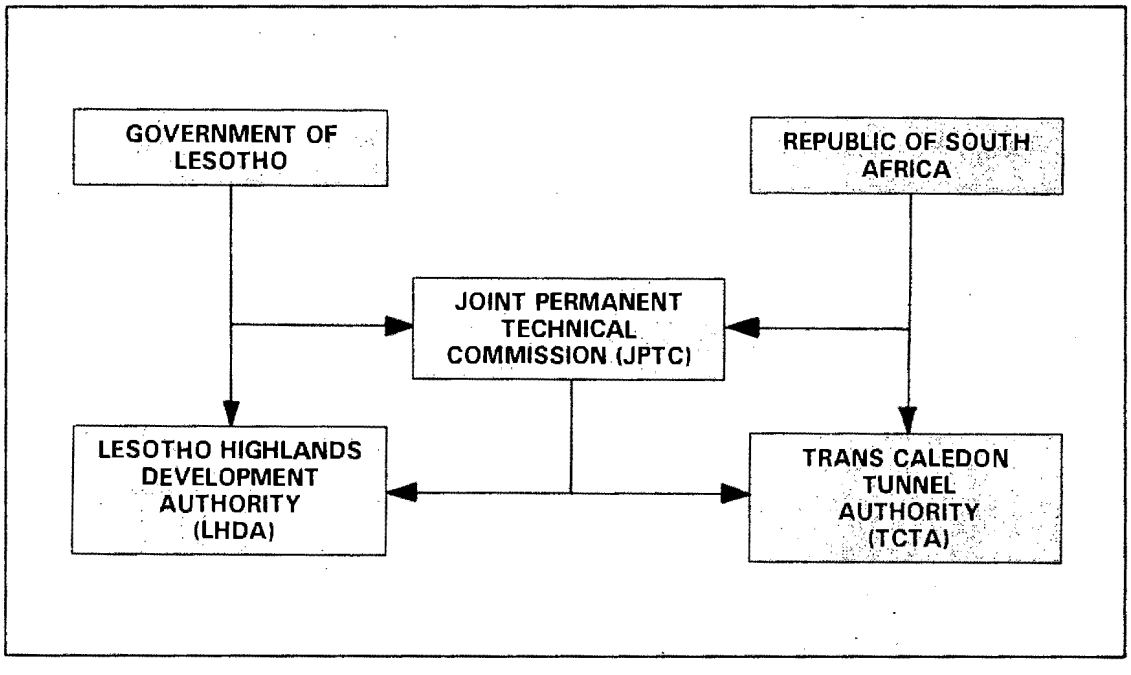

Figure 1.3 INSTITUTIONAL ASPECTS OF THE LHWP

The JPTC will ultimately make a decision regarding which of the two alternative proposals should be implemented. It is likely that financial costs will form an important basis for the decision, along with social and

environmental considerations. Should a dispute arise within the JPTC, the Treaty stipulates that the matter be referred to arbitration.

EIAs are not legally mandatory in Lesotho. Such measures are, however, generally a requirement of funding agencies, such as the World Bank, on whom the Lesotho Highlands Water Project will partially depend for future financing. The LHDA are furthermore legally obligated to take "all reasonable measures" to protect the environment, and the conducting of this EIA could certainly be viewed as such a measure.

The LHDA have no legal obligation to carry out optimisation measures. Both partners have, however, stated their intention to enhance positive impacts of the LHWP [Setplan, 1991]. The extent to which such measures are carried out is likely to be decided upon by the JPTC. With regard to mitigation, however, the LHDA have the following legal obligation, spelt out in paragraph 18 of Article 7 of the treaty:

"The Lesotho Highlands Development Authority shall effect all measures to ensure that members of local communities in the Kingdom of Lesotho, who will be affected by the flooding, construction works, or other similar Project related causes, will be enabled to maintain a standard of living not inferior to that obtaining at the time of first disturbance: Provided that such authority shall effect compensation for any loss to such member as a result of such Project related causes, not adequately met by such measures."

Article 15 further indicates that parties to the treaty have an obligation to consider the social and environmental effects of the project:

"The Parties agree to take all reasonable measures to ensure that the implementation, operation and maintenance of the Project are compatible with the protection of the existing quality of the environment and, in particular, shall pay due regard to the maintenance of the welfare of persons and communities immediately affected by the Project."

A further administrative aspect of relevance to the study relates to financing arrangements of the Government of Lesotho (GoL). As a result of a large budget deficit, Lesotho has entered into a structural adjustment facility arrangement (SAFA) with the International Monetary Fund. The resultant controls on public expenditure place limits on the extent to which the GoL is able to fund developments ancillary to the LHWP in the short term [Setplan, 1991].

It is important to note that the LHDA is not subject to the SAFA, and has relatively unconstrained access to credit. This factor is relevant to the choice of a preferred route, because it illustrates the disadvantages of a route which provides savings to the LHDA at the expense of GoL.

A number of other national and regional development plans and policies will be directly or indirectly affected by the proposed road construction i.e. their objectives will either be reinforced or contradicted by the proposal. These include national transport plans, the Fifth Five Year Development Plan for Lesotho [Ministry of Planning, 1993], as well as the

National Settlement Policy [LSPP, 1990]. These are discussed in more detail in section 1.7.4.

This concludes the discussion of legal, administrative and policy requirements relating to the study. The next section provides an outline of proposed project actions and alignments.

1.6 PROJECT ACTIONS AND ROUTE ALIGNMENTS

Project actions and information regarding route alignments for the Least Cost Alternative Route (LCAR) and the Western Access Road (WAR) are summarised below. For a more detailed discussion of these aspects, the reader is referred to section 5 of the baseline reports, EEU/2/93/104 b and c.

1.6.1 ROUTE ALIGNMENTS

1.6.1.1 The Western Access Road

The proposed route of the Wetern Access Road (WAR) essentially follows the existing Mountain Road from Maseru via St. Michael's and Nazareth to Patiseng (see Figure 1.4). In a few instances the route will deviate slightly from the Mountain Road alignment for safety or operational reasons. Details of realignments are provided in section 5.2.6 of EEU/2/93/104b.

The section of road between Maseru and Nazareth falls within the lowland zone of Lesotho and that between Nazareth and Patiseng within the highland zone (above 1800 m). The lowland zone is characterised by gentle slopes, with the exception of a section near St. Michael's where the road negotiates a sandstone escarpment. From Nazareth the road ascends up the western slopes of the mountainous region by way of Bushman's Pass lying at an altitude of 2268 m. After crossing through the Makhaleng River Valley the road ascends up Lekhalong-la-Molimo-Nthuse Pass (God Help Me Pass) to an altitude of 2318 m. Hereafter, the road passes through very mountainous terrain over the Blue Mountain pass lying at 2650 m, to Patiseng.

Construction traffic using the WAR will make use of the railhead at Maseru, which will be upgraded for this purpose. A bypass will be built at Maseru, to obviate the problem of construction traffic passing through the congested city centre.

1.6.1.2 The Least Cost Alternative Route

The Least Cost Alternative Route (LCAR) from Maputsoe to the Mohale Dam site is 112 km in length. Of this 55 km will be entirely new road.

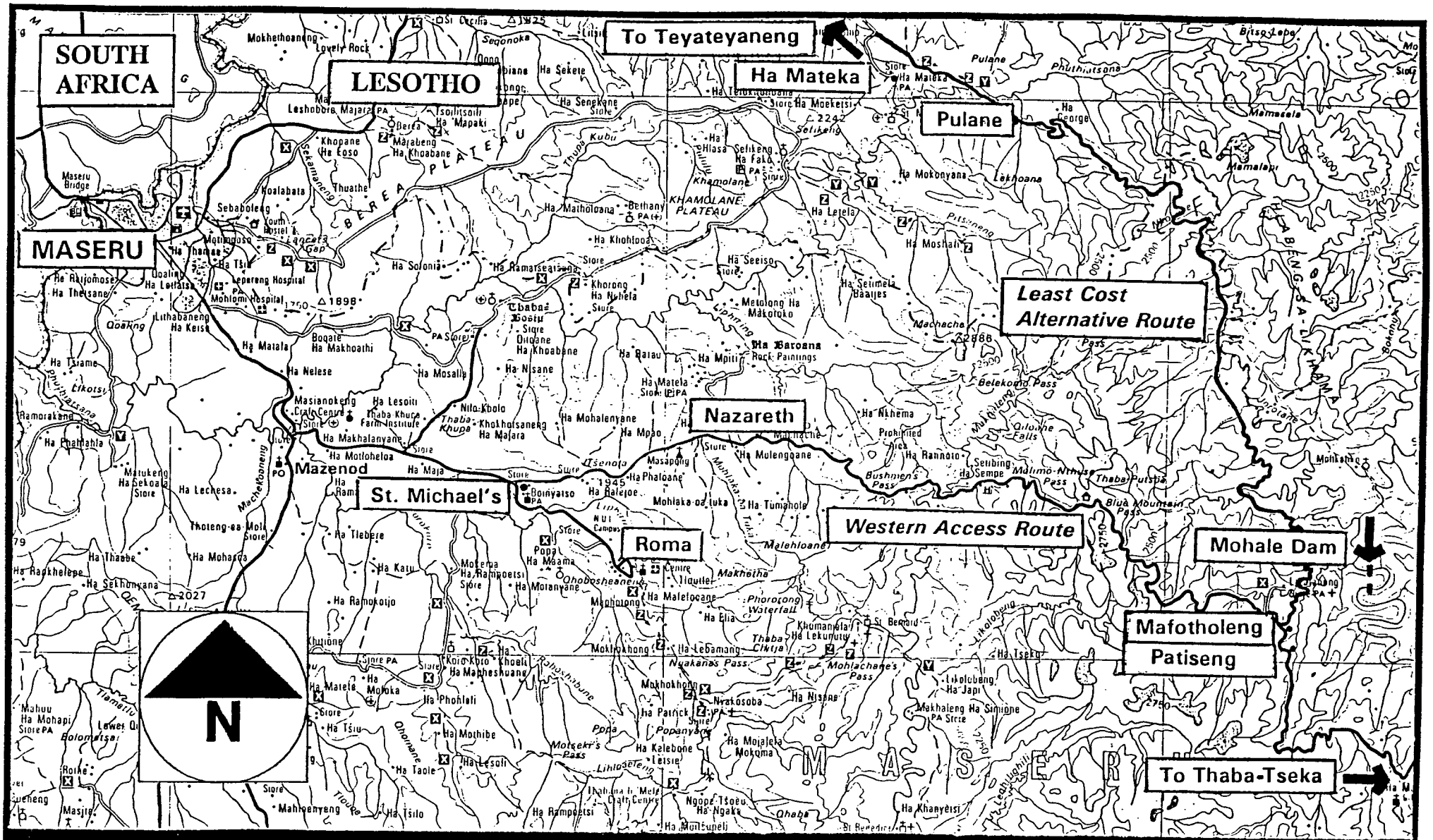

Figure 1.4: MAP SHOWING PROPOSED ROUTE ALIGNMENTS **Scale 1: 269 000**

From Maputsoe the LCAR travels in a southerly direction along existing roads via Peka and Teya-Teyaneng to Ha Mateka (see Figure 1.1). A new road is proposed from the turnoff at Ha Mateka to Pulane (see Figure 1.4). This would follow the present track to Pulane and continue over the Maluti Mountains via the Lekhalong-la-Likhaebaneng Pass into the Jorodane Valley. The proposed new road will then run north/south along the length of the western side of the Jorodane Valley, to the Mohale Dam site, and will join up with the existing Mountain Road near Patiseng.

Construction traffic along this route would utilise the existing railhead and border facilities at Ficksburg for the passage of construction traffic and materials. No upgrading of these facilities will be required. It is anticipated that Maseru, will carry much of the light administrative traffic. The road crossing the Berea Plateau from Maseru to Ha Mateka is currently being upgraded by the Lesotho Roads Department. This link between Maseru and the LCAR would offer an alternative link between Lesotho's capital and the Mohale Dam site i.e. an alternative to the existing Mountain Road.

1.6.2 DESIGN STANDARDS

The standards specified below generally apply to those sections of the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR) which involve major construction or upgrading i.e. the stretch of the WAR between St Michael's and Patiseng, and the section of "new road" on the LCAR, south of Ha Mateka.

The WAR forms part of the Lesotho trunk road system linking Maseru and Thaba-Tseka. The importance of this road thus warrants slightly higher design standards than would normally be applied to an access road for the Lesotho Highlands Water Project, and which will be applied in the case of the LCAR [L.Esterhuizen, pers. comm.].

1.6.2.1 Design life and maintenance

Both roads will be designed for a 20 year life span. The Lesotho Highlands Development Authority (LHDA), will be responsible for maintenance during the estimated five years of dam construction (1997-2002). Thereafter, maintenance of the road will become the responsibility of the Roads Department of the Government of Lesotho.

1.6.2.2 Road width

The road reserve will be 20 m in width. It is proposed by the road engineers that the WAR be a bitumen-surfaced road approximately 6.6 m wide, and the LCAR 6.5 m wide. The WAR will have a total shoulder width of 3 m, and the LCAR 1.5 m, although these may vary at times e.g. due to topographical constraints. Thus the total road width will

generally be 9.6 m in the case of the WAR and 8 m in the case of the LCAR.

Where necessary the road will be widened on corners in accordance with standards agreed upon by the LHDA and based on the Lesotho Highlands Water Project (LHWP) Feasibility Study [LHDA, 1986b].

1.6.2.3 Design speed

Design speeds along the LCAR will vary from 50 to 80 km/h, and along the WAR from 30 km/hr (in the mountainous zone) to 75 km/hr.

1.6.2.4 Bridges

A minimum of two bridges will be required along the LCAR - on the Phuthiatsana River near Pulane and on the Bokoaneng river. Where smaller watercourses are crossed, ARMCO structures will generally be used.

Along the WAR, all existing large drainage structures will, where possible, be replaced by large ARMCO bridges or culverts [J.Schaap, pers. comm.].

On both routes, the normal road width will be increased by 1.5 m on bridges, to allow for pedestrian passage.

1.6.2.5 Drainage structures

Drainage structures are designed according to standards agreed to by the LHDA and based on the LHWP Feasibility Study [LHDA, 1986b]. On average 5 culverts per kilometer can be expected.

1.6.3 CONSTRUCTION MATERIALS AND SPOIL

Construction materials for the project will be obtained from borrow pits and quarries in the area. Several possible sites have been identified but the exact location of the chosen sites will be based on further geotechnical investigation. Material sources not required for road maintenance will be rehabilitated subsequent to completion of the road.

Soil and rock will be transported to spoil areas but the extent to which this is done will depend on cost, distance to spoil areas, quantity of spoil, whether transport is up or downhill, and the delay in road construction incurred as a result. The LHDA will lay down specific requirements for the handling of spoil at a later stage.

1.6.4 PREDICTED ROAD USAGE

Estimates of the average daily traffic flow (ADT) of construction-related vehicles along the road range from 80-200 vehicles per day [J.Schaap, pers. comm.], 16% of which are predicted to be heavy vehicles. The actual traffic volume will depend on whether the dam wall will be a rockfill embankment or a concrete arch. The present ADT along the Western Access Road is estimated at between 100-350, up to 20% of which are heavy vehicles [J.Schaap, pers. comm.].

1.6.5 PERSONNEL REQUIREMENTS

An estimated maximum of 500 persons are expected to be employed in construction activities [J.Schaap, pers. comm.]. According to the employment policy of the Lesotho Highlands Development Authority (LHDA), local Basotho workers will be hired where possible. Table 1.1 presents a breakdown of worker skill requirements.

Table 1.1: BREAKDOWN OF PERSONNEL SKILL REQUIREMENTS

Level of skill	Personnel requirements
Senior staff	10%
Skilled	25%
Semi-skilled	20%
Unskilled	45%
TOTAL	**500 persons**

1.6.6 CONSTRUCTION CAMPS

Where necessary, roadside construction camps will be built. The location and size of construction camps will be determined by the contractor. Satellite construction camps in which vehicles are stored and maintained are likely to be built at 20 km intervals along the road.

1.6.7 PHASES OF DEVELOPMENT

The construction of the road will take place in various phases. The timing and broad grouping of the actions involved in these various phases are indicated in Table 1.2.

Table 1.2: PHASES OF THE PROJECT		
Phase	**Year**	**Activities**
Pre-construction	Early 1993	Planning/surveying of the road alignment
Construction	Mid 1994	Construction and ongoing rehabilitation
Implementation	Mid 1997	Transport materials to the Mohale Dam

This concludes the discussion of project actions. In the next section, the existing environment of the study area is described.

1.7 THE AFFECTED ENVIRONMENT

A detailed description of the environment which will be affected by the two alternative proposals is provided in section B of supplementary reports EEU/2/93/104 b and c. A summary of this information is, however, provided below, in order to place this report in context.

In keeping with the principles of integrated environmental management (see section 2.3), a broad definition of the term "environment" is applied. Thus this section includes a description of the socioeconomic and biophysical environment, a discussion regarding archaeological sites in the area, as well as a consideration of the regional and national planning context.

The environment is thus considered at a local level, as well as from a regional and national perspective. At the local level, descriptions concentrate on those areas where the major upgrading and construction work is to take place, and where the main localised impacts are expected. i.e. between St Michael's and Patiseng on the Western Access Road (WAR), and between Ha Mateka and Patiseng on the Least Cost Alternative Route (LCAR).

1.7.1 THE SOCIOECONOMIC ENVIRONMENT

This section outlines the socioeconomic characteristics of the study area. All socioeconomic information, unless otherwise referenced, is derived from the report on the social survey, EEU/2/93/104e.

1.7.1.1 Introduction

Lesotho has a limited natural resource base, the two major resources being water and the western grasslands [Trollip, 1981]. Lesotho's economy is largely dependent on external markets, principally South Africa, and foreign donors. The country's large budget deficit means that the GoL is financially constrained and has a relatively weak institutional capacity [Setplan, 1991].

The agricultural sector, plays an important role in the domestic economy, officially producing 14% of the GDP [Ministry of Planning, 1993]. In reality, however, the contribution is likely to be higher, because of the extensive informal (and at times illegal) cash crop economy which has developed in the rural areas.

Lesotho has a population growth rate of approximately 2.6% per annum, which results in a further 25 000 people entering the job market each year [Setplan, 1991]. 65% of the potential labour force is presently employed, with migrant labour making up 15% of the labour force. Respondents in a recent survey [Sechaba Consultants, 1991] saw unemployment as a major cause of poverty, underlining that even in rural areas Basotho are dependent on the modern economy.

Lesotho is characterised by a great inequality of resource distribution. A lack of food and good water supply are the major concerns of the majority of the Basotho people [Sechaba Consultants, 1991]. Poverty levels have a geographical component - generally poverty is less evident in Maseru, greater in the lowland district centres and peri-urban areas, and greatest in the highlands [Setplan, 1991].

1.7.1.2 Landuse and settlement patterns

The Western Access Road (WAR) begins in the capital city, Maseru, which has an estimated population of 160 000. The main landuse components in the Maseru Urban Area are residential (35%) and agricultural (31%), with commercial and industrial activities comprising 2% of the area [LSPP, 1989].

Beyond Maseru, most villages along the WAR have developed spontaneously without physical planning, along both sides of the road (see Figure 1.5) Fields and grazing land occur within or surround the villages and most households have vegetable and flower gardens. As a consequence of the gently sloping ground and fertile soils, the lowland areas are more intensively cultivated than the highlands, which are mainly used for grazing of livestock. The main field crops grown are maize and wheat.

The total population within a 2 km wide corridor which may be affected by upgrading of the Mountain Road from St Michael's to Patiseng,

Figure 1.5: VILLAGE ON THE EXISTING MOUNTAIN ROAD, ALONG THE ROUTE OF THE PROPOSED WESTERN ACCESS ROAD

Figure 1.6 TYPICAL SCENERY IN THE JORODANE VALLEY AREA ALONG THE LEAST COST ALTERNATIVE ROUTE.

comprises approximately 13 villages of more than 100 inhabitants, and approximately 20 smaller villages.

The Least Cost Alternative Route (LCAR) begins in Maputsoe, a busy town, which is accustomed to the increased traffic and passage of construction vehicles, as the Ficksburg-Maputsoe border crossing presently accommodates the construction traffic for the Katse Dam.

Between Maputsoe and Teya-Teyaneng the road is well used, both for local transport and as a link between northern Lesotho and the capital, Maseru. Medium to high density settlement occurs along the road at points such as Peka, Kolonyama and Teya-Teyaneng.

The area between Teya-Teyaneng and Ha Mateka is more rural in character, and the road is less intensively used. Villages are frequent, but small, with houses set back from the roadside. Numerous roadside businesses and cafes occur along this section of the LCAR.

From Ha Mateka, villages become more remote, and strongly rural in character. Where the LCAR crosses the Maluti Mountains beyond Pulane it passes over extremely mountainous terrain, which is very sparsely populated. A few solitary dwellings with stone wall kraals are used as cattle posts during the summer grazing months.

The catchment area of the Jorodane River contains 15 villages of more than 100 inhabitants, and 33 villages of fewer than 100 inhabitants, giving an approximate population of between two and three thousand. Settlement in the Jorodane Valley is characterised by small villages scattered along both sides of the river catchment area (see Figure 1.6). The fertile valley-bottom and valley sides are intensively cultivated, and higher lying areas are used as grazing land for livestock.

1.7.1.3 Social patterns and lifestyle

The social surveys carried out between St Michael's and Patiseng on the Western Access Road (WAR), and in the Jorodane Valley, indicate that hunger, a lack of clothing and unemployment are the three main problems facing households in these areas. Access to water is also a problem - water for drinking and cooking purposes is usually collected from a communal spring or tap, while washing is carried out in nearby streams and rivers.

Traditional chiefs still wield considerable authority, particularly in the less "urbanised" highland areas, and generally have exclusive land allocation rights.

A high proportion of households (over 60%) send children to primary school; but fewer attend high school.

The relative isolation of villages in the Jorodane Valley from outsiders, except for occasional tourists, limits access to many of the negative and positive aspects of modern urban life. Negative aspects include crime, which, besides stock theft, is rare in the valley. Positive aspects include essential services such as provision of drought relief.

1.7.1.4 Economic activities

Livestock are an important cultural and economic resource in the rural areas, providing security in the form of wealth; draught power to assist agricultural production; food in the form of meat and milk and an annual income from the sale of wool and mohair [ERL, 1989]. Sale of agricultural crops, typically maize and wheat, also provides cash income, but is somewhat limited in areas such as the Jorodane Valley, where transportation is a problem.

The social surveys carried out along the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR) indicate that important sources of income in the area are remittances from mine workers in South Africa and from workers elsewhere in Lesotho. Tourist facilities, such as the pony-trekking centre and lodge at Molimo Ntuse, serve to provide further income, directly or indirectly, to local inhabitants.

Along the WAR, cash incomes are also derived by owners of small businesses in the area (shops, petrol stations, motor mechanics, home builders) and from sales of crafts, and food to travellers and tourists.

In the Jorodane Valley, 65% of survey respondents indicated that an important source of income is the informal sale of illegal cash crops.

1.7.1.5 Infrastructure and services

In Maseru, where the Western Access Road (WAR) begins, traffic congestion is a serious problem, with the main road through the central business district having reached its capacity (EEU/2/93/104a). Between Maseru and St Michael's the existing road is in a good condition, and is relatively free of congestion.

East of St Michael's the road becomes narrow and has a poor surface in many parts. Public transport along the road is largely limited to four buses per day, which do not operate after dark, and kombi taxis do not offer a regular service along the length of the route. Consequently, there is still a need for improved transport along the WAR, and better access to services such as clinics, schools and large shops. There is a general lack of higher order services such as high schools, post offices, banks, petrol stations and supermarkets.

Existing roads along the Least Cost Alternative Route (LCAR) from Maputsoe to Ha Mateka, are in a good condition. Where the road passes

through Teya-Teyaneng, however, it is fairly narrow, and congested, particularly with pedestrian traffic.

A track runs from Ha Mateka to Pulane and is accessible to 4X4 and 2X4 vehicles with high clearance. The track is, however, in a poor condition and is often impassable because of flooding.

In the Jorodane Valley, roads are virtually non-existent. A poor quality gravel track near Sehlabaneng, provides limited vehicular access into the valley from the west, and a 2 km track runs north from the Mountain Road near Patiseng. Apart from these tracks there is no vehicular access to the valley and the majority of people travel by foot or on horseback. Services in the valley are extremely limited, and access to clinics was identified by 60% of survey respondents as a major problem facing villages.

1.7.2 THE BIOPHYSICAL ENVIRONMENT

1.7.2.1 Geology and terrain

Lesotho can be broadly divided into two distinctive topographical areas, namely the lowlands and the highlands. Lowland areas are those lying at altitudes below 1800 m in the west of Lesotho, while highland areas occur above 1800 m and extend eastwards towards the Natal border where altitudes above 3400 m are attained. Topography in the lowland areas is generally gently undulating, and in the highlands is mountainous, with incised river valleys.

Lowland areas are chiefly underlain by shales and mudstones of the Elliot Formation ("Red Beds") which yield extremely erodible soils which have, in places, formed large, active dongas. Soil erosion is a severe problem in Lesotho, and is aggravated by overgrazing. The highland areas are predominantly underlain by basalts of the Lesotho Formation, which yield relatively hardier soils.

The section of the Western Access Road (WAR) between Maseru and Nazareth, and the Least Cost Alternative Route (LCAR) north of Ha Mateka, fall chiefly within the lowlands. The remaining sections of both routes traverse the mountainous highlands, or the foothills thereof. The WAR includes three mountain passes between Nazareth and Patiseng.

South of Ha Mateka the LCAR traverses the Lekhalong-la-Lekhaebaneng Pass over a rugged section of the Maluti mountains, reaching an altitude of 2 600 m, before passing into the Jorodane Valley. The Jorodane River is characterised by regular meanders spaced approximately 300 m apart, and incised into the valley floor to depths ranging from 10 to 80 m. The LCAR will follow the western side of the valley, which is less steep than the eastern side.

1.7.2.2 Climate and hydrology

Precipitation ranges from 540 mm per annum in the lowlands of Lesotho to more than 1000 mm per annum in the mountainous regions [Chutter *et al*, 1988]. Rainfall occurs throughout the year, mostly in summer between December and March generally as a result of thunderstorm activity. Thus flood events are typically short and intense.

Snow occurs in high lying areas in winter. Approximately 4 km of the proposed Least Cost Alternative Route (LCAR) and about 10 km of the Western Access Road (WAR) lies above the snow line, generally accepted to be 2 450 m [J.Schaap, pers. comm.].

Numerous tributary streams and source water wetlands are crossed by the WAR, particularly in the highland areas. Most of the streams and wetlands are presently spanned by ARMCO bridges or standard cross-flow culverts under the road. Agricultural practices, settlements and road crossings within the catchments have reduced river water quality.

The Jorodane River is a perennial river, generally very clear and fast flowing, only becoming turbid for short periods (1-2 days) during storm events. The water quality of the Jorodane River is high, particularly in the upper and middle reaches [Rall, 1992].

1.7.2.3 Flora and fauna

The natural vegetation in the lowlands is described by Acocks [1988] as *Cymbopogon-Themeda* grassland. Little of this natural vegetation remains as the area is highly cultivated and subject to severe overgrazing by domestic livestock.

Highland areas in the study region are typified by montane grassland, with alpine fynbos vegetation elements occurring at altitudes above 2500 m. Small patches of *Leucosidea sericea* woodland occur on steep, mainly south facing slopes. The vegetation is less disturbed than in the lowland areas, but is still in a degraded state due to overgrazing and fire.

An endangered plant species known to occur in the Jorodane Valley, and to a lessor extent along the Western Access Road, is the spiral aloe, *Aloe polyphylla.* It occurs in isolated colonies on steep mountain slopes at altitudes higher than 2 150 m [Donnay & Meyer, 1991].

Small wetland zones occur in the highland areas along the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR). The wetlands are dominated by broom grass (*Merxmuellera macowanii*). Many of these wetlands have, however, been reduced in size and degraded due to autumn burning of the broom grass.

Indigenous fauna in Lesotho have been significantly reduced due to human interference, and large birds of prey, such as Cape vultures, bearded vultures and black eagle, are under severe threat.

A number of rare and endangered species may be directly or indirectly impacted by construction of the LCAR through the Jorodane Valley. These include the Maluti Minnow, *Pseudobarbus quathlambae*, listed in the IUCN Red Data Book [IUCN, 1986] as endangered, and the Aquatic River frog, *Rana vertebralis*, listed as rare [Rall *et al*, 1993].

The Jorodane Valley is, on the whole, a more sensitive ecological environment than any areas through which the WAR passes.

1.7.3 ARCHAEOLOGY

The majority of archaeological sites in Lesotho are located within the sedimentary geological formations, especially in the lowland areas. Rock paintings made by Late Stone Age San people are commonly found in rock shelters and caves in sandstone cliffs, especially those of the Clarens Formation.

A significant part of the archaeological record represented by stone age tools is located in Lesotho, usually in sandstone formations. Stone tool assemblages are generally characterised by backed microliths which were hafted to make arrows, scrapers, adzes for woodworking, borers for making beads and reamers for making bored stones.

The Western Access Road (WAR) passes over a sandstone escarpment near St. Michael's after which it enters the basalt formations, typical of the rest of the alignment. Some stone age tools have been recorded scattered on the surface near the existing Mountain Road but no established sites have been found. A few rock paintings occur in the lowland section of the WAR, although none are located close to the road.

The Pulane basin, which the Least Cost Alternative Route (LCAR) passes through, is expected to be particularly rich in archaeological remains and rock paintings due to the nature of the Clarens Sandstone Formation and cave overhangs. A rock painting site reported to be one of the ten best in Lesotho, occurs at Mokhemeleli, approximately 1.5 km from the proposed alignment.

A copy of the report on the archaeological survey of the WAR and the LCAR may be found in Appendix 8 of supplementary report EEU/2/93/104b.

1.7.4 REGIONAL AND NATIONAL PLANNING AND DEVELOPMENT

In chapter 3 of this report, where the impacts of the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR) are assessed, an important consideration which emerges is whether the proposed roads will contradict or reinforce national planning and development objectives. It is thus necessary to provide the reader with background information concerning relevant planning objectives in Lesotho.

A detailed description of these aspects is provided in reports EEE/2/93/104 b and c, and a summary of this information is provided below.

1.7.4.1 National planning objectives

The primary developmental objectives outlined in the Fifth Five Year Development Plan [Ministry of Planning, 1993] are:

- the alleviation of poverty;
- the promotion of equity and social justice;
- the generation of more productive job opportunities, and
- the achievement of an adequate level of sustainable economic growth, with the emphasis on economic management.

Democracy and popular participation are also considered essential elements of the development process.

1.7.4.2 Rural Development

Rural development is seen as an important tool for the achievement of national planning objectives [Ministry of Planning, 1993].

A common assumption underpinning many transport plans is that the provision of improved transport infrastructure will promote economic development in rural areas. It is however clear from case studies in South Africa [Dewar, 1985] that improved transport infrastructure is not a *sufficient* condition to increase the agricultural output of subsistence farmers. Such improvements are, however, *necessary* conditions for improved productivity, because they can provide, inter alia, improved access to agricultural inputs and markets.

Infrastructural improvements tend to increase profitability and production in areas where there is an existing economic dynamism. In stagnant or depressed areas the effect of such improvements may be neutral or even negative. It is clear that where structural obstacles to development exist,

transport improvements implemented in isolation will have little or no benefit to the region [Dewar, 1985].

Structural obstacles to development which exist in rural parts of the study area include a general lack of access to resources and credit, problems regarding security of land tenure, and rural overcrowding. Other obstacles include social institutions such as migrant labour, and the tendency to invest surplus cash in stock as opposed to arable farming [R.James, pers. comm.].

1.7.4.3 Lesotho road network

The road network in Lesotho is significantly less developed in the eastern mountainous regions than in the western lowland areas (see Figure 1.7). Despite efforts to improve the road network, the majority of roads, including strategic routes, are still unpaved, low quality roads, which are frequently impassable during the wet season, and many areas are without access for motor vehicles, particularly in the mountain areas.

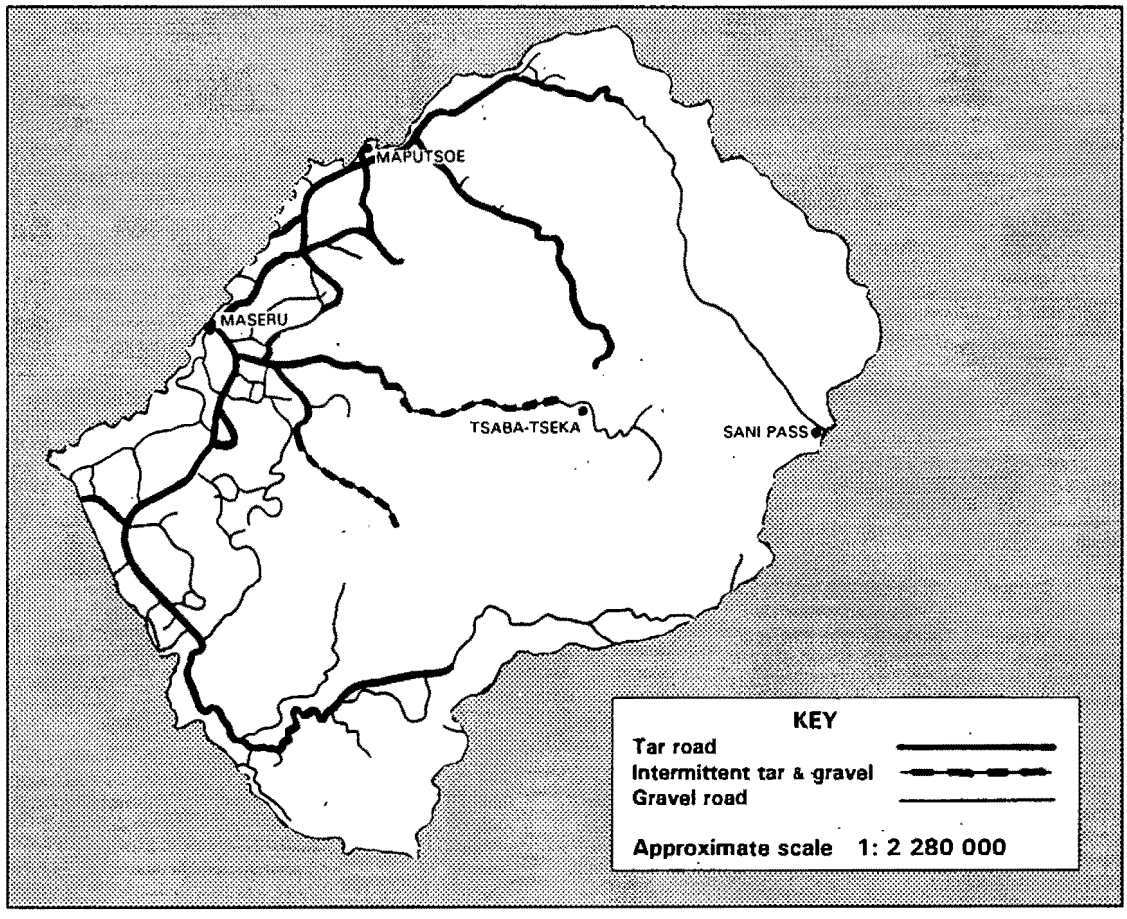

Figure 1.7: EXISTING ROAD NETWORK IN LESOTHO

Road maintenance budgets are rarely sufficient to prevent the steady deterioration of many of Lesotho's roads. For example, in 1990, the

Roads Department were only allocated 29% of their requirements. It is unlikely that the present situation with regard to road maintenance will change in the near future [Ministry of Works, 1992].

The Fifth Five Year Development Plan [Ministry of Planning, 1993] outlines activities which the Roads Department plans to undertake during the period 1991/1992 to 1995/1996. The reconstruction of a number of roads is envisaged, including the reconstruction of the existing Mountain Road between St Michael's and Thaba-Tseka (beyond Patiseng). It is also planned to reconstruct the road from Tsaba-Tseka to Sani Pass on Lesotho's eastern border. Funding for the implementation of the projects has still to be obtained.

1.7.4.4 Settlement planning

A framework for settlement development in Lesotho is set out in the National Settlement Policy [LSPP, 1990]. The aim of the National Settlement Policy (NSP) is to promote balanced settlement development and to protect natural resources and the environment affected by settlement development.

The present settlement pattern in Lesotho is viewed as unbalanced because, while the national capital is growing rapidly in an uncontrolled manner, settlement development in the mountain districts has been very limited.

The NSP calls for the unbalanced settlement to be influenced so that:

- the growth of Maseru is kept under control;
- at least one viable centre is developed in each district and some district centres are developed into regional centres, and
- settlement development is promoted in presently underserviced areas particularly in the mountain districts.

These goals should be achieved, *inter alia,* by harmonizing road plans with NSP proposals and promoting the decentralisation of public administration and the establishment of local authorities in all centres.

1.7.4.5 Tourism

Tourism in Lesotho has generally been limited by poor infrastructure and minimal advertising of Lesotho's attractions in South Africa and abroad. Since the decline in popularity of the Maseru gambling casinos in the late 1970s, the strategy adopted by the Lesotho Tourism Board has shifted emphasis to development of tourism based upon the natural attractions in the interior of Lesotho [ERL, 1990].

Estimates for revenue from tourism in Lesotho were M33.8 million in

1989, which constituted 3.1% of GDP. Direct employment by the tourism sector is low (2112 jobs in 1989), but the indirect role it plays, for example by stimulating trade, cannot be ignored [Ministry of Planning, 1993].

This concludes the description of the affected environment, and chapter 1. In the next chapter, theoretical aspects of relevance to the study are discussed.

CHAPTER 2
DISCUSSION OF THEORY

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2.1 INTRODUCTION

This chapter provides an overview of the theoretical basis of the study, and is comprised of the following components:

- a brief discussion of the status of integrated environmental management (IEM) and environmental impact assessment (EIA) in southern Africa - section 2.2;
- an outline of IEM principles, and a discussion of the study in the light of these - section 2.3;
- a consideration of the procedural aspects of IEM and of the study - section 2.4;
- a discussion of this report in the light of "ideal" requirements for environmental impact assessment reports - section 2.5;
- an overview of EIAs pertaining to roads and a discussion of the *framework approach* - section 2.6, and
- a discussion of the socioeconomic component of the study - section 2.7.

2.2 STATUS OF ENVIRONMENTAL IMPACT ASSESSMENT AND INTEGRATED ENVIRONMENTAL MANAGEMENT IN SOUTHERN AFRICA

Since the 1960s there has been a growing awareness of the often adverse effects of development on the environment [Fuggle and Rabie, 1992]. The need for a structured framework in which to evaluate and address these effects, has led to the development of the procedure known as environmental impact assessment (EIA).

In many developed countries environmental impact assessments (EIAs) have become institutionalised, and in South Africa EIAs are gradually being incorporated into the regulatory framework. In many less developed countries, including Lesotho, EIAs are not legally mandatory, but are often a requirement of foreign funding agencies.

In 1984, the South African Council for the Environment formed a committee to formulate a procedure whereby environmental concerns could be integrated into the development process [Fuggle and Rabie, 1992]. The product of the labours of this committee was a constructive procedure, tailored for developing countries, which was termed integrated environmental management (IEM).

2.3 INTEGRATED ENVIRONMENTAL MANAGEMENT (IEM) PRINCIPLES

2.3.1 OUTLINE OF PRINCIPLES

Integrated environmental management (IEM) is a procedure designed to ensure that the environmental consequences of development projects and policies are understood and are adequately considered in the planning process. It is intended to guide, rather than impede, the development process [Dept. of Env. Affairs, 1992].

The basic principles underpinning IEM are that there be:

- informed decision-making;
- accountability for decisions, and for information on which they are based;
- a broad meaning given to the term *environment*;
- an open, participatory approach in the planning of proposals;
- due consideration of alternatives;
- an attempt to mitigate negative impacts and enhance positive aspects of proposals;
- an attempt to ensure that the social costs of development proposals are outweighed by the social benefits, and
- compliance with these principles during all stages of the planning, implementation and decommissioning of proposals.

2.3.2 AN ASSESSMENT OF THE STUDY IN THE LIGHT OF INTEGRATED ENVIRONMENTAL MANAGEMENT (IEM) PRINCIPLES

An attempt was made throughout the study to adhere to the principles of integrated environmental management (IEM). The following discussion considers whether the above principles were applied during the study, and the implications thereof.

2.3.2.1 Informed decision-making

The results of the study are detailed in this comparative report (i.e. this individual dissertation) as well as in four supplementary reports EEU/2/93/104a, b, c and e, which were compiled jointly by the study team. The study was carried out by a multidisciplinary research team, with specialist input where necessary (see Appendix 3).

This comparative report aims to provide decision-makers with sufficient information on which to base a decision between two alternative routes. In section 5.6 of this report, a preferred route is recommended. Care has

been taken to ensure that the information provided is understandable, accurate and comprehensive, and that information which is not directly relevant to the decision is excluded.

This report, in conjunction with the supplementary reports, thus provides the opportunity for informed decision-making.

2.3.2.2 Accountability

The information provided in this report and in the supplementary reports is, wherever possible, backed up by references to theory and past studies, or by explanations of the manner in which the information was acquired. Personal communications are indicated where appropriate, and assumptions and limitations are explicitly stated in section 1.4. These steps aim to ensure that there is accountability for information contained in the report.

It is not possible for a researcher to ensure accountability for *decision-making*. The recommendations in section 5.7.2 of this report, however, aim to encourage such accountability. One of the recommendations is that authority and public review be undertaken. A further recommendation is that a *Record of Decision* be drawn up outlining the basis for the decision, and indicating how environmental considerations were incorporated into the decision-making process. It is also recommended that the *Record of Decision* be made available to the public, and that opportunity be provided for appeal against the decision.

The implementation of these recommendations will contribute towards a more open and accountable decision-making process.

2.3.2.3 Broad definition of the term "environment"

The terms of reference of the study limited to some extent the application of a broad definition of the term environment. The environmental study was only one component of a broader planning study, and the environmental study team formed part of a larger planning team. In addition to the environmental team, a number of other sub-consultants were concerned with separate and distinct aspects of the planning study. These included:

- geotechnical studies and assessments of road construction costs;
- a study and costing of the proposed upgrading of the Maseru railhead;
- traffic and transportation studies, and
- an overall macroeconomic assessment of the proposal.

The overall planning study was thus fragmented and communication between the abovementioned specialist study teams was limited for logistical reasons. The scope of the environmental impact assessment was not viewed as being all-encompassing by the client. It appeared

generally that the environmental impact assessment was viewed as a "specialist" report in the social and biophysical sphere.

The client did not appear to recognise the fact that in IEM an environmental impact assessment is essentially a *decision-making tool*, geared towards facilitating the reaching of an *overall decision* regarding a project proposal. It further was not recognised that in order for the environmental impact assessment (EIA) to achieve its purpose, the results of all other studies which were relevant to the decision-making process needed to be fed into the EIA. Failure to recognise this resulted in an under-utilisation of the services of the IEM-trained specialists on the environmental team.

In spite of the above perceptions and constraints, however, the study team *did* approach the study in a broad and holistic manner. Scoping was carried out in order to identify *all* possible issues of significance to officials and interested and affected parties. Thus physical, biological, social, economic, cultural and political components were included in the study.

Wherever possible the results of other specialist studies were obtained. Thus construction costs, and to a limited extent macroeconomic aspects, are included in this report as factors which will influence the choice of route.

2.3.2.4 Open, participatory approach

Stage 1 of the study, during which a "least cost alternative" to the Western Access Road (WAR) was identified, involved only limited scoping due to time constraints, and was thus neither open nor participatory. Thus interested and affected parties were not involved in the identification of routing alternatives, and in the selection of the Least Cost Alternative Route (LCAR). This is contrary to the principles of IEM and is viewed by the author as a serious procedural shortcoming of the study.

Stage 1 of the study would have been more effective if project schedules had been negotiated at the outset, and sufficient time allowed for meaningful public participation from the earliest possible stages. Notification of interested and affected parties by post, requesting their written input to stage 1, would also have been an effective way of dealing with the problem. The postal notification could have been carried out from the study team's base in Cape Town, prior to the commencement of stage 1 of the study in Lesotho.

Stage 2 of the study, where the LCAR and the WAR were evaluated and compared, involved extensive scoping, and thus did adopt an open and participatory approach. Appropriate authorities and interested and affected parties were consulted, and social surveys were carried out to ascertain whether the residents along the WAR and LCAR would

welcome a new or upgraded road (see Appendix 2 for details of scoping). The scoping process served to focus stage 2 of the study on significant and relevant issues. This resulted in an efficient assessment process and helped to optimise the use of time and resources.

2.3.2.5 Due consideration of alternative options

Consideration of alternatives was constrained by the terms of reference of the study, and by the prescribed project schedule.

Eight alternative corridors (i.e. alternatives to the Western Access Road) considered to be feasible from an engineering point of view were considered during stage 1 of the study. It is the opinion of the author that these alternative options were not given "due" consideration during stage 1, because of the following constraints:

- stage 1 was essentially a desk-top study, and aerial photographs scheduled to be completed in time for use during the study, were not available;

- the time constraint for stage 1 was one month, and

- interested and affected parties were not consulted during this stage.

Possible strategies which could have been adopted to improve participation of interested and affected parties and overcome the time constraint, are described in section 2.3.2.4 above.

Stage 2 of the study (the detailed assessment stage) was limited by the following factors:

- the terms of reference of the study dictated that the upgrading of the Western Access Road (WAR) *was* to be one of the alternatives to be considered in detail, and

- the terms of reference specified that only *one* other alternative to the WAR was to be selected for detailed consideration.

Thus it was presupposed that the WAR would be one of two alternatives considered during stage 2. While in practice this may have turned out to be the case, the assumption was an unnecessary and inappropriate constraint on the IEM process.

Besides the above-mentioned strategic (routing) alternatives, the study does consider other alternatives, including tactical and management alternatives. Tactical alternatives include suggested refinements to the road design, and additions to attenuate impacts, such as barriers and road signs. Management alternatives are those relating to aspects such

as scheduling, training, and monitoring. These are generally reflected in recommended mitigatory and optimisation measures.

On the whole, because of the limitations involved in the consideration of routing alternatives, the study is not considered to have fulfilled the ideal requirement of "*due* consideration of alternatives".

While this is a serious procedural shortcoming of the study, it is not judged to be significant from a substantive point of view. This judgement is based on the fact that assumptions made during the stage 1 preliminary assessment were later found to be accurate during scoping carried out during stage 2 of the study.

2.3.2.6 Mitigation of negative impacts and enhancement of positive aspects

In this regard the study fulfilled the ideal requirements. For each negative impact considered, mitigatory measures have been recommended where appropriate (see chapter 3). In the case of positive impacts, measures have been suggested to optimise associated benefits. Section 5.7.2 of this report includes recommendations aimed at facilitating the refinement or modification of mitigation and optimisation measures during later project stages, as project actions become more clearly defined.

2.3.2.7 An attempt to ensure that social costs are outweighed by the social benefits

This report makes use of the *framework approach* [ACTRA, 1979] which involves the compilation of a comparative framework table, listing positive impacts (social benefits) and negative impacts (social costs) of each route. The impacts are arranged according to various interest groups, which serves to emphasise the associated distributional effects. The framework table summarises information in a comparative manner, and facilitates the weighing up of the costs and benefits of alternative routes. The *framework approach* is discussed in more detail in section 2.6.

In chapter 4 of this report the routes are evaluated and compared in terms of the three criteria proposed by Stauth and Baskind [1992], namely:

- The efficiency criterion: Will the proposed route be efficient i.e. will the positive impacts (benefits) outweigh the negative impacts (costs)?

- The equity criterion: Will the costs and benefits be distributed fairly within society?

- The sustainability criterion: Will the benefits of the route continue to exceed costs over inter-generational time periods?

Use of the *framework approach* and the above evaluation criteria, indicate that an attempt is indeed being made to ensure that social costs are outweighed by social benefits. The report thus applies the above-mentioned principle of IEM.

2.3.2.8 Compliance with these principles during all stages of the planning, implementation and decommissioning of proposals.

The study was undertaken during the planning period of the proposal, and environmental input began at the earliest possible stages (see Figure 1.2 in chapter 1). In the case of the Western Access Road (WAR) a "preliminary route screening" for potential environmental issues was undertaken, and a report submitted to the engineers, *prior* to the commencement of the preliminary design of the WAR. In the case of the Least Cost Alternative Route (LCAR), the stage 1 report (regarding selection of the LCAR) served to provide environmental input into the preliminary design stage.

The preliminary design was furthermore drawn up with reference to environmental guidelines for alignment routing drawn up by the study team of the Environmental Evaluation Unit (see EEU/2/93/104c). Refinements to the preliminary design, to reduce compensation requirements and environmental impacts, were subsequently recommended by EEU researchers who walked the proposed routes, and modifications to the preliminary alignment were made.

On the whole, therefore, the study was truly integrated and pro-active, as environmental input into the planning process was timely, ongoing and iterative.

It is a recommendation of this report that IEM principles and procedures be adhered to throughout future stages of the project i.e. "from cradle to grave".

This concludes the discussion of the study in the light of IEM principles. In the section which follows, procedural aspects are discussed.

2.4 THE INTEGRATED ENVIRONMENTAL MANAGEMENT PROCEDURE

2.4.1 OUTLINE OF PROCEDURE

The integrated environmental management (IEM) procedure comprises three distinct stages, [Dept. of Env. Affairs, 1992] namely:

- STAGE 1: Where the proposal is *planned and assessed*;
- STAGE 2: Where a *decision* is taken, and
- STAGE 3: Where the proposal is *implemented*.

Figure 2.1 is a flow diagram of the IEM procedure, indicating the individual components of the three IEM stages. To prevent confusion when referring to "stages" in the text, the above IEM stages are written in capitals, in order to distinguish them from stages of the study itself.

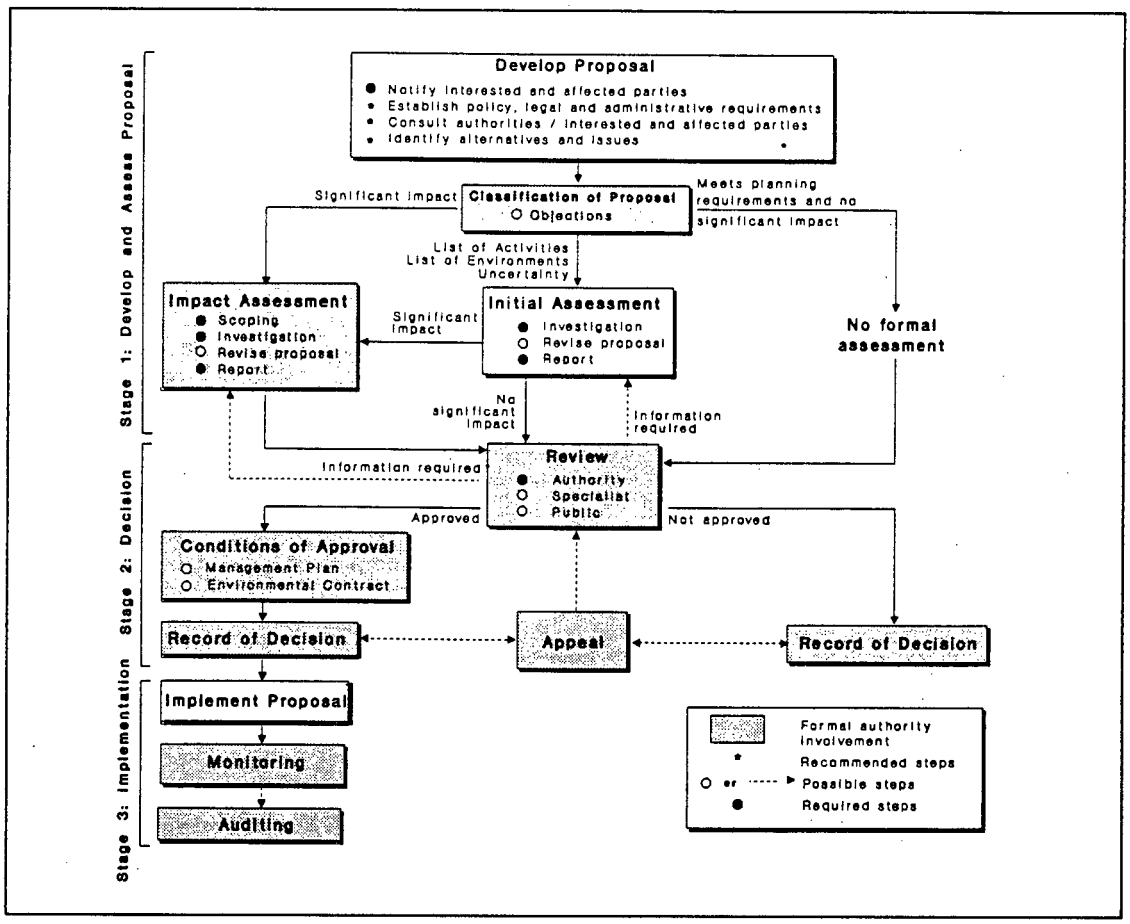


Figure 2.1 INTEGRATED ENVIRONMENTAL MANAGEMENT PROCEDURE

2.4.2 DISCUSSION OF PROCEDURAL ASPECTS OF THE STUDY

This section investigates how the components of the study plan fit into the IEM procedural framework. An indication is given of where the study deviated from recommended IEM procedure, and the implications thereof. Procedural aspects of the study which were particularly effective or noteworthy, are also identified and discussed.

To date most of the study falls into the planning and assessment stage, STAGE 1 of the IEM procedure. The review process, which is represented

in the IEM procedure as being part of STAGE 2 (the decision stage), has also taken place to some extent, in an integrated manner, but is not yet complete.

Figure 2.2 indicates how the components of the study fit into the IEM procedural framework, and includes comments which place the study in the context of IEM.

2.4.2.1 Deviations from standard IEM procedure

There were a number of instances where the study process differed somewhat from the "ideal" IEM procedure. The following are worthy of note:

- There was no explicit classification of the proposal. There is no institutional or legal framework for the application of IEM in Lesotho, and there was concomitantly no mandatory requirement that such a formal classification be carried out.

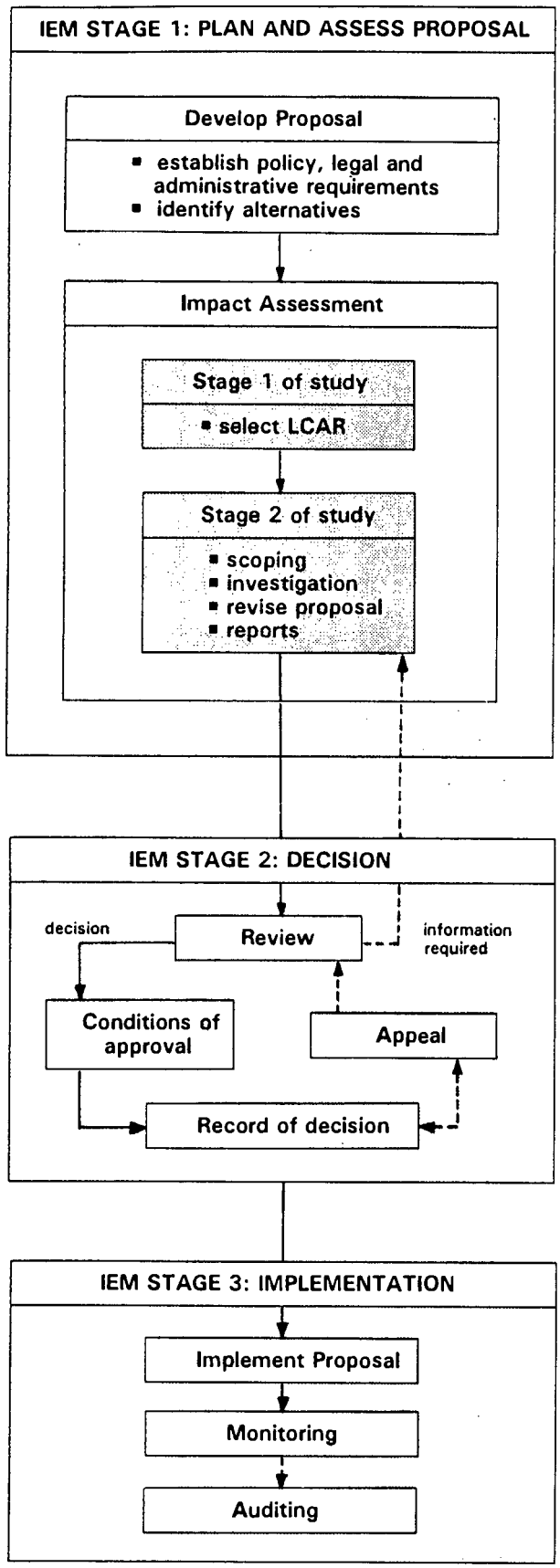
- No formal initial assessment was carried out. Once again this was because of the context of the study. The environmental impact assessment was carried out to comply with funding agency requirements, and it was furthermore clearly apparent that there would be significant environmental consequences associated with the project. In this context, the omission of this and the abovementioned step, is not a significant procedural shortcoming.

- The step required early on in the develop proposal stage *notification of interested and affected parties* was not carried out, due to a lack of time and logistical problems.

  This had repercussion further on in the process, in particular during scoping, because the interested and affected parties were not forewarned of the proposal. This made introductions and the arrangement of interviews less easy. Furthermore the interested and affected parties had not received prior background information on the proposal and therefore had to be briefed in this regard before comments could be elicited.

  If the interested and affected parties had received written notification early on (this would apply mainly to interested and affected parties based in Maseru) and had been informed as to the expected dates on which they would be contacted by the study team, they would have had more time to consider the proposal, and to consult with colleagues in this regard. This would have facilitated the scoping process.

- The step, *consult authorities/interested and affected parties,* was not carried out early enough in the study. The result of this was that interested and affected parties had only limited input into the



COMMENTS AND DEVIATIONS FROM STANDARD IEM PROCEDURE

- appointment of the EEU - January 1993
- no early notification of, or consultation with interested and affected parties
- alternatives provided by engineers
- no formal classification of proposal or initial assessment
- no public participation in stage 1 of study
- early integration of environmental issues e.g. guidelines for routing alignments
- input from engineers i.e. preliminary design of LCAR and WAR
- integrated and iterative planning and assessment steps
- reports include four supplementary reports, plus this report
- review process integrated with the assessment stage

↓ STEPS STILL TO BE COMPLETED ↓

- this report recommends specialist and public review be carried out
- this report recommends that conditions of approval include a management plan and an environmental contract
- this report recommends that the record of decision be made public, and opportunity provided for appeal
- once decision is made regarding choice of route, project moves into detailed design stage, with further environmental input from EEU
- proposed implementation date, mid 1997
- recommendations of this report include a monitoring programme, and environmental auditing

——— required step in IEM
– – – – – possible step in IEM

FIGURE 2.2: DIAGRAM INDICATING HOW THE STUDY PLAN RELATES TO IEM PROCEDURE

identify alternatives step. This served to alienate interested and affected parties to some extent, and to cast doubt on the legitimacy of the first stage of the study. The implications of this shortcoming were discussed in section 2.3.2.5 above.

2.4.2.2 Noteworthy procedural aspects

A number of procedural aspects of the study are noteworthy because they helped (or it is anticipated that they will help) the overall process.

Firstly the environmental team was involved early on in the planning stages of the proposal. This meant that it was relatively easy to bring about changes, for environmental reasons, to the proposed routing alignments, which at the time of the study were only "lines on maps", and had not yet been surveyed or pegged.

There was furthermore early integration of specialist and public review; the specialist reviewer gave input into the proposed methodology prior to the commencement of stage 2 of the study, and further input prior to the finalisation of the draft reports on the Maseru Bypass, the Least Cost Alternative Route, and the Western Access Road i.e. reports EEU/2/93/104a, b and c. Also at this point in the study, selected official parties who had provided substantive input earlier on, were asked to review relevant sections of the reports. The Lesotho Highlands Development Authority were furthermore provided with the opportunity to comment on the above-mentioned draft reports.

The implications of the integration of the review process are that the likelihood is reduced that "further information" will be requested by reviewers of the reports in the future. Beanlands and Duinker [1983, p3] underline the importance of integrated specialist review and point out that "the more conventional post-study peer review alone may be too late to influence assessment decisions".

In retrospect it is difficult to place many components of the study into either the "develop proposal" stage or the "impact assessment stage". This serves to underline the fact that the planning and assessment stages were truly integrated, thus ensuring that IEM principles directed the planning process, rather than being considerations to be addressed after the development of the proposal.

While this helped to expedite the process, at times this integration did not rest easy on the study team, as researchers were essentially taking on a dual role - that of "planner" and "assessor". It seemed at times that there was the risk that the "assessor" might loose objectivity when reviewing the work of the "planner". It became apparent that a balance has to be achieved in this regard. Planners of proposals, and the environmental scientists who assess those proposals, must each respect the role of the other, and must recognise the limit of their own expertise.

During the second stage of the study, rehabilitation guidelines were drawn up in anticipation of their eventual inclusion in a management plan and environmental contract (see Appendix 5 and 6 of EEU/2/93/104b and c). Other general mitigation and optimisation measures were also drawn up (see chapter 3). The early consideration of these aspects is considered to be "good process", as it familiarises and forewarns the proponent of likely resource commitments in the future. It is however, important that the guidelines and recommendations be seen as flexible, and that they are modified, where necessary, (subject to the approval of environmental specialists) as project actions become more clearly defined.

This concludes the discussion of noteworthy aspects of the study. In the following section, future stages of the project are considered in the light of the IEM procedure.

2.4.3 THE APPLICATION OF THE INTEGRATED ENVIRONMENTAL MANAGEMENT PROCEDURE DURING FUTURE STAGES OF THE PROJECT

It is a recommendation of this report that the remainder of the project be carried out in accordance with the Integrated Environmental Management (IEM) procedure. In particular the specific actions listed below should be undertaken:

- Specialist, authority and public review should be undertaken. This process should, in particular, include the distribution of copies of the comparative report to relevant government ministries and departments in Maseru, for feedback and comments. This is important, as it will serve to improve the present uneasy relationship between the Lesotho Highlands Development Authority (LHDA) and the Government. Specialist review is considered vital because of the close links between the proponent (the LHDA) and the decision-making body i.e. the Joint Permanent Technical Commission (JPTC).

- A Record of Decision should be drawn up jointly by the LHDA and the JPTC, and made public, and opportunity for appeal provided. This will serve to emphasize the open, participatory principles underlying IEM. It is recommended that workshops be held in villages which were involved in the social survey along the Western Access Road and the Least Cost Alternative Route, in order to provide the residents with feedback regarding the decision. All government bodies identified in the list of interested and affected parties in Appendix 2, as well as the Lesotho Council of NGOs, and the Molimo Ntuse Pony Trekking Centre should be advised of the decision by post. The Record of Decision, or a summary thereof, should also be published in national newspapers, and comments invited.

- A Management Plan, describing how negative impacts will be managed, rehabilitated and monitored and how positive impacts will be maximised, should be drawn up by the LHDA. The application of this Plan should be specified by the decision-maker as a condition of approval in the Record of Decision. The Plan should include detailed actions and specifications based on the mitigation and optimisation measures outlined in chapter 3 of this report, as well as any further measures which may be identified by the environmental team during the detailed design stage. Contingency plans for application in the event of accidents should also be included, as well as an estimate of resources required for the implementation of specified actions.

- An Environmental Contract should be negotiated between the LHDA and the contractor(s) responsible for the construction of the proposed road. The Environmental Contract should aim to ensure that mitigation measures are applied, and should include penalties to be applied if these measures are not carried out. The Environmental Contract should be specified by the decision-maker as one of the conditions of approval in the Record of Decision.

- The Record of Decision should include a description of the procedure whereby the Management Plan and Environmental Contract can be revised or updated during the life of the project.

- One year after the implementation of the proposal, an environmental audit should be carried out. The audit should primarily aim to provide feedback on the efficacy of the overall environmental management process, and should include recommendations for the management of future project components and phases of the Lesotho Highlands Water Project.

This completes the assessment of procedural aspects of the study in the light of the recommended IEM process. The section which follows focuses on the "ideal" requirements for environmental impact assessment reports.

2.5 ENVIRONMENTAL IMPACT ASSESSMENT REPORTS

This section considers the key requirements of competent environmental impact assessment reports, and indicates where and how these requirements have been met by this report. Where the requirements are not met, reasons are provided, and the implications discussed.

The requirements listed below are a synthesis of information collected from the following references: Hill and Fuggle [1990]; Dept. of Env. Affairs [1992]; Fuggle and Rabie, [1992] and Borcherds *et al* [1990].

"Ideal" requirements are specified in italics, followed by a brief discussion thereof:

Environmental impact assessment reports should provide all necessary information.

The guidelines for environmental impact assessment (EIA) reports published by the Department of Environment Affairs [1992] have been followed to ensure that all required elements are included in this report. Slight modifications to the "ideal" report structure were made to satisfy academic requirements. Information which would not normally be necessary in an EIA is provided in chapter 2 (this chapter) in order to provide the theoretical basis for the study. In chapter 1, 3 and 4, information regarding assumptions, limitations and methodologies are discussed in more detail than would normally be required in an environmental impact assessment report.

In each section of the report an attempt has been made to ensure that sufficient information is provided to allow a decision-maker to make an informed decision without seeking further information or analysis. Keeping the purpose of the report in mind, an effort has also been made to be selective, and to ensure that unnecessary details are not included. Only where it is considered essential, has information contained in the supplementary reports been summarised or repeated in this report.

The environmental impact assessment report should demonstrate that integrated environmental management (IEM) principles have been applied.

Section 1.3 of this report outlines the approach to the study, and provides the reader with a brief indication of the extent to which IEM principles were applied during the study. Further details in this regard are provided in section 2.3 above. A detailed description of scoping procedures is provided in Appendix 2.

Information should be synthesised and integrated.

To ensure that the report is an integrated whole, an introduction is included at the beginning of the report and at the commencement of each chapter, explaining its structure and purpose. At all times an attempt has been made to ensure that linkages between and within sections are clearly made. As far as possible the contextual basis for information has been set prior to its presentation.

The framework table, in section 3.5, provides a synthesised summary of impacts. In chapter 4 the comparative evaluation focuses on key issues to be considered in the decision-making process. In chapter 5 the main conclusions and recommendations are presented. Cross referencing has been used throughout the report to promote integration of the various report components.

The executive summary at the beginning of the report serves to further synthesise the report findings.

The report should be accurate, credible and unbiased.

The following steps have been taken to ensure that the accuracy and credibility of the information provided in the report is apparent, and that the impartiality of the study team and author is not brought into question:

- information is clearly referenced - it should be noted that this report does, at times, make more reference to theory than would normally be required in an environmental impact assessment report, in order to satisfy academic requirements;

- an indication of the composition and credentials of the study team is given in Appendix 3. Although "experience" should ideally be included in this list, it was omitted in this report, because the team are students;

- where subjective judgement is used, this is explicitly stated; opinions and facts are clearly distinguished;

- where uncertainties exist, for example in the prediction of certain impacts, this is explicitly stated. The implications of limitations which applied to the study are discussed in section 1.4.2, and

- the language used is as objective as possible, and use of "loaded" terminology is avoided.

One unfortunate exception to the latter is the use of the term "Least Cost Alternative Route" which to those unfamiliar with the study would seem to imply some advantage over the Western Access Road. It would have been more appropriate to use a neutral term such as "Northern Access Route". However, because the term "Least Cost Alternative Route" is used in all technical and engineering documentation, the terminology has been maintained.

Mitigation and optimisation measures should be proposed and should be clearly defined.

Mitigation and optimisation measures are described in chapter 3. As far as possible they were defined in specific and practical terms. The likely effectiveness of the proposed measures has been indicated by assigning a separate significance to each impact with, and without, such measures. The stage at which mitigation or optimisation should be applied is specified, and the manner in which the measures should be carried out has been outlined as clearly as is possible at this stage of the project.

Judgements regarding significance should be clear and consistent.

Decisions regarding impact significance are central to the environmental impact assessment. Because such decisions have a large subjective

component, it is crucial that they be made in a precise and reliable manner.

The criteria and procedure used to judge and assign the significance of impacts is outlined in section 3.2.2 of this report. The layout of the impact assessment section (section 3.4) is such that, for each impact, the allocation of significance is discussed under a separate sub-heading. For each impact an indication is given of which of the criteria listed in section 3.2.2.2 were used in assigning the significance, and to what extent the criteria were met.

Significance is allocated both with and without mitigation or optimisation, and the most likely scenario is identified.

The language and style of the report should be appropriate and effective.

The style used throughout the report is formal, since this is appropriate for such an academic dissertation. Thus the use of colloquialisms, slang and abbreviations has been avoided, and the use of personal pronouns minimised. The style of the report is more "academic" than an environmental impact assessment report would normally be. i.e. it is generally less "punchy", with more use of continuous prose. An effort has been made to be clear, unambiguous and concise in order to facilitate effective communication.

The report is a scientific and technical document, and the audience is considered to be an examiner with a specialist academic knowledge of the subject. The average Gunning Fog index is approximately 17, which is high, and indicates that the language and sentence length used is suitable for a reader who has had five years of tertiary education.

In a "real life" situation, where the report might be distributed for public review, or where the decision maker is a non-specialist, a lower Fog Index would be appropriate.

Main points should be emphasised.

This is done throughout by making use, *inter alia*, of:

- appropriate use of language and arrangement of the text e.g. main points are outlined at the beginning of sections, where they are more likely to receive attention and important facts repeated;
- headings and sub-headings in different fonts;
- bullet lists, figures and tables, and
- different character formats e.g. bold and italics.

The presentation of the report should be clear and should promote understanding.

The author aimed to provide a logical progression to the report, with a consistent numbering system used throughout, and pages numbered consecutively. The overall table of contents reflects major headings, and in front of each chapter there is a more detailed breakdown of chapter contents. Pages of coloured paper serve to indicate the beginning of new chapters.

Although limited by financial constraints graphics have been used, where possible, to facilitate communication. These include photographs, maps and flow diagrams.

The report should focus on key linkages between the project and important environmental components.

The report concentrates on impact prediction and comparative analysis. Purely descriptive components are limited to a summary of the affected environment in section 1.7. Methods used to identify impacts are described in section 3.2.1.

The structure of the report should facilitate comparison of alternatives.

The following structural aspects are aimed at facilitating comparison between the two routes:

- In section 3.4 of the report, the routes are discussed and assessed concurrently, impact by impact. After each impact a comparative table is provided of impact significance.

- In section 1.7, where the affected environment is considered, the routes are discussed concurrently, for each environmental components.

- In section 4.3, where the routes are evaluated, they are discussed concurrently, in a comparative manner, for each of the selected evaluation criteria.

The report should be organised according to interest groups affected so that trade-offs can be made between the interests of the different groups.

The *framework approach* used in this environmental impact assessment specifically arranges impacts according to interest groups. This approach is discussed in more detail in section 2.6 below.

The methods used in the comparative assessment of alternatives must simplify, rather than obscure information.

The *framework* approach used is appropriate in this regard because:

- it summarises the main impacts associated with the alternative proposals and facilitates comparison;

- it involves limited use of symbols (which can be unclear as they introduce a level of abstraction), and

- the framework uses some quantification where appropriate, but also allows the use of qualitative descriptions of impacts.

The report should give adequate attention to the preliminary evaluation of alternatives.

This study took place in two stages - during the first stage, eight feasible routing alternatives to the Western Access Road (WAR) were evaluated, and a report was produced recommending the selection of the Least Cost Alternative Route (LCAR) (see Appendix 1 of EEU/2/93/104c).

This dissertation is primarily concerned with stage 2 of the study, the aim of which was to compare the WAR and LCAR. The preliminary evaluation process is, however, briefly outlined in section 1.3, and for academic purposes the processes and procedures involved in stage 1 are considered in more detail in section 2.3 and 2.4.

The report should demonstrate the need for the project, and should consider the no-go option.

It is an assumption of this report that the need for the project is established, and that the no-go option is unacceptable. The basis for this assumption is discussed in section 1.4.1.

The impact assessment report should consider all stages of the proposal.

This report considers all stages of the proposed road project i.e. pre-construction, construction and implementation. In chapter 3 where impacts are described and assessed, the stage during which the impact is likely to occur is identified. Timing of mitigation and optimisation is also discussed. Chapter 5 includes recommendations regarding future stages of the project.

This concludes the discussion of this report in the light of ideal requirements for environmental impact assessment reports. In the next section environmental impact assessments pertaining to roads are briefly considered, and the *framework approach* is discussed.

2.6 ENVIRONMENTAL IMPACT ASSESSMENTS OF ROADS AND THE *FRAMEWORK APPROACH*

This section begins with a general introductory discussion regarding environmental impact assessments (EIAs) of roads. The *framework approach* is then described, and an indication given of why the approach was selected for this EIA. The shortcomings of the approach are then

discussed, followed by a discussion of ways in which the approach has been modified for application to this study.

2.6.1 ENVIRONMENTAL IMPACT ASSESSMENTS OF ROADS

In the appraisal of road projects a large number of disparate factors must be balanced against each other [ACTRA, 1979]. Thus such projects typically involve a number of specialists, including:

- engineers who are concerned that the project must be technically feasible;
- economists who are concerned that it should be economically acceptable, and
- environmental specialists, who are concerned that the project must be environmentally acceptable.

Within the context of Integrated Environmental Management (IEM) the environmental specialist is a *specialist in overall decision-making* who, seeks, *inter alia* to incorporate the net results of all other specialist studies, as well as input from interested and affected parties, into the decision-making framework of the environmental impact assessment (EIA).

EIAs of road projects must thus serve to bring together, in a rational manner, a large amount and range of information to assist in the decision-making process.

One approach to EIAs of roads is the *framework approach*.

2.6.2 DESCRIPTION OF THE *FRAMEWORK APPROACH*

The *framework approach* is a methodology which was developed in the United Kingdom specifically for the environmental appraisal of road projects. The approach makes use of an appraisal framework - a tabular presentation of data summarising the main direct and indirect impacts of the alternative options for a proposed scheme, on various affected parties [ACTRA, 1979].

Each feasible project alternative is given a separate column in the framework table, and the impacts of each alternative on six groups of interested and affected parties is considered [Lievesley, 1985]. A "comments" column, and a column dedicated to a consideration of the "do nothing" or "do minimum" alternative is also generally included in the framework.

In the United Kingdom it is standard practice that the following groups of affected parties are considered [Scottish Development Department, 1986]:

- travellers;
- occupiers;
- users of facilities;
- policies for conserving and enhancing the area;
- development and economic policies, and
- financial effects.

The framework is an aid to the decision-making process. Without judgement, applied both to the extent of the data and to their interpretation, frameworks have little value. With good judgement, frameworks can greatly assist the selection of routes [Scottish Development Department, 1986].

In the *framework approach* the major environmental impacts that can have an effect on the above groups are considered to be [Scottish Development Department, 1986]:

- traffic noise;
- driver stress;
- visual impact;
- air pollution;
- ecological impact;
- view from the road;
- community severance;
- effects on agriculture;
- disruption due to construction;
- effects on pedestrians and cyclists, and
- effects on heritage and conservation areas.

2.6.3 REASONS FOR SELECTING THE *FRAMEWORK APPROACH*

The *framework approach* was selected as an appraisal methodology for this environmental impact assessment report because it has a number of positive attributes, and was considered an appropriate methodology.

Firstly, it is a useful comparative approach, and is thus particularly suited to this comparative study. The *approach* can be used to concentrate analysis on impacts where there are real differences between alternatives [ACTRA, 1979].

The *framework approach* furthermore recognises that technical and economic aspects of relevance to the decision-making process should also be included in the framework table. Technical feasibility is generally represented by a cost in the table. This is in line with integrated

environmental management (IEM) principles which call for a holistic approach to environmental analyses.

The arrangement of the appraisal framework according to specific groups of interested and affected parties is particularly important as it serves to stress the importance of public participation [Scottish Development Department, 1986], which is a guiding principle of IEM. The grouping according to interested and affected parties is particularly useful in developing countries as it serves to underline the distribution of costs and benefits, and hence trade-offs regarding equity considerations, which are more important in developing than developed countries, because of colonial legacies and increased income disparities.

Another advantage of the *framework approach* is that it allows for the use of both quantitative and qualitative data, and recognises the use of judgement in the evaluation process [ACTRA, 1979]. It involves the minimum use of abstraction, i.e. symbols and numerical ratings, and is thus easily comprehensible, both to decision makers and to the public [Lievesley, 1985].

The *approach* was designed specifically for road projects and has been successfully applied and refined in the United Kingdom. The Department of Transport in the United Kingdom judged it to be the "most effective method of analysis of the environmental impacts of road schemes" [ACTRA, 1979, p6].

Finally, the *approach* is identified by the South African Roads Board in their Draft Transportation Environmental Assessment Manual [1992] as an appropriate technique for use during the route selection stage of planning.

2.6.4 SHORTCOMINGS OF THE *FRAMEWORK APPROACH*

The main shortcomings of the *framework approach* are the following:

i) The *approach* is not evaluative and does not, in itself, yield a decision - it is merely an aid to the decision making process. Thus the *approach* "still leaves the weighting of alternatives to judgement and ultimately the quality of the judgement will depend on the skill, knowledge and humanity of those who decide" [Bridle *et al*, 1881, p 303].

ii) There is no explicit feature of the *framework approach* which ensures comprehensive impact identification, or the consideration of cumulative impacts. It is an important requirement for methods of environmental impact analysis that they should encourage a review of the full range of environmental impacts associated with a given project [Fuggle and Rabie, 1992].

iii) The *approach* was developed in a "first world" country and therefore may not be appropriate to developing countries.

2.6.5 APPLICATION OF THE *APPROACH* TO THE STUDY

In order to overcome the above shortcomings and to make the method more applicable to the study, and to the southern African context, the following modifications were made:

- In order to partially address shortcoming i) discussed above, the significance of the impacts has been included in the framework. This is not standard practice in the *framework approach*. It goes one step further than the "magnitude-orientated" data usually used in frameworks. It provides the reader with an indication of the researcher's judgement regarding the importance of the impact, and thus further assists in the decision-making process.

- The *framework approach* was used in conjunction with a checklist of environmental characteristics [Dept. of Env. Affairs, 1992] to ensure a comprehensive consideration of impacts. This served to address the criticism outlined in point ii) above.

- While many of the assessment factors recommended by proponents of the *framework approach* in the United Kingdom were appropriate to the study, some recommended factors (e.g. air pollution) were considered by interested and affected parties in Lesotho, and by the researchers, to be of less significance to the route selection process. This is indicative of the different priorities of a developing nation such as Lesotho. Thus the study did not adhere rigidly to the recommended assessment factors (see chapter 3). This served to address the possible shortcoming outlined in point iii) above.

- Because of limited access to transport in the study area, few *users of facilities* are not *occupiers*. Thus these two groups were combined in order to reduce the risk of "double counting".

This concludes the discussion of the *framework approach*. In the section which follows, the socioeconomic component of the study is reviewed.

2.7 A REVIEW OF THE SOCIOECONOMIC COMPONENT OF THE EIA

2.7.1 INTRODUCTION

Social impact assessment has been defined as "a process in which intended projects and policies are examined for their possible effects on individuals, groups and communities" [Conland, undated, p3].

Social impact assessment (SIA), as an essential and integral component of environmental impact assessment, is a very new concept in South Africa [Khan, 1990]. Similar to experience overseas, early environmental impact assessments in this country tended to emphasise the impacts of development projects on the biophysical environment, while neglecting the human dimension [Sowman and Wiseman, 1990].

The situation in southern Africa is, however, slowly changing, along with the broader political groundswell towards democratisation of society at all levels.

The environmental impact assessment (EIA) which is the subject of this report, included an extensive social study. In section 2.7.2 below, the approach adopted in this social study is briefly discussed, and in section 2.7.3 the components of the social study are considered in the light of current SIA literature. In section 2.7.4 the methods and techniques used to identify social impacts are briefly assessed.

2.7.2 APPROACH TO THE SOCIAL STUDY

Structured approaches to SIA, such as the *social indicator approach* and the *systems approach* have come under criticism [Livesay and Harding, 1978; Tester, 1978]. They are considered to give too much prominence to the theoretical construct of those assessing social impacts. System regularities and quantitative representations of particular social features are abstracted from social life by the assessor. Such an approach is considered by many commentators to underplay the views and concerns of those affected by a proposed development.

In the light of the above, the approach employed by this social study was a more "feeling" approach, as proposed by Bisset [1984]. This approach pays attention to the views, feelings, fears and hopes of those to be affected by a proposal, with data being obtained from fieldwork observations and interviews, rather than by theoretical predictions.

2.7.3 A DISCUSSION OF THE COMPONENTS OF THE SOCIAL SURVEY

In this section the social study undertaken as part of this EIA, is discussed in the light of the writings of Khan [1990] and Burdge and Robertson [1990].

2.7.3.1 Khan [1990]

Khan identified the following aspects which she considers need to be addressed in social impact assessments:

- *Procedural aspects*: These include the early identification of impacts and issues, the gathering of community data and the implementation of public participation processes.

- *Mitigation and optimisation*: The SIA should not be just an assessment of impacts but should include recommended actions to mitigate negative impacts and optimise positive impacts.

- *Substantive aspects*: In addition to an assessment of project impacts, the substantive component should include a consideration of the extent to which the project contributes to the needs of the community.

- *Psychological aspects*: The SIA should consider the feelings which the community have towards the project, and to what extent the project may reinforce, threaten or aggravate existing attitudes toward the environment and development.

The *procedural* aspects identified by Khan concord with IEM principles.

The social survey carried out during this EIA along the two proposed alternative routes, had three main aims (see report EEU/2/93/104e). One of the aims was to inform the occupants of these areas of the nature of the proposal, and the alternatives being investigated. This served to facilitate the public participation process, by ensuring that the communities were in a position to provide relatively well-informed input. The second aim was to identify potential impacts and concerns of affected individuals, and thirdly, the survey was designed to obtain a socio-demographic profile of the affected communities. The survey was conducted during the planning stages of the project, and was thus taking place early on in the process.

The study thus incorporated all the main procedural aspects identified by Khan.

The study included a consideration of *mitigation and optimisation* measures (see chapter 3). In this regard the survey carried out along the Katse Road served to provide a valuable indication of types of measures

which would be required, and the likely effectiveness of these measures. It was clear from this study that procedural measures for the mitigation and optimisation of socioeconomic impacts are frequently more important than the specification of substantive measures, the former serving to better facilitate public involvement.

The questionnaires administered during the social study included questions which were specifically aimed at establishing the needs of the community, as well as their attitude towards a road. The Katse survey furthermore indicated how attitudes and perceptions would be likely to be affected if the project went ahead. Thus the main *substantive and psychological aspects* identified by Khan were also included in the study.

The above discussion indicates that all four of the components identified by Khan as needing to be addressed in SIAs, were incorporated into the study.

2.7.3.2 Burdge and Robertson [1990]

Burdge and Robertson conducted surveys of literature on SIAs and identify five features characteristic of the SIA process.

The first two of these features essentially coincide with components identified by Khan, namely an *early* start to the process in order that information derived from the SIA can actually influence decisions, and the inclusion of *mitigatory measures*. These features are therefore not discussed again.

The other three features are the following:

- SIA is a *means for developing alternatives* to the proposed course of action and determining the full range of consequences for each alternative;

- SIA *increases knowledge* on the part of the project proponent and the impacted community, and

- SIA *raises consciousness and the level of understanding* of the community and puts the residents in a better position to understand the broader implications of the proposed action.

As mentioned previously, stage 1 of the project, during which strategic *alternatives* (i.e. routing options) were assessed, did not involve public participation. The social study did, however, provide the affected communities with the opportunity to influence the development of tactical and management alternatives. These alternatives would be reflected in mitigation measures such as road safety features (e.g. barriers and speed humps) and recommended training options.

It is relevant here to note that, while the communities living along the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR) were not involved in the preliminary identification of alternatives, the author is of the opinion that this was acceptable within the framework of integrated environmental management, as these communities do not have the broad perspective necessary to have allowed them to provide meaningful input at this stage. Khan [1990, p1] states that while it is important that EIA procedure is applicable to all groups, "different emphases", depending on the community being affected, are at times necessary.

With regard to *increasing knowledge* and *raising consciousness* of the community, as mentioned above, one of the primary aims of the social component of the study was to inform the occupants along the WAR and LCAR of the proposal. It was originally hoped to arrange for a workshop between Katse residents, and residents of the Jorodane Valley prior to the survey being carried out. The aim of the workshop would have been to allow Katse residents to share their experiences of the new road in their area with Jorodane Valley residents, to give the latter an increased awareness of the implications of the project. Due to logistical problems, however, this workshop did not take place.

The discussion above indicates that, to varying degrees, the study incorporated all five of the features identified by Burdge and Robertson as characteristic of the SIA process.

In conclusion it can be stated that the social study included all the important components identified by Khan [1990], and Burdge and Robertson [1990]. The implication of this is that the social study is likely to have been comprehensive and *potentially* effective, and that it indeed qualifies to be referred to as a "social impact assessment".

In order to assess the *likely* effectiveness of the study, a more detailed consideration of the methodology is required.

2.7.4 A DISCUSSION OF METHODOLOGIES AND TECHNIQUES EMPLOYED IN THE SOCIAL STUDY

In this section the methodologies and techniques employed in the social study are discussed. Their advantages and associated limitations are considered, as well as the implications thereof.

The survey which formed the main component of the social study is described in detail in the social report (EEU/2/93/104e), but the methodology is summarised here for evaluative purposes.

The social survey incorporated two public participation techniques, namely questionnaires and informal (i.e. unstructured) interviews. The

questionnaires were administered by trained interviewers to the heads of households in selected villages. Approximately 75% of household heads were interviewed in each village. The informal interviews were held with key informants, such as chiefs, teachers and priests.

Burdge and Robertson [1990] underline the importance of using appropriate and properly applied public participation techniques. If not selected and undertaken correctly they can result in misleading information that in turn can lead to negative consequences for both the project proponent and the impacted community.

The main advantages of the interviewer-administered questionnaires were that:

- they were appropriate for illiterate communities;
- they could be used to ensure representativeness of the survey, and
- they were associated with a good response rate.

The informal interviews served a valuable purpose in that they identified omissions in the questionnaire, and provided a more open forum for discussion. The combination of interviews and questionnaires was thus a successful one.

Problems which can be associated with interviewer- administered questionnaires include interviewer bias, less candid responses due to a lack of privacy and anonymity, and the associated resource requirements i.e. the administration of the questionnaires is relatively costly and time-consuming [Dept. of Env. Affairs, 1992]. Interviewer bias did not appear to be a significant problem in this survey, however, because interviewers were well trained and were aware that they should remain impartial. Furthermore, because the interviews were not of a highly personal nature, respondents were generally open and forthcoming with information.

The study was constrained by time, as there was only a limited period available for pilot testing of the questionnaire. The implications of this are that important or relevant issues may have been left out of the questionnaire. The significance of this is, however, considered to be small, as the informal interviews served to compensate for inadequacies in the questionnaire.

Only household heads (mainly females) and key informants were involved in the survey, i.e. the survey was not a fully representative one. The objective of the study was, however, not to obtain accurate quantitative data, or statistically significant results. The purpose of the study was primarily to obtain information which would assist in the qualitative prediction of social impacts. For this purpose the extent of the survey is considered to have been adequate.

Bisset [1984] suggests that a close working collaboration between social and biophysical study teams should be a requirement for environmental assessments. A noteworthy point of the study, is that this was indeed the situation, as the social and biophysical researchers were part of one interdisciplinary team. This collaboration facilitated the identification of important linkages between social and biophysical components.

An inevitable effect of the survey is that it will have raised the expectations of the community, despite researchers attempts to avoid this. It is thus important that the decision concerning the choice of road be fed back to the communities involved, along with a clear explanation of the reasons for the choice. This point is reiterated as a recommendation of this report, in section 5.7.2.

This concludes the discussion of the socioeconomic component of the study, and chapter 2.

In the next chapter of this report the environmental impacts of the alternative proposals are assessed, and mitigation and optimisation measures recommended where appropriate.

CHAPTER 3
COMPARATIVE ASSESSMENT OF POTENTIAL IMPACTS

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3.1 INTRODUCTION

The purpose of this chapter is to synthesise and analyse information relevant to the environmental impacts associated with the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR).

This chapter comprises five sections.

In section 3.2 the assessment methodology is discussed, including methods used to identify impacts and to assess their significance, and in section 3.3 the layout and terminology used in the impact assessment section (section 3.4) is described and defined. In section 3.4 the potential impacts associated with the WAR and the LCAR are described and their significance discussed, and in section 3.5 the impacts are summarised in a framework table.

3.2 ASSESSMENT METHODOLOGY

This section describes the methodology of the assessment. Methods used to identify impacts are first outlined, followed by a discussion of the process whereby significance was assessed and assigned.

3.2.1 IDENTIFICATION OF IMPACTS

Procedures for identifying impacts should ideally meet five requirements [SARB, 1992]. They should be:

- comprehensive - the full range of environmental impacts associated with the project should be identified;
- precise - actions should be specifically rather than broadly defined;
- project specific - impacts related to the project must be differentiated from environmental changes due to other factors;
- accurate - the location, timing and duration of the impact must be specified, and
- consistent - analyst bias must be minimised.

A number of measures were taken to ensure that the identification of impacts was *comprehensive*. A checklist of environmental characteristics was consulted [Dept. of Env. Affairs, 1992] in order to ensure that all components of the affected environment were considered. During stage 2 of the project, extensive scoping was carried out. This included both public and authority scoping, during which meetings were held with interested and affected parties (I&APs) to discuss the project

and identify specific concerns. The scoping procedure is outlined in Appendix 2, which also includes a table indicating issues of concern identified during these meetings.

The scoping process also included a number of social surveys. Surveys, based on questionnaires and informal discussions, were carried out at villages along the Western Access Road (WAR), along the Jorodane Valley section of the Least Cost Alternative Route (LCAR), and along the recently completed Katse Road. Information from these surveys identified issues of concern to the residents likely to be affected. Findings of the social surveys are recorded in report EEU/2/93/104e.

The magnitude of local quantifiable impacts were established during field trips along the WAR and the LCAR. Approximately ten days, in total, were spent in the field. Physical features and resources falling within the proposed 20 m road corridor were recorded, as well as those which fell outside this distance but which would be indirectly affected by road construction or upgrading.

Wherever possible an effort was made to ensure that impacts were identified and described in a *precise* manner. There are, however, instances where this has not been possible, because the project is still in the planning stage, and many project actions are as yet, not well defined. This aspect is discussed in some detail in section 1.4.2 of this report.

Care was taken to ensure that identified impacts were *project specific*. Impacts of the Mohale Dam itself, in particular, were specifically excluded from the assessment. Because of the natural inter-connectedness of environmental impacts, this was a rather unnatural and unfortunate situation, but was dictated by the terms of reference of the study.

Although the impacts identified are project specific, it was at times necessary (e.g. when assessing their significance) to view them within the context of other planned projects, such as the Mohale Dam. Events related to other projects were also identified and discussed at times where they were relevant from the point of view of cumulative effects.

To provide a theoretical basis for impact identification, a baseline scenario was defined, against which the impacts were assessed. The baseline scenario is the continuation of the existing environmental situation in Lesotho, with no new or upgraded access road, and no construction traffic. This scenario is not a likely or feasible one, but is simply used to ensure that the assessment of impacts for both roads have the same theoretical basis, and are thus comparable.

To ensure *accurate* impact identification, the exact location of impacts, and the project phase during which they are likely to occur have been specified as far as possible. The impacts have also been described as either short, medium or long-term.

During the study, it was possible to define impacts of the WAR more accurately than those for the LCAR, because the existing centre line of the Mountain Road was used as a reference point for the preliminary design of the WAR alignment. Thus, for example, exact measurements could be taken of the location of environmental components relative to the proposed new road alignment. This was, however, not the case with the LCAR, where the accuracy was limited by the available scale (1: 5000) and quality of the alignment maps. No route markers were in existence along the LCAR at the time of the study.

This difference in accuracy essentially means that, despite highly accurate measurements being made on the WAR, the level of uncertainty associated with the comparative assessment of impacts, is similar to that associated with the LCAR. This is, however, not considered a serious shortcoming, provided that it is recognised by the reader. To ensure this, uncertainties relating to impact prediction are discussed, where appropriate, in section 3.4.

Where accurate quantitative data exists for the WAR, and not for the LCAR, this quantitative data is excluded from this assessment, to ensure consistent and comparative levels of accuracy.

The identification of impacts was, as far as possible, carried out in a *consistent* manner. Wherever possible, more than one member of the study team was involved in the identification and quantification of a particular impact, in order to reduce the risk of bias. The extent to which integrated environmental management (IEM) principles and procedures were adhered to throughout the study is discussed in section 2.3 and 2.4. Where existing information about impacts was scarce, or where impacts were uncertain or potentially highly significant, experts were appointed to assist in the assessment of impacts. Specialist consultants are listed in Appendix 3.

3.2.2 ASSESSING THE SIGNIFICANCE OF IMPACTS

3.2.2.1 Introduction

A significant impact is one which is considered to have, or is likely to have, considerable effect (either positive or negative) on some aspect of the environment. The judgement of significance is subjective and impact specific as there is no standard, objective threshold beyond which an impact becomes socially significant [Dept. of Env. Affairs, 1992].

Significance must be considered in terms of context (both spatial and temporal) and intensity. Intensity refers to the severity of the impact, as judged by someone with specialist knowledge, or by the affected parties, as appropriate in the specific circumstance.

3.2.2.2 Criteria for assessing significance

The following criteria were used for the assessment of impact significance; the list of criteria, which includes considerations of both intensity and context (i.e. duration and geographical extent of the impact), is based on information contained in the Draft Transportation Environmental Assessment Manual of the South African Roads Board [SARB, 1992] and the Integrated Environmental Management Guideline Documents [Dept. of Env. Affairs, 1992].

Significance is determined by the degree to which the impact:

- affects public health or safety;
- affects the overall well-being of people, and the number of people affected;
- involves impacts which are irreversible;
- will have effects over long time periods;
- affects or furthers national goals or local interests;
- affects the availability or functioning of key resources;
- affects environmental qualities, goods or services which are of special or unique character, in limited supply, or essentially irreplaceable;
- may establish a precedent for future actions;
- results in cumulative or synergistic impacts, and
- has the potential to optimise existing conditions.

3.2.2.3 Assigning significance

During stage 2 of the study, the environmental study team, in consultation with appropriate specialists, applied the above criteria to the impacts identified in the study, to determine the significance of the impacts. Positive and negative impacts were assigned a significance rating of either high, moderate or low, or where appropriate were described as having "no significant impact". The impacts and their significance ratings are detailed in reports EEU/2/93/104b and c.

During the compilation of this report, impacts have been regrouped and at times combined, in order to facilitate comparison of the two alternative routes. The author therefore found it necessary to carry out a second rigorous appraisal of the significance of each impact. This appraisal involved:

- the identification of criteria (from those listed in section 3.2.2.2.) which were applicable and appropriate to the impact in question;

- an assessment of the extent to which those criteria were, or were not met;

- the assigning of a significance rating of either high, moderate, or low, using professional judgement based on the above assessment.

The significance ratings of impacts with and without mitigation or optimisation are presented in the report.

3.3 LAYOUT AND TERMINOLOGY USED IN IMPACT ASSESSMENT SECTION

3.3.1 GROUPING OF IMPACTS

The grouping of impacts in section 3.4 below is based on appraisal groups recommended for road projects in the *framework approach* [Lievesley, 1985]. This grouping considers the effects of impacts on various groups of interested and affected parties, with indirect impacts grouped under "effects on policies". The advantages and disadvantages of the *framework approach*, and its application to this assessment, are discussed in section 2.6, of this report.

The impacts in section 3.4 are grouped as follows:

3.4.1 - Impacts on travellers
3.4.2 - Impacts on occupiers and users of facilities
3.4.3 - Impacts on parties concerned with conservation
3.4.4 - Impacts on policies for development and transport
3.4.5 - Financial effects

3.3.2 LAYOUT OF IMPACTS

The layout of the impacts themselves is based on recommendations in the IEM Guideline Documents [Dept. of Env. Affairs, 1992]. Each impact in section 3.4 is presented in the following format:

Impact statement
A highlighted statement of the type of impact that can be expected, and from which project actions it will arise.

Discussion of impact
An expanded explanation of the impact, its causes, frequency, duration and linkages to other impacts, is given. This includes a prediction of impact magnitude, and where possible the degree of confidence in the prediction, and the likelihood of occurrence of the impact.

Affected parties
Identification of the specific groups of individuals affected by an impact.

Mitigation and/or optimisation
Proposed measures to limit the negative consequences of the impact or promote the positive ones are stated.

Significance
The criteria which are considered applicable for the assessment of the significance of the impact in question are listed, and the extent to which the impact meets these criteria is discussed.

The significance of the impact, with and without mitigation or optimisation, is given as either low, moderate or high, or, where appropriate, "no significant impact" is recorded. These terms are defined in section 3.3.3 below.

The most likely future scenario, i.e. either with or without mitigation or optimisation, is then identified and discussed. The resources available to the party who would be responsible for carrying out the measures is taken into account, as well as their apparent commitment based on past performance, and stated policies.

Summary table
This table summarises the impact and its significance with and without mitigation or optimisation. The most likely scenario (i.e. either with or without mitigation or optimisation) is highlighted in bold print.

3.3.3 DEFINITION OF TERMS USED

The duration of impacts, are described as either *short-term, medium-term* or *long-term*.

A short-term impact is considered to be one which will not last longer than the period of road construction i.e. for up to 30 to 36 months. Medium-term impacts are defined as those which will continue beyond the road construction phase, into the implementation phases of the road project, but which will not continue after the conclusion of the construction of the Mohale Dam, estimated to be in the year 2004. An impact is described as long-term if its effects are likely to continue after the completion of Phase 1B in 2004.

Impacts are described in terms of their extent as being of either *local*, *regional* or *national* importance. These terms are defined on the basis of geographical extent in section 1.2.3. of this report.

Where reference is made to *residual impacts* this refers to the impact which remains after mitigation measures have been applied.

The allocation of *high*, *medium* and *low* significance ratings, or the judgement that a project action will have *no significant impact*, is based on the extent to which the criteria outlined in section 3.2.2.2 are met. Impacts are considered to be of high significance if one or more of the criteria apply to a considerable extent. In the case of impacts of medium and low significance, one or more of the criteria apply only to a moderate and small extent respectively. Where none of the criteria are met to a significant extent, project actions are considered to have no significant impact.

3.4 POTENTIAL IMPACTS ASSOCIATED WITH THE WESTERN ACCESS ROAD AND THE LEAST COST ALTERNATIVE ROUTE

3.4.1 IMPACT ON TRAVELLERS

(i) ***The construction of the bypass in Maseru, as part of the Western Access Road, will relieve traffic congestion in the capital city; the bypass will not be built in the case of the Least Cost Alternative Route.***

Discussion of impact
The Maseru central business district is highly congested at peak traffic flows, and the main road through Maseru has reached its capacity [E. Nicholson, pers. comm.]. This is due to the convergence of two major arterial roads in the central business district, and the absence of alternative routes past the city centre.

The Western Access Road (WAR) will include the construction of a Maseru bypass (see report EEU/2/93/104a). This bypass will be very beneficial to travellers, in particular motorists, as it will alleviate present congestion in Maseru by providing an alternate route for vehicles around the city centre.

The Least Cost Alternative Route (LCAR) proposal does not include the construction of a bypass at Maseru. Thus no benefits will accrue to travellers in the capital city in the case of the LCAR.

Affected parties
Motorists and pedestrians in Maseru who presently suffer the inconvenience of traffic congestion, and other travellers wishing to bypass the city centre.

Optimisation
A detailed environmental impact assessment (EIA) should be carried out during the pre-construction (planning) stage in order to establish the optimal route for the bypass. The EIA should take into consideration the findings and recommendations outlined in the initial assessment report (EEU/2/93/104a).

The Maseru bypass should be designed to reinforce urban and regional planning initiatives, in particular those outlined in the Maseru Development Plan [LSPP, 1989].

Significance
In assessing the significance of the above impact, the following were taken into consideration:

- the impact concerns public safety and well-being, in particular that of pedestrians and motorists in Maseru;
- the impact will affect a large number of people i.e. the bypass will potentially provide benefit to all residents of Maseru (estimated population 160 000) as well as to travellers passing through Maseru;
- the impact involves effects which are irreversible i.e. potential road fatalities, and
- the impact will be of a long duration i.e. it is likely to continue to provide benefits even after the completion of Phase 1B of the Lesotho Highlands Water Project (LHWP) in 2004.

Without optimisation, the significance of this positive impact is likely to be only moderate. In the light of present effective co-operation between the Lesotho Planning Department (LSPP) and the Lesotho Highlands Development Authority (LHDA), it is, however, considered most likely that optimisation measures will be applied to the extent that the impact becomes one of high significance.

The table below summarises this discussion regarding impact significance, and highlights the most likely scenario in bold print.

Table 3.1 SUMMARY: IMPACT OF THE MASERU BYPASS

SCENARIO	WAR	LCAR
With optimisation	**High positive impact**	**No impact**
Without optimisation	Moderate positive impact	No impact

(ii) ***The implementation of both of the proposed routes will improve safety and increase the well-being of travellers.***

Discussion of impact
This discussion considers the net effect which the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR) will have on the safety and well-being of travellers, compared to the existing situation. The effect of the Maseru bypass is not considered here, as it is dealt with separately in impact (i) above.

In this discussion "travellers" includes motorists, cyclists, pedestrians and horse-riders. Roads in Lesotho are frequently used by shepherds herding cattle on foot. The effects on livestock are thus also considered here, as this is viewed as an indirect impact on the travellers who possess the livestock.

Western Access Road:
Although there will be temporary disbenefits, the tarring and widening of the WAR will make it safer and more convenient for all road users in the long-term.

The WAR is at present in a very bad condition and is characterised by narrow hairpin bends, alternating stretches of gravel and severely degraded tar, and numerous potholes. Although there are no road accident statistics available for the WAR, there are several vehicle wrecks scattered along the roadside and residents say that accidents do occur "quite regularly", although there are generally few fatalities [EEU/2/93/104e].

Increased vehicle speeds along the WAR, as a result of the upgrading, will tend to increase the frequency and severity of accidents. This effect will, however, be counter-balanced by the fact that tarring of the road will improve road-holding, and widening will increase vehicle passing distances and provide more space for pedestrians and livestock.

As well as improving safety, tarring of the road will reduce vehicle maintenance costs and will alleviate problems associated with mud and dust from passing traffic which currently inconvenience pedestrians. The latter benefit was identified by survey respondents along sections of the Katse road that had been upgraded from a gravel to a bitumen surface [EEU/2/93/104e].

In the short-term during the estimated 30 to 36 months it will take to upgrade the WAR, road users will be inconvenienced due to increased traffic congestion and delays, and reduced road safety. Traffic volumes are, however, relatively low along this route. 1992 figures indicate that total traffic counts along the route typically vary between 85 to 352 vehicles per day. Because of these relatively low traffic volumes these short-term effects will not be too severe.

After completion of the road, during the five years of dam construction, traffic volumes along the route will increase by an estimated 80 to 200 vehicles, 16% of which are predicted to be heavy vehicles. Increased traffic volumes will result in increased risks to travellers in the medium-term, as well as to livestock. During this period the net benefit of the upgraded WAR to travellers is likely to be low.

In the long-term, once construction of the dam is complete, there is still likely to be an increase in traffic volumes compared to present figures, due to increased tourist traffic and "attracted" traffic due to the improved quality of the road. The percentage of heavy vehicles on the road will, however, decrease. On the whole it is considered that the improved safety and convenience of the upgraded road, will outweigh any increase in risks to travellers which might be associated with the increased traffic volumes.

In the long-term it is therefore predicted that the WAR will have a positive impact on all travellers.

The Least Cost Alternative Route:
The Least Cost Alternative Route (LCAR) will have the following benefits to travellers:

- It will provide an alternative shorter linkage between Teya-Teyaneng and the Mohale Dam. Traffic travelling down the A1 route from Northern Lesotho to the Mohale Dam site or adjacent areas, will no longer have to travel via Maseru and along the Mountain Road.

- The LCAR will provide travellers between Maseru and the Mohale Dam area with an alternative route to the Mountain Road i.e. from Maseru across the Berea Plateau and via Ha Mohale. This will be similar in distance to the Mountain Road, but will be a better quality road.

- The LCAR will include the upgrading of the 5 km track between Ha Mateka and Pulane to the north of the Jorodane Valley, as well as the construction of a bypass at Teya-Teyaneng.

- The construction of a new road through the Jorodane Valley would provide local pedestrian or equestrian travellers with the opportunity of getting a lift to their destination or of using a motorised form of transport, in particular public transport.

- The new stretch of road through the Jorodane Valley will be a much better "engineered" route than the WAR, due to the fact that it will be a new construction. The resulting smooth speed profiles will make it safer for traffic than the WAR. Only about 4 km of the proposed LCAR (as opposed to 10 km of the WAR) lies above the snow line, and it will thus be relatively safer for travellers in winter.

There will also be a number of disbenefits to travellers, mainly those travelling on foot or by horse:

- The introduction of vehicular traffic into the Jorodane Valley area, will bring with it the associated risk of traffic accidents, particularly those involving children and livestock. In places the road impinges on existing cattle paths and at times the terrain will make it very difficult for livestock and herders to use an alternative route to the road. Along the Katse Road, there have been 61 accidents in which livestock were either injured or killed, since the road was built in 1989 [EEU/2/93/104e].

- Steep cuttings and drainage canals associated with the road are physical obstacles which could pose a safety hazard to travellers on foot or horse-back, as well as to their livestock.

On the whole, however, it is judged that the benefits of the LCAR to travellers will outweigh the disbenefits.

Affected parties
Vehicular road users, travellers on foot or on horse-back and their livestock.

Mitigation and optimisation
Prior to the implementation stage, road signs indicating pedestrian hazard, zebra crossings, speed ripples, and reduced speed limits should be introduced at points where the road passes through villages, or near schools and other crossing points. Traffic barriers should be erected, where appropriate, to limit access to the road to safe crossing sites. Road safety education programmes should be introduced in villages and schools prior to, and during, the construction phase of the road.

Stopping points should be provided along the route to allow vehicles to pull off the road, and adequate road shoulders must be provided for the safe passage of pedestrians and livestock. Where bridges are built, there should also be sufficient space for the safe passage of pedestrians and livestock, particularly where there are no existing bridges that could serve as alternative crossing points.

The design of drainage canals should be modified to make them safer. A possible improvement is a fine mesh grating over the top, particularly alongside livestock ramps, to prevent animals falling into the canal.

With regard to temporary disruptions during the construction stage, road users should be informed of possible delays, by means of advertisements and notices detailing times and duration of road closure.

Significance
In assessing the significance of the above impact, the following were taken into consideration:

- the impact directly concerns public safety and well-being i.e. that of travellers on the proposed access road;

- the impact involves effects which are irreversible i.e. road fatalities, and

- the impact will, on the whole, be of a long duration i.e. it is likely to continue to provide benefits even after the completion of Phase 1B of the Lesotho Highlands Water Project (LHWP) in 2004.

Despite short-term disruptions during the 30-36 months of road construction, it is considered that the WAR will have an overall positive impact on the safety and well-being of travellers in the long-term. With mitigation and optimisation measures applied, this positive impact is judged to be of moderate significance.

In the case of the LCAR, benefits to motorists, and associated with the introduction of vehicular transport, are considered to outweigh the increased risks to equestrians, pedestrians, and their livestock. With mitigation and optimisation, it is considered that a positive impact of moderate to high significance, will result.

Without mitigation or optimisation, the significance of these positive impacts are likely to be reduced to low in the case of the WAR and moderate in the case of the LCAR. Because the mitigation and optimisation measures only require a moderate outlay of resources, it is, however, considered most likely that they will be implemented.

Table 3.2 SUMMARY: SAFETY AND WELL-BEING OF TRAVELLERS

SCENARIO	WAR	LCAR
With mitigation and optimisation	**Moderate positive impact**	**Moderate to high positive impact**
Without mitigation and optimisation	Low positive impact	Moderate positive impact

3.4.2 IMPACT ON OCCUPIERS AND USERS OF FACILITIES

(i) ***Both routes will improve access to facilities, goods and services, the Least Cost Alternative Route to a greater extent than the Western Access Road.***

Discussion of impact
Since the Mountain Road has been in existence for more than 40 years, it is to be expected that its upgrading will improve access to a lessor degree than the construction of the Least Cost Alternative Route (LCAR).

The latter, which includes an entirely new stretch of road from Pulane, via the Jorodane Valley, to the Mountain Road, will provide vehicular transport opportunities to this region for the first time.

Responses from the questionnaires and informal interviews suggest that an upgraded or new road will have a number of positive effects on the lives of local residents. In particular it will result in:

- easier and faster access to clinics, emergency services and mortuaries;
- improved transport for large items such as furniture, building materials, and bulk supplies;
- improved social contacts;
- improved transport for migrant workers;
- improved access to agricultural requirements, livestock facilities and regional markets, and
- improved access to schools.

In the case of the LCAR, approximately 33 small villages and 15 large villages will benefit from having access to a new road. A "large" village is defined as one with more than 100 inhabitants. In the case of the Western Access Road (WAR), approximately 13 large and 20 small villages will directly experience improved access due to an upgraded road. Residents of Maseru will also benefit from improved intra-city access as a result of the proposed bypass.

The new road in the Jorodane Valley is important in that it provides the opportunity for increased agricultural productivity and rural development. Dewar [1985] indicates that improved infrastructure is a necessary, although not a sufficient condition for improved productivity. If rural development opportunities are to be fully realised, institutional constraints and structural obstacles to development need to be addressed (see Appendix 7 of EEU/2/93/104c).

Affected parties
Local residents along sections of the WAR and LCAR which are to be subject to major construction and upgrading.

Optimisation
If the LCAR is built, an efficient and cheap public transport system should be developed along the route during the implementation stage of the project, and regular bus stops provided along the length of the road, to serve all villages or village clusters. If the WAR is selected as the preferred route, public transport along the route should be improved.

A wide shoulder or gravel track should be provided alongside the road to facilitate the safe movement of livestock and pedestrians. Bridges should also be wide enough to accommodate livestock and pedestrians. These measures will need to be considered during the pre-construction and construction stages of the project.

During the implementation stage of the LCAR, rural development programmes aimed at compensating for losses incurred as a result of the construction of the Mohale Dam should be extended to facilitate the optimisation of benefits of improved access throughout the length of the Jorodane Valley.

Significance
In the case of the LCAR, this impact is considered to be highly significance, both with and without optimisation, for the following reasons:

- the road will significantly improve the overall well-being of a large number of people, in particular the approximately 2000-3000 residents of the Jorodane Valley;
- the impact has the potential to optimise existing conditions, in particular with regard to rural development;
- the impact will significantly affect local interests, and
- the impact will have effect over a long time period i.e. the benefits will continue to accrue even after the completion of Phase 1B in 2004.

In the case of the WAR, where the improvement of access is mainly one of degree, i.e. a wider, and better surfaced road, rather than a new one, the impact is judged to be of only moderate significance without optimisation, but potentially moderate to high with optimisation.

Observations along the Katse Road indicate that it is likely the Lesotho Highlands Development Authority will implement some of the above optimisation measures (e.g. wide road shoulders and bridges). Other recommended measures, such as rural development programmes and improvements in public transport are, however, less likely to be effectively implemented.

Table 3.3 **SUMMARY: IMPACT OF IMPROVED ACCESS**

SCENARIO	WAR	LCAR
With optimisation	Moderate to high positive impact	High positive impact
Without optimisation	**Moderate positive impact**	**High positive impact**

(ii) ***The construction of both routes will provide employment opportunities to local residents; the influx of construction workers and the increase in travellers along the road, will also indirectly result in increased business opportunities to residents.***

Discussion of impact
Lack of jobs has been cited by 20% of respondents in the social survey as one of their major problems. Many people are hopeful that the road will bring employment opportunities.

The construction team for the access road will comprise approximately 500 people who will be employed for a maximum of 36 months. It is likely that some local people will derive benefits from these enhanced employment opportunities, although many local people may not be considered suitable for employment because of low literacy levels and a lack of experience with machinery. In the case of the Western Access Road (WAR), the proposed upgrading of the Maseru railhead is likely to provide further employment opportunities, possibly to up to 50 people for a year.

Economic benefits may also accrue indirectly to local residents from activities such as selling food and beer, washing clothes, prostitution and renting accommodation to construction workers in the area.

In the long term the road itself offers potential economic benefits to local women, who see it as a market place for selling crafts (mats, brooms and hats) and food. In this regard synergistic effects associated with other components of Phase 1B of the Lesotho Highlands Water Project are relevant; for example the cumulative impact of the road and increased tourist traffic to the Mohale Dam will serve to increase economic opportunities. Observations during the Katse survey, however, indicate that this impact is likely to be limited.

Affected parties
Local residents.

Optimisation
A training programme, which teaches local people appropriate skills associated with road construction, should be developed and implemented during the pre-construction and construction phases of the project. Local workers should also be trained in road maintenance skills, and locally coordinated road-maintenance projects established.

A rural development programme offering local residents access to business management skills should be implemented in conjunction with the road project.

Local builders should be used to construct compensation houses.

Road verges in the vicinity of bus stops should be designed to be wide enough to allow local people to sell their wares in as safe manner.

Significance
Without optimisation, this positive impact is likely to be one of low significance in the case of both the Western Access Road and the Least Cost Alternative Route, chiefly because of the relatively short-duration of road construction project (i.e. approximately 36 months).

Training programmes have, to a fair extent, taken place on the Katse project. Based on this fact, it is therefore assumed that optimisation will take place to the extent that this impact will become moderately significance.

Table 3.4 **SUMMARY: EMPLOYMENT AND BUSINESS OPPORTUNITIES**

SCENARIO	WAR	LCAR
With optimisation	**Moderate positive impact**	**Moderate positive impact**
Without optimisation	Low positive impact	Low positive impact

(iii) ***Improved access associated with the construction of the Least Cost Alternative Route will disrupt the informal cash economy in the Jorodane Valley; the Western Access Road will have no such comparable impact.***

Discussion of impact
The local economy of the Jorodane Valley is very strongly rooted in the informal economic sector. 65% of survey respondents indicated that an important source of income is the informal sale of illegal cash crops.

Improved policing of the area, as a result of improved access associated with the construction of the Least Cost Alternative Route (LCAR), is likely to disrupt this informal economy. It is estimated that the potential loss of income to the sub-region as a result of the road could be between M200 000 and M500 000 per annum. This will be a long-term impact with far reaching consequences for this remote community, who have limited access to the mainstream cash economy. A cash income is essential to the community in order to send their children to school, as well as to buy food, clothes and seed.

There is no evidence along the Western Access Road (WAR) of such informal economic activities, and it is therefore assumed that the upgrading associated with the WAR will have no significant impact in this regard.

Affected parties
Local residents who grow illegal cash crops.

Mitigation
It is the opinion of local residents that disturbances could be reduced by moving cash crops to fields some distance from the road.

Alternative sources of income, such as other legal cash crops, could also be developed in order to maintain the current standard of living, although this mitigatory measure is likely to be less effective, because returns would be lower.

Significance
From the point of view of the residents, this impact will be a negative one of high significance. It is clear that it will:

- affect the overall well-being of 65% of the 2-3000 residents of the Jorodane Valley, and
- will have an effect over a long time period.

On the basis of responses from residents during informal interviews, it is assumed that mitigatory measures will be applied to the extent that this impact will be reduced to one of moderate significance.

Table 3.5 SUMMARY: IMPACT ON INFORMAL CASH ECONOMY

SCENARIO	WAR	LCAR
With mitigation	**No significant impact**	**Moderate negative impact**
Without mitigation	No significant impact	High negative impact

(iv) ***Road upgrading and construction activities associated with both the Western Access Road and the Least Cost Alternative Route may directly damage, or indirectly affect, potable water supplies.***

Discussion of impact
Each village generally possesses one or more springs which serve as water collection points for the whole village. Potable water is already scarce in many areas. 43% of respondents to the social survey said that availability of water was a problem for their villages.

At least four springs are likely to be affected by the construction of the Least Cost Alternative Route (LCAR), and up to seven springs (two unused) may be directly or indirectly affected by the Western Access Road (WAR).

Road upgrading or construction activities may cause immediate, direct destruction of springs, or delayed interference effects as a result of pollution by road runoff, altered drainage patterns or rock falls. Delayed interference effects have been reported along the Katse Road, mainly as a result of rocks from unstable road cuttings falling into the springs.

Affected parties
Local residents whose springs are affected, particularly women, who are responsible for water collection.

Mitigation
Springs that will be destroyed during the construction stage of the project or to which access will be impeded, should be replaced with a suitable reliable water supply, such as standpipes or pumps. Care must be taken to ensure that the replacement water supply is of equivalent quality to the existing source and is located at an acceptable distance from the village. Where replacement water sources are likely to require regular maintenance, local residents must be trained to undertake this.

Significance
Without mitigation this negative impact will be of high significance in the case of both the WAR and the LCAR, for the following reasons:

- the impact will affect the overall well-being of a number of people - up to five villages may be affected;
- at the local level the impact will affect public health to a significant degree, and
- the impact could continue for a long time period, i.e. even after the construction of the road is complete.

Along the Katse road many respondents to the survey reported that, despite mitigatory measures, it now took them longer to fetch water than before the road had been constructed. It is therefore judged that, even with mitigatory measures, a residual negative impact of low significance will result.

Table 3.6 SUMMARY: IMPACT ON POTABLE WATER SUPPLIES

SCENARIO	WAR	LCAR
With mitigation	**Low negative impact**	**Low negative impact**
Without mitigation	High negative impact	High negative impact

(v) ***Both the construction and implementation of the Least Cost Alternative Route (LCAR) and the Western Access Road (WAR) will result in social disruption and disturbance of nearby communities; the LCAR to a slightly greater extent than the WAR.***

Discussion of impact
Villages closest to the road, or to construction camps housing construction workers, will suffer the most severe social disruption. Social disruption of communities could result from the following factors:

- relocation during, or prior to, road construction - the provision of compensation housing can alter the social hierarchy in a village, as very poor people might end up living in housing of a better standard than more wealthy villagers. This can result in conflict and jealousy [Thoahlane, 1991];

- disturbances during the construction and implementation stages relating to increased noise and other forms of pollution associated with the road, e.g. exhaust fumes - the survey at Katse, however, indicated that this is not perceived by residents to be a serious disbenefit;

- disturbance of grave sites as a result of road construction - while it is possible for burial sites to be relocated, with the necessary ceremonies, the process is nevertheless unsettling for many people [Thoahlane, 1991]. Grave sites, which may be affected by the LCAR, were noted in the Jorodane Valley. No sites were noted along the WAR;

- an increase in crime as a result of the influx of construction workers during the construction stage, and as a result of improved access during the implementation stage - in the social survey conducted on the Katse road, 37% of respondents reported an increase in stock theft since the road had been built, and

- changes in social patterns and life styles - negative social alteration of communities can result from general changes in lifestyle and the presence of external labour. The social survey along the Katse road indicates a considerable increase in rape since the introduction of the road.

Affected parties
Local residents, particularly residents of villages located near construction camps and roadworks.

Mitigation
During the pre-construction stage of the project, the possible presence of burial sites should be checked for at each individual house affected by the LCAR and the WAR. Where destruction of the site cannot be avoided, compensation and relocation procedures should be negotiated with residents.

Construction workers must be provided with adequate recreational facilities. The workers should be consulted to establish what type of facilities they would prefer.

Adequate policing of the area during the construction and implementation stages, and the provision of family housing for construction workers would also help to reduce some of the social concerns identified.

Significance
Without mitigation this impact is judged to be of high significance for the LCAR and moderate to high in the case of the WAR. The net long-term impact on social patterns and lifestyles is considered to be less severe in the case of the WAR, because it involves the upgrading of a road which has been in existence for over 40 years, rather than the construction of a new road, as is the case with the LCAR. Residents along the WAR have already been subject to social disturbances and changes in lifestyle associated with the presence of a road.

The significance is assigned with a consideration of:

- the degree to which the impact affects public health and safety - this is potentially high, particularly since prostitution, rape and other violent crimes are likely to increase;

- the degree to which the resulting effects are irreversible - many of the changes in lifestyle and social patterns are likely to be essentially irreversible;

- the degree to which the impact affects the overall well-being of people.

The recommended mitigation measures, in particular the provision of family housing, will require a reasonable outlay of resources. It is, however, considered likely that mitigation measures will be carried out to the extent that the significance of the impact becomes moderate in the case of the LCAR and low in the case of the WAR.

Table 3.7 SUMMARY: SOCIAL DISRUPTION AND DISTURBANCE

SCENARIO	WAR	LCAR
With mitigation	**Low negative impact**	**Moderate negative impact**
Without mitigation	Moderate to high negative impact	High negative impact

(vi) ***Construction activities and landtake associated with both routes will result in the loss of agricultural resources and facilities; the Least Cost Alternative Route to a greater extent than the Western Access Road.***

Discussion of impact
The loss of agricultural resources and facilities, whether permanent or temporary, will decrease the ability of affected communities to produce surplus produce for sale, or, in drought years, to provide subsistence requirements. This results in lowered self-sufficiency and resilience of the affected community.

The estimated loss of agricultural resources, without mitigation, for the Western Access Road (WAR) and Least Cost Alternative Route (LCAR) is given in Table 3.8 below. The figures indicate that the loss of agricultural resources and facilities associated with the LCAR is significantly larger than in the case of the WAR.

Table 3.8: LOSS OF AGRICULTURAL RESOURCES AND FACILITIES

Resource	WAR	LCAR
Arable Land	5730 m^2	148 600 m^2
Vegetable gardens	925 m^2	3 320 m^2
Fruit Trees	73	87
Other trees	104	±20
Stock enclosures	5	13
Dip tank	1	-
Winnowing areas	1	6

Respondents in the Katse road survey mentioned problems of ongoing loss of, or damage to, arable land as a result of erosion caused by water runoff from the road. Rocks from cutfaces and side spoil falling into lands has also affected fields by making them unploughable.

In addition to the permanent loss of arable land, some land will be lost temporarily, for example due to the siting of temporary access roads or temporary crusher sites on these lands. Compaction of the soil as a result of these temporary land uses could, however, lead to permanent loss of lands for agriculture. The siting of temporary construction facilities without permission from the local chief is likely to cause conflict [Thoahlane, 1991].

The loss of grazing land associated with the proposed access roads is of only minor significance, because of the fact that it is characterised by landuse of an extensive nature.

Fruit trees, usually peach and apple trees, are the main source of fruit for families. In other areas they serve as a source of income through sale on roadsides, which could occur in this valley once the road has been built. Other trees provide a source of shade, while willows are used for fuel, baskets, whips, and fodder. Poplars are used for fuel, building kraals and fences.

Stock theft is a major problem in this area, and cattle are frequently kept in kraals at night. It is thus important that stock owners are not left without stock enclosures for any length of time. The enclosures are also an important source of fuel (*diso*, cattle dung) for villagers.

Affected parties
Residents who grow crops, families possessing fruit and other trees and owners of livestock.

Mitigation and compensation
Damage to agricultural resources and facilities should be avoided wherever possible by making minor adjustments to the proposed alignment during the pre-construction stage. Compensation should be applied if damage is unavoidable. Interviews with several chiefs indicate that there is alternative land available in some areas, particularly in the Jorodane Valley, which could be allocated to individuals who lose fields to the road. Wherever possible, this should be arranged.

All infrastructure should be located with the permission of, and after negotiation with, local residents. Location of any infrastructure on arable land should be avoided where possible, and rehabilitation measures should be applied to all temporary sites.

New winnowing areas should be provided where these are destroyed, either by identifying and clearing suitably located flat rock sites, or by creating new cemented areas for winnowing.

Runoff from roads should be channelled into areas which are not cultivated, and rocks and spoil falling into lands must be removed.

Where destruction of kraals is unavoidable during construction, they should be dismantled before bulldozing or blasting takes place and the stones re-used to rebuild them. Sufficient time must be given to villagers to remove any uncollected dung from the kraal before it is destroyed.

Significance
Although the magnitude of this impact is much larger in the case of the LCAR, land is more freely available in the Jorodane Valley than it is along the relatively more populated WAR. Thus in the case of the WAR, the

loss of an equivalent amount of land is of greater significance to local residents, because it is less easy to find replacement land.

In the light of this, the significance of the loss of agricultural resources and facilities is judged to be high, without mitigation, for both the WAR and the LCAR. This allocation of significance also took into consideration the fact that:

- the impact affects the availability of a key resource i.e. agricultural land is a valuable resource in Lesotho, which is becoming increasingly scarce due to human settlement and soil erosion, particularly in the lowlands [LSPP, 1990];
- the impact is associated with cumulative effects resulting from other project components i.e. flooding of land due to the Mohale Dam itself;
- the impact directly affects the well-being of a relatively large number of families, and
- will have effects over a long time period.

The mitigatory measures described above are likely to be effective. Based on the policy adopted by the Lesotho Highlands Development Authority during the construction of the Katse Road [LHDA, 1990], it is assumed that they will be applied, and that the residual negative impact will be one of low significance.

Table 3.9 SUMMARY: AGRICULTURAL RESOURCES AND FACILITIES

SCENARIO	WAR	LCAR
With mitigation	**Low negative impact**	**Low negative impact**
Without mitigation	High negative impact	High negative impact

(vii) ***The construction of both routes will necessitate the demolition of houses and businesses, the Western Access Road to a greater extent than the Least Cost Alternative Route.***

Discussion of impact
The following table shows the numbers of houses and businesses likely to be lost as a result of the construction of the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR), if no mitigation measures (e.g. alignment changes) are applied:

Table 3.10 HOUSES AND BUSINESSES LIKELY TO BE AFFECTED		
	WAR	LCAR
Houses	29	19
Businesses	4	2

It is the policy of the Lesotho Highland Development Authority (LHDA) to provide replacement buildings where houses or business are damaged or destroyed by road construction.

The LHDA has provided compensation houses in the Katse area but there are still some people who are waiting to be compensated for their lost houses or compounds [Makuta, 1991; Thoahlane, 1991]. Where houses have already been provided, they have satisfied some residents, but others have complained that despite their high construction costs, the compensation houses are inferior to traditional houses in several respects: concrete floors are colder and less comfortable for people who have no furniture to sleep on, and, zinc used for roofs on the new houses is a poorer insulator than thatch.

According to the Compensation Division of the LHDA, contractors, unlike traditional builders, have not allowed a "settling period" with the result that the walls of some houses have cracked. Maintenance costs of the new houses are higher (and require cash, as opposed to the collection of local materials), and there are fewer people with the skills to repair the new houses compared with traditional ones.

Despite the above, the compensation houses of block and zinc roofing are regarded as a status symbol by many of the local inhabitants.

Affected parties
Residents who lose houses, and business-owners and their staff.

Mitigation
Compensation must be paid timeously and houses provided or compensated for before existing ones are destroyed. Business-owners should be compensated for loss of premises and loss of income during construction of a new premises in a suitable location i.e. one that is near the road and conveniently situated to receive a similar number of customers.

Supervision of contractors who build the compensation houses should be improved and local people should be trained in their maintenance.

Significance
Without mitigation or compensation the loss of houses and businesses would be a negative impact of high significance for both the LCAR and the WAR, because:

- the impact would significantly affect the well-being of the owners of the homes and businesses, and

- the impact would have effects over a long time period.

Based on the policy adopted by the LHDA during the construction of the Katse Road [LHDA, 1990], it is, however, assumed that the compensation policy will be applied, and that the negative impact will be reduced to one of only low significance.

Table 3.11 SUMMARY: IMPACT ON HOMES AND BUSINESSES

SCENARIO	WAR	LCAR
With mitigation	**Low negative impact**	**Low negative impact**
Without mitigation	High negative impact	High negative impact

3.4.3 IMPACTS ON PARTIES CONCERNED WITH CONSERVATION

3.4.3.1 Hydrological impacts

(i) ***Construction activities and resultant erosion will result in increased sediment loading of rivers and streams; this impact will be more severe in the case of the Least Cost Alternative Route than the Western Access Road.***

Discussion of impact
It has been shown that much greater than normal levels of suspended solids occur in rivers and streams during the construction of roads and bridges. Even after construction activities are complete, as much as five times higher than normal levels of suspended sediments typically occur, until revegetation has effectively stabilised unprotected areas [Barton, 1977]. Sources of suspended solids include:

- erosion from surfaces cleared of vegetation, unstable cutfaces and side spoil;

- sheet runoff and runoff from hardened surfaces being channeled through culverts into existing drainage courses which are subsequently eroded by the increased volume and velocity of water passing down the drainage course, and

- dumping of rubble and clay into watercourses and movement of heavy machinery in the river or stream during bridge construction.

The Least Cost Alternative Route:
Increased sediment loading will affect the ecological functioning of the Jorodane River system, which compared to hydrological systems along the Western Access Road (WAR), is relatively pristine.

Studies have shown that the long-term effects of highway construction on the ecological functioning of rivers and streams are complex and may only be evident after many years. Those species less tolerant to silt loading are likely to decrease in numbers or disappear completely from the river or stream [Taylor and Roff, 1986].

Western Access Road:
As the Mountain Road has been in operation for more than 40 years, the rivers and streams along this road have probably adjusted to altered conditions of runoff and siltation. River conditions in the lowlands are generally degraded, and additional silt loading from road upgrading is likely to have only minimal long-term impact on river quality. Rivers and streams in mountainous regions along the WAR are generally less silt laden and will thus be relatively more sensitive to new inputs.

Affected parties
People and groups interested in the natural ecological functioning of hydrological systems: these include the Lesotho Protection and Preservation Commission, the Environment Division of the Lesotho Highlands Development Authority (LHDA) and academics at Roma University.

Mitigation
Erosion control measures should be strictly enforced throughout the construction stage (see rehabilitation guidelines in EEU/2/93/104b and c). All runoff from the road should be channelled into side drains prior to its entering an existing watercourse, to allow for settling out of most of sediment arising directly from erosion of unprotected surfaces.

It is recommended that an Environmental Control Officer (ECO) be employed to monitor road construction, and be on site at all times during construction of the road.

An Environmental Management Plan (EMP), specifically applicable to the building of bridges, erosion control and the rehabilitation of road spoil sites, cutfaces and road fill slopes, should be drawn up and agreed upon by the Engineer, the Contractor and the ECO, which should be enforceable by the ECO in the field.

Significance
While the magnitude of the above effects may be comparable for the WAR and the LCAR, the context differs in that in the case of the WAR, existing hydrological systems are relatively degraded compared to those along the LCAR.

Thus the significance of this impact without mitigation is judged to be only moderate in the case of the WAR, but is likely to be high in the case of the LCAR. This allocation of significance is based on the following:

- the significant degree to which the impact will impinge on environmental components and systems of special character - the hydrological and ecological systems along the LCAR are deserving of high conservation status because of their limited modification by human practices [MacMillan, 1986], and

- the potential for indirect effects of an irreversible nature i.e. populations of rare aquatic fauna may be indirectly affected (see section 3.4.3.3).

While mitigation will require a fair commitment of resources, it is assumed that the above recommended measures will be implemented, and will be effective in reducing, at least partially, the severity of the impact. Thus the significance of the residual impact is likely to be moderate in the case of the LCAR and low in the case of the WAR.

Table 3.12 SUMMARY: SILTATION OF RIVER AND STREAM COURSES

SCENARIO	WAR	LCAR
With mitigation	**Low negative impact**	**Moderate negative impact**
Without mitigation	Moderate negative impact	High negative impact

(ii) ***Clogging of streams by spoil, and enforced drainage through culverts, will result in the alteration of watercourses; this impact will be more severe along the Least Cost Alternative Route than along the Western Access Road.***

Discussion of impact

Partial blockage of streams could result in increases in stream flow velocity, silt loading, and erosion rates on the stream bed and banks. This would indirectly result in altered ecological functioning of the stream. The aesthetic quality of streams will also be reduced by the presence of spoil.

The use of *ARMCO* culverts will result to some extent in channelisation of the watercourse affected. Straightening of a watercourse or reduction in the stream bed roughness when the river or stream is passed through metal or concrete culverts, leads to increased flow velocities and higher erosive forces. After disturbance, the stream will attempt to re-establish an equilibrium condition. Channel erosion will result in increased sediment transport and deposition in lower reaches. The stream channel in the region of the culvert tends to erode outwards and downwards,

often progressing upstream. The impacts therefore do not only occur in the modified reach of the watercourse, but also in upstream and downstream sections.

Changes in stream flow velocities and sediment loading will also impact on stream biota which will have evolved under different flow regimes.

Affected parties
People and groups interested in the natural ecological functioning of hydrological systems: these include the Lesotho Protection and Preservation Commission, the Environment Division of the LHDA, and academics at Roma University.

Mitigation
The dumping of spoil material in stream or rivers should not be permitted, and care should be taken to avoid siting of borrow pits or quarries along stream or river courses. Stream courses disturbed or blocked by rockfall arising from construction of the road should be cleared and rehabilitated prior to completion of the contract.

ARMCO culverts should only be used for minor stream tributaries. Culvert allowance should be in excess of predicted maximum streamflow volumes. This will effectively reduce the impact of the culvert, and will prevent the overflow of water from the culvert at high velocity. This measure will also allow for the movement of riparian fauna (animals living along river banks) through the culvert, without their having to enter the water, or pass over the road.

Significance
In the case of the Western Access Road (WAR), existing hydrological systems are relatively degraded compared to those along the Least Cost Alternative Route (LCAR), and many are already diverted through *ARMCO* culverts. The significance of this impact without mitigation is thus likely to be moderate in the case of the WAR, but high in the case of the LCAR, because of:

- the significant degree to which the impact will impinge on environmental components and systems of special character - the hydrological and ecological systems along the LCAR are deserving of high conservation status because of their limited modification by human practices [MacMillan, 1986].

- the potential for indirect effects of an irreversible nature i.e. populations of rare aquatic fauna may be indirectly affected (see section 3.4.3.3).

It is assumed that the above recommended measures will be implemented, and will be effective in reducing the severity of the impact. Thus the significance of these impacts with mitigation is likely to be low.

Table 3.13 SUMMARY: ALTERATION OF WATER COURSES

SCENARIO	WAR	LCAR
With mitigation	**Low negative impact**	**Low negative impact**
Without mitigation	Moderate negative impact	High negative impact

3.4.3.2 Impacts on ecologically sensitive areas

(i) ***The construction of both the Western Access Road and the Least Cost Alternative Route will result in the degradation or partial destruction of wetlands and bogs; this impact will be slightly more severe in the case of the LCAR.***

Discussion of impact
Several marshes are crossed or occur adjacent to the proposed access roads. These marshes are important in the ecological functioning of riverine systems as they act as water storage for streams and rivers and as filters of sediment and excess nutrients. Disturbance or destruction of these wetlands by construction activities may lead to a change in the flow regime of the rivers, possibly causing erosion of gullies, and a reduction in the water quality as a result of siltation [Meakins and Duckett, 1993].

Most of these wetlands are dominated by broom grass (*Merxmuellera macowanii*) which is the main source of thatching and broom-making material. A useful supply of broom grass will therefore be lost.

The Least Cost Alternative Route:
Areas where marshes and wetlands occur along the present alignment of the Least Cost Alternative Route (LCAR) are identified in Appendix 10 of EEU/2/93/104c. The more extensive wetland areas occur on gently sloping areas below the road, along streams and in gullies. A large wetland occurs at the source region of the Jorodane River, and is crossed by the present alignment of the LCAR. These wetlands will be very sensitive to disturbance and are important for the hydrological functioning of the entire river.

Western Access Road:
The wetlands along the Western Access Road (WAR) are generally not as extensive as those along the LCAR. However, several small patches of marshland are crossed or occur adjacent to the road in small gullies, especially on the God Help Me Pass and Blue Mountain Pass. The majority of marsh areas lost will be a result of cutting of the right side of the road, as one travels towards Patiseng.

Affected parties
Conservationists and local people living downstream of marsh areas who may suffer from decreased water quality and loss of thatching grass.

Mitigation
Where possible construction activities within wetland areas should be avoided altogether. If unavoidable, damage to marshes should be minimised during the construction stage by performing the minimum amount of infilling.

It is preferable to construct many culverts of medium diameter rather than few culverts of large diameter, in order to reduce the concentration of water flow. Gabions or other mechanisms for breaking the velocity of water should be erected, and should allow for wide dispersal, rather than create a narrow channel that would concentrate water flow.

A gabion or concrete weir should be constructed upstream of culverts to maintain the water level in wetlands, particularly in large wetlands.

Further specific mitigatory measures are detailed in the Rehabilitation Guidelines in reports EEU/2/93/104b and c.

Significance
Without mitigation the significance of this impact is judged to be moderate to high in the case of the LCAR and moderate in the case of the WAR. This was based on the fact that:

- wetlands are relatively unique habitats and are environmental components which are becoming increasingly scarce, and

- impacts on the wetlands are likely to be difficult to reverse; experience with the Bokong Wetlands along the Katse Road has shown that it is extremely difficult to rehabilitate wetlands, especially those at high altitudes [R.Millard, pers. comm.].

With the implementation of mitigation measures aimed at avoiding and minimising negative effects, the impacts will be low in the case of the WAR, and low to moderate in the case of the LCAR. Because these mitigation measures will require only a moderate outlay of resources, it is assumed that they will be implemented.

Table 3.14 SUMMARY: IMPACT ON WETLANDS AND BOGS

SCENARIO	WAR	LCAR
With mitigation	**Low negative impact**	**Low to moderate negative impact**
Without mitigation	Moderate negative impact	Moderate to high negative impact

(ii) ***The Least Cost Alternative Route will adversely affect the future option of the Jorodane River and surrounding Maluti Mountain Range becoming a conservation area. The Western Access Road will have no such impact.***

Discussion of impact
While the Western Access Road (WAR) essentially involves the upgrading of an existing road, the Least Cost Alternative Route (LCAR) incorporates a stretch of new road through the presently remote Jorodane River Valley.

The Jorodane River, according to criteria of stream assessment given by MacMillan [1986], would be considered deserving of high conservation status for the following reasons:

- the river catchment processes are entirely without industrial development, only being modified to a minor extent by riparian agricultural practices;
- the input of pollutants into the system is negligible, mostly in the form of sediment;
- there are endemic species present in the river which are endangered or vulnerable, and
- there are no exotic or introduced species of fish present in the river.

A conservation program has been proposed for the introduction of the endangered Maluti minnow presently occurring in the lower reaches of the Jorodane River (which will be inundated by the Mohale Dam), into the upper reaches of the Jorodane River, above the waterfall at Pampiri [Rall *et al*, 1993]. The riverine conditions of the upper reaches of the river are ideal for the relocation of the Maluti minnow [J. Rall, pers. comm.]. A road development in the upper reaches of the Jorodane Valley, as proposed by the present alignment of the LCAR, and the associated effluent and siltation arising from road construction and use, would reduce the viability of these proposals.

Plans are presently under consideration for the management of the region encompassing the upper reaches of the Jorodane River Valley and the Western Maluti Mountain Range as a conservation area, ultimately to link up with the conservation of the Bokong River catchment [M. Maema, pers. comm.]. Road construction and operation along the present LCAR alignment would reduce the viability of this area for its conservation as a remote, undeveloped Maluti Mountain Reserve.

Affected parties
Tourists, researchers and persons involved with catchment management and conservation of resources for the Mohale Dam catchment and Maluti

Mountain Range: these include the Lesotho Protection and Preservation Commission and the Environment Division of the LHDA.

Mitigation
The proposed research program [Rall *et al*, 1993] should be continued in order to identify alternative sites suitable as a sanctuary stream for the conservation of the Maluti minnow occurring in the Jorodane River catchment, as the present habitat may be threatened by the construction of the LCAR.

If the LCAR is constructed, strict environmental controls, enforced by an on site Environmental Control Officer, must be applied at all stages of construction to ensure minimal scarring of the landscape and minimal damage to the ecological functioning of the region. The use of natural stone for side drains and retaining walls and the revegetation of cleared areas or spoil slopes will enhance the visual quality of the road itself. The attention to environmental concerns in the construction of the LCAR can ensure that future options for the use of the region as a protected nature area are not foreclosed by the construction of the road.

Significance
This impact is considered to be of high significance because of:

- the degree to which the impact will bring about irreversible changes to the Jorodane Valley i.e. the associated loss of the option to preserve the valley as a relatively remote sanctuary;

- the associated adverse effect on environmental components of special character i.e. the Jorodane River system, which is worthy of a high conservation status, and

- the potential for indirect effects of an irreversible nature on unique environmental components i.e. populations of rare aquatic fauna may be indirectly affected (see section 3.4.3.3).

If mitigation measures are applied during the construction of the road, the area could still be conserved as a protected natural area, albeit not a "remote" one. It is assumed that the most likely scenario is a residual negative impact of moderate significance.

Table 3.15 SUMMARY: CONSERVATION OF JORODANE VALLEY AREA

SCENARIO	WAR	LCAR
With mitigation	**No impact**	**Moderate negative impact**
Without mitigation	No impact	High negative impact

3.4.3.3 Impacts on rare and endangered species

(i) ***Silt and pollution loading of the Jorodane River during the construction and implementation of the Least Cost Alternative Route, will negatively impact on two rare and endangered species of aquatic fauna. The Western Access Road will have no significant affect on these species.***

Discussion of impact
The two rare aquatic species which will be affected are the Maluti minnow, *Pseudobarbus quathlambae*, which is listed in the South African Red Data Book as having "endangered" status, and the Aquatic River frog, *Rana vertebralis*, which is assigned the status "restricted". The species do not occur in the vicinity of the Western Access Road (WAR), and this proposal will accordingly have no significant impact on them.

Both species do, however, occur along the proposed route of the Least Cost Alternative Route (LCAR), in the Jorodane River. A full description of the distribution and conservation status of the Maluti minnow and the Aquatic River frog is given in Appendix 8 of report EEU/2/93/104c.

Both the Maluti minnow and the Aquatic River frog populations occurring in the Jorodane-Senqunyane River system may represent a genetic variation of the species. This is being verified by ongoing research on the populations in the Jorodane River [J. Rall, pers. comm.]. The possibility of the genetic uniqueness of the Maluti minnow and the Aquatic River frog of the Jorodane River catchment emphasises the high conservation status of these two Red Data Book species.

Both species have been shown to be sensitive to silt loading of the river environment, particularly during the late spring and early summer months, when they spawn [Rall *et al*, 1993; Cambray & Meyer, 1987]. Silt and pollution loading of the Jorodane River will occur during the construction and implementation stages of the LCAR project. Such effects could result directly from increased erosion (see impact (i) and (ii) in section 3.4.3.1), and from pollution runoff from road surfaces. Improved access during implementation of the project, will indirectly increase silt and pollution loading as a result of altered agricultural and human practices, for example, mechanised ploughing, and increased use of fertilizers, pesticides and dip tanks.

The Maluti minnow is known to exist in only six Lesotho Rivers. 86% of the known habitat of the Maluti minnow in three of these rivers, (the Jorodane, the Bokong and Senqunyane) will be flooded by the Mohale Dam. The present alignment of the LCAR along the length of the Jorodane River may jeopardize the continued presence of the Maluti minnow within this river, reducing the area of occurrence of the minnow to perhaps only 10% of its former distribution in the upper Senqunyane River system. A reduction of habitat availability of this magnitude may force the species to extinction within this locality.

Affected parties
Future generations; conservationists; researchers.

Mitigation
If the LCAR is selected as the preferred route, an effective management programme to address this impact must be drawn up by environmental specialists during the detailed design stage. The programme should include steps to minimise silt and pollution runoff during both the construction and the post-construction stage of the project.

It is recommended that present research regarding the distribution and habitat requirements of these two aquatic species [Rall *et al*, 1993] is continued in order to establish the extent of occurrence of these species in other catchments, and the probability of extinction of the Maluti minnow in the present threatened locality i.e. the Jorodane River.

Significance
The negative impact associated with the construction and implementation of the LCAR is considered to be of high significance, because:

- the impact affects environmental components which are unique, and in limited supply, and which are essentially irreplaceable i.e. two Red Data species of aquatic fauna will be affected;

- the impact is linked to cumulative effects associated with the implementation of Phase 1B as a whole i.e. the negative effects of the road will be further exacerbated by the construction of the Mohale Dam;

- the impact will contribute towards the possible irreversible loss of species.

Even if mitigation measures are applied, it is considered unlikely that a road can be constructed along the present alignment of the LCAR without resulting in increased siltation and pollution loading of the Jorodane River.

It is thus judged that the effect of this impact with mitigation will also be of high significance.

Table 3.16 SUMMARY:IMPACT ON ENDANGERED AQUATIC FAUNA

SCENARIO	WAR	LCAR
With mitigation	**No significant impact**	**High negative impact**
Without mitigation	No significant impact	High negative impact

(ii) ***Improved access associated with the proposed roads could cause increased destruction of spiral aloes, (Aloe Polyphylla) as a result of more extensive collection of the plant.***

Discussion of impact
The spiral aloe, *Aloe polyphylla*, is endemic to the Mountain Region of Lesotho and is under threat due to illegal collection for sale and medicinal purposes. The known distribution of the spiral aloe is believed to have shrunk by about a third due to collection and willful destruction [Donnay & Meyer, 1991]. The spiral aloe occurs on steep, north-east to north-west facing basalt slopes at altitudes of 2150 to 2850 m. Spiral aloe plants are currently sold for between M10 and M50.

There is an element of uncertainty involved in the prediction of impacts on the spiral aloe. It is, however, likely that improved access to aloe sites (mainly during the implementation stage of the project) will cause increased collection of aloes by local villagers for roadside selling. This could result in the local destruction of certain of the sites, especially those close to the road.

A large and important spiral aloe population in the vicinity of the Least Cost Alternative Route (LCAR) is situated near the village of Soosa, about 10 km west of the proposed road alignment. The social survey also indicated four other smaller aloe sites near the proposed alignment of the LCAR.

The Western Access Road (WAR) will have less of an impact on the spiral aloe populations because the degree to which access is improved is less than in the case of the LCAR i.e because the WAR involves upgrading rather than a totally new road. There are several localities near the WAR where the spiral aloe is known to occur, one of which is approximately 12 km west of Patiseng.

Affected parties
Tourists who want to see naturally growing aloes; conservationists, and residents desiring sustainable use of aloes to allow for continued use for medicinal purposes.

Mitigation
Aloe sites near the access routes should be investigated in order to facilitate the proclamation of strictly protected aloe reserves near the LCAR. Surveillance by conservation officials and police along tourist routes should be increased, particularly during the post-construction phase of the project.

Local people who are currently involved in illegally selling aloes, should be trained to cultivate aloes from seed in order to sell them legally to passing tourists. This would avoid the negative economic impact of reduced income to locals if they could no longer sell aloes due to stricter protection.

Significance
Without mitigation the likely increased rate of destruction of the spiral aloe in the vicinity of the LCAR will be a negative impact of high significance, for the following reasons:

- the impact affects environmental components which are of unique character and in limited supply - the remaining population of spiral aloes is estimated to be between 12 000 and 14 000 individual plants [Donnay & Meyer, 1991], and

- the impact contributes towards the possible irreversible loss of a species.

The WAR will have a negative impact of only moderate significance, because the degree to which access is improved is less than in the case of the LCAR i.e the severity of the impact is likely to be smaller.

Mitigation measures are likely to be only partially effective - they could reduce collection but will probably not eliminate it. Even if measures were implemented to control aloe collection and sale, continued small scale collection for medicinal purposes is likely to continue.

The significance of the impact of the LCAR and WAR with mitigation is thus judged to be moderate and low respectively. This is considered to be the most likely scenario.

Table 3.17: SUMMARY: IMPACT ON THE SPIRAL ALOE POPULATION

SCENARIO	WAR	LCAR
With mitigation	**Low negative impact**	**Moderate negative impact**
Without mitigation	Moderate negative impact	High negative impact

3.4.3.4 Impacts on flora and fauna which are not classified as rare and endangered species

(i) ***Loss of habitat due to landtake associated with the proposed routes, as well as increased noise levels and traffic, and the presence of construction workers will result in increased disturbance and death of terrestrial fauna.***

Discussion of impact
The construction of the access road will have a negative impact on terrestrial fauna. The impact is likely to be more severe in the case of the

new section of the Least Cost Alternative Route (LCAR), than in the case of the Western Access Road (WAR).

Noise and vibrational effects emanating from the operation of road-building equipment may cause disturbance to faunal species living adjacent to the road. Species likely to be affected by road upgrading activities are rodents, reptiles (lizards and snakes), and some grassland birds. Most of these species are generalists living in a wide range of habitats and will therefore tend to move away to more suitable areas.

The impact of construction workers on fauna may be more severe than the direct impacts resulting from loss of habitat, as several species are killed for food (hares), medicine (vultures, reptiles), out of fear (snakes) or because considered to be vermin (vultures).

Vehicular accidents involving fauna are likely to increase, and the passage of greater numbers of people along the new or upgraded roads may have a detrimental effect on fauna as a result of increased poaching and killing of animals. Species likely to be most affected are large birds of prey, such as the Cape and bearded vulture and black eagle, which nest on cliffs. Capture of these birds are prized, as their body parts are used for medicinal purposes and their feathers for costume displays.

Affected parties
Conservationists, tourists, bird watchers, and members of local communities.

Mitigation
Construction workers should be educated, during the pre-construction and construction phases, regarding the importance of maintaining populations of remaining faunal elements, and signs should be erected to alert road users to the importance and conservation status of rare and endangered fauna.

Construction camps should preferably be located in areas which are already degraded, preferably where some infrastructure exists. Camps should not be located near cliffs which provide nesting sites for threatened species of birds.

Surveillance by conservation officials and police along roads should be implemented (in the case of the new section of the LCAR) or increased (in the case of the WAR) during the implementation stage of the project.

Significance
Human impacts have already reduced the numbers of several faunal species, especially the larger species such as antelope, bushpigs and baboons [PPC, 1983]. Observations during the study indicated that this is particularly so along the WAR.

In this context, the impacts on terrestrial fauna are likely to be of only moderate and low significance, in the case of the LCAR and WAR

respectively. It is assumed most likely that mitigation measures will be applied, and will effectively reduce the impact significance to low in the case of the LCAR. With mitigation, no significant impact will result in the case of the WAR.

Table 3.18 SUMMARY: IMPACT ON TERRESTRIAL FAUNA

SCENARIO	WAR	LCAR
With mitigation	**No significant impact**	**Low negative impact**
Without mitigation	Low negative impact	Moderate negative impact

(ii) ***Construction activities associated with the proposed routes will result in the destruction of Leucosidea shrubland, Erica alopecurus communities and other vegetation, primarily grasslands.***

Discussion of impact
Construction activities which will impact on vegetation include direct clearance of vegetation for road building, dumping of spoil, movement of construction vehicles and establishment of road construction camps.

Leucosidea sericea is not classified as rare and endangered itself, but the shrubland and scrub forest community consisting of this plant may be considered relatively rare and threatened in Lesotho. Such shrubland occurs in patches along both the Least Cost Alternative Route (LCAR) and the Western Access Road (WAR).

A number of communities of *Erica alopecurus* occur along the WAR. This species is endemic to areas of short grassland in the Afro-alpine biome of Lesotho [Schmitz, 1982]. Although *Erica alopecurus* is not rare, impacts on this species should be avoided because of its limited distribution.

The majority of other vegetation that will be lost is grassland. The direct loss of vegetation due to the Western Access Road (WAR) will be about half that of the LCAR, because of the fact that the WAR involves upgrading of an existing road. Compared to the grasslands along the WAR, the loss of grassland in the low-lying bottom of the Jorodane Valley is considered relatively important, as this has a high grazing potential and is fairly resistant to erosion due to the flat topography. Grassland along the WAR is generally degraded due to overgrazing.

Affected parties
Conservationists, tourists, botanists and local residents who rely on *Leucosidea* as a source of firewood.

Mitigation
Route alignments should be modified, where possible, to avoid *Leucosidea* woodland and *Erica alopecurus*, and construction activities, such as side-spoiling, should avoid areas where these communities occur. Spoil should be transported to designated spoiling areas. Reports EEU/2/93/104b and c provide details regarding exact locations of these plant communities and recommended spoiling areas.

Areas where vegetation is destroyed should be rehabilitated in accordance with the guidelines in Appendix 5 and 6 of report EEU/2/93/104b and c.

Significance
Without mitigation the significance of this impact is judged to be moderate for both routes because:

- the roads will to a moderate extent be affecting environmental components which are of unique character, and in limited supply - the extent is only considered "moderate" because the plant communities described above are generally in a degraded condition, and the *Leucosidea* shrubland communities along the WAR and the LCAR, contain few trees of sizable proportions;

- insofar as the vegetation provides ground cover, and thus minimises soil erosion, its loss will affect the functioning of a key resource in Lesotho i.e soil. The severity of this effect is considered to be moderate, because of its limited geographical extent.

With mitigation, however, the significance of this negative impact will be low. In view of the fact that it is the general policy of the Lesotho Highlands Development Authority (LHDA) to rehabilitate areas where vegetation has been lost [LHDA, 1989], it is assumed that mitigation will be applied.

Table 3.19 SUMMARY: IMPACT ON VEGETATION WHICH IS NOT RARE

SCENARIO	WAR	LCAR
With mitigation	**Low negative impact**	**Low negative impact**
Without mitigation	Moderate negative impact	Moderate negative impact

3.4.3.5 Impact on cultural resources

(i) ***Archaeological sites along the proposed routes may be damaged by construction activities, or threatened by associated increases in human traffic; this effect will be more severe in the case of the Least Cost Alternative Route.***

Discussion of impact
Archaeological sites along the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR) may be directly damaged by road construction activities, or indirectly threatened by increased human traffic as a result of improvements in access resulting from the proposed roads.

Two archaeological sites consisting of Middle Stone Age stone tool scatters were observed along the WAR. Both are likely to be affected by construction activities but both are low density and probably not *in situ* (See Appendix 8 of EEU/2/93/104b).

The Pulane Valley on the LCAR is extremely rich in archaeological sites, largely because of the extensive exposures of Cave Sandstone which provide large rock shelters, often with deep deposits. The construction and implementation of the LCAR may directly or indirectly threaten rock painting sites and stone tool scatters (see Appendix 9 of EEU/2/93/104c).

Affected parties
Persons and groups concerned with the conservation of cultural resources: these include the Lesotho Protection and Preservation Commission and the Environment Division of the Lesotho Highlands Development Authority (LHDA).

Mitigation
Prior to the commencement of the construction stage of the project, stone tool scatters should be investigated, and significant items collected and housed in a local museum. If the LCAR is selected as the preferred route, the alignment should be walked by a professionally trained archaeologist during the detailed design stage of the project. The archaeologist should identify valuable sites along the road corridor, and should make site specific recommendations.

Significance
In the case of the WAR, the archaeological sites are not unique or rare. The impact will thus be of low significance without mitigation, and of no significance with mitigation.

In the case of the LCAR, the quantity and quality of archaeological sites affected is higher. The significance of the impact is thus judged to be moderate without mitigation, but low with mitigation. Based on the LHDA's past record of concern for the preservation of archaeological sites in the Katse area [LHDA, 1988], it is assumed most likely that mitigation measures will be implemented.

Table 3.20 SUMMARY: IMPACT ON ARCHAEOLOGICAL SITES

SCENARIO	WAR	LCAR
With mitigation	No significant impact	Low negative impact
Without mitigation	Low negative impact	Moderate negative impact

3.4.4 EFFECTS ON POLICIES FOR DEVELOPMENT AND TRANSPORT

3.4.4.1 Promotion of national development objectives

(i) ***The construction and implementation of both routes will promote the national planning objectives of economic growth and employment creation; the Western Access Road to a slightly greater extent than the Least Cost Alternative Route.***

Discussion of impact
Both the proposed roads will reinforce the objective of economic growth identified in the Fifth Five Year Development Plan [Ministry of Planning, 1993]. Both the Least Cost Alternative Route (LCAR) and the Western Access Road (WAR) will serve to improve infrastructure in Lesotho, and this will have an indirect positive impact on the economy of the country. The WAR is predicted to have slightly more of a beneficial impact on the Lesotho economy because construction materials are likely to be transported via the railhead at Maseru, rather than via Ficksburg's railhead, as would be the case if the LCAR were built. If the railhead at Ficksburg is used, profits relating to break-of-bulk services will not accrue to Lesotho.

Both the LCAR and the WAR will serve to reinforce the Five Year Plan's objective of job creation. The construction of the access road is predicted to provide employment opportunities for up to 500 people for 30-36 months.

Affected parties
The Lesotho Government (and indirectly all Basotho people) will benefit from economic growth and increased employment opportunities.

Optimisation
Economic management should be improved and optimised wherever possible. A significant portion of the royalties generated by the Lesotho Highlands Water Project, should be allocated to regionally coordinated rural development projects.

A training programme, which teaches local people appropriate skills associated with road construction, should be developed and implemented during the pre-construction and construction phases of the project.

Significance
With optimisation this impact will be positive and of high significance for both the LCAR and the WAR. This allocation of significance is based on the following considerations:

- the impact involves the promotion of national goals, and
- the impact will potentially affect the overall well-being of a large number of people, i.e. the entire Lesotho nation.

The optimisation measures outlined above will require a moderate to high commitment of manpower and resources. Because of the general lack of resources, and the limited institutional capacity of the Government of Lesotho [Setplan, 1991], it is assumed that these measures will not be carried out to the full extent possible. Thus the most likely scenario is taken to be one without optimisation.

The impact without optimisation is judged to be moderate in the case of the LCAR, and moderate to high in the case of the WAR.

Table 3.21 SUMMARY: ECONOMIC GROWTH & EMPLOYMENT

SCENARIO	WAR	LCAR
With optimisation	High positive impact	High positive impact
Without optimisation	**Moderate to high positive impact**	**Moderate positive impact**

(ii) ***Both routes will promote the national objective of democratisation, the Least Cost Alternative Route to a greater extent than the Western Access Road.***

Discussion of impact
Due to improved access, the implementation of both the Least Cost Alternative Route (LCAR) and the Western Access Road (WAR), will facilitate the process of democratisation and people's participation, which, according to the Five Year Plan, is a priority goal of the Lesotho Government [Ministry of Planning, 1993].

In the case of the WAR, approximately 13 large and 20 small villages will directly experience improved access due to an upgraded road. A "large" village is defined as one with more than 100 inhabitants. In the case of

the LCAR, approximately 33 small villages and 15 large villages will benefit from having access to a new road.

Affected parties
The Lesotho Government, the residents along the WAR and LCAR, and indirectly all Basotho people will benefit from increased democratisation.

Optimisation
Infrastructural improvements planned by the Government of Lesotho should be completed, so as to maximise the benefits of the WAR or LCAR. If the WAR is built, the proposed reconstruction of the remainder of the Mountain Road to Tsaba-Tseka should be undertaken. If the LCAR is built, the proposed reconstruction of the entire stretch of Mountain Road from St Michael's to Tsaba-Tseka would serve to optimise the above benefits.

Significance
The above impact, although it serves to promote a national objective, is relatively localized in extent. In the case of the WAR, where the improvement of access is merely one of degree, i.e. a wider and better surfaced road, the impact is judged to be insignificant, unless optimisation is carried out, in which case it will result in a positive impact of low significance.

In the case of the LCAR, a positive impact of low significance is likely to result without optimisation, and one of moderate significance with optimisation.

Because the road reconstruction plans identified as possible optimising measures above, are listed in the Five Year Plan as being a priority of the Lesotho Roads Department, it is considered more likely than not, that they will be carried out.

Table 3.22 SUMMARY: PROMOTION OF DEMOCRATISATION

SCENARIO	WAR	LCAR
With optimisation	**Low positive impact**	**Moderate positive impact**
Without optimisation	No significant impact	Low positive impact

(iii) ***While the Western Access Road will reinforce Lesotho's National Settlement Policy, the Least Cost Alternative Route will contradict this Policy.***

Discussion of impact
A framework for settlement development in Lesotho is set out in the National Settlement Policy [LSPP, 1990]. Lesotho's settlement pattern is dominated by the primacy of the national capital Maseru, and accordingly the primary aim of the National Settlement Policy is to promote a more balanced settlement structure.

The Least Cost Alternative Route:
Neither the National Settlement Policy, district plans nor decentralisation policies envisage the introduction of a route such as the proposed Least Cost Alternative Route (LCAR) through the Jorodane Valley area i.e. this section of the route does not reinforce existing plans and policies [T.Gregory, pers. comm.].

Much of the mountainous region of the LCAR falls within areas which do not have an adequate degree of administrative control and which lack effective planning initiatives. In other words, even if settlements were to develop along the route, the existing institutional capacity is such that these centres would be poorly controlled.

The potential, however, for the establishment of new settlement centres within the Jorodane Valley is low. It is more effective to invest for purposes of development in centres that already possess some advantages than to start new developments from scratch [LSPP, 1990]. Investment in new settlements along the Jorodane Valley, where urban development is essentially nonexistent, may thus be relatively ineffective.

Furthermore, the creation of new settlements along the proposed road through the Jorodane Valley would occur at the expense of existing ones i.e. the proposed road would contradict, rather than reinforce, the growth of emerging development nodes along the existing Mountain Road.

The LCAR will, however, to a limited extent reinforce the development objectives outlined in the Leribe District Physical Plan [LSPP, 1992], and it could reinforce the development of Teya-Teyaneng as a district centre. In Appendix 7 of EEU/2/93/104c these aspects are discussed in more detail.

On the whole, however, the LCAR will contradict rather than reinforce the National Settlement Policy [T.Gregory, pers. comm.].

Western Access Road:
This route reinforces the objectives of the National Settlement Policy. The planned context for the Western Access Road (WAR) exists, and administrative and infrastructural support for settlement development along the route is relatively well established, particularly when compared to that along the LCAR [T.Gregory, pers. comm.]

With a view to promoting balanced settlement in Lesotho, the National Settlement Policy identifies the development of the presently under-developed Mountain Region as a priority, with Thaba-Tseka targeted as a future regional centre. To this end the upgrading of the entire Maseru-Thaba-Tseka link is vital. The upgrading of the St. Michael's-Patiseng section which the WAR entails, may provide an added incentive to accelerate the process. Thus the WAR will reinforce the National Settlement Policy in this regard.

Although the proposed upgrading of the railhead facilities in Maseru could have the effect of reinforcing the primacy of Maseru, this is likely to be outweighed by "centrifugal" factors such as those mentioned above. On the whole, therefore, the WAR is likely to promote balanced settlement development by reinforcing the development of existing settlements along and near the Mountain Road [T.Gregory, pers. comm.].

Affected parties
Residents in the Leribe, Maseru and Berea Districts; the Lesotho Government; Urban and Regional Planners.

Mitigation and optimisation
Positive impacts should be optimised by co-ordinating the implementation of the proposed road project with other efforts to promote settlement development, as recommended in the National Settlement Policy. These include decentralisation of public administration and the establishment of local authorities. Upgrading of the link from Patiseng to Tsaba-Tseka should be completed.

If the LCAR is selected as the preferred route, physical planning specialists should be appointed to draw up a mitigation programme to reduce the severity of the predicted impact.

Significance
The significance of the positive impact of the WAR is likely to be low without optimisation, but potentially moderate to high with optimisation. In the case of the LCAR, the negative impact is judged to be moderate without mitigation, but low with mitigation.

In assigning the above significance ratings, it was taken into consideration that there is a degree of uncertainty involved in the prediction of the magnitude of this impact. Additional factors considered were:

- the impact could affect the well-being of a large number of people i.e the entire Lesotho nation;

- the impact is likely to extend over a long time period i.e. disbenefits and benefits will continue to accrue even after completion of Phase 1B of the Lesotho Highlands Water Project in 2004, and

- the impact affects national goals.

Optimisation and mitigation measures are likely to require an extensive commitment of resources. Considering the present financial situation of the Lesotho Government, it is thus assumed that these measures will not be carried out.

Table 3.23 SUMMARY: IMPACT ON NATIONAL SETTLEMENT POLICY

SCENARIO	WAR	LCAR
With mitigation and optimisation	Moderate to high positive impact	Low negative impact
Without mitigation or optimisation	**Low positive impact**	**Moderate negative impact**

(iv) ***Despite short-term disruptions to tourist traffic during construction of the Western Access Road (WAR), improved access resulting from the implementation of both routes will serve to promote tourism in Lesotho; the WAR serving to benefit tourism to a greater extent than the Least Cost Alternative Route (LCAR).***

Discussion of impact
Potential impacts which the access roads will have on tourism in Lesotho include disruptions to existing tourist activities, the promotion or creation of tourist "circuits" and the promotion of tourist attractions. These three aspects are considered in turn below:

Disruptions to existing tourist activities:
The LCAR is considered to have a more severe negative impact than the WAR in this regard, because of the fact that the disruptions associated with the LCAR will be of a long-term nature, whereas those associated with the WAR are short-term.

The upgrading of the WAR will cause a temporary disruption to tourist traffic along the Mountain Road for between 30-36 months. During the tourist season in January 1990 total traffic counts along the Mountain Road were fairly low, varying from 289 vehicles per day at Nazareth to 104 per day at villages east of Patiseng.

While the construction of the LCAR will not result in disruptions to existing motorists because it is a "new" road, the LCAR will disrupt existing tourist pony trekking activities in the Jorodane Valley. The pony trekking centre at Molimo Nthuse provides a valuable source of income for the Project and the local population. In 1991 the Trekking Centre income was reported as almost M200 000. Alternative routes are, however, available in the area for such activities, although access to the

present wide range of options will be reduced by the road as well as by the construction of the proposed Mohale Dam.

Promotion of tourist attractions:
Both routes could potentially have a net benefit in this regard, although in the case of the WAR, this net benefit is likely to be greater.

Due to improved access the WAR is likely to reinforce existing tourist facilities on and near the Mountain Road. These include hotels and lodges at Maseru and Molimo Nthuse, the mountain fortress at Thaba-Bosiu, rock paintings at Ha Baroana, the weaving centre near Masianokeng and the Pony Trekking Centre.

The LCAR will foreclose the option of the future use of the Jorodane Valley area as an undeveloped, "get-away" experience, accessible only by pony, or on foot. However, improved access to the area as a result of the implementation of the LCAR, could facilitate exploitation of the motor tourist potential in the area. Possible tourist attractions include the rock paintings at Pulane, the mountainous area to the north of the valley, and the scenic attractions of the river valley itself.

Creation or promotion of tourist circuits:
With regard to this impact the WAR is likely to provide a greater positive impact than the LCAR.

The circular route incorporating the WAR and passing through Maseru, Tsaba-Tseka, Katse, and Leribe has been identified as a possible tourist route [ERL, 1990] and the long term possibility also exists for a scenic circuit (also incorporating the WAR) to the south of the country [LHDA, 1986b]. The WAR would involve the upgrading of one portion of these routes, and would thus reinforce their long term potential.

The LCAR creates a possible "circular" tourist route from Maputsoe via Mohale to Maseru. This route is, however, somewhat limited in comparison to circuits associated with the WAR, in that it only incorporates a small segment of the country, and would be likely to attract day-trippers, rather than tourists making overnight stops. Overnight tourists provide more revenue for Lesotho than daytrippers, so encouragement of the former is preferable [E. Moeketsi, pers. comm.].

Affected parties
Rural populations will benefit indirectly from increased economic opportunities; tourists will benefit from an increase in number and diversity of facilities; and Lesotho, as a whole, will benefit from economic growth accruing from the tourist industry.

Optimisation and mitigation
Optimisation measures should include improved marketing of Lesotho's tourist attractions as well as improvements in car hire facilities, vehicle servicing facilities, accommodation standards and security. The

successful implementation of tourism plans for Katse and Mohale Dams will also serve to optimise and reinforce potential benefits.

With regard to traffic control the tourist board, tourists and other road users should be informed of possible disruptions, by means of advertisements and notices detailing times and duration of road closure.

Pony trekking routes should be altered, where necessary, so as to avoid areas where the road may constitute a disturbance.

Significance
In assigning a significance to this impact the following criteria were considered relevant:

- the extent to which the impact results in cumulative or synergistic impacts - the significance of the impact will be increased because of synergistic effects which will arise with the completion of the Mohale Dam itself i.e. the cumulative effect on tourism of the proposed access road and the Dam will be greater than the effect either might have alone;
- the likely duration of the impact - benefits will continue to accrue following the completion of Phase 1B in 2004, and
- the extent to which the above impact will further national goals - contributions to economic growth and employment creation, will be small, because tourism in Lesotho is relatively limited. In 1989 it contributed 3.1% to the Gross Domestic Product of Lesotho, and provided direct employment to approximately 2000 people [Ministry of Planning, 1993].

Without mitigation or optimisation the positive impact which the WAR will have on tourist initiatives in Lesotho is judged to be low and that of the LCAR to be insignificant.

The above-mentioned mitigation measures are simple to apply and are likely to require an outlay of only a few hundred Maloti for printing of notices and advertising. The optimisation measures will, however, require a high commitment of resources. It is assumed that optimisation and mitigation measures will be carried out, but that the former will only be carried out to the extent that they will increase the significance of the impacts to "moderate" in the case of the WAR and "low" in the case of the LCAR.

Table 3.24 SUMMARY:IMPACT ON NATIONAL TOURISM INITIATIVES

SCENARIO	WAR	LCAR
With mitigation and optimisation	**Moderate positive impact**	**Low positive impact**
Without mitigation or optimisation	Low positive impact	No significant impact

3.4.4.2 Promotion of National Transport Objectives

(i) ***While the Western Access Road will reinforce existing plans for the Lesotho road network and will result in savings to the Lesotho Government, the Least Cost Alternative Route will contradict road network plans, and will be an increased burden on Lesotho's road maintenance budget.***

Discussion of impact
National transport objectives are set out in the Fifth Five Year Plan [Ministry of Planning, 1993]. The quality of the existing road network in Lesotho is very poor, and for this reason national plans emphasise the improvement and upgrading of existing roads, rather than the construction of entirely new roads.

Plans for the Lesotho road network for the period 1991/92 to 1995/96 include the reconstruction of the 150 km stretch of road from St. Michael's to Thaba-Tseka (the existing Mountain Road). Funding for the reconstruction is still to be obtained.

The theoretical allowance per kilometer for maintenance of bitumen roads in Lesotho is M2 800 per year for routine maintenance and M32 000 every eight years for re-sealing [Ministry of Works, 1992].

Western Access Road:
The selection of the Western Access Road (WAR) as the preferred route could result in a savings to the Government of Lesotho of approximately M10 million.

The reconstruction of this route, has already been identified as a priority by the Department of Roads and is therefore in line with overall plans for the Lesotho road network. The Government of Lesotho has budgeted M20 million for the reconstruction of the road between St. Michael's and Thaba-Tseka [Ministry of Planning, 1993], although the money has not yet been raised. As a rough estimate, upgrading from St. Michael's to the Mohale Dam turnoff might therefore save Lesotho about half of the total amount budgeted i.e. a savings of approximately M10 million.

The Least Cost Alternative Route:
Although the Least Cost Alternative Route (LCAR) provides new linkages, it will have an overall negative impact on the Lesotho Road Network because it does not accord with existing road plans and will be an additional burden on the maintenance budget.

The LCAR will involve the construction of approximately 55 km of new road. Based on the theoretical allowance per kilometre for maintenance of bitumen roads in Lesotho, the estimated maintenance costs for the stretch of new road will be at least M150 000 per year (for routine maintenance) and about M1.8 million every eight years for re-sealing.

Thus the road will be a significant additional burden on Lesotho's already overtaxed maintenance programme.

Affected parties
The Lesotho Government, particularly the Ministry of Works, Department of Roads, and indirectly, all the people of Lesotho.

Optimisation and mitigation
Proposed reconstruction plans as outlined in the Five Year Plan should be completed (in particular the remainder of the road to Tsaba-Tseka), and the system of feeder roads into rural areas should be improved. This would serve to optimise the benefits of the WAR. Continued effective maintenance of the road following its upgrading, and successful implementation of the Pavement Management and Maintenance System would further serve to optimise the positive impact.

The negative impact of the LCAR cannot be effectively mitigated.

Significance
The positive impact of the WAR is considered to be of high significance both with and without optimisation. The negative impact of the LCAR is also judged to be of high significance.

The following criteria were considered important when assigning these significance ratings:

- the degree to which the impact affects or furthers national goals - both road proposals directly affect national transport plans;
- the number of people affected - increased costs or savings to the Lesotho Government will ultimately affect the well-being of all the country's citizens, and
- the long-term nature of the impact - a new road, such as that proposed through the Jorodane Valley, will continue to be an increased burden on the maintenance budget of the Ministry of Works, even after the completion of Phase 1B in 2004.

Because the road reconstruction plans identified as possible optimising measures above, are listed in the Five Year Plan as being a priority of the Lesotho Roads Department, it is considered more likely than not, that they will be carried out.

Table 3.25 SUMMARY: IMPACT ON EXISTING ROAD NETWORK PLANS

SCENARIO	WAR	LCAR
With mitigation and optimisation	**High positive impact**	**High negative impact**
Without mitigation or optimisation	High positive impact	High negative impact

3.4.5 FINANCIAL EFFECTS

3.4.5.1 Costs to the Lesotho Highlands Development Authority

(i) ***The total financial cost to the LHDA to construct and implement the Western Access Road (WAR) will be M53 million less than the Least Cost Alternative Route (LCAR).***

Discussion
A breakdown of costs to the LHDA is provided in Table 3.26 below. Capital costs include the cost of all proposed upgrading and construction, including the upgrading of railhead facilities in Maseru, and the cost of constructing the Maseru bypass. Rehabilitation costs are those costs involved in bringing about minor repairs to existing roads along the route i.e. between Ficksburg and Ha Mateka on the LCAR, and between Maseru and Patiseng on the WAR.

Compensation costs are rough estimates, particularly in the case of the LCAR, and will be subject to finalisation during the detailed design stage. They include compensation for homes and businesses affected by the roads, as well as agricultural facilities, such as fields and kraals. Compensation costs associated with the WAR include those arising from the upgrading of the road between St Michael's and Patiseng, and from the construction of the Maseru Bypass. Compensation costs for the LCAR, are for the section between Ha Mateka and Patiseng where major construction work is to occur.

Transport costs are those costs incurred in moving construction materials and goods from their point of origin at the Lesotho border to the dam site, and maintenance costs are those costs involved in maintaining the access road during the period of dam construction.

Costs are based on the assumption that the dam will be a rockfill embankment. All costs are basic costs, with no discounting, and costs exclude design and supervision costs, contract price adjustments and contingencies. For comparative purposes these aspects are, however, not considered significant omissions.

Table 3.26 FINANCIAL COSTS TO THE LHDA

Type of Cost	WAR	LCAR
Capital Costs	M 92 035 108	M 120 361 000
Rehabilitation Costs	M 1 784 774	M 5 004 770
Compensation Costs	M 1 253 949	M 973 791
Transport Costs	M 76 645 000	M 98 517 000
Maintenance Costs	M 391 230	M 511 290
TOTAL COST	**M 172 110 060**	**M 225 367 821**

Significance
From the point of view of the LHDA, financial costs are an important consideration in the selection of a preferred route [J.Schaap, pers. comm.]. These financial effects are therefore judged to be of high significance.

3.5 FRAMEWORK TABLE

The above impacts and costs are summarised in the framework table overleaf. The framework table aims to present an outline of relevant information in a comparative manner, so as to aid balanced judgement in decision-making. The particular strengths and weaknesses of the *framework approach* are discussed in section 2.6 of this report.

Quantified information regarding impacts is provided wherever possible, but where this is not available, descriptive information is given. The framework table also indicates the *most likely* significance rating of each impact.

A column for comments is included in the table. Entries in this column include the identification of those impacts where mitigation is particularly critical in reducing the impact severity.

The framework table is the last component of this chapter.

In chapter 4 the impacts presented in the framework table are evaluated.

TABLE 3.27 FRAMEWORK TABLE COMPARING IMPACTS OF WESTERN ACCESS ROAD (WAR) AND LEAST COST ALTERNATIVE ROUTE (LCAR)

IMPACT ON TRAVELLERS

SUB-GROUP	IMPACT	WAR	LCAR	COMMENTS
Travellers in Maseru	Construction of a bypass at Maseru	The WAR proposal includes the construction of a bypass at Maseru. This will help relieve congestion in the central business district of Maseru. **High positive impact**	The LCAR does not include the construction of a bypass at Maseru. **No significant impact**	The impact significance is assigned on the assumption that the bypass will be designed to reinforce urban and regional planning objectives.
Travellers beyond Maseru	Improved safety and well-being of travellers	Despite temporary disruptions during construction (for 30-36 months) tarring and widening of the 60.5 km of the Mountain Road will make it safer and more convenient for travellers. No new linkages will be created by the WAR. **Moderate positive impact**	The LCAR will create new linkages for travellers. The proposal includes 55 km of new road, which will provide travellers in the Jorodane Valley area with a new transport option i.e. motorised transport. **Moderate to high positive impact**	Travellers typically include motorists, pedestrians and people on horseback. Impact significance assumes mitigation of hazards associated with the road, and optimisation of benefits.

IMPACT ON OCCUPIERS AND USERS OF FACILTIIES

SUB-GROUP	IMPACT	WAR	LCAR	COMMENTS
All residents along the proposed routes	Improved access to facilities, goods and services	Access improved due to upgraded road between St Michael's and Patiseng, plus improved intra-city access in Maseru. **Moderate positive impact**	Involves new stretch of road through Jorodane Valley, where no road existed before. **High positive impact**	In surveys along routes, residents identified improvements in access as a perceived major benefit.
	Increased employment and business opportunities	Road construction will provide employment for 500 people for 30-36 months, plus railhead upgrading and "spin off" opportunities will provide further jobs. **Moderate positive impact**	Road construction will provide employment for 500 people for 30-36 months, plus "spin-off" opportunities. **Moderate positive impact**	Impact largely short-term i.e. restricted to construction stage of project. 20% of residents surveyed said lack of jobs is a major concern.

IMPACT ON OCCUPIERS AND USERS OF FACILTIIES (CONTINUED)

All residents along the proposed routes	Interference with potable water supplies	7 springs (2 unused) likely to be affected. **Low negative impact**	At least 4 springs likely to be affected. **Low negative impact**	43% of residents surveyed said water availability was already a problem. Mitigation is critical in reducing impact significance.
	Social disruption and disturbance to community	Likely to result in slight disturbance of lifestyle e.g. increased noise, pollution and crime. **Low negative impact**	Could result in a fairly significant disturbance of existing rural life, in particular in the Jorodane Valley. **Moderate negative impact**	Significance of impacts assume that mitigation will be applied e.g. recreational facilitities provided for construction workers.
Agriculture	Disruption of local economy	No significant disruption of the local economy, since illegal cash crops are not grown along the WAR. **No significant impact.**	Cultivation of illegal cash crops in remote Jorodane Valley will be disturbed. Potential loss of income to residents of Valley could total M500 000 per annum. **Moderate negative impact**	Significance rating assumes mitigation will be applied i.e. fields will be moved some distance from the road.
	Loss of resources and facilities	Arable land: 3146 m^2 Vegetable gardens: 568 m^2 Trees: 36 fruit + 81 others Facilities: 3 kraals, 1 diptank **Low negative impact**	Arable Land: 148 600 m^2 Vegetable gardens: 3 320 m^2 Trees: 87 fruit + 20 others Facilities: 9 kraals, 4 stables. **Low negative impact**	Mitigation i.e. the application of the compensation policy significantly reduces the significance of this impact.
Residential	Residences which will need replacement	13 houses will be affected. **Low negative impact**	19 houses potentially affected. **Low negative impact**	Mitigation i.e. provision of compensation housing, significantly reduces the impact significance.
Business	Loss of business premises	3 businesses will be affected **Low negative impact**	2 businesses likely to be affected. **Low negative impact**	Mitigation i.e. compensation will significantly reduce the impact significance.

IMPACT ON PARTIES CONCERNED WITH CONSERVATION

PARTIES	PLANS	THE WAR	LCAR	COMMENTS
LHDA Environment Division	Proposal by LHDA that the Jorodane Valley and western Maluti Mountains be managed as a conservation area.	The WAR will have no impact in this regard. **No significant impact**	The LCAR will result in the loss of the option of conserving the area as a remote sanctuary. **Moderate negative impact**	Impact significance is based on the assumption that recommended mitigation measures will be implemented.
LHDA Environment Division, and the Lesotho Protection and Preservation Commission, as well as the international community.	Preservation of rare/ endangered aquatic fauna i.e. Maluti Minnow (*Pseudobarbus quathlambae*) and Aquatic River Frog (*Rana vertabralis*).	The WAR will have no significant impact, as these species do not occur along this route. **No significant impact**	Increased sediment loading and pollution associated with the LCAR is likely to harm populations of Maluti Minnow and Aquatic River Frog occurring in the Jorodane River. **High negative impact.**	Maluti Minnow (*Pseudo-barbus quathlambae*) has "endangered" status, and River Frog (*Rana verte-bralis*) has "restricted" status in SA Red Data Book.
	Protection of spiral aloe populations (*Aloe polyphylla*) endemic to Lesotho Mountain region.	The WAR will have only a slight impact on the spiral aloe population because the degree to which access is improved is small i.e. merely upgrading. **Low negative impact**	Because of improved access to remote Jorodane Valley, collection of spiral aloes likely to increase relatively significantly. **Moderate negative impact.**	Impact significance assumes mitigation measures, such as increased policing, are applied to reduce rates of collection.
	Protection of wetlands and bogs.	Small patches of wetland areas occur along the WAR will be affected, but areas are not as extensive as those along the LCAR. **Low negative impact**	Some large wetland areas (e.g. along 1.5 km stretch of the road) will be impacted by the LCAR. Quality of wetlands are moderately good. **Low to moderate negative impact**	Impact significance assumes that mitigation will be applied.

IMPACT ON PARTIES CONCERNED WITH CONSERVATION (CONTINUED)

PARTIES	PLANS	WAR	LCAR	COMMENTS
LHDA: Environment Division	Proposal by LHDA that the Jorodane Valley and western Maluti Mountains be managed as a conservation area.	The WAR will have no impact in this regard. **No significant impact**	The LCAR will result in the loss of the option of conserving the Jorodane Valley area as a remote sanctuary. **Moderate negative impact**	Impact significance is based on the assumption that recommended mitigation measures will be implemented.
LHDA Environment Division, and the Lesotho Protection and Preservation Commission (PPC), as well as the international community.	Preservation of rare/ endangered aquatic fauna, namely the Maluti Minnow (*Pseudobarbus quathlambae*) and the Aquatic River Frog (*Rana vertabralis*).	The WAR will have no significant impact, as these species do not occur along this route. **No significant impact**	Increased sediment loading and pollution associated with the LCAR is likely to harm populations of Maluti Minnow and Aquatic River Frog occurring in the Jorodane River. **High negative impact**	Maluti Minnow (*Pseudo-barbus quathlambae*) has "endangered" status, and the Aquatic River Frog (*Rana verte-bralis*) has "restricted" status in SA Red Data Book.
	Protection of spiral aloe populations (*Aloe polyphylla*) endemic to Lesotho Mountain region.	The WAR will have only a slight impact on the spiral aloe population because the degree to which access is improved is small i.e. merely upgrading. **Low negative impact**	Because of improved access to remote Jorodane Valley, collection of spiral aloes likely to increase relatively significantly. **Moderate negative impact.**	Impact significance assumes mitigation measures, such as increased policing, are applied to reduce rates of collection.
	Protection of wetlands and bogs.	Small patches of wetland areas occuring along the WAR will be affected, but areas are not as extensive as those along the LCAR. **Low negative impact**	Some large wetland areas (e.g. along a 1.5 km stretch of the road) will be impacted by the LCAR. Quality of wetlands are moderately good. **Low to moderate negative impact**	Impact significance assumes that mitigation will be applied.
LHDA Environment Division, and the Protection & Preservation Commission	Preserve natural functioning of hydrological systems.	Hydrological functioning of streams along the WAR is already disturbed due to human impact; thus impact of upgrading will be only slight. **Low negative impact**	Impacts on Jorodane River will be significant mainly due to increased siltation and altered drainage patterns. **Moderate negative impact**	Impact significance assumes that mitigation will be applied.

IMPACT ON PARTIES CONCERNED WITH CONSERVATION (CONTINUED)

LHDA Environment Division, and the Protection and Preservation Commission.	Preserve flora and fauna of Lesotho	Very slight disturbance of fauna e.g. due to noise and presence of construction workers. Vegetation destroyed by landtake and construction activities mainly degraded grassland, and some *Leucosidea* shrubland and *Erica alopecurus*. **Low negative impact**	Slight disturbance of fauna e.g. due to introduction of traffic in Jorodane Valley, and presence of construction workers. Vegetation destroyed by landtake and construction activities mainly degraded grassland and *Leucosidea* shrubland. **Low negative impact**	Impact significance assumes that mitigation measures, including rehabilitation, will be carried out.
	Preserve cultural resources of Lesotho	Two archaeological sites consisting of Middle Stone Age stone tool scatters will be disturbed. These are not considered rare as they are of a low density. **No significant impact**	The Pulane Valley along the LCAR is extremely rich in archaeological sites e.g. rock paintings and stone tool scatters. Improved access to the area may result in the degradation of sites. **Low negative impact**	The impact significance assumes that mitigation measures will be applied.

IMPACT ON POLICIES FOR DEVELOPMENT AND TRANSPORT

POLICIES	AUTHORITIES	WAR	LCAR	COMMENTS
National Planning Objectives	Ministry of Planning Manpower and Economic Development, Government of Lesotho	Promotes objectives of economic growth and employment creation. **Moderate - high positive impact**	Promotes objectives of economic growth and employment creation. **Moderate positive impact**	Objectives are identified in Fifth Five Year Plan of Lesotho. Significance assumes no optimisation.
		Upgrading of the WAR will promote national objective of democratisation to a small degree. **Low positive impact**	Improved access, particularly in the Jorodane Valley, will serve to facilitate democratisation. **Moderate positive impact**	Impact significance assumes optimisation of benefits e.g. completion of proposed infrastructural improvements.
National Settlement Policy	Department of Land Surveys and Physical Planning, Maseru	The WAR will promote balanced settlement development and thus reinforce the National Settlement Policy. **Low positive impact**	On the whole the LCAR will contradict, rather than reinforce the National Settlement Policy. **Moderate negative impact**	Impact significance assumes that no mitigation or optimisation will be carried out.

IMPACT ON POLICIES FOR DEVELOPMENT AND TRANSPORT (CONTINUED)

Tourism Development Initiatives	Lesotho Tourist Board	Despite short-term disruptions to tourist traffic, the WAR will serve to promote tourism in Lesotho. **Moderate positive impact**	The construction of the LCAR will, on the whole, promote tourism to a slight extent. **Low positive impact**	Impact significance assumes mitigation and optimisation will be carried out to a moderate extent.
National Road Transport Plans	Lesotho Ministry of Works	The WAR is in line with transport plans and will result in savings to the government (see financial implications below). **High positive impact**	The LCAR is not in line with transport plans, and will create an additional burden on the maintenance budget of the Ministry of Works (see below). **High negative impact**	Impact significance of the WAR assumes optimisation. There is no effective mitigation for the negative impact of the LCAR.

FINANCIAL IMPLICATIONS

ASPECT	AUTHORITY	WAR	LCAR	COMMENTS
Road construction and maintenance budget	Lesotho Government, Ministry of Works	Approximately M10 million saved, because the Government's planned improvements to the Mountain Road will not need to be carried out if the WAR is constructed.	The LCAR will create an additional burden on the maintenance budget of approximately M150 000 per year plus M1.8 million every 8 years.	The increased burden on the maintenance budget will be a long-term effect.
Total cost of route to the proponent	Lesotho Highlands Development Authority	M 172 110 060	M 225 367 821	Costs include transport, maintenance, compensation, rehabilitation and capital costs (see section 3.4.5.1).

ABBREVIATIONS USED IN TABLE
WAR: Western Access Road
LCAR: Least Cost Alternative Route
LHDA: Lesotho Highland Development Authority

CHAPTER 4
EVALUATION OF THE PROPOSED ALTERNATIVE ROUTES

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4.1 INTRODUCTION

In the previous chapter the impacts of the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR) were described, and the significance of each impact assessed. In this chapter, issues of key importance to the decision-making process are identified. On the basis of these key issues, the two routes are then evaluated in order to establish which route is the preferred environmental alternative.

This chapter comprises four sections. In section 4.2 the methodology used to identify key issues and to evaluate the alternative routes is discussed. In section 4.3 the WAR is compared to the LCAR with regard to the three selected evaluation criteria, i.e. efficiency, equity and sustainability. Finally, in section 4.4, a conclusion is reached with regard to which route is the preferred option, and the "sensitivity" of this conclusion to evaluation methods and assumptions is discussed.

4.2 METHODOLOGY OF EVALUATION

4.2.1 INTRODUCTION

Environmental evaluation involves the process of obtaining, organising and *weighing* information on the consequences or impacts of alternatives, in order to determine which alternative is in the best interests of the community at large [Dept. of Env. Affairs, 1992].

The primary aim of this evaluation is to decide which of the two alternative routes, the Western Access Road (WAR) or the Least Cost Alternative Route (LCAR) is in the best interests of society.

The evaluation carried out is thus a relative, rather than an absolute one. Impacts which may be of high significance when evaluating a particular alternative in "absolute" terms, will not be of relevance to a comparative evaluation if the impacts are similar for both alternatives.

In order to focus the evaluation on key issues, it is necessary to identify for which impacts there is a significant difference between the alternative routes. The procedure adopted for this purpose is described below.

4.2.2 PROCEDURE TO IDENTIFY KEY ISSUES

Summarising framework tables involves implicit judgement. In order to increase the rigour in the process of identifying and distilling key issues, the procedure outlined below was adopted. This procedure does not aim at replacing judgement, but rather at facilitating it:

The procedure involved the following steps:

STEP 1: The impacts were listed one below the other in tabular form (see table in Appendix 4).

STEP 2: The "most likely" significance assigned to each impact in chapter 3, was assigned a category number, according to its order on an imaginary continuum of increasing impact severity. The following category numbers were applied:

High positive impact:	+3	High negative impact:	-3
Moderate positive:	+2	Moderate negative:	-2
Low positive impact:	+1	Low negative impact:	-1

No significant impact: 0

STEP 3: For each impact the number of categories of divergence between the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR) was calculated (see column 4 of table in Appendix 4).

STEP 4: Each impact was considered in turn to establish whether, for that particular impact, there were any significant equity considerations i.e. whether the distribution of the effects of the impact differed between the WAR and the LCAR. This included a consideration of numbers of people affected, income-groups of people affected, as well as intergenerational equity. Equity considerations were recorded in column 5.

STEP 5: The sensitivity of each impact to the assumptions regarding the application of mitigation and optimisation was checked, and recorded in column 6. This was done firstly by comparing impact significance ratings with and without mitigation or optimisation, and secondly by considering the degree of certainty involved in the prediction of the likely effectiveness, and likelihood of implementation, of the mitigation or optimisation measures.

STEP 6: It is important that the evaluation process should reflect the needs, aspirations and values of all persons affected [Fuggle, 1990]. Thus the degree of importance which interested and affected parties (I&APs) attached to each impact was considered. Where impacts were considered by I&APs to be important, this was recorded in column 6.

STEP 7: Impacts were considered *not* to be key issues if all of the following conditions applied:

a) there were no, or only a few, categories of divergence between the WAR and the LCAR (typically 0 or 1);

b) there were no significant differences in distributional effects between the two routes;

c) the difference between the numerical ratings was not unduly sensitive to the assumptions concerning mitigation or optimisation;

d) the impact was not considered particularly important by I&APs, and

e) the author judged that the issue was not of key concern.

STEP 8: Where "double-counting" appeared to be occurring, impacts where combined. Entries in column 6 indicate where this was done.

During the procedure it was recognised that a "difference" between routes for one particular impact is not necessarily comparable to a "difference" for another impact; thus even where small differences between routes occurred, judgement was not suspended i.e. the procedure was merely used as an aid to judgment.

It was furthermore recognised that a large number of impacts of low significance may, when combined, add up to a significant though disparate "effect". This effect was checked for at the conclusion of the evaluation; it was noted that most of the impacts screened out on the basis of low significance favoured the selection of the route which was ultimately identified as the preferred route. It was thus concluded that this issue would not have significantly affected the outcome of the evaluation.

4.2.3 CRITERIA USED FOR EVALUATION

Stauth and Baskind [1992] suggest that the ultimate goal of a decision-maker is to establish which alternative will provide the highest possible level of well-being over multiple generations. The three criteria which Stauth and Baskind propose be used to assess the degree to which this goal is satisfied are:

- the efficiency criterion - do the benefits exceed the costs?
- the equity criterion - are the costs and benefits fairly distributed amongst the individuals constituting present-day society?
- the sustainability criterion - will benefits continue to exceed costs over intergenerational time periods?

Environmental impact assessment is grounded in the perceptions and values of society [Beanlands and Duinker, 1983], and the degree to which different people would give weight to each of these three criteria

will depend on the individual's perceptions and rationality. For example an environmentalist is likely to consider sustainability as the most important criterion, whereas an economist would be likely to put more weight on the efficiency criterion [Stauth and Baskind, 1992]. Thus it must be recognised that in applying the above criteria to the study, the author is making use of subjective judgement.

4.2.3.1 Efficiency

The selection of a method to "weigh" the key issues in order to establish which of the routes is more *efficient*, is discussed in this section.

The following methods were considered as possible alternatives at this stage of the study:

- panel evaluation techniques e.g. the Delphi-procedure;
- cost-benefit analysis;
- explicit arithmetic weighting of impacts, and
- professional judgement, backed up by a clear written discussion.

The panel evaluation techniques, while they may have provided an acceptable solution, were not pursued by the author for logistical reasons.

A formal cost-benefit analysis involves expressing costs and benefits as far as possible in monetary terms, with future costs adjusted to reflect their net present value. Costs and benefits are then added for each route, and the route with the greatest net benefit is chosen as the preferred option.

Cost-benefit analysis has, however, been criticised by a number of authors [Stauth and Baskind, 1992; Lievesley, 1985; ACTRA, 1979; Dohan, 1977]. The discounting of future benefits can create problems in the case of environmental goods, by unduly focussing attention on the short term, and cost-benefit analysis furthermore cannot deal in a satisfactory way with irreversible changes, such as the possible extinction of a species.

Furthermore, not all impacts are quantifiable in monetary terms; this can result in non-quantifiable impacts having less influence on decision making. Quantification can also give a false sense of certainty, and can serve to obscure the role of judgement.

Explicit arithmetic weighting was considered unsuitable, for similar reasons, and a "non-quantitative" discussion involving professional judgement was thus the method chosen. This is, indeed, the method recommended by ACTRA [1979] for decision-making in environmental impact assessments using the *framework approach*.

4.2.3.2 Equity

Three different approaches are commonly used to address distributional effects in projects [Dixon *et al*, 1988]:

- qualitative considerations - for example where the net benefit or cost is estimated for each income class or group and a judgment made on the basis of this;

- explicit weighting of benefits and costs borne by various groups - normally benefits received, or costs borne, by disadvantaged groups are given more weight than those which accrue to wealthier groups, and

- the setting of distributional constraints - for example, targets might be set which establish a minimum acceptable distribution of benefits (e.g. a certain percentage) to a particular low-income group.

Distributional constraints are not ideal for comparative studies, and explicit weightings tend to create a false sense of certainty and disguise the central role of judgement. A "qualitative consideration" was thus considered most appropriate in this case.

4.2.3.3 Sustainability

Sustainability implies a fair distribution of costs and benefits over successive generations. In section 4.3.3 each key issue is evaluated and discussed in the light of this, and on the basis of this evaluation, the most sustainable route overall is identified.

4.3 RELATIVE EVALUATION OF PROPOSED ROUTES

4.3.1 EFFICIENCY

Issues identified as being of key importance to the decision-making process are indicated in Table 4.1. In the case of each of the key issues, the impact of the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR) is described and the preferred route highlighted in bold print.

Table 4.1 COMPARISON OF ROUTES WITH REGARD TO KEY ISSUES

Key Issues	WAR	LCAR
Impact on plans for a Maseru bypass	Bypass will be built	Bypass will not be built
Impact on residents due to improved access	Slight positive impact	Significant positive impact
Impact on informal cash economy	No effect	Negative impact
Impact on conservation initiatives/plans	No serious effect	Significant negative impact
Impact on the National Settlement Policy	Reinforces	Contradicts
Impact on national transport plans	Reinforces	Contradicts
Total financial cost to LHDA	M 172 million	M 225 million

The relative benefits of the Western Access Road (WAR) proposal are thus the following:

- the proposal will include the construction of a bypass at Maseru, with all its associated benefits;
- it will avoid the negative impact on the informal cash economy which will be associated with the Least Cost Alternative Route;
- it will not involve a significant negative impact on conservation initiatives, and in particular on the conservation of rare and endangered species;
- the proposal will serve to reinforce the National Settlement Policy;
- the proposal is in line with national transport plans, and will avoid the additional long-term burden on Lesotho's road maintenance budget associated with the Least Cost Alternative Route,
- it results in a relative financial savings to the Lesotho Highlands Development Authority (LHDA) of M53 million.

The relative benefit of the Least Cost Alternative Route (LCAR) proposal is that it will:

- result in greater improvements in access, compared to the Western Access Road.

In order to establish which of the proposed routes is more efficient the following question needs to be addressed:

Does the benefit of improved access associated with the Least Cost Alternative Route outweigh all the above-mentioned benefits of the Western Access Road?

The benefits of a new road in the Jorodane Valley are undoubtedly significant. Dewar [1985] indicates that improved infrastructure is a necessary, although not a sufficient condition for improved productivity. Insofar as improvements in access provide the *opportunity* for rural development, they are indeed valuable, but if this opportunity is to be realised, institutional constraints and structural obstacles to development need to be addressed (see Appendix 7 of EEU/2/93/104c).

Thus *likely* benefits of improved access must be clearly distinguished from *potential* benefits which are unlikely to be realised.

It is certainly likely that the improvement in access will significantly affect the lives of the residents of the Jorodane Valley. It is, however, unlikely that opportunities for development created by the road through the Jorodane Valley, will be fully realised. It is thus considered that the relative benefit associated with the Least Cost Alternative Route (i.e. greater improvements in access), will not outweigh the above-mentioned benefits of the Western Access Road.

It is thus concluded that the Western Access Road is more efficient than the Least Cost Alternative Route, because the Western Access Road is associated with a greater net benefit.

4.3.2 EQUITY

In this section the distribution of the costs and benefits associated with the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR) are considered, and the most equitable route identified. In order to decide which of the two alternative routes is the most equitable it is necessary to identify which groups bear the associated costs or benefits associated with the routes.

If the WAR is constructed the relative costs and benefits will be distributed as follows:

- The Maseru bypass will mainly benefit the residents of Maseru, and more so those individuals who can afford to own their own

vehicles. Thus the benefit accrues to a relatively advantaged group.

- The relative "cost" associated with the WAR because it will not improve access to as great an extent as the LCAR, is borne largely by the relatively disadvantaged residents of the Jorodane Valley. The relative "benefit" associated with the WAR because it will not unduly interfere with the informal cash economy, will also accrue to the residents of the Valley.

- The benefits to conservation are considered to accrue to all groups equally, particularly in the case of the preservation of rare and endangered species, because ultimately all humans will suffer if the potential benefits associated with a particular species are lost forever due to its extinction.

- The National Settlement Policy (NSP) aims to ensure a balanced settlement pattern in Lesotho. It could be argued that the NSP has an inherent bias towards the more advantaged groups because it focuses on the development of relatively "developed" urban centres at the expense of less developed rural areas. However, in the long term, rural and urban development go hand in hand, and improvements in the urban settlement structure in Lesotho will ultimately benefit rural development [T. Gregory, pers. comm.]. The benefits associated with the reinforcement of the NSP are thus considered to accrue equally to all groups.

- The fact that the WAR reinforces national transport plans has financial implications for the Government of Lesotho. Firstly it results in relative savings with regard to maintenance, and secondly, it means that the cost of the upgrading of the WAR will be borne by the Lesotho Highland Development Authority (LHDA), rather than by the Government. While this latter factor is of no significance in the context of efficiency, it is important in the context of equity. The Government of Lesotho is significantly less financially advantaged than LHDA, due to accumulated debt, and the constraints of the IMF's structural adjustment programme [Setplan, 1991]. In the case of this impact, the Government of Lesotho is thus considered to be a less advantaged party.

- With regard to financial costs, LHDA is viewed as an advantaged party, because of its relatively easy access to financial resources and credit.

If the LCAR is constructed, the relative benefits associated with the WAR become relative costs, and are borne by the same groups; and similarly relative costs become relative benefits.

In the light of the above discussion, the table below indicates how the relative benefits and costs of the WAR and LCAR are distributed:

Table 4.2 DISTRIBUTION OF THE RELATIVE BENEFITS AND COSTS OF THE WAR AND THE LCAR

Key Impacts	WAR		LCAR		Most Equitable Route
	Adv. Group	Less Adv.	Adv. Group	Less Adv.	
Maseru bypass	Benefit		Cost		WAR
Improved access		Cost		Benefit	LCAR
Cash economy		Benefit		Cost	WAR
Conservation	Benefit	Benefit	Cost	Cost	WAR
Settlement Policy	Benefit	Benefit	Cost	Cost	WAR
Transport plans		Benefit		Cost	WAR
Construction Cost	Benefit		Cost		WAR

Adv. Group = Advantaged Group
Less Adv. = Less Advantaged Group

In weighing the above, the costs and benefits which accrue to less advantaged groups deserve more weighting than costs borne by relatively advantaged groups. The rationale behind this differential weighting relates to the economic concept of *marginal utility*. According to this concept, the utility or satisfaction derived from some absolute benefit (or cost) will differ from one income group to another, with a member of a lower income group deriving more satisfaction from the same benefit than a member of the upper income group [Curry, 1987].

In Table 4.2 above, three factors emerge as important with respect to distribution because they soley impact on less advantaged groups. These are:

- improved access;
- impacts on the cash economy, and
- impacts on transport plans.

In the case of improved access the LCAR is the most equitable route, because the benefit accrues to a less advantaged group. In the case of the impacts on the informal cash economy and transport plans, the WAR is in both cases the most equitable route because it will result in net benefits to less advantaged groups.

The only significant relative cost associated with the WAR, is borne by a less advantaged group. Thus the significance of this cost is relatively higher than if it had been borne by an advantaged group. However, it appears that, even

if this cost receives more weight, it is still unlikely to outweigh all the other benefits associated with the WAR.

If one specifically considers the residents of the Jorodane Valley, who directly bear the relative cost of the WAR, it appears likely that the loss of the opportunity for improved access would be outweighed by the following benefits:

- there would be no disturbance of the informal cash economy in the Valley;
- the residents of the Valley would indirectly benefit, along with all other groups, from the advantage which the road holds for conservation;
- the fact that the WAR reinforces the National Settlement Policy will have indirect benefits for residents in the valley, because rural development and urban settlement growth are interdependent, and
- with regard to the impact on transport plans, they will indirectly benefit, along with all other citizens of Lesotho, from the relative savings which will accrue to the Government.

While it may be true that the WAR could be seen to be providing *more* relative benefit to advantaged groups than to less advantaged groups, it still provides a net benefit to both groups, whereas the LCAR provides a net cost to both.

The benefits of the WAR are furthermore widely distributed, because many of the benefits accrue to the Lesotho nation as a whole, or, as in the case of the impact on rare and endangered species, to the international community. The "relative cost", associated with the WAR, although it accrues to a less advantaged group, only affects a limited number of people i.e. primarily the approximately 2-3000 residents of the Jorodane Valley.

In the light of the above discussion it is thus concluded that the Western Access Road is the most equitable alternative of the two routes.

4.3.3 SUSTAINABILITY

Sustainability implies intertemporal allocative efficiency i.e. the efficient inter-generational distribution of resources [Norgaard, 1992].

The World Conservation Strategy [IUCN *et al*, 1980] defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." For development to be sustainable, it must not interfere with the

functioning of ecological processes and life support systems. To this end, the preservation of genetic diversity is viewed as a priority concern.

The concept of sustainability is, however, not necessarily limited to ecological considerations. It can be applied to all forms of economic and social activity [Barbier, 1987].

Sustainable development in the social sphere should ensure secure employment, use appropriate technology, should introduce easily assimilable new skills and should minimise displacement of traditional economic activities. With regard to human settlements, sustainability implies appropriate landuse control and provision of services [Barbier, 1987].

Barbier [1987] sees the cornerstone of sustainability as the meeting of basic needs i.e. food, shelter, fuel and water, since environmental degradation in less developed countries is often linked to people's need to satisfy these basic requirements.

In the light of the above, the Western Access Road (WAR) could be viewed as being relatively more sustainable than the Least Cost Alternative Route (LCAR) for the following reasons:

- It is the best option with respect to conservation. It will minimise potential adverse effects on rare and endangered species, and is thus less likely than the LCAR to cause irreversible environmental changes, such as the extinction of a species.

- It will not cause a disruption of the traditional local cash economy of the Jorodane Valley.

- It will reinforce the National Settlement Policy, and thus will promote appropriate landuse control, and provision of services.

- It involves the upgrading of an existing road rather than the building of a new road, and will thus not be creating a significant additional burden on Lesotho's long-term maintenance budget.

It is debatable whether the benefit of improved access in the Jorodane Valley would promote sustainability. On the one hand, it could better facilitate the meeting of basic needs e.g. due to improved access to agricultural requirements, such as fertilizer. On the other hand, the improvement in access could result in the introduction into the valley of relatively unsustainable agricultural, and other, practices. The degree of sustainability would ultimately depend on the extent to which management and optimisation measures are carried out. In a country as poor as Lesotho, however, such measures are likely to be limited.

The construction of the Maseru Bypass is also less easy to assess in terms of the sustainability criterion. It could however, be argued that it is not *absolutely* sustainable because it will promote the further growth of

Maseru, which will in turn promote the generally unsustainable economic development characteristic of the capital city. However, it can certainly be implemented in a *relatively* sustainable way if the optimisation measures discussed in section 3.4.1 are carried out.

In the case of four of the seven key issues identified, the Western Access Road is considered to be clearly more sustainable than the Least Cost Alternative Route. In the case of the remaining three issues, neither of the routes holds any definite advantage with regards to the sustainability criterion.

Thus, on the whole, the Western Access Road is judged to be more sustainable than the Least Cost Alternative Route.

4.4 CONCLUSION AND SENSITIVITY ANALYSIS

The discussion above concludes that the Western Access Road (WAR) is preferable with regard to all three evaluation criteria, namely efficiency, equity and sustainability. It is thus judged to be the preferred route.

This conclusion is based on professional judgement and the subjective weighting of the costs and benefits relating to the seven key issues.

Evaluations such as the above would typically depend, *inter alia*, on the following:

- The procedure used to identify key issues - the majority of impacts "eliminated" during this procedure would, however, have served to count in favour of the WAR, which was identified as the preferred route. Thus it is judged that the outcome of this evaluation is not unduly sensitive to this aspect.

- The relative weightings given to each impact - the only relative cost associated with the WAR is that related to improved access, and the weighting given to this impact could be critical to the conclusion. Because of the substantial benefits associated with the WAR, however, it is not felt that the outcome of this study was particularly sensitive to this aspect.

- The relative weighting given to the three efficiency criteria which would depend on the rationality of the decision maker - as the author is an environmentalist, the sustainability criterion would be likely to receive more weight. However, in the case of this environmental impact assessment, because the WAR emerged as the better option in the case of each of the three criteria, the conclusion is not sensitive to this factor.

- The assumptions regarding mitigation and optimisation - if all these assumptions had been changed to favour the Least Cost

Alternative Route (LCAR), is it possible that the LCAR might have emerged as the preferred route? Three of the key issues were identified as being more sensitive than others to such assumptions, namely the impacts on conservation, the cash economy and improved access. It is *conceivable* that mitigation could significantly reduce the impact of the first two and optimisation greatly increase the positive effect of the latter, to the extent that the relative efficiency of the WAR could come into question. However, such a scenario is highly unlikely, because of the limited resources available to the Lesotho Highlands Development Authority and the Government of Lesotho. It is furthermore noted that one of the more important criteria, namely "impacts on transport plans", is essentially independent of any assumptions regarding mitigation or optimisation. Financial costs incurred by the Lesotho Highlands Development Authority are also largely independent of such assumptions. On the whole, it is judged that the conclusion would not be significantly affected by even moderate changes in the assumptions regarding mitigation and optimisation.

- Other general assumptions made during the study (see section 1.4.1) - the outcome of the study is relatively sensitive to the assumption made that the WAR would involve the construction of bypass at Maseru, because the bypass emerges as a key issue in the decision-making process. If a bypass were not constructed, the WAR would certainly have a reduced relative benefit, and the decision would be less clear cut. However, because of the many other benefits associated with the WAR, it is judged that the WAR would still emerge as the preferred route.

On the whole, therefore, it is concluded that the result of the evaluation, i.e. the selection of the Western Access Road as the preferred route, is not unduly sensitive to the type of evaluation method adopted, or to the assumptions made during the study.

This concludes the comparative evaluation of the routes. In the next chapter, the conclusions and recommendations arising from the study are summarised.

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

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5.1 INTRODUCTION

The conclusions and recommendations in this chapter are structured in such a way as to address the seven report objectives identified in chapter 1. Each objective is dealt with separately in consecutive sections of this chapter.

In section 5.2 conclusions relating to theoretical objectives of the study are summarised. Section 5.3 concerns the assessment of impacts and the identification of mitigation and optimisation measures. In section 5.4 issues of key importance to the decision-making process are outlined, and in section 5.5, conclusions arising from the comparative evaluation of the routes are recorded.

Conclusions and recommendations regarding the preferred access route are presented in section 5.6, and further recommendations, relating to the incorporation of environmental aspects into future stages of the project, are outlined in section 5.7.

In the last section, section 5.8, general recommendations for future environmental impact assessments are made, based on the experiences of this study.

5.2 THEORETICAL ASPECTS

5.2.1 REPORT OBJECTIVE

Develop the theoretical basis for the study and critically assess the study plan in terms of the requirements of integrated environmental management (IEM) and environmental impact assessment (EIA).

5.2.2 CONCLUSIONS

The theoretical basis for the study is developed in chapter 2. This chapter includes, inter alia, an assessment of the study plan in the light of recommended procedures and principles of integrated environmental management (IEM). The main shortcomings identified and their implications are:

- the lack of early notification of interested and affected parties as required in the *develop proposal* stage of the IEM procedure, due to a lack of time and logistical problems. This had repercussions further on in the process, in particular during scoping, mainly because interested and affected parties (I&APs) were not forewarned of the proposal;

- the lack of public participation during stage 1 of the study, which meant that the public were not involved in the identification of routing alternatives. This served to alienate I&APs to some extent, and to cast doubt on the legitimacy of the first stage of the study. While this is a serious procedural shortcoming of the study, it is not judged to be significant from a substantive point of view, because assumptions made during the stage 1 preliminary assessment were later found to be accurate during scoping carried out during stage 2 of the study;

- the fact that the results of other specialist studies, carried out concurrently with the EIA by other sub-consultants (e.g. economists and transport engineers) were not available to the author at the time this report was written. Thus this EIA is not as "holistic" as it might have been, had the results of the other studies been integrated into it. The client did not appear to recognise the fact that, in IEM, an environmental impact assessment is essentially a decision making tool, geared towards facilitating the reaching of an *overall* decision. Failure to recognise this resulted in an under-utilisation of the services of the IEM-trained specialists.

In spite of the above shortcomings, the EIA was a good example of a truly integrated and pro-active study, as environmental input into the planning process was timely, ongoing and iterative.

Four aspects of the study are considered to have been particularly successful.

Firstly, the environmental team was involved early on in the planning stages of the proposal. This meant that it was relatively easy to bring about changes, for environmental reasons, to the proposed routing alignments. Secondly, the planning and assessment stages were truly integrated. This ensured that IEM principles directed the planning process, rather than being considerations to be addressed after the development of the proposal.

The third aspect of the study which is particularly noteworthy, it that there was early integration of specialist and public review; this early input from reviewers served to influence and direct the study in a more meaningful way than a "post-study" review is likely to have done.

Finally, the study involved the compilation of mitigation and optimisation measures and general guidelines for rehabilitation *early on* in the life of the project i.e. during the planning stages. This is considered particularly useful because it serves to familiarise and forewarn the proponent of likely resource commitments in the future, thus improving the likelihood that the recommended measures and guidelines will be successfully implemented.

Recommendations arising from the consideration of the above theoretical aspects of the study are included in sections 5.7 and 5.8.

5.3 ASSESSMENT OF IMPACTS

5.3.1 REPORT OBJECTIVE

Assess the impacts of the two routes in a comparative manner and identify appropriate mitigation and optimisation measures.

5.3.2 CONCLUSIONS

The impacts of the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR) are assessed in a comparative manner in chapter 3, and significance ratings of high, moderate or low are assigned to each impact. The most important positive impacts identified were the following:

- Both routes will promote the safety and well-being of travellers, and the WAR will include the construction of a much-needed bypass at Maseru.
- Both proposals will provide improved access to residents along the route, the LCAR to a greater extent than the WAR.
- Both proposals will serve to promote Lesotho's national planning objectives of economic growth and employment creation.
- The WAR will reinforce existing plans for the Lesotho Road network, and will result in savings to the Lesotho government in this regard.

The following were the main negative impacts identified:

- Construction activities, and improvements in access associated with the proposals, could adversely affect sensitive and rare ecological components. This effect will be more severe in the case of the LCAR, than the WAR.
- The LCAR could adversely affect the local informal cash economy in the Jorodane Valley.
- The LCAR is not in line with national road transport plans, and will create an increased burden on Lesotho's road maintenance budget.

Mitigation and optimisation measures are described for each impact in chapter 3. The main types of mitigation measures recommended are compensation for losses incurred, reduction or avoidance of impacts by design modifications, and rehabilitation of impacted areas. Optimisation measures recommended relate predominantly to the enhancement of development opportunities through co-ordinated action.

In section 5.7 the most important mitigation and optimisation actions are summarised.

5.4 KEY ISSUES

5.4.1 REPORT OBJECTIVE

Identify impacts and issues of key importance in the decision-making process

5.4.2 CONCLUSIONS

Seven impacts/issues were identified as being of key importance in the selection of a preferred route. These include the impact on plans for a Maseru bypass, the impact on residents along the Least Cost Alternative Route (LCAR) and the Western Access Road (WAR) due to improvements in access, and the likely impact on the informal economic sector. The impact on conservation initiatives, in particular those concerned with the preservation of rare and endangered species, was also identified as a key issue.

Two other aspects which emerged as being of key importance are whether the routes will serve to promote or contradict the National Settlement Policy and national transport plans. A final key issue identified is the financial cost to the Lesotho Highlands Development Authority (LHDA) associated with the alternative proposals.

The above key issues served as a basis for the comparative evaluation the two alternatives.

5.5 EVALUATION OF ROUTES

5.5.1 REPORT OBJECTIVE

Evaluate routes on the basis of the criteria of efficiency, equity and sustainability, and recommend a preferred route.

5.5.2 CONCLUSIONS

The relative benefits of the Western Access Road (WAR) are the following:

- it will include the construction of a bypass at Maseru, with all its associated benefits;
- it will avoid the negative impact on the informal cash economy which will be associated with the Least Cost Alternative Route (LCAR);
- it will not involve a significant negative impact on conservation initiatives, and in particular on the conservation of rare and endangered species;
- it serves to reinforce the National Settlement Policy;
- it is in line with national transport plans, and will avoid the additional long-term burden on Lesotho's road maintenance budget associated with the LCAR,
- it results in a relative financial savings to the Lesotho Highlands Development Authority (LHDA) of M53 million.

The only relative benefit of the LCAR is that it will result in a greater improvement in access compared to the WAR.

The Western Access Road (WAR) is thus judged to be more efficient than the Least Cost Alternative Route (LCAR) because it is considered that the net relative benefit of the WAR exceeds that of the LCAR.

With regard to the "equity" criterion, the study indicates that the relative benefits of the WAR are widely distributed. Many of the benefits accrue to the Lesotho nation as a whole e.g. the reinforcing of national transport plans and the National Settlement Policy. In the case of the impact on rare and endangered species, benefits are even more widely distributed, i.e. benefits accrue to the international community.

The only significant "relative cost", associated with the WAR is the fact that it will not improve access as significantly as the LCAR. This "cost" is borne by a less advantaged group. However, it is considered that, even if this cost receives more *weight* because of the fact that it is borne by a less-advantaged group, it is still unlikely to outweigh all the other benefits associated with the WAR. Furthermore, it is clear that, although this "cost" accrues to a less advantaged group, it only affects a limited number of people i.e. primarily the approximately 2-3000 residents of the Jorodane Valley.

The Western Access Road is judged to be the most equitable route, because its benefits are distributed more widely than those of the Least Cost ALternative Route.

With regard to sustainability, the WAR has a number of advantages over the LCAR. Firstly, it is the best option from the point of view of environmental conservation. It will minimise potential adverse effects on rare and endangered species, and is thus less likely than the LCAR to cause irreversible environmental changes, such as the extinction of a species.

The WAR will, furthermore, not disrupt the traditional local cash economy of the Jorodane Valley, and will reinforce the National Settlement Policy, thus promoting appropriate landuse control and provision of services. Finally, the WAR involves the upgrading of an existing road rather than the building of a new road, and will thus not be creating a significant additional burden on Lesotho's long-term maintenance budget.

The LCAR holds no definite advantages with regards to sustainability.

Thus, on the whole, the Western Access Road is judged to be more sustainable than the Least Cost Alternative Route.

5.6 PREFERRED ROUTE

5.6.1 REPORT OBJECTIVE

Identify a preferred access route.

5.6.2 CONCLUSIONS AND RECOMMENDATIONS

The Western Access Road (WAR) is preferable with regard to all three evaluation criteria, namely efficiency, equity and sustainability. There are furthermore no serious adverse effects or risks associated with the WAR, which cannot be effectively mitigated.

The Least Cost Alternative Route (LCAR), on the other hand, is associated with a number of serious negative effects. Not only will it involve adverse long-term cost implications which cannot be mitigated, but it will also contribute towards increasing the risk of extinction of two rare and endangered species.

In the light of the above, the Western Access Road is judged to be the preferred route. It is thus recommended that the Western Access Road be constructed, rather than the Least Cost Alternative Route.

5.7 RECOMMENDATIONS FOR FUTURE STAGES OF THE PROJECT

5.7.1 REPORT OBJECTIVE

Recommend measures whereby environmental considerations can be incorporated into future stages of the project.

5.7.2 RECOMMENDATIONS REGARDING THE INTEGRATED ENVIRONMENTAL MANAGEMENT PROCESS

The following recommendations concern the completion of integrated environmental management (IEM) procedures; the Lesotho Highlands Development Authority (LHDA) and the Joint Permanent Technical Commission (JPTC) are jointly responsible for the implementation of these recommendations:

5.7.2.1 The IEM procedure should be followed during the decision-making and implementation stages of the project - in particular the specific actions listed below. IEM principles should be adhered to throughout the life of the project i.e. "from cradle to grave".

5.7.2.2 Specialist, authority and public review should be undertaken. This process should, in particular, include the distribution of copies of the comparative report to relevant government ministries and departments in Maseru, for feedback and comments. Specialist review is considered vital because of the close links between the proponent (the LHDA) and the decision-making body (the JPTC).

5.7.2.3 A Record of Decision should be drawn up jointly by the LHDA and the JPTC, and made public, and opportunity for appeal provided. This will serve to emphasize the open, participatory principles underlying IEM. It is recommended that workshops be held in villages which were involved in the social survey along the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR), in order to provide the residents with feedback regarding the decision. All government bodies identified in the list of interested and affected parties in Appendix 2 of this report, as well as the Lesotho Council of NGOs, and the Molimo Ntuse Pony Trekking Centre should be advised of the decision by post. The Record of Decision, or a summary thereof, should also be published in national newspapers, and comments invited.

5.7.2.4 A Management Plan, describing how negative impacts will be managed, rehabilitated and monitored and how positive

impacts will be maximised, should be drawn up by the LHDA. The application of this Plan should be specified by the decision-maker as a condition of approval in the Record of Decision. The Plan should include detailed actions and specifications based on the mitigation and optimisation measures outlined in chapter 3 of this report, as well as any further measures which may be identified by the environmental team during the detailed design stage. Contingency plans for application in the event of accidents should also be included, as well as an estimate of resources required for the implementation of specified actions.

5.7.2.5 An Environmental Contract should be negotiated between the Lesotho Highlands Development Authority (LHDA) and the contractor(s) responsible for the construction of the proposed road. The Environmental Contract should aim to ensure that mitigation measures are applied, and should include penalties to be applied if these measures are not carried out. The Environmental Contract should be specified by the decision-maker as one of the conditions of approval in the Record of Decision.

5.7.2.6 The Record of Decision should include a description of the procedure whereby the Management Plan and Environmental Contract can be revised or updated during the life of the project.

5.7.2.7 One year after the implementation of the proposal, an environmental audit should be carried out. The audit should primarily aim to provide feedback on the efficacy of the overall environmental management process, and should include recommendations for the management of future project components and phases of the Lesotho Highlands Water Project.

5.7.3 RECOMMENDATIONS CONCERNING MITIGATION AND OPTIMISATION

This section includes both general recommendations, and a summary of specific recommendations concerning mitigation and optimisation. For a detailed list of specific mitigation and optimisation measures, the reader is referred to chapter 3.

The party or parties responsible for the implementation of these measures, are indicated in brackets after each recommendation.

5.7.3.1 Mitigation and optimisation measures specified in chapter 3 of this report should be carried out wherever possible. These measures should, however, be seen as flexible, and

should be modified, subject to the approval of environmental specialists, as project actions become more clearly defined during the detailed design stage.
[LHDA]

5.7.3.2 Rehabilitation guidelines outlined in Appendix 5 and 6 of reports EEU/2/93/014b and c respectively, should be applied during the construction and post-construction phases of the project. It is particularly important that measures relating to erosion control and the preservation of wetland areas are effectively implemented.
[LHDA]

5.7.3.3 Costs relating to mitigation and optimisation, including rehabilitation costs, should be written into the construction contract.
[LHDA]

5.7.3.4 An Environmental Control Officer should be appointed on a full-time basis to monitor construction activities.
[LHDA]

5.7.3.5 An environmental education programme should be implemented during the pre-construction and construction phases of the project to increase the awareness of all personnel involved in the construction of the road.
[LHDA]

5.7.3.6 Labour intensive methods should be adopted where possible during construction of the road, and local labour used wherever possible. Local builders should be used to construct compensation houses.
[LHDA]

5.7.3.7 A training programme, which teaches local people appropriate skills associated with road construction should be implemented during the pre-construction and construction phases of the project. Local workers should also be trained in road maintenance skills, and locally coordinated road maintenance projects established.
[LHDA]

5.7.3.8 Where impacts on structures, facilities and other property of residents along the road cannot be avoided, owners must be compensated. Compensation must be discussed with residents, and options provided where possible to provide affected groups with an opportunity to influence decisions affecting them.
[LHDA]

5.7.3.9 Where possible, mitigation measures involving compensation should be carried out *prior* to the project actions which necessitate them e.g. provide a replacement dwelling prior to destruction of the existing dwelling.
[LHDA]

5.7.3.10 Construction camps should preferably be located in areas where the biophysical environment is already relatively degraded. Construction workers must be provided with adequate recreational facilities.
[LHDA/Contractor]

5.7.3.11 If the Western Access Road (WAR) is built, the bypass at Maseru should be designed in such as way that it is in harmony with urban and regional planning initiatives proposed by the Land Surveys and Physical Planning Department (LSPP) of the Ministry of the Interior.
[LHDA/LSPP]

5.7.3.12 If the WAR is built, the proposed reconstruction of the remainder of the Mountain Road to Tsaba-Tseka should be undertaken by the Government of Lesotho (GoL). It is also recommended that the system of feeder roads leading off the WAR into rural areas should be improved. Continued effective maintenance of the road and successful implementation of the Pavement Management and Maintenance System would further serve to optimise the positive impact of the road.
[GoL: Ministry of Works]

5.7.3.13 The upgrading of the WAR should be optimised by co-ordinating road construction with other efforts to promote settlement development, as recommended in the National Settlement Policy [LSPP, 1990]. These include decentralisation of public administration and the establishment of local authorities.
[LHDA/LSPP]

5.7.3.14 A significant portion of the royalties generated by the Lesotho Highlands Water Project, should be allocated to regionally coordinated rural development projects.
[GoL]

5.7.4 ADDITIONAL RECOMMENDATIONS CONCERNING THE LEAST COST ALTERNATIVE ROUTE

If, despite the recommendations of this report, the Least Cost Alternative Route (LCAR) is implemented, the following additional actions are recommended:

5.7.4.1 A further environmental impact assessment (EIA) should be carried out during the detailed design stage of the LCAR. This EIA should include a reassessment of compensation costs, and should generate site specific mitigation and optimisation measures.
[LHDA]

5.7.4.2 Prior to the commencement of construction, detailed ecological studies should be carried out to serve as a baseline for a rigorous monitoring programme.
[LHDA]

5.7.4.3 The Management Plan for the project should specifically include a detailed strategy to reduce the risk to rare and endangered species, and should incorporate contingency plans to deal with accidental events. The Management Plan should include detailed actions to prevent abnormal increases in the sediment loading of rivers and streams during both the construction and the implementation stage of the project.
[LHDA]

5.7.4.4 A regionally co-ordinated rural development programme should be implemented in the Jorodane Valley. This should include co-ordination between the following: the LHDA's programmes aimed at compensating for losses incurred as a result of inundation of the Jorodane Valley associated with the Mohale Dam; rural development initiatives of the Government of Lesotho (GoL) e.g. the Land Management and Conservation Project; and initiatives of Non-Government Organisations (NGOs), such as church groups and the US Peace Corp.
[LHDA, GoL, NGOs]

5.7.4.5 Physical planning specialists should be appointed to draw up a mitigation programme to reduce the severity of the predicted impact on the National Settlement Policy.
[LHDA/LSPP]

5.7.5 RECOMMENDATIONS CONCERNING FURTHER STUDIES

5.7.5.1 Environmental input into future stages of the project should include an assessment of the impacts of those project components which were not clearly defined during the planning stages. This should include an assessment of the impacts associated with quarries, borrow pits, spoil areas and road construction camps. Environmental input should also be provided into the siting of these project components,

and should include recommendations regarding the mitigation and optimisation of impacts.
[LHDA]

5.7.5.2. Present research regarding the distribution of the Maluti Minnow, *Pseudobarbus quathlambae*, [Rall *et al*, 1993] should continue in order to establish the extent of occurrence of this species, and the probability of extinction of the Minnow in the present threatened locality i.e. the Jorodane River. The research should be sponsored, if necessary, by the Lesotho Highlands Development Authority.
[LHDA]

5.7.5.3 An integrated development plan for the entire Phase 1B project area should be compiled, to facilitate co-ordination between various project components.
[LHDA]

5.8 RECOMMENDATIONS FOR FUTURE EIAs

5.8.1 REPORT OBJECTIVE

Based on the experiences of this study, formulate general recommendations for future environmental impact assessments.

5.8.2 RECOMMENDATIONS

Based on the experiences of this study, the following are recommended for future environmental impact assessment (EIA) studies:

5.8.2.1 A specialist in integrated environmental management (IEM) appointed to carry out an EIA, should ensure that the client recognises that in order for the EIA to achieve its purpose, the results of all other relevant studies need to be integrated into the EIA. This recognition needs to be reflected explicitly in project schedules.

5.8.2.1 The IEM specialist should ensure that project schedules allow sufficient time for the notification of interested and affected parties prior to the commencement of the study, and for meaningful public participation from the earliest possible stages.

5.8.2.3 When an alignment is "walked" by an environmental team, an engineer should accompany the team to provide technical

input in the field. This would be serve to facilitate integration of the planning and assessment stages of IEM.

5.8.2.4 To avoid confusion and possible bias, project alternatives should, where possible, not be given "loaded" names such as *Least Cost* Alternative Route.

5.8.2.5 EIA researchers should make use of opportunities during interaction with officials, interested and affected parties, and developers, to disseminate information on environmental impact assessment and integrated environmental management (IEM) procedures. This is particularly recommended in countries, such as Lesotho, where IEM principles and procedures are little known.

REFERENCES

REFERENCES

Acocks, J.P.H., 1988: Veld Types of South Africa, 3rd ed., Memoirs of Botanical Survey of South Africa no. 57, Department of Agriculture, Pretoria.

ACTRA (Standing Advisory Committee on Trunk Road Assessment), 1979: Trunk Road Proposals - A Comprehensive Framework for Appraisal, HMSO, London.

Barbier, E.B., 1987: The Concept of Sustainable Economic Development, Environmental Conservation, 13 (3), 101-110.

Barton, B., 1977: Short-term Effects of Highway Construction on the Limnology of a Small Stream in Southern Ontario, Freshwater Biology, 7, 99-108.

Beanlands, G.E. and Duinker, P.N., 1983: An Ecological Framework for Environmental Impact Assessment in Canada, Institute for Resource and Environmental Studies, Dalhousie University, Halifax, Nova Scotia.

Bisset, R., 1984: Assessment of Social/Behavioural Impacts, Paper Presented at International Seminar on Environmental Impact Assessment, University of Aberdeen, Scotland, 8-21 July.

Borcherds, M.M., English, P.J., Fielding, M.L., Honikman, K.S., Jacobs, G.A., Kurgan, A.Z., Pickering-Dunn, E.K., Steyn, M.E. & Van der Merwe, N.M., 1990: Handbook: A Guide to Effective Spoken and Written Communication, Arrow Publishers, Cape Town.

Bridle, R.J., Broome, M.R. & Holmes, R.W., 1981: Environmental Appraisal of Trunk Roads, in Proceedings of the Institution of Civil Engineers, 71 (2), 287-304.

Burdge R.J. and Robertson R.A., 1990: Social Impact Assessment and the Public Involvement Process, Environmental Impact Assessment Review, 10, 81-90.

Cambray, J.A. and Meyer, K., 1988: Early Ontogeny of an Endangered, Relict, Cold-water Cyprinid from Lesotho, Revue d'Hydrobiologie Tropicale 21(4), 309-333.

Chutter, F.M., Ashton, P.J. and Hely-Hutchinson, J.R., 1988: Predicted limnological conditions in the Phase 1A of the Lesotho Highlands Development Scheme, Confidential Report for the Lesotho Highlands Development Authority, Maseru.

Conland, J. (ed), undated: Social Impact Assessment in New Zealand: A Practical Approach, Town and Country Planning Directorate, Ministry of Works and Development, New Zealand.

Council for Scientific and Industrial Research (CSIR), 1988: South African Red Data Book - Reptiles and Amphibians, 1988, South African National Scientific Programmes Report no. 151, CSIR, Pretoria.

Curry, N., 1987: Recreation Cost-Benefit Analysis and the Equity Effect, Journal of Environmental Management, 25, 363-375.

Department of Environment Affairs, 1992: The Integrated Environmental Management Guideline Series, Dept. of Env. Affairs, Pretoria.

Dewar, D., 1985: Some Developmental Issues relating to Transportation Planning in the Peripheral Areas of South Africa, CSIR Technical Report RT/27, National Institute for Transport and Road Research, CSIR, Pretoria.

Dixon, J.A., *et al*, 1988: Economic Analysis of the Environmental Impacts of Development Projects, Earthscan Publications Ltd, London.

Dohan, M.R., 1977: Economic Values and Ecosystems, in Hall, C.S. and Day, J.W. (eds.) Ecosystem Modelling in Theory or Practice, John Wiley and Sons, New York, pp 166-168.

Donnay, T.J. and Meyer, K., 1991: The Distribution and Status of the Endemic Spiral Aloe, *Aloe polyphylla* in Lesotho, Excelsa, 15, 29-34.

Environmental Resources Limited (ERL), 1989: Rural Enterprises, Lesotho Highlands Water Project Environmental Study (Draft Final Report), Report for the LHDA, Maseru.

Environmental Resources Limited (ERL), 1990: Tourism, Lesotho Highlands Water Project Environmental Study (Draft Final Report), Report for the LHDA, Maseru.

Fuggle, R.F., 1990: Integrated Environmental Management: An Appropriate Approach to Environmental Concerns in Developing Countries, Impact Assessment Bulletin, 8, 31-46.

Fuggle R.F. and Rabie M.A. (eds.), 1992: Environmental Management in South Africa, Juta & Co, Cape Town.

Hill R.C. and Fuggle R.F., 1990: Improving the Practice of Environmental Impact Assessment: Five Case Studies to Show Layout of Final Report, Environmental Evaluation Unit, University of Cape Town.

International Union for the Conservation of Nature (IUCN), 1986: 1986 IUCN Red List of Threatened Animals, IUCN, Gland, Switzerland.

IUCN, UNEP and WWF, 1980: World Conservation Strategy: Living Resources Conservation for Sustainable Development, IUCN, UNEP and WWF, Gland, Switzerland.

Khan. F., 1990: Issues to be Addressed in Social Impact Assessments, Environmental Evaluation Unit, University of Cape Town.

Land Surveys and Physical Planning Department (LSPP), 1989: Maseru Development Plan, LSPP, Ministry of the Interior, Maseru.

Land Surveys and Physical Planning Department (LSPP), 1990: National Settlement Policy (Final Draft), LSPP, Ministry of the Interior, Maseru.

Land Surveys and Physical Planning Department (LSPP), 1992: Leribe District Physical Plan, LSPP, Ministry of the Interior, Maseru.

Lesotho Highlands Development Authority (LHDA), 1986a: Lesotho Highlands Water Project Feasibility Study, Phase 1A: Supporting Report E, LHDA, Maseru.

Lesotho Highlands Development Authority (LHDA), 1986b: Lesotho Highlands Water Project Feasibility Study, Phase 1A: Supporting Report G, LHDA, Maseru.

Lesotho Highlands Development Authority (LHDA), 1988: Lesotho Highlands Water Project, LHDA Brochure, Maseru.

Lesotho Highlands Development Authority (LHDA), 1989: The Natural Environment and Heritage Plan, LHDA, Maseru.

Lesotho Highlands Development Authority (LHDA), 1990: Lesotho Highlands Water Project Compensation Plan: Phase 1A, LHDA, Maseru.

Lievesley, K.M., 1985: Environmental Assessment of Trunk Roads: The Framework Approach, Department of Transport, London.

Livesay, J.M. and Harding, J., 1978: Social Impact Assessment: Conceptual Frameworks and their Implications, Paper Presented to Annual Meeting of the American Anthropological Association, Los Angelos, 18 Novemeber.

MacMillan, L.A., 1986: Criteria for Evaluating Streams for Protection, in Campbell, I.C. (ed.) The Management of Rivers for Instream Users, Water Studies Centre, Chisholm, Institute of Technology, Australia.

Makuta, A. M., 1991: An Assessment of the Socio-economic Impacts associated with the LHWP on the Village of Ha Mensel - Katse, Lesotho, Unpublished Honours Thesis, Dept. of Environmental and Geographical Science, University of Cape Town.

Meakins, R.H. and Duckett, D.J., 1993: Vanishing Bogs of the Mountain Kingdom, Veld & Flora, 79(2), 49-51.

Ministry of Planning, Economics and Manpower Development, 1993: Fifth Five Year Development Plan (Final Draft), Maseru.

Ministry of Works, Roads Department, 1992: Southern Perimeter Road Project, Feasibility Study and Preliminary Engineering - Final Report, Volume 1, Maseru.

Norgaard, R.B., 1992: Sustainability as Intergenerational Equity: The Challenge to Economic Thought and Practice, Environmental Impact Assessment Review, 12 (1/2), 85-125.

Protection and Preservation Commission (PPC), 1983: Lesotho's Heritage in Jeopardy, Morija Printing Works, Maseru.

Rall, J.L., 1992: An Ecological Study on the Maluti Minnow, *Pseudobarbus quathlambae*, in the Catchment Area of Phase 1B of the Lesotho Highlands Water Scheme, Progress Reports, November 1991 to September 1992, Rand Afrikaans University, Johannesburg.

Rall, J.L., Steyn, G. du Preez, H.H., Harmse, J.T. and Maema, M., 1993: Proposal for the Development of a Conservation Program on *Pseudobarbus quathlambae* in the Catchment Area of Phase 1B of the Lesotho Highlands Water Project, Department of Zoology, Rand Afrikaans University, Johannesburg.

Schmitz, M., 1982: Wild flowers of Lesotho, Essa, Roma, Lesotho.

Scottish Development Department (UK), 1986: Scottish Traffic and Environmental Appraisal Manual, HMSO, Edinburgh.

Sechaba Consultants, 1991: Poverty in Lesotho - A Mapping Exercise, Maseru.

Settlement Planning Services (Setplan), 1991: LHDA Contract 62 - Phase 1A Regional Development Plan, Volume II, Setplan, Maseru.

South African Roads Board (SARB), 1992: Transportation Environmental Assessment Manual (Draft), Report PR 91/468, Research and Development Advisory Committee, SARB, Pretoria.

Sowman, M. and Wiseman, K., 1990: Socio-economic Effects of the Mossel Bay (Wolwedans Dam) Government Water Scheme, in Great Brak River Environmental Study with reference to a Management Plan for the Wolwedans Dam, CSIR Report EMA-C9036.

Stauth, R.B. and Baskind, P.H., 1992: Resource Economics, in Fuggle, R.F. and Rabie, M.A. (eds.) Environmental Management in South Africa, Juta and Co, Ltd, Cape Town, pp 26-52.

Taylor, B.R. and Roff, J.C., 1986: Long-term Effects of Highway Construction on the Ecology of a Southern Ontario stream, Environmental Pollution (Series A), 40, 317-344.

Tester, F.J., 1978: Social Impact Assessment: Approaching the Third World, Paper Presented to First Canadian Symposium on Social Impact Assessment, Banff, Alberta, 30 November - 2 December.

Thoahlane, T., 1991: The Missing Link in Developing Phase 1A for the Lesotho Highlands Water Project, Unpublished PhD Thesis, Graduate School of Arts and Sciences, Columbia University, New York.

Trollip, J., 1981: Rural Development in Lesotho, SALDRU Working Paper 33, Cape Town.

PERSONAL COMMUNICATIONS

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Millard, R., Environmental Consultant: Environmental Impact Management Services, Johannesburg.

Moeketsi, E., Senior Investment Officer, Lesotho Tourist Board, Maseru.

Nicholson, E., Engineer: Roads Department, Ministry of Works, Maseru.

Rall J., Researcher, Rand Afrikaans University.

Schaap, J., Project Co-ordinator: Contract LHDA 1000, Gibb-Bergman Joint Venture, Maseru.

APPENDIX 1
ACADEMIC GUIDELINES FOR REPORT

University of Cape Town

DEPARTMENT OF ENVIRONMENTAL AND GEOGRAPHICAL SCIENCE

EGS 502W: INTEGRATED ENVIRONMENTAL MANAGEMENT PROJECT 1993

MEMO: 2 December 1992

FROM: Richard Hill

TO: Second year M Phil Students

This memo is in three parts:

1 Background to the EGS 502W Master's Project/Dissertation

2 Guidelines for the individual dissertation

3 The role of the supervisor

Background to the 1993 EGS 502W Master's Project

The **six month project** is an exercise in the application of the scientific method to **real life issues in environmental planning, impact assessment and management**. The department believes that the best way to equip our graduates with the skills they will require as environmental professionals is for them to work together as a multi-disciplinary team to collect data but to interpret and consolidate the data individually.

The project is carried out under the joint supervision of the Department of Environmental and Geographical Science and the Environmental Evaluation Unit.

This project involves the Master's group in the collection of data on variables relevant to impact prediction. This will take approximately three months, during which time researchers will be working as a group under close supervision of John Raimondo. An interim draft report should be submitted at the end of the second month, in order to allow the EEU, and possibly the client, to respond to the information gathering stage (the exact timing of this draft report will need to decided in preparing an appropriate study plan). At the end of the third month the group is required to submit a **final baseline information report, compiled by the group as a whole**, to the EEU - **due date, beginning April 1993**. This will form a common data base which each researcher will be required to analyse, interpret and evaluate.

During the first three months it will be the responsibility of each student to liaise with their personal supervisor, to gain input on important decisions that have to be made by the group about the direction of the study, and to keep the supervisor informed of progress. During the last three months, each researcher will work individually, under the guidance of their personal supervisor.

Individual dissertations will communicate the findings of the assessment, and will not duplicate the material contained in the baseline report. The latter report will be considered as a supplementary report, and will be submitted to the internal and external examiners with the individual dissertations.

There will be a **team of internal examiners** (2 or 3) who will each evaluate all 9 dissertations. There will be one external examiner for the whole group. Each examiner will evaluate the dissertations independently of the other examiners. The Head of Department will then consolidate the evaluations and will decide with the examiners on the allocation of a mark (out of 500) to each dissertation.

Guidelines for dissertation

The individual dissertation is an impact assessment report written for the purpose of academic evaluation by examiners. It differs from consultants' reports which usually place more emphasis on the project findings than on the analytical rigour and logic used to reach conclusions and recommendations. While the application of intelligent analysis is important for consultants, clients are often not in a position to judge the adequacy of studies, and assume that consultants are competent to reach well reasoned conclusions. As a University we have a responsibility to develop these skills in researchers for use in their future work as consultants or research workers.

The individual dissertations should be rigorous in developing the logic of arguments, and should draw on literature more frequently than is usually the case in consultants' reports. For example, where practical constraints have determined the use of a particular approach or method, the implications of this could be critically assessed with reference to theory. However, the individual dissertation is not a critique of the project, and the primary focus should be on the findings of the project. A chapter of the dissertation should develop the theoretical basis for the study and critically assess the study plan in terms of the requirements of IEM/EIA.

The following three paragraphs list what we expect from our M Phil students:

In terms of **what** is presented, the individual dissertations should:

- demonstrate an adequate grasp of principles, methods and techniques for analysing, evaluating and presenting information, appropriate to the project in question
- satisfy general and specific requirements for good assessment reports
- include a concise executive summary, in which it is permissible to repeat information presented in the baseline report.

In terms of **the way** the dissertation is presented, the individual dissertations should:

- demonstrate an ability to deal with problems of an interdisciplinary nature
- demonstrate resourcefulness in the analysis of data, power of critical assessment and alertness to significance of results
- comprise a logical and coherent account of the project
- display diligence and care in the presentation of the dissertation, with due attention to style and layout (including grammar, spelling, freedom from typographical errors), and the execution of maps and diagrams.

The following points pertain to **the format** of the individual dissertations.

- Dissertations must be typewritten, and although presentation on A4 format using single-sided reproduction and 1,5 spacing is usual, this is not essential.
- Immediately following the title page must be an executive summary, giving an outline of the work and its findings.
- Acknowledgement of the extent to which assistance has been rendered by others in all aspects of the research project is required.
- An adequate table of contents must precede the main body of the text.
- All dissertations must contain a thorough and accurate list of references cited. A standard and recognised form of referencing must be used, and journal abbreviations must follow the usage of the World List of Scientific Publications.
- SI units must be used in the dissertation.

Role of the Supervisor

Your supervisor is required to:

- give advice on the necessary completion dates of successive stages of the dissertation, so that the whole may be submitted by the due date
- ensure that you are aware of the norms and conventions applying to the presentation of academic material
- read and comment on drafts of the dissertation
- carefully consider the structure and balance of the dissertation and advise you of possible alternative ways of presenting material
- impress on you that late entries will not be accepted - **the date for final submission of individual dissertations is 30 June 1993 (six months after start)** - late submissions by one or more individuals will jeopardise comparative evaluation by both the internal examining team and the one external examiner. Only medical and compassionate reasons for at most one or two week extensions will be considered.

APPENDIX 2
OUTLINE OF SCOPING PROCEDURES

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OUTLINE OF SCOPING PROCEDURES

According to the guidelines for integrated environmental management [Dept. of Env. Affairs, 1992] scoping is a procedure for determining the extent of and approach to an impact assessment, and should involve the following tasks:

- involvement of relevant authorities and interested and affected parties;
- identification and selection of alternatives;
- identification of significant issues to be examined in the impact assessment, and
- determination of specific guidelines or terms of reference for the impact assessment.

The preliminary desktop study (Stage 1) during which a "Least Cost Alternative Route" to the Western Access Road was identified involved no public participation in the scoping process. The implications of this are discussed in chapter 2 of this report.

During Stage 2 of the study, where the Least Cost Alternative Route (LCAR) and the Western Access Road (WAR) were evaluated and compared, official and interested and affected parties were consulted (see list overleaf of parties consulted).

The initial identification of relevant authorities and interested and affected parties (I&APs) was carried out by consulting directories and business reviews, as well as by speaking to persons with a knowledge of social networks in the study area. Identified parties were then approached and, by means of chain referral, further I&APs were identified.

Most contacts with I&APs involved individual interviews or small group meetings and workshops, which were held between 3 February and 31 March 1993. Where parties were unable to meet with members of the study team, telephonic interviews were held. The main aim of the meetings and interviews was to ascertain whether the parties had any information which might be relevant to the impact assessment, and in particular to establish which issues the parties felt should be addressed by the study.

A background information document (including terms of reference, an outline of the project proposal, and major issues identified to date) was drawn up and was provided to I&APs who requested such information. Photographs of the study area were also used on occasions to give I&APs a clearer idea of the type of terrain with which the study was concerned.

Specific guidelines and terms of reference for the impact assessment were clarified during meetings with the Lesotho Highlands Development

Authority and the client. Where differences in the interpretation of the brief arose, position papers were compiled in order to clarify details.

Communities living along the proposed route alignments constituted a major group of I&APs, whose views needed to be obtained. Social surveys, which included both the administration of questionnaires as well as informal interviews, were thus conducted along the WAR and in the Jorodane Valley area of the LCAR, between 8-17 March 1993. Surveys were also done along the new road to the Katse Dam, in order to establish what effect the road has had on residents of the area, and to aid in the prediction of impacts which were likely to occur along the WAR and LCAR. All the abovementioned surveys helped to identify further issues which should be addressed by the study.

The major issues identified by interested and affected parties during scoping are summarised in the table at the end of this appendix.

LIST OF OFFICIAL AND INTERESTED AND AFFECTED PARTIES CONSULTED

GOVERNMENT MINISTRIES/DEPARTMENTS

- Ministry of the Interior: Lands, Surveys and Physical Planning, Maseru: Tony Gregory, Klas Klasson, Physical Planners.
- Ministry of Planning, Manpower and Economic Development, Maseru: Mr Fanana (Director: Sectoral Division) and Mr Anthony Norman (Transport and Infrastructure Planner).
- Ministry of Works, Roads Department: Mr Ramanaheng (Chief Engineer) and Mr Paul Roach.
- Ministry of Agriculture/Ministry of Interior, Land Management and Conservation Project: Mr Robin James, Project Facilitator.
- Department of Rural Devleopment: Mr John Mosenye, Parks Administrator.

LOCAL AUTHORITIES

Village Chiefs (See EEU/2/93/104e)

BODIES ASSOC. WITH THE BUILDING OF THE ROAD AND DAM

- Lesotho Highlands Development Authority, Technical Division.

ROAD USERS/RESIDENTS

- Permanent residents in villages adjacent to proposed routes (See EEU/2/93/104e)
- Migrant workers in villages adjacent to proposed routes (See EEU/2/93/104e)

COMMUNITY SERVICE GROUPS

- Lesotho Council of NGOs: Mr George Koski (US Peace Corp).
- Highlands Church Action Group, Mr Rantsiu Mohau

PARTIES CONCERNED WITH ENVIRONMENTAL CONSERVATION

- Lesotho Highlands Development Authority, Environment Division: Dr M Maema, Mr D. Nkalai, Ms S. Madela, Mr B. Mateka, Mr J. Jenness, Mavuso Tshabalala, Mr Makheta, Ms V. Queku, Mr Sibollo, Mr Chetbourn, Mr Lebese Lekholoane, Ms M. Mothepu, Dr Nyapisi.
- Protection and Preservation Commission: Tseliso Ramakhula.
- Mr R. Millard and W. van Riet: Environmental Consultants
- Ms G. Ratcliff: Environmental Monitor, U.C.T.

PARTIES CONCERNED WITH TOURISM

- Lesotho Tourist Board: Mrs E.M Moeketsi, Senior Investment Officer, Maseru
- Molimo Nthuse Pony Trekking Centre: Mr J. O'Donavan, (Manager) and Mr S. Qhola (Guide), and staff.

ACADEMICS

- David Ambrose, Roma University.
- Dr Tim Quinland, Social Anthropology Department, University of Durban Westville.
- Steven Piper, Psychology Dept, Durban University.
- Prof Prassad, Palaeontology Department, National University of Lesotho, Roma.
- Dr Lynch, Mammologist, Bloemfontein Museum.
- Chaba Mokuku, Department of Biology, National University of Lesotho, Roma.
- J. Rall, Researcher, Rand Afrikaans University.

OTHER COMPANIES/ORGANISATIONS CONSULTED

- SetPlan, Cape Town: Rod Cromwright and Steve van der Westhuizen.
- Council for Scientific and Industrial Research, Cape Town: Alan Wright.
- Sechaba Consultants (Lesotho).

I&AP GROUPS

ISSUES IDENTIFIED

	OTHER PARTIES	GOVERNMENT OFFICIALS	ROAD USER/RESIDENTS	COMMUNITY SERVICE GRPS	ACADEMICS	ENV/CONSERVATION GRPS	TOURIST BODIES
Rare/endangered fauna may be harmed e.g. Maluti Minnow, Bearded Vulture & Aquatic River Frog		■			■	■	
The route should reinforce national policies and plans e.g. NSP, Five Year Plan, etc.		■					
Loss of, or damage to, houses and other structures, and relocation are likely negative impacts							
Rare/endangered flora and sensitive habitats may be harmed e.g. Aloe Polyphylla, wetlands		■			■	■	
National Plans for the Lesotho road network must be taken into consideration		■					
Starvation, a lack of clothing, and unemployment are typical problems in rural areas			■				
A new road implies additional maintenance costs to the Lesotho Government		■					
A new road could promote development and provide employment opportunities in rural areas		■	■				■
The route could reinforce existing tourist attractions and/or open up new potential				■		■	■
The actual implementation of the compensation plan is a potential problem area			■	■		■	
A bypass at Maseru and the upgrading of the railhead would benefit Lesotho		■				■	
The road may improve access to services, such as public transport, clinics, drought relief, etc.		■	■	■			■
A new road might cause an increase in crime, in particular stock theft			■				
Facilities and resources may be destroyed, such as springs, trees, broom grass, herbs, etc.	■		■				
A new road may cause an increase in social problems e.g. alcoholism, aids, prostitution, etc.	■		■		■		
Increased erosion and siltation/blockage of water courses is a possible negative impact					■	■	
Safety aspects e.g. traffic accidents, structures on cut faces, etc. need attention	■		■	■		■	
The road may interfere with cultural/religious sites e.g. graves, archaeological sites			■		■		
The route may result in traffic disruptions or unacceptable increases in heavy traffic		■				■	■
A new road through a rural area may adversely affect the local informal cash economy			■		■	■	■
Pollution associated with the road could be problematic e.g. dust, noise, tar pollution, etc.			■		■	■	
Available institutional capacity is a problem area in Lesotho	■	■		■			
Environmental management and rehabilitation are important issues					■	■	
The road could result in the loss of vegetable gardens and/or arable land			■			■	
The road will disrupt present pony trekking routes							■

TABLE SHOWING MAJOR ISSUES IDENTIFIED BY INTERESTED AND AFFECTED PARTIES

APPENDIX 3
THE PROJECT TEAM

APPENDIX 3
PROJECT TEAM

PROJECT MANAGER:	Dr J. Raimondo, EEU: MSc (Environmental Science) (UCT), PhD (Paper Technology) (Grenoble)
PROJECT LEADER:	S. Grindley, EEU: BA (English Lit.)(Natal), MSc (Environmental Science)(UCT)
RESEARCH CO-ORDINATOR:	M. Sowman, EEU: HED (UCT), MA (Environmental Science) (UCT)
RESEARCHERS (EEU):	J. Avis BSc (Hons) (Forestry Science) (Stell). H. Fawkes BSc (Chemical Engineering) (UCT). R. Heydenrych BL (Landscape Architecture) (Pretoria). J. Hughes BSc (Hons) MSc (Zoology) (Natal). M. Laros BSc (Hons) (Env. and Geographical Science) (UCT). H. Mackinnon BSc (Hons) (Biochemistry) (Wits). B. McCourt BSc (Hons) (Geology) (Wits). H. McMurray BSc (Hons) MSc (Zoology) (UCT). B. Schreiner BA (Hons) MA (Creative Writing) (Lancaster, UK).
SPECIALIST CONSULTANTS:	
Archaeology	Prof. J. Parkington, Department of Archaeology, UCT.
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APPENDIX 4

TABLE SHOWING SELECTION OF KEY ISSUES

APPENDIX 4: TABLE SHOWING IDENTIFICATION OF KEY ISSUES (SEE SECTION 4.2.2)

IMPACT/ISSUE	IMPACT CATEGORY		*CoD	EQUITY EFFECTS	OTHER CONSIDERATIONS	CONCLUSION
	WAR	LCAR				
1. Construction of the Maseru Bypass.	+3	0	3	WAR benefits many urban dwellers.	Without optimisation assumed, CoD still high (2)	**Key issue**
2. Safety and well-being of travellers	+2	+2.5	0.5	No significant differences in distribution.	CoD not particularly sensitive to assumptions**	Not a key issue
3. Improved access	+2	+3	1	Benefits of LCAR accrue to remote rural poor.	I&APs see issue as important	**Key issue**
4. Employment and business opportunities	+2	+2	0	No significant differences in distribution.	No change in CoD with changed assumptions	Not a key issue
5. Effect on the informal cash economy	0	-2	2	Disbenefits of LCAR accrue to rural poor.	CoD could increase if mitigation not effective.	**Key issue**
6. Impact on potable water supply	-1	-1	0	No significant differences in distribution.	CoD not sensitive to assumptions	Not a key issue
7. Social disruptions and disturbance	-1	-2	1	No significant differences in distribution.	CoD no particularly sensitive to assumptions	Not a key issue

* CoD = Number of categories of divergence between the two routes
** assumptions generally refer to those regarding mitigation and optimisation.

IMPACT/ISSUE	IMPACT CATEGORY		*CoD	EQUITY EFFECTS	OTHER CONSIDERATIONS	CONCLUSION
	WAR	LCAR				
8. Impact on agricultural facilities and resources	-1	-1	0	No significant differences in distribution.	CoD not sensitive to assumptions re. mitigation.	Not a key issue
9. Impact on homes and businesses	-1	-1	0	No significant differences in distribution.	CoD not sensitive to assumptions re. mitigation.	Not a key issue
10. Siltation of rivers and streams	-1	-2	1	Intergenerational equity effects.	Indirect effect on rare fauna is covered by 14.	Not a key issue in itself
11. Alteration of watercourses	-1	-1	0	Intergenerational equity effects.	CoD not sensitive to assumptions re mitigation.	Not a key issue
12. Impact on wetland and bogs	-1	-1.5	0.5	Intergenerational equity effects.	Indirect effect on rare fauna is covered by 14.	Not a key issue
13. Future options for conservation of Jorodane Valley	0	-2	2	Intergenerational equity effects.	Effect on rare fauna is covered under 14.	Not a key issue in itself
14. Impact on rare and endangered aquatic fauna	0	-3	3	Intergenerational equity effects.	Risk cannot be effectively mitigated.	**Key issue**

* CoD = Number of categories of divergence between the two routes

IMPACT/ISSUE	IMPACT CATEGORY		*CoD	EQUITY EFFECTS	OTHER CONSIDERATIONS	CONCLUSION
	WAR	LCAR				
15. Impact on spiral aloe population (*Aloe polyphylla*)	-1	-2	1	Intergenera-tional equity effects.	CoD is not sensitive to assumptions.	Not a key issue
16. Impact on terrestrial fauna	0	-1	1	Intergenera-tional equity effects.	CoD is not sensitive to assumptions.	Not a key issue
17. Impact on vegetation not classified as rare	-1	-1	0	Intergenera-tional equity effects.	CoD is not sensitive to assumptions.	Not a key issue
18. Impact on archaeological sites	0	-1	1	Intergenera-tional equity effects.	CoD is not sensitive to assumptions.	Not a key issue
19. Promotion of economic growth and employment	+2.5	+2	0.5	No significant distributional differences.	CoD is fairly insensitive to assumptions.	Not a key issue
20. Promotion of democratisation	+1	+2	1	LCAR benefits remote rural poor.	CoD is not sensitive to assumptions	Not a key issue
21. Impact on the National Settlement Policy	+1	-2	3	Indirect affect on all citizens of Lesotho	CoD is fairly insensitive to assumptions	**Key issue**

* CoD = Number of categories of divergence between the two routes

IMPACT/ISSUE	IMPACT CATEGORY		*CoD	EQUITY EFFECTS	OTHER CONSIDERATIONS	CONCLUSION
	WAR	LCAR				
22. Impact on tourism initiatives	+2	+1	1	No significant distributional differences.	CoD is not sensitive to assumptions.	Not a key issue
23. Impact on national road transport plans	+3	-3	6	Indirect affect on all citizens of Lesotho.	Impact cannot be effectively mitigated.	**Key issue**
24. Financial costs to Lesotho Highlands Development Authority	+3	-3	6	No significant equity effects.	Proponent sees impact as key decision factor.	**Key issue**

* CoD = Number of categories of divergence between the two routes